Nuclear Data Sheets for $A = 109^*$

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Abstract: Evaluated nuclear structure and decay data for all nuclei with mass number $A=109$ (Y,Zr,Nb,Mo,Tc,Ru,Rh, Pd,Ag,Cd,In,Sn,Sb,Te,I,Xe) are presented. The experimental data are compiled and evaluated, and the best values for level and gamma-ray energies, quantum numbers, lifetimes, gamma-ray intensities, and other nuclear properties are recommended. Inconsistencies and discrepancies that exist in the literature are noted. This work supersedes the earlier evaluation by J. Blachot (2006Bl02), published in *Nuclear Data Sheets* **107**, 355 (2006).

General Policies and Organization of Material: see <http://www.nndc.bnl.gov/nds/NDSPolicies.pdf>.

General Comments: The gamma-ray transition probabilities were calculated using the ENSDF analysis program *ruler* (http://www.nndc.bnl.gov/nndcscr/ensdf_pgm/analysis/ruler/). However, the reader should be warned that the program may produce incorrect results when dealing with non-symmetric uncertainties.

Cutoff Date: Literature available in the NSR database up to May 31, 2016 has been included.

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NUCLEAR DATA SHEETS

Skeleton Scheme for A=109

Skeleton Scheme for A=109 (continued)

Skeleton Scheme for A=109 (continued)

Ground-State and Isomeric-Level Properties

Nuclide	Level	J π	T _{1/2}	Decay Modes
¹⁰⁹ Y	0.0	(5/2+)	25 ms 5	% β^- =100
¹⁰⁹ Zr	0.0	(5/2+)	56 ms 3	% β^- =100
¹⁰⁹ Nb	0.0	(5/2+)	108 ms 5	% β^- =100; % $\beta^-n\leq 15$
¹⁰⁹ Mo	0.0	(5/2+)	0.61 s +3-4	% β^- =100; % $\beta^-n=1.3\ 6$
¹⁰⁹ Tc	0.0	(5/2+)	0.91 s 3	% β^- =100; % $\beta^-n=0.08\ 2$
¹⁰⁹ Ru	0.0	(5/2+)	34.4 s 2	% β^- =100
¹⁰⁹ Rh	0.0	7/2+	80.8 s 7	% β^- =100
¹⁰⁹ Pd	0.0	5/2+	13.59 h 12	% β^- =100
	188.9903	11/2-	4.703 min 9	%IT=100
¹⁰⁹ Ag	0.0	1/2-	stable	
	88.0337	7/2+	39.79 s 21	%IT=100
¹⁰⁹ Cd	0.0	5/2+	461.9 d 4	% ϵ =100
¹⁰⁹ In	0.0	9/2+	4.159 h 10	% ϵ +% β^+ =100
	649.79	1/2-	1.34 min 6	%IT=100
	2101.86	19/2+	210.0 ms 9	%IT=100
¹⁰⁹ Sn	0.0	5/2+	18.1 min 2	% ϵ +% β^+ =100
¹⁰⁹ Sb	0.0	(5/2+)	17.2 s 5	% ϵ +% β^+ =100
¹⁰⁹ Te	0.0	(5/2+)	4.4 s 2	% ϵ +% β^+ =96.1 13; % α =3.9 13; % β^+p =9.4 31; % $\beta^+\alpha$ <0.0043
¹⁰⁹ I	0.0	(1/2+,3/2+)	92.8 μ s 8	%p=99.986 4; % α =0.014 4
¹⁰⁹ Xe	0.0	(7/2+)	13 ms 2	% α =100
¹¹³ I	0.0	(5/2+)	6.6 s 2	% α =3.31 $\times 10^{-5}$; ...
¹¹³ Xe	0.0	(5/2+)	2.74 s 8	% α =0.010 10; ...

Adopted Levels

$Q(\beta^-)=12992$ SY; $S(n)=3980$ SY; $S(p)=15320$ CA; $Q(\alpha)=-11600$ CA.

$\Delta Q(\beta^-)=862$, $\Delta S(n)=920$ (2012Wa38).

$Q(\beta^-)$ and $S(n)$ from 2012Wa38. $S(p)$ and $Q(\alpha)$ predictions from 1997Mo25.

 ^{109}Y Levels

E(level)	$J\pi$	$T_{1/2}$	Comments
0 . 0	(5 / 2 +)	25 ms 5	$\% \beta^- = 100$. $J\pi$: from systematics of the lighter, odd-A Y isotopes. $J\pi=5/2+$ is predicted in 1997Mo25. $T_{1/2}$: using ion- $\beta(t)$ in 2015Lo04. configuration: likely $\pi 5/2+[422]$ orbital. The assignment is tentative. $\% \beta^- n = 55.6$ and $\% \beta^- 2n = 1.5$ are predicted in 1997Mo25.

Adopted Levels

$Q(\beta^-)=10427$ SY; $S(n)=2910$ SY; $S(p)=16190$ SY; $Q(\alpha)=-10010$ SY 2012Wa38.
 $\Delta Q(\beta^-)=727$, $\Delta S(n)=640$, $\Delta S(p)=780$, $\Delta Q(\alpha)=710$ (2012Wa38).

^{109}Zr Levels

E(level)	J π	T $_{1/2}$	Comments
0 . 0	(5 / 2 +)	56 ms 3	<p>%β^-=100.</p> <p>Jπ: from systematics of odd-A Zr isotopes; probable direct β^- feeding to the (7/2+) state in ^{109}Nb (2011Wa03, 2012Wa41); J$\pi=7/2^-$, associated with the $\nu 7/2-[523]$ orbital, is predicted in 1997Mo25.</p> <p>T$_{1/2}$: using ion-$\beta(t)$ in 2015Lo04. Other: 63 ms +38-17 using the maximum likelihood method in 2011Ni01.</p> <p>configuration: likely $\nu 5/2+[402]$ orbital. The assignment is tentative.</p> <p>%$\beta^-n=3.2$ is predicted in 1997Mo25.</p>

Adopted Levels, Gammas

$Q(\beta^-)=10050\ 530$; $S(n)=5150\ 530$; $S(p)=12556\ SY$; $Q(\alpha)=-8223\ SY$ 2012Wa38.
 $\Delta S(p)=661$, $\Delta Q(\alpha)=727$ (2012Wa38).

 ^{109}Nb LevelsCross Reference (XREF) Flags

A ^{109}Zr β^- Decay
 B $^9\text{Be}(^{238}\text{U}, F\gamma)$

E(level) [†]	J π	XREF	T _{1/2}	Comments
0.0	(5/2+)	AB	108 ms 5	$\% \beta^- = 100$; $\% \beta^- n \leq 15$ (2009Pe06). Others: $\% \beta^- n = 31\ 5$ (1996Me09). T _{1/2} : weighted average of 110 ms 6 from ion- $\beta\gamma(t)$ in 2015Lo04, 100 ms +9-8 from ion- $\beta(t)$ in 2011Ni01 and 130 ms 21, from 130 ms 5(syst) 20(stat) in 2009Pe06 using ion- $\beta(t)$. Others: 190 ms 30 in 1996Me09. J π : from systematics in lighter, odd-A Nb isotopes and the expected configuration. The assignment is tentative. configuration: likely $\pi 5/2+[422]$ orbital, as in the lighter, odd-A Nb isotopes. The assignment is tentative. PES calculations in 2011Wa03 predicted $J^\pi=3/2^-$, $\pi 3/2-[301]$ with $\beta_2=0.324$, $\beta_4=-0.030$ and $\gamma=0^\circ$. Calculations of 1997Mo25 predicted $J^\pi=5/2^-$, $\pi 5/2-[303]$ with $\beta_2=0.355$, $\beta_4=-0.067$ and $\beta_6=0.007$.
116.7 4	(7/2+)	AB		J π : systematics of the lighter, odd-A Nb isotopes indicate that this is most likely the first member of the ground state band. However, the alternative, $J^\pi=5/2^-$, $\pi 5/2-[303]$ assignment cannot unambiguously be excluded.
312.5 4		AB	132 ns 18	T _{1/2} : unweighted average of 114 ns +8-7 using 117, 213 $\gamma(t)$ in 2012Ka36 and 150 ns 30 using 117, 196, 213 $\gamma(t)$ in 2011Wa03 in $^9\text{Be}(^{238}\text{U}, F\gamma)$. configuration: interpreted as an oblate-shape isomer and associated with the $\pi 7/2[413]$ orbital in 2011Wa03. The assignment is tentative. $\pi 5/2[303]$ assignment cannot unambiguously be excluded.

[†] From a least-square fit to $E\gamma$.

 $\gamma(^{109}\text{Nb})$

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	Comments
116.7	117.0 5	100	
312.5	196.2 5	61 23	I γ : Others: $I\gamma(196\gamma)/I\gamma(312\gamma)=132\ 24$ in 2012Ka36 in contradiction with 2011Wa03. The authors in 2012Ka36 stated that the 196.2 γ is contaminated in their work by a 197.1 keV γ ray, produced in the $^{19}\text{F}(n,n')$ reaction, and that a correction to $I\gamma(196.2\gamma)$ was applied.
	312.2 5	100 32	I γ : see the comment to the 196.2 γ .

[†] From 2012Ka36 in $^9\text{Be}(^{238}\text{U}, F\gamma)$.

[‡] From 2011Wa03 in $^9\text{Be}(^{238}\text{U}, F\gamma)$.

^{109}Zr β^- Decay 2011Wa03,2011Ni01,2015Lo04

Parent ^{109}Zr : $E=0.0$; $J\pi=(5/2+)$; $T_{1/2}=56$ ms 3; $Q(\text{g.s.})=10427$ syst; $\%\beta^-$ decay=100.

$^{109}\text{Zr}-Q(\beta^-)$: From 2012Wa38, $\Delta Q(\beta^-)=727$.

2011Wa03: ^{109}Zr was produced in $\text{Be}(^{238}\text{U},\text{F})$ reactions at $E=345$ MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an active stopper consisting of 9 DSSDs, and surrounded by four Compton-suppressed Clover-type Ge detectors and one $\text{LaBr}_3(\text{Ce})$ detector. Measured: implant- $\gamma(t)$, implant- $\beta(t)$ and implant- $\beta\gamma(t)$.

2011Ni01: ^{109}Zr was produced in $\text{Be}(^{238}\text{U},\text{F})$ reactions at $E=345$ MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an active stopper consisting of 9 DSSDs. Measured: implant- $\beta(t)$. Deduced: ^{109}Zr half-life using the maximum likelihood analysis technique.

2015Lo04: ^{109}Zr was produced in $\text{Be}(^{238}\text{U},\text{F})$ reactions at $E=345$ MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an active stopper consisting of 8 DSSDs, and surrounded by 84 HpGe detectors of the EURICA array. Measured: implant- $\beta(t)$ and implant- $\beta\gamma(t)$. Deduced: ^{109}Zr half-life.

 ^{109}Nb Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}^\ddagger$
0.0	(5/2+)	108 ms 5
116.9 6	(7/2+)	
313.1 5		132 ns 18

† From a least-squared fit to $E\gamma$.

‡ From Adopted Levels.

 $\gamma(^{109}\text{Nb})$

$E\gamma^\dagger$	$E(\text{level})$
117 1	116.9
196.3 5	313.1
313.1 5	313.1

† From ^{109}Zr β^- decay in 2011Wa03. $\Delta E\gamma$ were estimated by the evaluators.

Decay Scheme

$^9\text{Be}(^{238}\text{U},\text{F}\gamma)$ 2011Wa03,2012Ka36

2011Wa03: ^{109}Nb was produced in $\text{Be}(^{238}\text{U},\text{F})$ reactions at $E=345$ MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an active stopper consisting of 9 DSSDs, and surrounded by four Compton-suppressed Clover-type HpGe detectors and one $\text{LaBr}_3(\text{Ce})$ detector. Measured: implant- $\gamma(t)$, implant- $\beta(t)$ and implant- $\beta\gamma(t)$.

2012Ka36: ^{109}Nb was produced in $\text{Be}(^{238}\text{U},\text{F})$ reactions at $E=345$ MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an aluminum stopper and surrounded by three Clover-type HPGe detectors. Measured: implant- $\gamma(t)$.

 ^{109}Nb Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}$	Comments
0.0	(5/2+)	108 ms 5	$T_{1/2}$: From adopted levels. 110 ms 6 using ion- $\beta\gamma(t)$ in 2015Lo04 and 100 ms +9-8 using ion- $\beta(t)$ in 2011Ni01.
116.7 4	(7/2+)		
312.5 4		132 ns 18	The number of implanted ^{109}Nb ions in the isomeric state was 1.6×10^6 (2012Ka36) and 2.3×10^5 (2011Wa03). $T_{1/2}$: unweighted average of 114 ns +8-7, using 117, 213 $\gamma(t)$ in 2012Ka36, and 150 ns 30, using 117, 196, 213 $\gamma(t)$ in 2011Wa03. configuration: interpreted as an oblate-shape isomer and associated with the $\pi 7/2+[413]$ Nilsson orbital in 2011Wa03.

† From a least-squares fit to $E\gamma$.

‡ From Adopted Levels.

 $\gamma(^{109}\text{Nb})$

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\ddagger$	Comments
117.0 5	116.7	47 23	$I\gamma$: From $I\gamma(117\gamma)/I\gamma(312\gamma)=76$ 28 and $I\gamma(312\gamma)=62$ 20 (2011Wa03). Note that $I\gamma(117\gamma)/I\gamma(312\gamma)=126$ 20 in 2012Ka36.
196.2 5	312.5	38 14	$I\gamma$: $I\gamma(196\gamma)/I\gamma(312\gamma)=61$ 24 in 2011Wa03, but 132 24 in 2012Ka36. The authors in 2012Ka36 stated that the 196.2 γ is contaminated in their work by a 197.1 keV γ ray, produced in the $^{19}\text{F}(n,n')$ reaction, and that a correction to $I\gamma(196.2\gamma)$ was applied.
312.2 5	312.5	62 20	

† From 2012Ka36.

‡ From 2011Wa03.

Level Scheme

Intensities: relative
 $I\gamma$

Adopted Levels, Gammas

$Q(\beta^-)=7608$ 15; $S(n)=3981$ 14; $S(p)=14415$ 14; $Q(\alpha)=-7626$ 16 2012Wa38.

 ^{109}Mo Levels**Cross Reference (XREF) Flags**

A ^{248}Cm SF Decay
 B ^{252}Cf SF Decay
 C Be($^{238}\text{U}, \text{F}\gamma$)

E(level) [†]	$J\pi^{\ddagger}$	XREF	$T_{1/2}$	Comments
0.0 [§]	(5/2+)	ABC	0.61 s +3-4	$\% \beta^- = 100$; $\% \beta^- n = 1.3$ 6 (2009Pe06). $J\pi$: 222.2 γ E1 from (7/2-) and $\gamma(110.8)\gamma(222.2)(\theta)$ (2006Ur01) in ^{248}Cm SF decay; direct β^- decay feeding to the ^{109}Tc ground state ($J\pi=5/2+$) (2012Ku28). Note, that 1997Hw03 (^{252}Cf SF decay) proposed $J\pi=(7/2-)$, based on their interpretation, but no experimental evidences were presented by the authors. $T_{1/2}$: weighted average of 0.70 s +4-6, using implant- $\beta\gamma(t)$ in 2015Lo04, 0.66 s 5, using $\beta(t)$ and the maximum likelihood method in 2009Pe06 and 0.53 s 6 using β -K α (t) in 1992Ay02, and 1992PeZX. configuration: $\nu 5/2+[402]$ ($g_{7/2}$) orbital. The assignment is tentative. The strong β^- feedings to the $\pi g_{9/2}$ -dominated levels in the daughter ^{109}Tc nuclide would support $\nu g_{7/2}$ over $\nu d_{5/2}$ assignment.
69.7 5	(1/2+)	C	0.194 μ s +76-49	$J\pi$: Tentative assignment proposed in 2012Ka36 (Be($^{238}\text{U}, \text{F}\gamma$)), based on expectations from the Nilsson model. Similarity to known isomers in neighboring odd-N nuclei. $T_{1/2}$: using 69.7 $\gamma(t)$ in 2012Ka36 (Be($^{238}\text{U}, \text{F}\gamma$)). configuration: $\nu 1/2+[411]$ expected from the Nilsson model and similarities to known isomers in neighboring odd-N nuclei. The assignment is tentative.
144.01 [§] 25	(7/2+)	A		
222.19 [#] 25	(7/2-)	AB		$J\pi$: 78.2 γ E1 to (7/2+); proposed configuration. configuration: $\nu 7/2-[523]$ orbital. The assignment is tentative.
333.0 [#] 3	(9/2-)	AB		$J\pi$: 110.8 γ M1+E2 to (7/2-) and 189.0 γ to (7/2+); band assignment.
336.4 [§] 6	(9/2+)	A		$J\pi$: 192.4 γ to (7/2+) and 336 γ to (5/2+); band assignment.
472.0 [#] 4	(11/2-)	AB		$J\pi$: 138.9 γ M1(+E2) to (9/2-) and 250.0 γ to (7/2-); band assignment.
553.3 [§] 4	(11/2+)	A		$J\pi$: 216.8 γ to (11/2+) and 409.3 γ to (7/2+); band assignment.
730.3 [#] 5	(13/2-)	AB		$J\pi$: 258.3 γ to (11/2-) and 397.2 γ to (9/2-); band assignment.
810.6 [§] 8	(13/2+)	A		$J\pi$: 474.2 γ to (9/2+); band assignment.
885.7 [#] 5	(15/2-)	AB		$J\pi$: 155.4 γ to (13/2-) and 413.7 γ E2 to (11/2-); band assignment.
1095.4 [§] 7	(15/2+)	A		$J\pi$: 542.1 γ to (11/2+); band assignment.
1286.7 [#] 11	(17/2-)	A		$J\pi$: 401 γ to (15/2-) and 556 γ to (13/2-); band assignment.
1442.7 [#] 6	(19/2-)	AB		$J\pi$: 557.0 γ to (15/2-); band assignment.
2137.7 [#] 12	(23/2-)	A		$J\pi$: 695 γ to (19/2-); band assignment.

[†] From a least-squares fit to γ -ray energies.

[‡] From 2006Ur01 in ^{248}Cm SF decay, based on deduced transition multipolarities, using $\alpha(\text{exp})$ and $\gamma\gamma(\theta)$, and the proposed band structures, unless otherwise stated.

[§] (A): $\nu 5/2[402]$ band. The assignment is tentative.

[#] (B): $\nu 7/2[523]$ band. The assignment is tentative.

Adopted Levels, Gammas (continued)

$\gamma(^{109}\text{Mo})$						
E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
69.7	69.7 5	100	[E2]		4.42 14	B(E2)(W.u.)=11 +4-3.
144.01	144.0 3	100				
222.19	78.2 5	23 2	E1		0.257 6	Mult.: from $\alpha(\text{exp})$ in 2006Ur01 using intensity balance considerations.
	222.2 3	100 5	E1		0.01262	Mult.: from $\alpha(\text{exp})$ in 2006Ur01 using intensity balance considerations; $A_2/A_0=+0.11$ 2, $A_4/A_0=-0.03$ 2 for (110.8 γ)(222.2 γ)(θ), gives $\Delta J=1$ for 222.2 γ (2006Ur01). E γ : Other: 222.5 keV in 1997Hw03.
333.0	110.8 3	100 4	M1+E2	0.55 20	0.34 9	Mult.: from $\alpha(\text{exp})=0.34$ 8, deduced by the evaluators from the intensity balances and I_{γ} in 2006Ur01; $A_2/A_0=+0.11$ 2, $A_4/A_0=-0.03$ 2 for (110.8 γ)(222.2 γ)(θ), gives $\Delta J=1$ for 110.8 γ , in-band transition (2006Ur01). δ : calculated by evaluators from $\alpha(\text{exp})$ and the BrIccMixing program. E γ : Other: 111.3 keV in 1997Hw03.
	189.0 3	34 3				
336.4	192.4 5	100				
472.0	138.9 3	100 4	M1(+E2)		0.1016 16	Mult.: $A_2/A_0=+0.07$ 1, $A_4/A_0=-0.0$ 2 for (110.8 γ)(138.9 γ)(θ), gives $\Delta J=1$ for 138.9 γ . Also $A_2/A_0=-0.09$ 2, $A_4/A_0=-0.0$ 2 (138.9 γ)(413.7 γ)(θ), gives $\Delta J=1$ for 138.9 γ ; in-band transition (2006Ur01). E γ : Other: 139.3 keV in 1997Hw03.
	250.0 5	28 3				
553.3	216.8 [#] 5					
	409.3 3	100				
730.3	258.3 5	100 9				E γ : Other: 258.6 keV in 1997Hw03.
	397.3 5	57 9				E γ : Other: 397.9 keV in 1997Hw03.
810.6	474.2 5	100				
885.7	155.4 5	29 4				E γ : Other: 155.5 keV in 1997Hw03.
	413.7 3	100 5	E2		0.00846	Mult.: $A_2/A_0=-0.09$ 2, $A_4/A_0=-0.0$ 2 (138.9 γ)(413.7 γ)(θ), gives $\Delta J=2$ for 413.7 γ , in-band transition (2006Ur01). E γ : Other: 413.2 keV in 1997Hw03.
1095.4	542.1 5	100				
1286.7	401 1	100				
1442.7	557.0 3	100				E γ : Other: 557.4 keV in 1997Hw03.
2137.7	695 1	100				

[†] From 2006Ur01 in ^{248}Cm SF decay. ΔE_{γ} assigned by evaluators.

[‡] From 2006Ur01 in ^{248}Cm SF decay based on $\alpha(\text{exp})$ and $\gamma\gamma(\theta)$.

[§] If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multiplicities.

[#] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued) ^{248}Cm SF Decay 2006Ur01

Parent ^{248}Cm : $E=0.0$; $J\pi=0+$; $T_{1/2}=3.48\times 10^5$ y 6; %SF decay=8.39 16.

2006Ur01: Source: ^{248}Cm ; Detectors: EUROGAM 2 array and four LEPS detectors, Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ coin, $\gamma\gamma(0)$.

 ^{109}Mo Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
0.0 §	(5/2+)	0.61 s +3-4	$T_{1/2}$: from Adopted Levels.
144.01 § 25	(7/2+)		
222.19 # 25	(7/2-)		
333.0 # 3	(9/2-)		
336.4 § 6	(9/2+)		
472.0 # 4	(11/2-)		
553.3 § 4	(11/2+)		
730.3 # 5	(13/2-)		
810.6 § 8	(13/2+)		
885.7 # 5	(15/2-)		
1095.4 § 7	(15/2+)		
1286.7 # 11	(17/2-)		
1442.7 # 6	(19/2-)		
2137.7 # 12	(23/2-)		

[†] From a least-square fit to $E\gamma$.

[‡] From 2006Ur01, based on deduced transition multiplicities, using $\alpha(\text{exp})$ and $\gamma\gamma(0)$, and the proposed band structures.

§ (A): v5/2[402] band; assignment is tentative.

(B): v7/2[523] band; assignment is tentative.

^{248}Cm SF Decay 2006Ur01 (continued) $\gamma(^{109}\text{Mo})$

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. [†]	δ	α	Comments
78.2 5	222.19	23 2	E1		0.257 6	Mult.: from $\alpha(\text{exp})$ in 2006Ur01 using intensity balance considerations.
110.8 3	333.0	77 3	M1+E2	0.55 20	0.34 9	Mult.: from $\alpha(\text{exp})=0.34 8$, deduced by the evaluators from the intensity balances and $I\gamma$ in 2006Ur01; $A_2/A_0=+0.11 2$, $A_4/A_0=-0.03 2$ for $(110.8\gamma)(222.2\gamma)(\theta)$, gives $\Delta J=1$ for 110.8 γ . δ : deduced by evaluators from $\alpha(\text{exp})$ using the BrIccMixing program.
138.9 3	472.0	68 3	M1(+E2)		0.23 14	Mult.: $A_2/A_0=+0.07 1$, $A_4/A_0=-0.0 2$ for $(110.8\gamma)(138.9\gamma)(\theta)$, gives $\Delta J=1$ for 138.9 γ ; $A_2/A_0=-0.09 2$, $A_4/A_0=-0.0 2$ for $(138.9\gamma)(413.7\gamma)(\theta)$, gives also $\Delta J=1$ for 138.9 γ (2006Ur01).
144.0 3	144.01	74 4				
155.4 5	885.7	16 2				
189.0 3	333.0	26 2				
192.4 5	336.4	15 2				
216.8 [‡] § 5	553.3					
222.2 3	222.19	100 5	E1		0.01262	Mult.: from $\alpha(\text{exp})$ in 2006Ur01 using intensity balance considerations; $A_2/A_0=+0.11 2$, $A_4/A_0=-0.03 2$ for $(110.8\gamma)(222.2\gamma)(\theta)$, gives $\Delta J=1$ for 222.2 γ .
250.0 5	472.0	19 2				
258.3 5	730.3	23 2				
336 [‡] § 1	336.4					
397.3 5	730.3	13 2				
401 1	1286.7					
409.3 3	553.3	26 3				
413.7 3	885.7	55 3	E2		0.00846	Mult.: $A_2/A_0=-0.09 2$, $A_4/A_0=-0.0 2$ for $(138.9\gamma)(413.7\gamma)(\theta)$, gives $\Delta J=2$ for 413.7 γ .
474.2 5	810.6					
542.1 5	1095.4	9 3				
556 [‡] § 1	1286.7					
557.0 3	1442.7	29 3				
695 1	2137.7	20 4				

[†] From 2006Ur01, $\Delta E\gamma$ is quoted as 0.1 keV for strong lines to 0.5 keV for weak lines. The evaluators have assigned 0.3 keV for $I\gamma>25$, 0.5 keV for $I\gamma<25$, and 1 keV for 336, 401, 556, 695 γ -rays.

[‡] Contaminated line.

[§] Placement of transition in the level scheme is uncertain.

^{252}Cf SF Decay 1997Hw03

Parent ^{252}Cf : $E=0.0$; $J\pi=0+$; $T_{1/2}=2.645$ y 8; %SF decay=3.086 8.

1997Hw03: Source of $^{252}\text{Cf} \approx 25$ μCi was placed between two Ni foils and in the center of Gammasphere array (at LBNL), consisting of 72 Compton-suppressed Ge detectors. A total of 9.8×10^9 triple- γ or higher coincidence events were collected. Measured: $E\gamma$, $I\gamma$, $\gamma\gamma(0)$, $\gamma\gamma\gamma$. Others (from the same group): 1998Ha65.

 ^{109}Mo Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0	(5/2+)	0.61 s +3-4	
144.01 25	(7/2+)		$E(\text{level}), J\pi$: Not observed in 1997Hw03.
222.5 5	(7/2-)		
333.7 7	(9/2-)		$J\pi$: (9/2+) in 1997Hw03.
473.1 7	(11/2-)		
731.6 7	(13/2-)		$J\pi$: (13/2+) in 1997Hw03.
886.4 8	(15/2-)		
1443.8 9	(19/2-)		

† From a least-squares fit to γ -ray energies.

‡ From adopted levels. Values from 1997Hw03 are given in the comments. Note, the different interpretation in the adopted levels, which contradicts the 1997Hw03 level scheme and interpretation.

 $\gamma(^{109}\text{Mo})$

$E(\text{level})$	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult. †	$\delta^\dagger$	Comments
144.01	144.0 3	100			$E\gamma, I\gamma$: Not observed in 1997Hw03.
222.5	78.2 5	23 2	E1		$E\gamma, I\gamma$: Not observed in 1997Hw03.
	222.2 3	100 5	E1		$E\gamma$: 222.5 keV in 1997Hw03.
333.7	110.8 3	100 4	M1+E2	0.55 20	$E\gamma$: 111.3 keV in 1997Hw03.
	189.0 3	34 3			$E\gamma, I\gamma$: Not observed in 1997Hw03.
473.1	138.9 5	100 4	M1 (+E2)		$E\gamma$: 139.3 keV in 1997Hw03.
					$I\gamma$: 74.7 in 1997Hw03.
					Mult.: E1 from $\alpha=0.04$ 3 in 1997Hw03, obtained by double gating on 111 γ and 222 γ . However, the uncertainty overlaps with M1 assignment within two standard deviations. The individual intensities were not given by the authors.
	250.5 5	28 3			$E\gamma$: $E\gamma=326.4$ keV, listed in table II of 1997Hw03, seems a misprint.
					$I\gamma$: 100 in 1997Hw03.
731.6	258.3 5	100 9			$E\gamma$: 258.6 keV in 1997Hw03.
	397.3 5	57 9			$I\gamma$: 430.7 in 1997Hw03.
					$E\gamma$: 397.9 keV in 1997Hw03.
					$I\gamma$: 100 in 1997Hw03.
886.4	155.4 5	29 4			$E\gamma$: 155.0 keV in 1997Hw03.
					$I\gamma$: 89.1 in 1997Hw03.
	413.7 3	100			$E\gamma$: 413.2 keV in 1997Hw03.
1443.8	557.0 3	100			$E\gamma$: 557.4 keV in 1997Hw03.

† From adopted gammas. Values from 1997Hw03 are given in the comments.

Be($^{238}\text{U},\text{F}\gamma$) 2012Ka36,2015Lo04

2012Ka36: ^{109}Mo was produced in Be($^{238}\text{U},\text{F}$) reactions at E=345 MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an aluminum stopper and surrounded by three Clover-type HPGe detectors. Measured: implant- $\gamma(t)$.

2015Lo04: ^{109}Mo was produced in Be($^{238}\text{U},\text{F}$) reactions at E=345 MeV/nucleon at RIKEN. BigRIPS spectrometer was used to separate the recoiling nuclei, which were implanted into an active stopper consisting of 8 DSSDs, and surrounded by 84 HpGe detectors of the EURICA array. Measured: implant- $\beta(t)$ and implant- $\beta\gamma(t)$.

 ^{109}Mo Levels

<u>E(level)[†]</u>	<u>J$\pi^{\ddagger}$</u>	<u>T$_{1/2}^{\ddagger}$</u>	<u>Comments</u>
0.0	(5/2+)	0.61 s +3-4	T $_{1/2}$: Other: 0.70 s +4-6 from implant- $\beta\gamma(t)$ in 2015Lo04.
69.7 5	(1/2+)	0.194 μ s +76-49	The number of implanted ^{109}Mo nuclei in the isomeric state was 8.3×10^3 (2012Ka36). T $_{1/2}$: using 69.7 $\gamma(t)$ in 2012Ka36. configuration: likely v1/2+[411] orbital from the comparisons with neighboring nucleus ^{107}Mo (2012Ka36).

[†] From E γ .

[‡] From Adopted Levels, unless otherwise stated.

 $\gamma(^{109}\text{Mo})$

<u>E$\gamma^{\dagger}$</u>	<u>E(level)</u>	<u>Mult.</u>	<u>α</u>
69.7 5	69.7	[E2]	4.42 14

[†] From 2012Ka36.

Adopted Levels, GammasQ(β^-)=6456 13; S(n)=6431 13; S(p)=10807 14; Q(α)=-6794 10 2012Wa38. ^{109}Tc Levels

Cross Reference (XREF) Flags

A ^{109}Mo β^- Decay
 B ^{248}Cm SF Decay
 C ^{252}Cf SF Decay

E(level) [‡]	J $\pi^{\dagger}$	XREF	T _{1/2}	Comments
0.0 [§]	(5/2+)	ABC	0.91 s 3	<p>%β^-=100; %β^-n=0.08 2 (1996Me09). %β^-n: Other: ≤ 1 (2009Pe06). Jπ: direct feeding in ^{109}Mo β^- decay (Jπ=(5/2+)); systematics of odd-Z Tc isotopes; configuration assignment. T_{1/2}: weighted average of 1.04 s 11 (using $\beta(t)$ in 2009Pe06 and the maximum likelihood method, but the uncertainty was deduced by the evaluators by taking in quadrature the systematic uncertainty of 0.10 and the statistical uncertainty of 0.05), 0.82 10 (using $\beta(t)$ in 1996Me09), 0.87 s 4 (using 96.1,128.7,195.6γ-$\beta(t)$ in 1992PeZX), 0.93 s 3 (using 96.1,122.2,128.5,376.9,445.0γ-$\beta(t)$ in 1969WiZX) and 0.9 s 1 (using 68.7$\gamma(t)$ in 1990Al43). Other: 1.4 s 4 (1976Tr02, from the growth of 206$\gamma(t)$ in ^{109}Ru). configuration: Kπ=5/2+, π5/2[422] Nilsson orbital. The assignment is consistent with the observed g_K values from in-band cascade-to-crossover branching ratios, compared to g_K=1.49 expected from deformed Woods-Saxon model (β_2=0.322, β_4=-0.003 and β_6=-0.005). Jπ: based on comparisons of the structure of low-lying states in ^{109}Tc in ^{109}Mo β^- decay (2012Ku28); assigned configuration. The assignment is tentative.</p>
7.0 ^{&} 3	(5/2-)	AB		<p>configuration: possible π5/2[303] Nilsson orbital. The assignment is consistent with the observed g_K values from in-band cascade-to-crossover branching ratios, compared to g_K=0.45 expected from deformed Woods-Saxon model (β_2=0.322, β_4=-0.003 and β_6=-0.005). Jπ: based on comparisons of the structure of low-lying states in ^{109}Tc in ^{109}Mo β^- decay (2012Ku28). The assignment is tentative.</p>
18.37 24	(3/2-)	A		<p>Jπ: based on comparisons of the structure of low-lying states in ^{109}Tc in ^{109}Mo β^- decay (2012Ku28). The assignment is tentative. configuration: possible π3/2[301] Nilsson orbital (2012Ku28).</p>
50.63 22	(3/2+)	A		<p>Jπ: 32.2γ (E1) to (3/2-) and 43.6γ (E1) to (5/2-). configuration: Likely a member of the Kπ=1/2+, π1/2[431] band (2012Ku28). The assignment is tentative.</p>
69.13 [§] 8	(7/2+)	ABC		J π : 69.1 γ M1+E2 to (5/2+); band assignment.
172.00 ^{&} 10	(7/2-)	AB		J π : 165.0 γ to (5/2-); band assignment.
206.17 [§] 10	(9/2+)	ABC		J π : 137.0 γ M1+(E2) to (7/2+), 206.1 γ to (5/2+); band assignment.
333.14 ^b 13	(3/2+)	A		J π : 333.3 γ to (5/2+), 314.8 γ to (3/2-), 282.5 γ to (3/2+); direct β^- feeding from (5/2+); band assignment.
358.60 ^b 12	(7/2+)	A		J π : 152.1 γ to (9/2+), 358.7 γ to (5/2+); band assignment.
387.80 ^{&} 10	(9/2-)	B		J π : 380.8 γ E2 to (5/2-), 215.8 γ to (7/2-).
423.78 ^b 12	(5/2+)	A		J π : 65.2 γ M1+E2 to (7/2+), 90.7 γ M1+E2 to (3/2+); band assignment.
489.32 25	(3/2, 5/2)	A		J π : 471.0 γ to (3/2-), 438.6 γ to (3/2+); direct feeding in ^{109}Mo β^- decay (J π =(5/2+)) (5/2+).
494.55 [#] 8	(9/2+)	B		J π : 494.6 γ Q to (5/2+), 425.4 γ D to (7/2+); band assignment.
504.20 [§] 12	(11/2+)	BC		J π : 298.0 γ to (9/2+), 435.0 γ to (7/2+); band assignment.
605.70 ^{&} 14	(11/2-)	B		J π : 433.7 γ E2 to (7/2-), band assignment.
632.37 [#] 13	(11/2+)	BC		J π : 426.2 γ to (9/2+), 563.9 γ to (7/2+); band assignment.
643.68 [§] 13	(13/2+)	BC		J π : 437.5 γ E2 to (9/2+), 139.4 γ to (11/2+); band assignment.
702.9 3	(3/2, 5/2, 7/2+)	A		J π : 652.3 γ to (3/2+); direct feeding in ^{109}Mo β^- decay (J π =(5/2+)).
745.00 13	(7/2+)	A		J π : 386.6 γ to (7/2+), 412.0 γ to (3/2+); direct feeding in ^{109}Mo β^- decay (J π =(5/2+)). configuration: Likely the K π =7/2+, π 7/2[413] state (2012Ku28). The assignment is tentative.
915.20 ^{&} 22	(13/2-)	B		J π : 527.4 γ E2 to (9/2-), band assignment.
964.71 [#] 16	(13/2+)	BC		J π : 332.4 γ to (11/2+), 758.8 γ to (9/2+); band assignment.
1083.94 [§] 16	(15/2+)	BC		J π : 440.3 γ to (13/2+), 579.7 γ to (11/2+); band assignment.
1171.70 ^{&} 25	(15/2-)	B		J π : 566.0 γ E2 to (11/2-); band assignment.
1231.35 [§] 15	(17/2+)	BC		J π : 147.2 γ M1+E2 to (15/2+), 587.6 γ E2 to (13/2+); band assignment.
1262.28 [#] 17	(15/2+)	BC		J π : 297.6 γ to (13/2+), 629.9 γ to (11/2+); band assignment.

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Adopted Levels, Gammas (continued)

¹⁰⁹Tc Levels (continued)

E(level) [†]	Jπ [†]	XREF	Comments
1383.1 ^a 4	(15/2+)	C	Jπ: 414.8γ to (13/2+), 750.8γ to (11/2+); band assignment.
1440.75 15	(13/2+)	B	Jπ: 808.4γ to (11/2+), 946.3γ E2 to (9/2+); band assignment.
1575.2 ^{&} 4	(17/2-)	B	Jπ: 660.0γ to (13/2-); band assignment.
1635.9 [#] 3	(17/2+)	BC	Jπ: 374.0γ to (15/2+), 671.0γ to (13/2+); band assignment.
1680.4 ^a 5	(17/2+)	C	Jπ: 297.3γ to (15/2+), 715.7γ to (13/2+); band assignment
1749.61 [@] 15	(15/2-)	B	Jπ: 308.9γ d to (13/2+); band assignment.
1756.0 4	(3/2, 5/2, 7/2)	A	
1796.06 [§] 23	(19/2+)	BC	Jπ: 564.7γ to (17/2+), 712.2γ to (15/2+); band assignment
1861.3 ^{&} 4	(19/2-)	B	Jπ: 689.6γ Q to (15/2-); band assignment.
1930.69 [@] 16	(17/2-)	BC	Jπ: 181.1γ to (15/2-); band assignment.
1951.06 [§] 17	(21/2+)	BC	Jπ: 155.1γ to (19/2+), 719.7γ E2 to (17/2+); band assignment.
2022.85 18	(3/2+, 5/2, 7/2+)	A	Jπ: 1664.2γ to (7/2+), 1689.6γ to (3/2+); direct feeding in ¹⁰⁹ Mo β ⁻ decay (Jπ=(5/2+)).
2068.4 5	(3/2, 5/2, 7/2)	A	Jπ: 1365.5γ to (3/2, 5/2, 7/2+); direct feeding in ¹⁰⁹ Mo β ⁻ decay (Jπ=(5/2+)).
2078.1 ^a 6	(19/2+)	C	Jπ: 695.0γ to (15/2+); band assignment.
2136.91 [@] 16	(19/2-)	BC	Jπ: 206.3γ to (17/2-), 387.3γ to (15/2-); band assignment.
2286.4 4	(3/2, 5/2, 7/2+)	A	Jπ: 2235.7γ to (3/2+); direct feeding in ¹⁰⁹ Mo β ⁻ decay (Jπ=(5/2+)).
2346.2 ^{&} 6	(21/2-)	B	Jπ: 771.0γ to (17/2-); band assignment.
2375.58 [@] 20	(21/2-)	BC	Jπ: 238.6γ to (19/2-), 444.9γ to (17/2-); band assignment.
2552.4 [§] 4	(23/2+)	C	Jπ: 601.3γ to (21/2+), 756.4γ to (19/2+); band assignment.
2642.68 [@] 23	(23/2-)	BC	Jπ: 267.0γ to (21/2-), 505.9γ to (19/2-); band assignment.
2660.2 ^{&} 5	(23/2-)	B	Jπ: 798.9γ to (19/2-); band assignment.
2753.4 [§] 3	(25/2+)	BC	Jπ: 201.1γ to (23/2+), 802.3γ E2 to (21/2+); band assignment.
2940.3 [@] 3	(25/2-)	B	Jπ: 297.5γ to (23/2-), 564.8γ to (21/2-); band assignment.
3217.4 [§] 4	(27/2+)	C	Jπ: 464.1γ to (25/2+), 665.0γ to (23/2+); band assignment.
3438.9 [§] 4	(29/2+)	BC	Jπ: 221.5γ to (27/2+), 685.5γ E2 to (25/2+); band assignment.
4072.1 [§] 5	(33/2+)	BC	Jπ: 633.2γ E2 to (29/2+); band assignment.
4833.1 [§] 7	(37/2+)	BC	Jπ: 761.0γ to (33/2+); band assignment.

[†] From ²⁴⁸Cm SF decay (2010Ur03), based on angular correlation measurements, ce data and observed band structure, unless otherwise noted.

[‡] From a least-squares fit to Eγ.

[§] (A): Kπ=5/2+, π5/2[422] band.

[#] (B): Kπ=(9/2+), π5/2[422]⊗2⁺ γ-vibrational band.

[@] (C): Kπ=(15/2-) band. Possible configuration=π5/2[422]⊗v(1/2[420],9/2[514]).

[&] (D): Kπ=5/2-, π5/2[303] band.

^a (E): Band at 1383 keV, observed only in ²⁵²Cf SF decay (2010Gu07).

^b (F): Likely Kπ=1/2+, π5/2[422]⊗2⁺ band.

γ(¹⁰⁹Tc)

E(level)	Eγ [†]	Iγ [†]	Mult. [†]	δ [#]	α	Comments
7.0	(7.0)					
18.37	(18.3)					
50.63	32.2 [‡] 2	39 [‡] 11	(E1)		3.28 8	Mult.: α(K)exp=4.7 4 for 32.2γ+43.6γ (2012Ku28).
	43.6 [‡] 2	100 [‡] 6	(E1)		1.42 3	Mult.: α(K)exp=4.7 4 for 32.2γ+43.6γ (2012Ku28).
69.13	69.1 1	100	M1+E2	0.11 10	0.84 12	Mult.: α(K)exp=0.90 20 and α(exp)=0.90 20 in 2012Ku28. Also α(K)exp=1.12 25 for 65.2γ+69.1γ in 2012Ku28. Other: α(K)exp=2.9 8 in 2010Ur03.
						δ: From α(K)exp=0.90 20 (2012Ku28). Other: 1.9 9 in ²⁴⁸ Cm SF decay (2010Ur03) and 0.16 +7-12 in ²⁵² Cf SF decay (2004Lu20).
172.00	165.0 1	100	[M1+E2]			Mult.: α(K)exp=2.2 7 (2010Ur03) from comparison of Iγ(165γ) and Iγ(Kα x rays), but the value is too large for either Mult=E1, M1 or E2. (433γ)(165γ)(θ) data (2010Ur03) are also inconclusive.
206.17	137.0 1	100.0 18	M1(+E2)	0.6 6	0.19 10	Mult.,δ: from α(exp)=0.19 9 in ²⁵² Cf SF decay (2004Lu20) and (437.5γ)(137.0γ)(θ) in ²⁴⁸ Cm SF decay (2010Ur03).
	206.1 2	1.9 4				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Tc})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [†]	$\delta^{\#}$	α	Comments
333.14	282.5 $\frac{+}{-}$ 2	8.7 $\frac{+}{-}$ 9				
	314.8 $\frac{+}{-}$ 3	4.8 $\frac{+}{-}$ 6				
	333.3 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 5				
358.60	152.1 $\frac{+}{-}$ 5	1.4 $\frac{+}{-}$ 3				
	289.5 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 6				
	358.7 $\frac{+}{-}$ 2	56 $\frac{+}{-}$ 6				
387.80	215.8 2	48 2				
	380.8 1	100 7	E2			Mult.: (380.8 γ)(527.4 γ)(θ) in ^{248}Cm SF decay (2010Ur03); band assignment.
423.78	65.2 $\frac{+}{-}$ 2	45 $\frac{+}{-}$ 4	M1+E2	0.30 6	1.34 16	Mult., δ : from $\alpha(\text{K})_{\text{exp}}=1.1$ 1 in ^{109}Mo β^- decay (2012Ku28). Also: $\alpha(\text{K})_{\text{exp}}=1.12$ 25 for 65.2 γ +69.1 γ (2012Ku28).
	90.7 $\frac{+}{-}$ 2	47 $\frac{+}{-}$ 7	M1+E2	0.37 +10-11	0.54 9	Mult., δ : from $\alpha(\text{K})_{\text{exp}}=0.45$ 6 in ^{109}Mo β^- decay (2012Ku28).
	354.6 $\frac{+}{-}$ 4	15.8 $\frac{+}{-}$ 13				
	423.9 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 10				
489.32	438.6 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 9				
	471.0 $\frac{+}{-}$ 2	77 $\frac{+}{-}$ 7				
494.55	425.4 1	38 4	D			Mult.: from (946.3 γ)(425.4 γ)(θ) (2010Ur03).
	494.6 1	100 8	Q			Mult.: from (946.3 γ)(494.6 γ)(θ) (2010Ur03).
504.20	298.0 1	100 3				
	435.0 2	25 2				
605.70	433.7 1	100	E2			Mult.: from (566.0 γ)(433.7 γ)(θ); band assignment (2010Ur03).
632.37	426.2 1	100				
	563.9 $\frac{+}{-}$ 1	9				I γ : from 2004Lu20 in ^{252}Cf SF decay.
643.68	139.4 2	32.2 22				
	437.5 1	100 3	E2			Mult.: from (437.5 γ)(587.6 γ)(θ); band assignment (2010Ur03).
702.9	213.5 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 4				
	652.3 $\frac{+}{-}$ 3	23 $\frac{+}{-}$ 4				
745.00	321.4 $\frac{+}{-}$ 2	29.6 $\frac{+}{-}$ 15				
	386.6 $\frac{+}{-}$ 3	18.7 $\frac{+}{-}$ 25				
	412.0 $\frac{+}{-}$ 2	100 $\frac{+}{-}$ 15				
	744.6 $\frac{+}{-}$ 2	70 $\frac{+}{-}$ 8				
915.20	527.4 2	100	Q			Mult.: from (380.8 γ)(527.4 γ)(θ); band assignment (2010Ur03).
964.71	332.4 2	100 20				
	460.4 2	55 10				
	758.8 $\frac{+}{-}$ 5					I γ : 15 in ^{252}Cf SF decay (2004Lu20).
1083.94	440.3 2	100 9				
	579.7 2	27 7				
1171.70	566.0 2	100	E2			Mult.: from (566.0 γ)(433.7 γ)(θ); band assignment (2010Ur03).
1231.35	147.2 3	11.4 14	M1+E2			Mult.: from (719.7 γ)(147.2 γ)(θ); band assignment (2010Ur03).
	587.6 1	100 3	E2			Mult.: from (719.7 γ)(587.6 γ)(θ); band assignment (2010Ur03).
1262.28	297.6 2	88 13				
	618.7 $\frac{+}{-}$ 5					
	629.9 3	100 13				
	758.4 $\frac{+}{-}$ 5					
1383.1	418.4 $\frac{+}{-}$ 5					
	750.8 $\frac{+}{-}$ 5					
1440.75	808.4 2	27 6				
	946.3 2	100 9	E2			Mult.: from (946.3 γ)(494.6 γ)(θ); band assignment (2010Ur03).
1575.2	660.0 3	100				
1635.9	374.0 5	80 20				
	552.1 $\frac{+}{-}$ 5					
	671.0 5	100 20				
	992.4 $\frac{+}{-}$ 5					
1680.4	297.3 $\frac{+}{-}$ 5					

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Tc})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [†]	Comments
1680.4	715.7 § 5			
1749.61	308.9 1	100	D	Mult.: from (946.3 γ)(308.9 γ)(θ) (2010Ur03).
1756.0	1332.2 ‡ 3	100 ‡		
1796.06	564.7 3	100 18		
	712.2 3	29 8		I_{γ} : 58 in ^{252}Cf SF decay (2004Lu20).
1861.3	689.6 2	100	Q	Mult.: from (566.0 γ)(689.6 γ)(θ) (2010Ur03).
1930.69	181.1 1	100 7		
	294.9 § 5			
	668.5 2	80 12		
	699.7 § 5			
	847.0 § 5			
1951.06	155.1 § 5			
	719.7 1	100	E2	Mult.: from (719.7 γ)(802.3 γ)(θ); band assignment (2010Ur03).
2022.85	1599.1 ‡ 3	31.6 ‡ 17		
	1664.2 ‡ 4	12.5 ‡ 15		
	1689.6 ‡ 3	100 ‡ 6		
	2022.9 ‡ 3	20.5 ‡ 17		
2068.4	1365.5 ‡ 4	100 ‡		
2078.1	695.0 § 5			
2136.91	206.3 1	100 14		
	387.3 1	54 10		
	905.2 2	96 7		
	1053.0 § 5			
2286.4	2235.7 ‡ 3	100 ‡		
2346.2	771.0 4	100		
2375.58	238.6 2	100 25		
	444.9 2	43 8		
2552.4	601.3 § 5			
	756.4 § 5			
2642.68	267.0 2	39 11		
	505.9 3	100		
	691.6 § 5			
2660.2	798.9 3	100		
2753.4	201.1 § 5	14		I_{γ} : from 2004Lu20 in ^{252}Cf SF decay.
	802.3 2	100	E2	Mult.: from (719.7 γ)(802.3 γ)(θ); band assignment (2010Ur03).
2940.3	297.5 3	100 33		
	564.8 3	100 33		
3217.4	464.1 § 5			
	665.0 § 5			
3438.9	221.5 § 5			
	685.5 2	100	E2	Mult.: from (685.5 γ)(802.3 γ)(θ); band assignment (2010Ur03).
4072.1	633.2 3	100	E2	Mult.: from (685.5 γ)(633.2 γ)(θ); band assignment (2010Ur03).
4833.1	761.0 5	100		

† From ^{248}Cm SF decay (2010Ur03), unless otherwise stated.‡ From ^{109}Mo β^- decay (2012Ku28).§ From ^{252}Cf SF decay; $\Delta E_{\gamma}=0.5$ keV were estimated by the evaluators.

Deduced by evaluators using experimental conversion coefficient and BrIccMixing v2.3 program.

Adopted Levels, Gammas (continued)

Adopted Levels, Gammas (continued)

(E) Band at 1383 keV,
observed only in ^{252}Cf SF
decay (2010Gu07)

(F) Likely $K\pi=1/2+$,
 $\pi 5/2[422]\otimes 2^+$ band

$^{109}_{43}\text{Tc}_{66}$

^{109}Mo β^- Decay 2012Ku28

Parent ^{109}Mo : $E=0.0$; $J\pi=(5/2+)$; $T_{1/2}=0.61$ s +3-4; $Q(\text{g.s.})=7608$ 15; $\%\beta^-$ decay=100.

2012Ku28: Monoisotopic ^{109}Mo produced in deuteron-induced fissions on natural uranium target using 25 MeV beam at the University of Jyväskylä IGISOL3 facility. Penning trap isotopic purification. Detectors: two 120% Ge detectors, a LEPS spectrometer and a 2 mm-thick plastic scintillator detector. Measured: $E\gamma$, $I\gamma$, ce , $\gamma\gamma$ -coin, $\gamma(\text{x-ray})$ -coin., $\gamma\beta$ -coin.

 ^{109}Tc Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0 §	(5/2+)	0.91 s 3	
7.0 # 3	(5/2-)		
18.36 23	(3/2-)		configuration: Likely the $K\pi=3/2-$, $\pi 3/2[301]$ state. The assignment is tentative.
50.62 21	(3/2+)		configuration: Likely a member of the $K\pi=1/2+$, $\pi 1/2[431]$ band. The assignment is tentative.
69.12 § 15	(7/2+)		
172.0 # 5	(7/2-)		
206.2 § 3	(9/2+)		
333.14 @ 13	(3/2+)		
358.59 @ 13	(7/2+)		
423.78 @ 12	(5/2+)		
489.31 25	(3/2, 5/2)		
702.8 3	(3/2, 5/2, 7/2+)		
745.00 13	(7/2+)		configuration: Likely the $K\pi=7/2+$, $\pi 7/2[413]$ state. The assignment is tentative.
1756.0 4	(3/2, 5/2, 7/2)		
2022.85 18	(3/2+, 5/2, 7/2+)		
2068.4 5	(3/2, 5/2, 7/2)		
2286.3 4	(3/2, 5/2, 7/2+)		

† From a least-squares fit to $E\gamma$.

‡ From Adopted Levels.

§ (A): $K\pi=5/2+$, $\pi 5/2[422]$ band.

(B): $K\pi=5/2-$, $\pi 5/2[503]$ band.

@ (C): Likely $K\pi=1/2+$, $\pi 5/2[422]\otimes 2^+$ band.

 $\gamma(^{109}\text{Tc})$

Decay scheme is incomplete (pandemonium and presence of low-energy transitions with not well established properties) and no values are given for $\%I\beta$, $\%I\gamma$ and $\log ft$. The authors in 2012Ku28 reported ^{109}Mo ground-state to ground-state β^- -decay intensity of 53% 5, which should also include feedings to the 7.0- and 18.0-keV levels. Using this information and the present decay scheme, a normalization factor of 0.100 13 can be deduced. The strongest-fed levels are 333-, 358-, 423- and 745-keV, associated with $\pi g_{9/2}$ orbital, as well as the 2022-keV level, which would support $\nu g_{7/2}$ assignment for the ^{109}Mo parent state.

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\ddagger\&$	Mult. ‡	$\delta^\S$	α	Comments
(7.0)	7.0					
(18.3)	18.36					
32.2 2	50.62	11 3	(E1)		3.28 8	Mult.: $\alpha(K)\text{exp}=4.7$ 4 for $32.2\gamma+43.6\gamma$ in 2012Ku28.
43.6 2	50.62	28.2 16	(E1)		1.42 3	Mult.: $\alpha(K)\text{exp}=4.7$ 4 for $32.2\gamma+43.6\gamma$ in 2012Ku28.
65.2 2	423.78	34.8 27	M1+E2	0.30 6	1.34 16	Mult., δ : from $\alpha(K)\text{exp}=1.1$ 1 in 2012Ku28. Also $\alpha(K)\text{exp}=1.12$ 25 for $65.2\gamma+69.1\gamma$ in 2012Ku28.
69.1 # @ 2	69.12	44 15	M1+E2	0.11 10	0.84 12	Mult., δ : $\alpha(K)\text{exp}=0.90$ 20 and $\alpha(\text{exp})=0.90$ 20 in 2012Ku28. Also $\alpha(K)\text{exp}=1.12$ 25 for $65.2\gamma+69.1\gamma$ in 2012Ku28.
90.7 2	423.78	36 5	M1+E2	0.37 +10-11	0.54 9	Mult., δ : $\alpha(K)\text{exp}=0.45$ 6 in 2012Ku28.
$\times 128.7$ # 2		51 9				
137.0 # 3	206.2	4 1	M1 (+E2)	0.6 6	0.193 93	
152.1 5	358.59	1.4 3	[M1]		0.0880 15	
165.0 3	172.0	4.1 4	[M1+E2]		0.0707 11	
206.1 2	206.2	0.076 25	[E2]		0.0934	$E\gamma, I\gamma$: From Adopted levels.
213.5 2	702.8	37.9 14				
282.5 2	333.14	17.4 18	[M1]		0.01732	
289.5 2	358.59	100 6	[M1]		0.01628	
314.8 3	333.14	9.6 12	[E1]		0.00513	

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¹⁰⁹Mo β⁻ Decay 2012Ku28 (continued) $\gamma(^{109}\text{Tc})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger\&$	Mult. [‡]	α
321.4 2	745.00	17.9 9	[M1]	0.01250
333.3 2	333.14	200 9	[M1]	0.01142
354.6 4	423.78	12.2 10	[M1]	0.00978
358.7@ 2	358.59	56 6	[M1]	0.00951
386.6 3	745.00	11.2 15	[M1]	0.00791
412.0 2	745.00	60 9	[E2]	0.00908
423.9 2	423.78	77 8	[M1]	0.00631
438.6 2	489.31	43 4		
471.0 2	489.31	33 3		
652.3 3	702.8	8.9 16		
744.6@ 2	745.00	42 5	[M1]	1.68×10^{-3}
1332.2 3	1756.0	20.2 17		
1365.5 4	2068.4	6.6 8		
1599.1 3	2022.85	13.1 7		
1664.2 4	2022.85	5.2 6		
1689.6 3	2022.85	41.5 25		
2022.9 3	2022.85	8.5 7		
2235.7 3	2286.3	15.4 8		

[†] From 2012Ku28.

[‡] From experimental conversion coefficient in 2012Ku28, unless otherwise specified.

§ Deduced by evaluators using experimental conversion coefficient and BrIccMixing v2.3 program. If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

Observed also in ^{109}Tc β^- decay.

[@] Observed also in ¹⁰⁹Ru β⁻ decay.

& For absolute intensity per 100 decays, multiply by ≈ 0.10 .

^x γ ray not placed in level scheme.

Decay Scheme

Intensities: relative I_y

^{248}Cm SF Decay 2010Ur03

Parent ^{248}Cm : $E=0.0$; $J\pi=0+$; $T_{1/2}=3.48\times 10^5$ y 6; %SF decay=8.39 16.

2010Ur03: $^{248}\text{Cm}(\text{SF})$ source (5 mg of curium oxide, embedded uniformly in a pellet of potassium chloride). Detectors:

EUROGAM2 array with four LEPS. Measured: $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin., $\gamma\gamma(\theta)$. Deduced: levels, $J\pi$, configurations, particle-rotor model calculations.

Others: 1997Bh06, $^{248}\text{Cm}(\text{SF})$ source with EUROGAM II array. The 137γ - 437γ double gate shows several γ rays of ^{109}Tc .

 ^{109}Tc Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}$	Comments
0.0 §	(5/2+)	0.91 s 3	$T_{1/2}$: From Adopted Levels.
7.0 & 3	(5/2-)		$E(\text{level})$: From Adopted Levels. 2010Ur03 suggests $x < 30$ keV.
69.14 § 8	(7/2+)		
172.00 & 10	(7/2-)		
206.15 § 10	(9/2+)		
387.80 & 10	(9/2-)		
494.55 # 8	(9/2+)		
504.19 § 12	(11/2+)		
605.70 & 14	(11/2-)		
632.32 # 13	(11/2+)		
643.68 § 13	(13/2+)		
915.20 & 22	(13/2-)		
964.63 # 17	(13/2+)		
1083.97 § 17	(15/2+)		
1171.70 & 25	(15/2-)		
1231.34 § 15	(17/2+)		
1262.17 # 19	(15/2+)		
1440.69 15	(13/2+)		
1575.2 & 4			
1635.6 # 6	(17/2+)		
1749.54 @ 16	(15/2-)		
1796.1 § 3	(19/2+)		
1861.3 & 4	(19/2-)		
1930.59 @ 17	(17/2-)		
1951.05 § 18	(21/2+)		
2136.83 @ 17	(19/2-)		
2346.2 & 6			
2375.49 @ 21	(21/2-)		
2642.60 @ 25	(23/2-)		
2660.2 & 5			
2753.3 § 3	(25/2+)		
2940.2 @ 3	(25/2-)		
3438.9 § 4	(29/2+)		
4072.1 § 5	(33/2+)		
4833.1 § 7	(37/2+)		

† From a least-squares fit to $E\gamma$.

‡ From 2010Ur03, based on deduced transition multiplicities, using $\alpha(\text{exp})$ and $\gamma\gamma(\theta)$, and the assigned band structure.

§ (A): $K\pi=5/2+$, $\pi 5/2[422]$ band.

(B): $K\pi=(9/2+)$, $\pi 5/2[422]@2^+$ γ -vibrational band.

@ (C): $K\pi=(15/2-)$ band. Possible configuration= $\pi 5/2[422]@v(1/2[420], 9/2[514])$.

& (D): $K\pi=5/2-$, $\pi 5/2[303]$ band.

 $\gamma(^{109}\text{Tc})$

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\dagger$	Mult. ‡	δ	α	Comments
69.1 1	69.14	192 12	M1+E2	1.9 9	3.9 12	Mult., δ : using $\alpha(K)\text{exp}=2.9$ 8 (2010Ur03).
137.0 1	206.15	220 4	M1+E2			Mult.: (437.5 γ)(137.0 γ)(θ); band assignment (2010Ur03).
139.4 2	643.68	29 2				
147.2 3	1231.34	8 1	M1+E2			Mult.: from (719.7 γ)(147.2 γ)(θ); band assignment (2010Ur03).
165.0 1	172.00	76 4				Mult.: $\alpha(K)\text{exp}=2.2$ 7 (2010Ur03) from comparison of $I\gamma(165\gamma)$ and $I\gamma(K\alpha$ x rays), but the value is too large for either Mult=E1, M1 or E2. (433 γ)(165 γ)(θ) data are also inconclusive.
181.1 1	1930.59	8.7 6				

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^{248}Cm SF Decay 2010Ur03 (continued) $\gamma(^{109}\text{Tc})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. [‡]	Comments
206.1 2	206.15	4.1 9		
206.3 1	2136.83	7 1		
215.8 2	387.80	21 1		
238.6 2	2375.49	12 3		
267.0 2	2642.60	7 2		
297.5 3	2940.2	3 1		
297.6 2	1262.17	7 1		
298.0 1	504.19	100 3		
308.9 1	1749.54	19.2 14	D	Mult.: from (946.3 γ)(308.9 γ)(θ) (2010Ur03).
332.4 2	964.63	20 4		
374.0 § 5	1635.6	4 1		
380.8 1	387.80	44 3	E2	Mult.: (380.8 γ)(527.4 γ)(θ); band assignment (2010Ur03).
387.3 1	2136.83	3.8 7		
425.4 1	494.55	9 1	D	Mult.: from (946.3 γ)(425.4 γ)(θ) (2010Ur03).
426.2 1	632.32	37 4		
433.7 1	605.70	67 5	E2	Mult.: from (566.0 γ)(433.7 γ)(θ); band assignment (2010Ur03).
435.0 2	504.19	25 2		
437.5 1	643.68	90 3	E2	Mult.: from (437.5 γ)(587.6 γ)(θ); band assignment (2010Ur03).
440.3 2	1083.97	22 2		
444.9 2	2375.49	5 1		
460.4 2	964.63	11 2		
494.6 1	494.55	24 2	Q	Mult.: from (946.3 γ)(494.6 γ)(θ) (2010Ur03).
505.9 3	2642.60	18 4		
527.4 2	915.20	30 2	E2	Mult.: from (380.8 γ)(527.4 γ)(θ); band assignment (2010Ur03).
564.7 3	1796.1	7.9 14		
564.8 3	2940.2	3 1		
566.0 2	1171.70	39 3	E2	Mult.: from (566.0 γ)(433.7 γ)(θ); band assignment (2010Ur03).
579.7 2	1083.97	6.0 15		
587.6 1	1231.34	70 2	E2	Mult.: from (719.7 γ)(587.6 γ)(θ); band assignment (2010Ur03).
629.9 3	1262.17	8 1		
633.2 3	4072.1	4 1	E2	Mult.: from (685.5 γ)(633.2 γ)(θ); band assignment (2010Ur03).
660.0 3	1575.2	8.9 19		
668.5 2	1930.59	7 1		
671.0 5	1635.6	5 1		
685.5 2	3438.9	8 1	E2	Mult.: from (685.5 γ)(802.3 γ)(θ); band assignment (2010Ur03).
689.6 2	1861.3	16 2	Q	Mult.: from (566.0 γ)(689.6 γ)(θ) (2010Ur03).
712.2 3	1796.1	2.3 6		
719.7 1	1951.05	31 1	E2	Mult.: from (719.7 γ)(802.3 γ)(θ); band assignment (2010Ur03).
761.0 5	4833.1	2 1		
771.0 4	2346.2	4.1 17		
798.9 3	2660.2	3.6 18		
802.3 2	2753.3	12 1	E2	Mult.: from (719.7 γ)(802.3 γ)(θ); band assignment (2010Ur03).
808.4 2	1440.69	1.8 4		
905.2 2	2136.83	6.7 5		
946.3 2	1440.69	6.7 6	E2	Mult.: from (946.3 γ)(494.6 γ)(θ); band assignment (2010Ur03).

† From 2010Ur03.

‡ From $\alpha(\text{exp})$ and $\gamma\gamma(\theta)$ data in 2010Ur03.

§ Placement of transition in the level scheme is uncertain.

^{252}Cf SF Decay $^{2004}\text{Lu20},^{2010}\text{Gu07}$

Parent ^{252}Cf : $E=0.0$; $J\pi=0+$; $T_{1/2}=2.645$ y 8; %SF decay=3.092 8.

$^{2004}\text{Lu20}$, $^{2010}\text{Gu07}$: ^{252}Cf source ≈ 62 μCi sandwiched between two Fe foils with a thickness of 10 mg/cm^2 at LBNL.

Detectors: Gammasphere array (consisting of 102 Compton-suppressed Ge detectors). Measured: $E\gamma$, $I\gamma$, $\gamma\gamma$. A total of 5.7×10^{11} triple- γ or higher coincident events were collected. Deduced: level scheme, band structure.

Others: 1998Hw04, 1970Wa05, 1971Ho29, 1970Jo20, 1973Ho22.

The interpretation of the collective structures in $^{2004}\text{Lu20}$ was not adopted by the evaluators.

 ^{109}Tc Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}$	Comments
0.0	(5/2+)	0.91 s 3	$T_{1/2}$: From Adopted Levels.
69.37 $\S$ 9	(7/2+)		
206.68 $\S$ 10	(9/2+)		
504.81 $\S$ 11	(11/2+)		
633.21 $\#$ 11	(11/2+)		
644.35 $\S$ 12	(13/2+)		
965.30 $\#$ 12	(13/2+)		
1084.41 $\S$ 12	(15/2+)		
1231.99 $\S$ 13	(17/2+)		
1263.24 $\#$ 13	(15/2+)		
1383.8 $@$ 4	(15/2+)		$E(\text{level}), J\pi$: from $^{2010}\text{Gu07}$.
1636.86 $\#$ 14	(17/2+)		
1681.1 $@$ 4	(17/2+)		$E(\text{level}), J\pi$: From $^{2010}\text{Gu07}$.
1796.69 $\S$ 14	(19/2+)		
1931.7 $\#$ 3	(19/2+)		$E(\text{level}), J\pi$: From $^{2010}\text{Gu07}$.
1951.71 $\S$ 15	(21/2+)		
2078.8 $@$ 6	(19/2+)		$E(\text{level}), J\pi$: From $^{2010}\text{Gu07}$.
2137.46 $\&$ 17	(19/2+)		
2375.99 $\&$ 20	(21/2+)		
2553.03 $\S$ 17	(23/2+)		
2643.35 $\&$ 18	(23/2+)		
2754.08 $\S$ 17	(25/2+)		
3218.13 $\S$ 19	(27/2+)		
3439.56 $\S$ 20	(29/2+)		
4072.7 $\S$ 6	(33/2+)		$E(\text{level}), J\pi$: From $^{2010}\text{Gu07}$.
4834.0 $\S$ 6	(37/2+)		$E(\text{level}), J\pi$: From $^{2010}\text{Gu07}$.

† From a least-squares fit to $E\gamma$.

‡ From $^{2004}\text{Lu20}$, unless otherwise stated.

$\S$ (A): Band 1 in $^{2004}\text{Lu20}$, interpreted as $\pi 7/2[413]$.

$\#$ (B): Band 6 in $^{2004}\text{Lu20}$ (band 2 in $^{2010}\text{Gu07}$), interpreted as $K=11/2+$, 1-phonon γ -vibrational band.

$@$ (C): Band 3 in $^{2010}\text{Gu07}$, interpreted as $K=15/2+$, 2-phonon γ -vibrational band.

$\&$ (D): Band 2 in $^{2004}\text{Lu20}$, interpreted as (19/2+) band.

 $\gamma(^{109}\text{Tc})$

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\dagger$	Mult. $\S$	$\delta^\S$	α	Comments
69.43 10	69.37		M1+E2	0.16 +7-12	0.88 10	Mult., δ : using $\alpha(\text{exp})=0.80$ 9 ($^{2004}\text{Lu20}$) from intensity balance considerations.
$\times$ 115.1 2						$E\gamma$: observed by 1971Ho29 and 1970Jo20. 1970Jo20 measured $T_{1/2}=18$ ns 4 for this γ .
$\times$ 119.7 2						$E\gamma$: observed by 1971Ho29 and 1970Jo20. 1970Jo20 measured $T_{1/2}=16$ ns 5 for this γ .
$\times$ 123.2 2						$E\gamma$: observed by 1970Wa05 and 1971Ho29.
$\times$ 125.3 2						$E\gamma$: observed by 1973Ho22 only.
137.26 10	206.68	100	M1+E2	0.6 6	0.19 10	Mult., δ : using $\alpha(\text{exp})=0.19$ 9 ($^{2004}\text{Lu20}$) from intensity balance considerations.
139.63 10	644.35	23.3				
147.49 10	1231.99	2.9				
155.13 10	1951.71	1.6				
201.1 1	2754.08	0.4				
206.54 15	206.68	<1.5				
221.49 23	3439.56					
238.58 13	2375.99	0.4				

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^{252}Cf SF Decay 2004Lu20,2010Gu07 (continued) $\gamma(^{109}\text{Tc})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Comments
267.41 15	2643.35	0.2	
294.9 $\frac{5}{2}$	1931.7		
297.3 $\frac{5}{2}$	1681.1		
297.91 10	1263.24	3.6	
298.08 10	504.81	28.0	
332.09 10	965.30	7.8	
373.62 12	1636.86	0.3	
418.4 $\frac{5}{2}$	1383.8		
426.53 10	633.21	9.9	
435.51 10	504.81	2.8	
437.58 10	644.35	22.4	
440.12 10	1084.41	5.7	
460.44 13	965.30	1.2	
464.10 13	3218.13		
505.89 12	2643.35	0.5	
552.1 $\frac{5}{2}$	1636.86		
563.9 1	633.21	0.9	
564.70 10	1796.69	1.9	
579.56 10	1084.41	1.8	
587.59 10	1231.99	17.9	
601.33 23	2553.03	0.8	
618.7 $\frac{5}{2}$	1263.24		
630.08 10	1263.24	2.1	
633.1 $\frac{5}{2}$	4072.7		
665.01 22	3218.13	0.3	
668.6 $\frac{5}{2}$	1931.7		
671.57 11	1636.86	0.7	
685.46 11	3439.56	1.6	
691.55 18	2643.35	0.2	
695.0 $\frac{5}{2}$	2078.8		
699.7 $\frac{5}{2}$	1931.7		
712.43 11	1796.69	1.1	
715.7 $\frac{5}{2}$	1681.1		
719.57 10	1951.71	7.9	
750.8 $\frac{5}{2}$	1383.8		
756.40 15	2553.03	0.4	
758.4 $\frac{5}{2}$	1263.24		
758.8 $\frac{5}{2}$	965.30		
761.37 12	4834.0	0.4	$E\gamma$: from 2004Lu20; placement from 2010Gu07. This gamma was placed by 2004Lu20 from a level at E=4200.8.
802.33 10	2754.08	2.8	
847.0 $\frac{5}{2}$	1931.7		
905.51 13	2137.46	1.4	
992.4 $\frac{5}{2}$	1636.86		
1053.0 5	2137.46		

† From 2004Lu20, unless otherwise stated. The $E\gamma$ uncertainties are estimated by evaluators by adding in quadrature the quoted statistical and systematic (0.1 keV) uncertainties in 2004Lu20.

$\frac{5}{2}$ From 2010Gu07, $\Delta E\gamma=0.5$ keV were assumed by the evaluators.

$\S$ From $\alpha(\text{exp})$ using intensity balances consideration. BrIccMixing v2.3 program was used in δ deduction.

x γ ray not placed in level scheme.

Adopted Levels, Gammas $Q(\beta^-)=4264$ 10; $S(n)=5148$ 12; $S(p)=12105$ 12; $Q(\alpha)=-5818$ 13 2012Wa38. ^{109}Ru Levels

Cross Reference (XREF) Flags

A ^{109}Tc β^- Decay
 B ^{248}Cm SF Decay
 C ^{252}Cf SF Decay
 D ^{254}Cf SF Decay
 E $^{238}\text{U}(\alpha, \text{F}\gamma)$

E(level) [†]	$J\pi^{\ddagger}$	XREF	$T_{1/2}$	Comments
0.0 [§]	(5/2+)	A CDE	34.4 s 2	% β^- =100. $J\pi$: direct feeding in ^{109}Tc β^- decay ($J\pi=(5/2+)$); systematics of odd-N Ru isotopes; configuration assignment. $T_{1/2}$: Weighted average of 34.5 s 10 (using 206, 226 γ (t) in 1978Fr16), 33 s 3 (using 206, 358 γ (t) in 1976MaYL), 34.5 s 2 (using 68, 206, 226, 890 γ (t) in 1987Ka29, 1986KaZS) 32.2 s 10 (using 116.4, 206, 226, and 358 γ (t) in 1969WiZX), 34.5 s 24 (1967Fr16, 1967Gr25, using chemical separation), and 35 s 2 (using 206 γ (t) in 1976Tr02). Other: 35 s (1971Ri02); 1987Ka29 found no evidence for a 12.6 s activity reported by 1978Fr16, 1969WiZx. configuration: probably a mixture of $v5/2[413]$ or $v5/2[402]$ Nilsson configurations. The assignment is consistent with the observed $g_K-g_R=0.4$ from the in-band cascade-to-crossover branching ratios, compared to 0.7 and 0.05 expected from deformed Woods-Saxon model for the $v5/2[402]$ and $v5/2[413]$ orbitals, respectively.
68.75 12	(1/2+)	A	0.50 μ s 20	$J\pi$: 68.8 γ E2 to (5/2+); probable $v1/2[411]$ Nilsson configuration. $T_{1/2}$: using 68.8 γ (t) in ^{109}Tc β^- decay (1992PeZX).
96.14 [@] 15	(5/2-)	A CDE	0.68 μ s 3	configuration: probable $K\pi=1/2+$, $v1/2[411]$ Nilsson configuration. $\mu=-0.550$ 25 (1976ChZD). $J\pi$: 96.2 γ E1 to (5/2+); band assignment; possible configuration= $v5/2[532]$. $T_{1/2}$: from 96 γ (t), weighted average of 0.68 μ s 3 (1999Ge01), 0.75 μ s 15 (1976ChZD), 0.54 μ s 15 (1974ClZX), and 0.54 μ s 17 (1992PeZX). Other: 0.55 μ s from 96 γ (t) in 1970Jo20. μ : from $g=-0.22$ 1 using TDPAD (1976ChZD). configuration: $v5/2[532]$ Nilsson orbital. From the experimental g factor, one can deduce a $g_K=-0.20$, assuming $g_R=0.28$, which is consistent with $g_K(v5/2[532])=-0.38$ and $g_K(v5/2[402])=-0.42$, but not with $g_K(v5/2[413])=+0.33$ and $g_K(v1/2[411])=+1.75$. The larger energy staggering supports $v5/2[532]$, compared to $v5/2[402]$.
131.84 [@] 16	(7/2-)	A CDE	1.0 ns 2	$J\pi$: 35.7 γ M1 to (5/2-), 131.8 γ (E1) to (5/2+); band assignment. $T_{1/2}$: from ^{254}Cf SF decay (1981SeZW) using time-of-flight method.
137.83 12	(3/2-)	A	1.44 ns 11	$J\pi$: 137.9 γ E1+M2 to (5/2+), 69.1 γ to (1/2+). $T_{1/2}$: from β^- -137.9 γ (t) in ^{109}Tc β^- decay (1995Sc24).
185.0 [§] 3	(7/2+)	C E		$J\pi$: 185.1 γ M1+E2 to (5/2+); band assignment.
190.9 3	(3/2-)	A		$J\pi$: 122.2 γ E1 to (1/2+); direct feeding from (5/2+) in ^{109}Tc β^- decay.
195.03 20	(3/2, 5/2, 7/2)+	A	0.20 ns 6	$J\pi$: 195.0 γ M1 to (5/2+), 98.9 γ (E1) to (5/2-). $T_{1/2}$: from β^- -195 γ (t) in ^{109}Tc β^- decay (1995Sc24).
197.41 13	(3/2-)	A		$J\pi$: 128.7 γ E1+M2 to (1/2+), 197.4 γ to (5/2+), direct feeding from (5/2+) in ^{109}Tc β^- decay.
230.07 [@] 24	(9/2-)	A CDE	0.95 ns 5	$J\pi$: 98.2 γ (M1) to (7/2-), 134.2 γ to (5/2-); band assignment. $T_{1/2}$: from ^{254}Cf SF decay (1981SeZW) using time-of-flight method.
255.57 14	(3/2+)	A		$J\pi$: 186.8 M1+E2 to (1/2+), 58.2 γ E1 to (3/2-), 117.7 γ E1 to (3/2-), 255.6 γ to (5/2+).
304.2 [@] 4	(11/2-)	CDE	0.70 ns 5	$J\pi$: 172.3 (E2) to (7/2-); band assignment. $T_{1/2}$: from ^{254}Cf SF decay (1981SeZW) using time-of-flight method.
332.20 [#] 22	(7/2+)	A C		$J\pi$: 332.5 γ to (5/2+); band assignment. configuration: possible $v7/2[404]$ Nilsson state (2009Di12 in ^{252}Cf SF decay). The assignment is tentative.
405.42 19	(3/2, 5/2, 7/2-)	A		$J\pi$: 208.0 γ to (3/2-); direct feeding from (5/2+) in ^{109}Tc β^- decay.
407.7 [§] 4	(9/2+)	C E		$J\pi$: 222.7 γ M1+E2 to (7/2+), 407.8 γ (E2) to (5/2+); band assignment.

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Adopted Levels, Gammas (continued) ^{109}Ru Levels (continued)

E(level) [†]	J $\pi^{\ddagger}$	XREF	T _{1/2}	Comments
514.57 17	(3/2, 5/2+)	A	0.16 ns 13	J π : 514.5 γ to (5/2+), 445.8 γ to (1/2+), 376.7 γ to (3/2-); direct feeding from (5/2+) in ^{109}Tc β^- decay. T _{1/2} : from β -445.8 γ (t) in ^{109}Tc β^- decay (1995Sc24).
553.4# 5	(9/2+)	C		J π : 368.5 γ to (7/2+); band assignment.
618.9@ 5	(13/2-)	C E		J π : 314.7 γ to (11/2-), 388.9 γ to (9/2-); band assignment.
627.94 17	(3/2+, 5/2, 7/2-)	A		J π : direct feeding from (5/2+) in ^{109}Tc β^- decay; 490.2 γ to (3/2-), 295.7 γ to (7/2+).
657.8§ 4	(11/2+)	C E		J π : 250.1 γ to (9/2+), 472.8 γ to (7/2+); band assignment.
678.9@ 5	(15/2-)	C E	=0.15 ns	J π : 374.7 γ (E2) to (11/2-); band assignment. T _{1/2} : from ^{254}Cf SF decay (1981SeZW) using time-of-flight method.
777.1# 4	(11/2+)	C		J π : 369.5 γ (M1) to (9/2+), 444.8 γ to (7/2+); band assignment.
948.4§ 5	(13/2+)	C E		J π : 290.6 γ to (11/2+), 540.7 γ to (9/2+); band assignment.
995.01 25	(3/2, 5/2, 7/2-)	A		J π : 804.7 γ to (3/2-); direct feeding from (5/2+) in ^{109}Tc β^- decay.
1056.0# 5	(13/2+)	C		J π : 502.5 γ to (9/2+); band assignment.
1159.0 3	(3/2, 5/2, 7/2)	A		J π : 1158.7 γ to (5/2+); direct feeding from (5/2+) in ^{109}Tc β^- decay.
1184.0@ 6	(17/2-)	C E		J π : 505.1 γ to (15/2-), 565.1 γ to (13/2-); band assignment.
1220.5@ 6	(19/2-)	C E		J π : 541.6 γ (E2) to (15/2-); band assignment.
1256.2§ 5	(15/2+)	C E		J π : 307.8 γ to (13/2+), 598.4 γ to (11/2+); band assignment.
1267.8 5	(3/2, 5/2, 7/2)	A		J π : 1267.8 γ to (5/2+); direct feeding from (5/2+) in ^{109}Tc β^- decay.
1350.5# 5	(15/2+)	C		J π : 573.4 γ to (11/2+); band assignment.
1502.6 3	(3/2, 5/2, 7/2)	A		J π : 1502.6 γ to (5/2+); direct feeding from (5/2+) in ^{109}Tc β^- decay.
1600.1§ 5	(17/2+)	C E		J π : 343.9 γ to (15/2+), 651.7 γ to (15/2+); band assignment.
1677.0# 5	(17/2+)	C		J π : 621.0 γ to (13/2+); band assignment.
1890.6@ 7	(21/2-)	C E		J π : 706.6 γ to (17/2-); band assignment.
1911.5@ 7	(23/2-)	BC E	1.45 ps 22	J π : 691.0 γ (E2) to (19/2-); band assignment. T _{1/2} : using the Doppler Profile Method in ^{248}Cm SF decay (2012Sm02). statistical uncertainty=0.16 ps, systematic uncertainty=0.15 ps.
1964.57 24	(3/2+, 5/2, 7/2)	A		J π : 1632.6 γ to (7/2+); direct feeding from (5/2+) in ^{109}Tc β^- decay.
1965.9§ 7	(19/2+)	C E		J π : 709.7 γ to (15/2+); band assignment.
2011.8# 5	(19/2+)	C		J π : 661.2 γ to (15/2+); band assignment.
2328.6# 6	(21/2+)	C E		J π : 651.6 γ to (17/2+); band assignment.
2364.3§ 6	(21/2+)	C		J π : 764.2 γ to (17/2+); band assignment.
2693.1# 6	(23/2+)	C		J π : 681.3 γ to (19/2+); band assignment.
2715.0@ 7	(25/2-)	C E		J π : 824.4 γ to (21/2-); band assignment.
2733.5@ 9	(27/2-)	BC E	0.56 ps 8	J π : 822.0 γ to (23/2-); band assignment. T _{1/2} : using the Doppler Profile Method in ^{248}Cm SF decay (2012Sm02). statistical uncertainty=0.062 ps, systematic uncertainty=0.055 ps.
2773.3§ 9	(23/2+)	C E		J π : 807.4 γ to (19/2+); band assignment.
2994.7# 7	(25/2+)	C		J π : 666.1 γ to (21/2+); band assignment.
3179.3§ 8	(25/2+)	C		J π : 815.0 γ to (21/2+); band assignment.
3390.9# 8	(27/2+)	C		J π : 697.8 γ to (23/2+); band assignment.
3635.9@ 9	(29/2-)	C E		J π : 920.9 γ to (25/2-); band assignment.
3662.3§ 10	(27/2+)	C E		J π : 889.0 γ to (23/2+); band assignment.
3666.6@ 10	(31/2-)	C E		J π : 933.1 γ to (27/2-); band assignment.
4022.5§ 10	(29/2+)	C		J π : 843.2 γ to (25/2+); band assignment.
4167.2# 10	(31/2+)	C		J π : 776.3 γ to (27/2+); band assignment.
4622.3§ 14	(31/2+)	E		J π : 960 γ to (27/2+); band assignment.
4639.0@ 14	(33/2-)	E		J π : 1003 γ to (29/2-); band assignment.
4693.7@ 14	(35/2-)	E		J π : 1027 γ to (29/2-); band assignment.
5804.7@ 18	(39/2-)	E		J π : 1111 γ to (29/2-); band assignment.

[†] From a least-square fit to E γ .[‡] From the measured transition multiplicities and the apparent band structures.§ (A): K π =5/2+ band, a mixture between v5/2+[413] and v5/2+[402] Nilsson configurations.

(B): v7/2[404] band (2009Di12).

@ (C): v5/2[532] band (1995Bu14).

Adopted Levels, Gammas (continued)

$\gamma(^{109}\text{Ru})$						
E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. #	$\delta@&$	α	Comments
68.75	68.8 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$	E2		4.97 9	Mult.: $\alpha(K)_{\text{exp}}=3.5$ 9 and $K/L=3.0$ 2 (1992PeZX). B(E2)(W.u.)=4.0 16.
96.14	96.2 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$	E1		0.1557	Mult.: $\alpha(K)_{\text{exp}}=0.13$ 2 (1992PeZX); $a_2/a_0=+0.08$ 5, $a_4/a_0=0.07$ 6 (1976ChZD). B(E1)(W.u.)=4.24 $\times 10^{-7}$ 19.
131.84	35.7 $\frac{1}{2}^+$ 2	88 $\frac{1}{2}^+$ 6	M1		6.02 13	Mult.: $\alpha(K)_{\text{exp}}=5.2$ 14 (1992PeZX). B(M1)(W.u.)=0.059 13.
	131.8 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 10	(E1)		0.0627	Mult.: $a_2/a_0=-0.14$ 4, $a_4/a_0=0.06$ 4 for (172 γ)(132 γ)(θ) in ^{252}Cf SF decay (1995Bu14). B(E1)(W.u.)=1.8 $\times 10^{-5}$ 5.
137.83	69.1 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 5	[E1]		0.403 7	B(E1)(W.u.)=0.00028 3.
	137.9 $\frac{1}{2}^+$ 2	78 $\frac{1}{2}^+$ 5	E1		0.0551	Mult.: from $\alpha(K)_{\text{exp}}=0.084$ 10 (1992PeZX); $\delta=0.20$ 3 from $\alpha(K)_{\text{exp}}$, but B(M2)(W.u.)=250 80 exceeds RUL(IV)=1 by more than 3 sigma. B(E1)(W.u.)=2.8 $\times 10^{-5}$ 3.
185.0	185.1 5	100	M1+E2	-0.25 6	0.062 3	Mult., δ : from $a_2/a_0=-0.16$ 2, $a_4/a_0=0.01$ 3 for (473 γ)(185 γ)(θ) (2009Go18). Other value: $\delta(E2/M1)=-2.0$ 4 (2009Go18).
190.9	122.2 $\frac{1}{2}^+$ 4	100	E1		0.0780 14	Mult.: $\alpha(K)_{\text{exp}}=0.080$ 14 (1992PeZX).
195.03	98.9 $\frac{1}{2}^+$ 2	2.6 $\frac{1}{2}^+$ 4	(E1)		0.1438	Mult.: $\alpha(K)_{\text{exp}}=0.26$ 5 for both 98.2 γ and 98.9 γ (1992PeZX). B(E1)(W.u.)=3.7 $\times 10^{-5}$ 13.
	195.0 $\frac{1}{2}^+$ 3	100 $\frac{1}{2}^+$ 2	M1		0.0500	Mult.: $\alpha(K)_{\text{exp}}=0.039$ 4 (1992PeZX). B(M1)(W.u.)=0.014 5.
197.41	128.7 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 2	E1+M2	0.152 +21-24	0.095 8	Mult., δ : $\alpha(K)_{\text{exp}}=0.087$ 7 (1992PeZX).
	197.4 $\frac{1}{2}^+$ 2	15.1 $\frac{1}{2}^+$ 22				
230.07	98.2 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$	(M1)		0.326	Mult.: $\alpha(K)_{\text{exp}}=0.26$ 5 for both 98.2 γ and 98.9 γ (1992PeZX). B(M1)(W.u.)=0.0171 10.
	134.2 5	7	[E2]		0.452 9	B(E2)(W.u.)=21.7 13.
255.57	58.2 $\frac{1}{2}^+$ 2	25 $\frac{1}{2}^+$ 3	E1		0.657 12	Mult.: $\alpha(K)_{\text{exp}}=0.6$ 3 (1992PeZX).
	117.7 $\frac{1}{2}^+$ 2	62 $\frac{1}{2}^+$ 6	E1		0.0870	Mult.: $\alpha(K)_{\text{exp}}=0.09$ 5 (1992PeZX).
	186.8 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 4	M1+E2	0.5 3	0.073 16	Mult., δ : $\alpha(K)_{\text{exp}}=0.066$ 12 (1992PeZX); other: E1+M2 with $\delta=0.42$ 7.
	255.6 $\frac{1}{2}^+$ 3	54 $\frac{1}{2}^+$ 4				
304.2	74.2 5	100 10	[M1]		0.720 18	I γ : From 1981SeZW in ^{254}Cf SF decay. B(M1)(W.u.)=0.038 7.
	172.3 5	26 10	(E2)		0.185 4	I γ : From 1981SeZW in ^{254}Cf SF decay. Mult.: $a_2/a_0=0.12$ 3, $a_4/a_0=0.03$ 3 for (374 γ)(172 γ)(θ)(1995Bu14). B(E2)(W.u.)=22 9.
332.20	147.4 5	10				
	332.5 5	100				
405.42	208.0 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 5				
	267.7 $\frac{1}{2}^+$ 3	18 $\frac{1}{2}^+$ 3				
407.7	222.7 5	34	M1+E2	-0.35 6	0.0396 15	I γ : Other: 72 6 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01). Mult., δ : from $a_2/a_0=-0.20$ 3, $a_4/a_0=-0.03$ 2 for (540.7 γ)(222.7 γ)(θ) (2009Go18). Other value: $\delta(E2/M1)=-1.8$ 4 (2009Go18).
	407.8 5	100	(E2)		0.00991	Mult.: $a_2/a_0=-0.08$ 7, $a_4/a_0=-0.06$ 11 for (369.5 γ)(407.8 γ)(θ) (2008Di11).
514.57	324.0 $\frac{1}{2}^+$ 5	$\leq 10\frac{1}{2}^+$				
	376.7 $\frac{1}{2}^+$ 3	76 $\frac{1}{2}^+$ 3				
	445.8 $\frac{1}{2}^+$ 2	90 $\frac{1}{2}^+$ 4				
	514.5 $\frac{1}{2}^+$ 3	100 $\frac{1}{2}^+$ 5				
553.4	368.5 5	100				
618.9	314.7 5	100				I γ : Other: 74 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).
	388.9 5	63				I γ : Other: 100 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).
627.94	295.7 $\frac{1}{2}^+$ 3					
	490.2 $\frac{1}{2}^+$ 2	100 $\frac{1}{2}^+$ 5				
	627.9 $\frac{1}{2}^+$ 3	31 $\frac{1}{2}^+$ 4				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Ru})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [#]	α	Comments
657.8	250.1 5	54			I γ : Other: 31 9 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).
	472.8 5	100			
678.9	60.0 5		[M1]	1.33 4	E γ : 374.2 (1973Ho22), 374.2 (1981SeZW). Mult.: $a_2/a_0=0.12$ 3, $a_4/a_0=0.03$ 3 for (374 γ)(172 γ)(θ) and $a_2/a_0=0.12$ 2, $a_4/a_0=-0.01$ 2 (541 γ)(374 γ)(θ) (1995Bu14). B(E2)(W.u.)=16.
	374.7 5	100	(E2)	0.01295	
777.1	223.7 5	16			(M1) 0.00971 Mult.: $a_2=-0.08$ 7, $a_4=-0.06$ 11 (369.5 γ)(407.8 γ)(θ) (2009Di12).
	369.5 5	100			
	444.8 5	74			
948.4	290.6 5	41			I γ : Other: 14 13 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).
	540.7 5	100			
995.01	589.7 $\frac{5}{2}$ 3	100 $\frac{5}{2}$ 10			
	804.0 $\frac{5}{2}$ 3	97 $\frac{5}{2}$ 13			
	995.0 $\frac{5}{2}$ 5	65 $\frac{5}{2}$ 11			
1056.0	398.2 5	89			
	502.5 5	100			
	648.3 5	64			
1159.0	531.2 $\frac{5}{2}$ 3				
	964.6 $\frac{5}{2}$ a 3				
	1158.7 $\frac{5}{2}$ 5	100 $\frac{5}{2}$			
1184.0	505.1 5	54			I γ : Other: 66 10 in $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).
	565.1 5	100			
1220.5	36.5 5				(E2) 0.00424 Mult.: $a_2/a_0=0.19$ 5, $a_4/a_0=-0.05$ 5 for (691 γ)(541 γ)(θ) and $a_2/a_0=0.12$ 2, $a_4/a_0=-0.01$ 2 (541 γ)(374 γ)(θ) (1995Bu14).
	541.6 5	100			
1256.2	307.8 5	14			
	598.4 5	100			
1267.8	1073.5 $\frac{5}{2}$ a 3				
	1267.8 $\frac{5}{2}$ 5	100 $\frac{5}{2}$			
1350.5	402.2 5	25			
	573.4 5	100			
	692.8 5	15			
1502.6	1502.6 $\frac{5}{2}$ 3				
1600.1	343.9 5	6			
	651.7 5	100			
1677.0	420.8 5	25			
	621.0 5	84			
	728.6 5	100			
1890.6	670.1 5	8			
	706.6 5	100			
1911.5	691.0 5	100	(E2)	0.00218	Mult.: $a_2/a_0=0.19$ 5, $a_4/a_0=-0.05$ 5 for (691 γ)(541 γ)(θ) (1995Bu14). B(E2)(W.u.)=80 13.
1964.57	1632.6 $\frac{5}{2}$ 3				
	1964.3 $\frac{5}{2}$ 3				
1965.9	709.7 5	100			
2011.8	411.7 5	21			
	661.2 5	100			
	755.6 5	15			
2328.6	651.6 5	31			
	728.5 5	100			
2364.3	764.2 5	100			
2693.1	328.8 5	100			
	681.3 5	75			
2715.0	803.5 5	5			
	824.4 5	100			
2733.5	822.0 5	100	[E2]	1.40 $\times 10^{-3}$	
2773.3	807.4 5	100			B(E2)(W.u.)=87 13.
2994.7	630.4 5	100			
	666.1 5	41			
3179.3	815.0 5	100			
3390.9	697.8 5	100			
3635.9	920.9 5	100			

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Ru})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
3662.3	889.0 5	100
3666.6	933.1 5	100
4022.5	843.2 5	100
4167.2	776.3 5	100
4622.3	960 § 1	100
4639.0	1003 § 1	100
4693.7	1027 § 1	100
5804.7	1111 § 1	100

† From ^{252}Cf SF decay (2009Di12,2008Di11), unless otherwise stated. $\Delta E\gamma=0.5$ keV was estimated by the evaluators.

‡ From ^{109}Tc β^- decay (1992PeZX,1989Gr23).

§ From $^{238}\text{U}(\alpha, F\gamma)$ (2006Wu01).

Based on ce data in ^{109}Tc β^- decay (1992PeZX) and $\gamma\gamma(\theta)$ in ^{252}Cf SF decay (1995Bu14,2009Go18).

@ Deduced by evaluators from ce data in ^{109}Tc β^- decay (1992PeZX) using the BrIccMixing program, unless otherwise stated.

& If no value given it was assumed $\delta=1.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

^a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued) $^{109}_{44}\text{Ru}_{65}$

¹⁰⁹Tc β⁻ Decay 1992PeZX,1989Gr23

Parent ¹⁰⁹Tc: E=0.0; Jπ=(5/2+); T_{1/2}=0.91 s 3; Q(g.s.)=6456 13; %β⁻ decay=100.

1992PeZX: Activity from ²³⁸U(p,f) E_p=25 MeV, IGISOL. Detectors: planar Ge detectors for x ray, large coaxial HPGe detectors for γ rays, plastic scintillators for β particles. Measured Eγ, Iγ, E(x-ray), I(x-ray), γγ-coin, γ(x-ray)γ-coin, γ(t), E(ce), I(ce). Deduced levels, Jπ, T_{1/2}, γ-ray branching ratios, conversion coefficients, γ-ray multipolarities.

1989Gr23: Activity from ²³⁹Pu(n,f) on-line mass separator LOHENGRIN at ILL, Grenoble. Detectors: plastic scintillator telescope, Ge(I). Measured: Eγ, Iγ, βγ coin., α(K)exp, γγ coin, βγ(t).

Others: 1995Sc24: activity from ²⁴⁹Cf(n,f), radiochemical separation, online SISAK Method. Measured: βγ(t);

Detectors: thin plastic scintillator, two Ge(Li). 1999Ge01: activity from ²⁴¹Pu(n,f) on-line ms LOHENGRIN.

Measured γ, γ(t) 1990Al43: activity from ²⁴⁹Cf(n,f), radiochemical separation. Detectors: Planar HPGe (2 cm³) and co-axial Ge(Li) (159 cm³) and HPGe (75 cm³). Measured: Eγ, Iγ, γγ(t).

¹⁰⁹Ru Levels

E(level) [†]	Jπ [‡]	T _{1/2}	Comments
0.0	(5/2+)	34.4 s 2	T _{1/2} : from Adopted Levels.
68.76 12	(1/2+)	0.50 μs 20	T _{1/2} : From 1992PeZX (using 68.8γ(t)).
96.09 15	(5/2-)	0.68 μs 3	T _{1/2} : From γ(t) in 1999Ge01. Other: 0.75 μs 15 (1976ChZD), 0.54 μs 17 (1992PeZX, using 96.1γ(t)).
131.80 16	(7/2-)		
137.84 12	(3/2-)	1.44 ns 11	T _{1/2} : Using 137.9γ(t) (1995Sc24).
190.9 3	(3/2-)		
194.89 17	(3/2, 5/2, 7/2)+	0.20 ns 6	T _{1/2} : Using 195γ(t) (1995Sc24).
197.41 14	(3/2-)		
230.0 3	(9/2-)		
255.57 14	(3/2+)		
332.05 20	(7/2+)		E(level): Also from coincidence of 138γ and 195γ (1990Al43,1989Gr23).
405.42 19	(3/2, 5/2, 7/2-)		
514.57 17	(3/2, 5/2+)	0.16 ns 13	T _{1/2} : Using 445.8γ(t) (1995Sc24).
627.97 16	(3/2+, 5/2, 7/2-)		
995.0 3	(3/2, 5/2, 7/2-)		
1159.29 19	(3/2, 5/2, 7/2)		
1268.2 3	(3/2, 5/2, 7/2)		
1502.6 3	(3/2, 5/2, 7/2)		
1964.49 24	(3/2+, 5/2, 7/2)		

[†] From a least-square fit to Eγ.

[‡] From Adopted Levels.

β⁻ radiations

The decay scheme is incomplete (pandemonium). Thus, Iβ and log ft values are tentative and given as approximate.

Eβ ⁻	E(level)	Iβ ⁻	Log ft	Comments
(5188 13)	1268.2	≈2.77	≈5.8	
(5297 13)	1159.29	≈4.50	≈5.6	
(5461 13)	995.0	≈2.31	≈6.0	
(5828 13)	627.97	≈3.11	≈6.0	
(5941 13)	514.57	≈8.49	≈5.6	
(6051 13)	405.42	≈2.05	≈6.2	
(6124 13)	332.05	≈3.58	≈6.0	
(6200 13)	255.57	≈4.48	≈5.9	
(6226 13)	230.0	≈0.71	≈8.71 ^u	
(6259 13)	197.41	≈3.81	≈6.0	
(6261 13)	194.89	≈13.4	≈5.5	
(6265 13)	190.9	≈1.52	≈6.4	
(6318 13)	137.84	≈2.1	≈6.3	
(6324 13)	131.80	≈4.0	≈6.0	
(6360 13)	96.09	≈1.9	≈6.4	
(6387 13)	68.76	≈6.2	≈5.9	
(6456 13)	0.0	35 6	≈5.1	Iβ ⁻ : From 2012Ku28.

¹⁰⁹Tc β⁻ Decay 1992PeZX,1989Gr23 (continued)

γ(¹⁰⁹Ru)

I_γ normalization: From ΣI(γ+ce)[g.s.(¹⁰⁹Ru)]=65% 6, using Iβ₀=35% 6, reported for the g.s. to g.s. decay in 2012Ku28. Other: 0.19 3, deduced from %γ/fission of 0.167% 10 (128.5γ) from 1969WiZX and the cumulative fission yield of 0.190% 25 for ¹⁰⁹Tc from JEFF3.1.1 data library. Since the decay scheme is incomplete (pandemonium), NR and %I_γ are tentative and given as approximate.

E _γ [†]	E(level)	I _γ [†] &	Mult.#	δ# [@]	α	Comments
35.7 2	131.80	4.6 3	M1		6.02 13	%I _γ =0.57, using the calculated normalization. Mult.: α(K)exp=5.2 14 (1992PeZX).
58.2 2	255.57	3.3 4	E1		0.657 12	%I _γ =0.41, using the calculated normalization. Mult.: α(K)exp=0.6 3 (1992PeZX).
68.8 2	68.76	33.5 14	E2		4.97 9	%I _γ =4.1, using the calculated normalization. E _γ : Other: 68.7 3 (1990Al43). I _γ : Other: 54 5, includes also I _γ (69.1γ) (1990Al43).
69.1 2	137.84	30.6 15	[E1]		0.403 7	Mult.: α(K)exp=3.5 9 and K/L=3.0 2 (1992PeZX). %I _γ =3.8, using the calculated normalization. I _γ : Other: 54 5, includes also I _γ (68.8γ) (1990Al43).
96.2 2	96.09	44.3 9	E1		0.1557	%I _γ =5.5, using the calculated normalization. E _γ : Other: 95.9 3 in 1990Al43. I _γ : Other: 64 6 in 1990Al43.
98.2 2	230.0	4.0 3	(M1)		0.326	Mult.: α(K)exp=0.13 2 (1992PeZX). %I _γ =0.50, using the calculated normalization. Mult.: α(K)exp=0.26 5 for both 98.2γ and 98.9γ (1992PeZX).
98.9 2	194.89	2.6 4	(E1)		0.1438	%I _γ =0.32, using the calculated normalization. Mult.: α(K)exp=0.26 5 for both 98.2γ and 98.9γ (1992PeZX).
117.7 2	255.57	8.3 8	E1		0.0870	%I _γ =1.03, using the calculated normalization. Mult.: α(K)exp=0.09 5 (1992PeZX).
122.2 4	190.9	19.0 10	E1		0.0780 14	%I _γ =2.4, using the calculated normalization. Mult.: α(K)exp=0.080 14 (1992PeZX).
128.7 2	197.41	45.0 10	E1+M2	0.152 +21-24	0.095 8	%I _γ =5.6, using the calculated normalization. E _γ : Other: 128.4 3 (1990Al43). I _γ : Other: 54 5 (1990Al43). Mult.: δ: α(K)exp=0.087 7 (1992PeZX).
131.8 2	131.80	5.2 5	(E1)		0.0627	%I _γ =0.64, using the calculated normalization.
134.2 5	230.0	0.28 2	[E2]		0.452 9	%I _γ =0.035, using the calculated normalization. E _γ ,I _γ : From Adopted Levels and I _γ (98.2γ)=4.0.
137.9 2	137.84	24.0 14	E1		0.0551	%I _γ =3.0, using the calculated normalization. E _γ : Others:137.8 3 (1990Al43), 137.7 3 (1989Gr23). I _γ : Other: 27 3 (1990Al43).
^x 172.0 2		2.5 6				Mult.: δ: α(K)exp=0.084 10 (1992PeZX).
186.8 2	255.57	13.3 5	M1+E2	0.5 3	0.073 16	%I _γ =0.31, using the calculated normalization. %I _γ =1.65, using the calculated normalization. Mult.: δ: α(K)exp=0.066 12 (1992PeZX).
195.0 3	194.89	100.0 20	M1		0.0500	%I _γ =12.4, using the calculated normalization. E _γ : Others: 194.9 3 (1990Al43), 194.6 3 (1989Gr23). I _γ : Other: 100 5 (1990Al43).
197.4 2	197.41	6.8 10	[E1]		0.0197	Mult.: α(K)exp=0.039 4 and K/L=6.6 20 (1992PeZX). %I _γ =0.84, using the calculated normalization.
^x 200.5 4		≤2.6				%I _γ =0.16, using the calculated normalization. I _γ : ≤2.0 6 in 1992PeZX.
208.0 2	405.42	20.0 9				%I _γ =2.5, using the calculated normalization. E _γ : Other: 208.0 3 (1990Al43). I _γ : Other: 32 3 (1990Al43).
^x 242.2 3		2.9 5				%I _γ =0.36, using the calculated normalization.
255.6 3	255.57	7.2 5	[M1]		0.0247	%I _γ =0.89, using the calculated normalization.
267.7 3	405.42	3.6 6				%I _γ =0.45, using the calculated normalization.
^x 278.8 3		3.7 6				%I _γ =0.46, using the calculated normalization.
^x 289.5 3		9.3 7				%I _γ =1.15, using the calculated normalization.
295.7 [‡] 3	627.97					
^x 300.4 4		3.5 5				%I _γ =0.43, using the calculated normalization.

Continued on next page (footnotes at end of table)

^{109}Tc β^- Decay 1992PeZX,1989Gr23 (continued) $\gamma(^{109}\text{Ru})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger\&$	Mult.#	α	Comments
324.0 5	514.57	≤ 2.6			%I γ =0.16, using the calculated normalization. I γ : ≤ 1.8 7 in 1992PeZX.
332.0 § 3	332.05	28.5 9	[M1]	0.01268	%I γ =3.5, using the calculated normalization. E γ : Other: 331.9 3 (1989Gr23).
^x 336.9 5		1.2 6			%I γ =0.15, using the calculated normalization.
376.7 3	514.57	19.2 8			%I γ =2.38, using the calculated normalization.
445.8 2	514.57	22.7 9			%I γ =2.8, using the calculated normalization.
490.2 2	627.97	19.1 10			%I γ =2.4, using the calculated normalization.
514.5 3	514.57	25.3 13			%I γ =3.1, using the calculated normalization.
531.2 ‡ 3	1159.29				
589.7 3	995.0	7.1 7			%I γ =0.88, using the calculated normalization.
627.9 3	627.97	6.0 7			%I γ =0.74, using the calculated normalization. E γ : Other: 628.2 3 (1989Gr23).
^x 739.4 5		6.6 8			%I γ =0.82, using the calculated normalization.
804.0 3	995.0	6.9 9			%I γ =0.85, using the calculated normalization.
^x 848.1 5		11.4 10			%I γ =1.41, using the calculated normalization.
964.6 ‡ ^a 3	1159.29				
995.0 5	995.0	4.6 8			%I γ =0.57, using the calculated normalization.
1073.5 ‡ ^a 3	1268.2				
1158.7 § 5	1159.29	36.3 16			%I γ =4.5, using the calculated normalization. E γ : Other: 1159.2 3 (1989Gr23).
1267.8 § 5	1268.2	22.3 14			%I γ =2.8, using the calculated normalization. E γ : Other: 1268.2 3 (1989Gr23).
1502.6 ‡ 3	1502.6				
1632.6 ‡ 3	1964.49				
1964.3 ‡ 3	1964.49				

† From 1992PeZX, unless otherwise noted.

‡ From 1989Gr23. Not seen in 1992PeZX.

§ Placement by 1989Gr23. Unplaced in 1992PeZX.

From Adopted Gammas.

@ If no value given it was assumed $\delta=1.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

& For absolute intensity per 100 decays, multiply by =0.124.

^a Placement of transition in the level scheme is uncertain.^x γ ray not placed in level scheme.

^{109}Tc β^- Decay 1992PeZX,1989Gr23 (continued)

Decay Scheme

^{248}Cm SF Decay 2012Sm02

Parent ^{248}Cm : $E=0.0$; $J\pi=0+$; $T_{1/2}=3.48\times 10^5$ y 6; %SF decay=8.39 16.

2012Sm02: Measured $E\gamma$, $\gamma\gamma$ -, $\gamma\gamma\gamma$ -coin, Doppler-broadened lineshapes, level lifetimes using EUROGAM-2 array in conjunction with the Doppler Profile Method.

 ^{109}Ru Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}$	Comments
0.0 §	(5/2+)		
96.15 # 17	(5/2-)		
131.85 # 17	(7/2-)		
230.08 # 24	(9/2-)		
304.2 # 4	(11/2-)		
618.9 # 5	(13/2-)		
678.9 # 5	(15/2-)		
1184.0 # 6	(17/2-)		
1220.5 # 6	(19/2-)		
1912.0 # 8	(23/2-)	1.45 ps 22	$T_{1/2}$: from 2012Sm02. statistical uncertainty=0.16 ps, systematic uncertainty=0.15 ps.
2734.0 # 10	(27/2-)	0.56 ps 8	$T_{1/2}$: from 2012Sm02. statistical uncertainty=0.062 ps, systematic uncertainty=0.055 ps.

† From a least-square fit to $E\gamma$.

‡ From Adopted Levels.

§ (A): $K\pi=5/2+$, a mixture between $v5/2+[413]$ and $v5/2+[402]$ Nilsson orbitals.

(B): $K\pi=5/2-$ band, $v5/2[532]$ Nilsson orbital.

 $\gamma(^{109}\text{Ru})$

$E\gamma^\dagger$	$E(\text{level})$	I_γ	Comments
35.7 2	131.85	88 6	
36.5 5	1220.5		
60.0 5	678.9		
74.2 5	304.2	100 10	
96.2 2	96.15	100	
98.2 2	230.08	100	
131.8 2	131.85	100 10	
134.2 5	230.08	7	
172.3 5	304.2	26 10	
314.7 5	618.9	100	
374.7 5	678.9	100	
388.9 5	618.9	63	
505.1 5	1184.0	54	
541.6 5	1220.5	100	
565.1 5	1184.0	100	
691.5 5	1912.0		$E\gamma$: 691.5 in 2012Sm02.
822.0 5	2734.0		$E\gamma$: 828 in 2012Sm02.

† From Adopted Gammas. Values quoted in 2012Sm02 are given in the Comments.

²⁵²Cf SF Decay 2009Di12,2008Di11,1995Bu14

Parent ²⁵²Cf: E=0.0; J π =0+; T_{1/2}=2.645 y 8; %SF decay=3.086 8.

2009Di12,2008Di11: ²⁵²Cf source $\approx$ 62 μ Ci sandwiched between two Fe foils with a thickness of 10 mg/cm² at Lawrence Berkeley National Laboratory, USA. Detectors: Gammasphere array (consisting of 102 Compton-suppressed Ge detectors). Measured: E γ , I γ , $\gamma\gamma$, $\gamma\gamma(\theta)$. A total of 5.7 $\times$ 10¹¹ triple- γ or higher coincident events were collected. Deduced: level scheme, band structure. Comparison with Triaxial-rotor-plus-particle Model, TRS calculations.

1995Bu14: ²⁵²Cf source, two experiments, first experiment with 32 Ge Detector array (earlier GAMMASPHERE), second experiments with three Ge detector and two LEPS detector. Measured: E γ , I γ , $\gamma\gamma$, $\gamma\gamma(\theta)$.

Others:1998Hw02,1998Zh39,1976ChZD,1974ClZX,1973Ho22,1970Jo20,1969WiZX.

¹⁰⁹Ru Levels

E(level) [†]	J π [‡]	E(level) [†]	J π [‡]	E(level) [†]	J π [‡]
0.0 §	5/2+	948.5 §	13/2+	2364.4 §	21/2+
96.4 @ 4	5/2-	1056.1 # 5	13/2+	2693.2 # 7	23/2+
132.1 @ 4	7/2-	1184.6 @ 7	17/2-	2715.6 @ 8	25/2-
185.1 § 4	7/2+	1221.1 @ 7	19/2-	2734.1 @ 10	27/2-
230.6 @ 5	9/2-	1256.3 § 5	15/2+	2773.4 § 9	23/2+
304.8 @ 6	11/2-	1350.7 # 5	15/2+	2994.8 # 7	25/2+
332.5 # 4	7/2+	1600.2 § 5	17/2+	3179.4 § 8	25/2+
407.8 § 4	9/2+	1677.1 # 5	17/2+	3391.0 # 8	27/2+
553.6 # 5	9/2+	1891.2 @ 8	21/2-	3636.5 @ 10	29/2-
619.5 @ 6	13/2-	1912.1 @ 8	23/2-	3662.4 § 10	27/2+
657.9 § 4	11/2+	1966.0 § 7	19/2+	3667.2 @ 11	31/2-
679.5 @ 6	15/2-	2011.9 # 6	19/2+	4022.6 § 10	29/2+
777.3 # 4	11/2+	2328.7 # 6	21/2+	4167.3 # 10	31/2+

[†] From a least-squares fit to E γ .

[‡] From 2009Di12 based on the deduced transition multiplicities and the observed band structures, unless otherwise stated.

§ (A): K π =5/2+ band, a mixture between v5/2+[413] and v5/2+[402] Nilsson configurations.

(B): v7/2[404] band.

@ (C): v5/2[532] band.

 $\gamma(^{109}\text{Ru})$

E γ [†]	E(level)	I γ [†]	Mult. [‡]	δ [‡]	α	Comments
35.7 5	132.1					
36.5 5	1221.1					
60.0 5	679.5					
74.2 5	304.8					E γ : Others: 74.2 keV (1973Ho22) and 74 keV (1969WiZX),.
96.4 5	96.4					E γ : Other: 96.1 keV (1974ClZX).
98.5 5	230.6	100				E γ : Other: 98.2 keV (1974ClZX).
132.1 5	132.1	19	(E1)		0.0623 11	E γ : Other: 132.0 keV (1974ClZX) and 131.8 keV (1973Ho22). Mult.: A ₂ /A ₀ =-0.14 4, A ₄ /A ₀ =0.06 4 for (172 γ)(132 γ)(θ) (1995Bu14).
134.2 5	230.6	7.0				
147.4 5	332.5	1.8				
172.7 5	304.8	19	(E2)		0.183 4	E γ : other: 172.3 keV (1973Ho22) and 172 keV (1969WiZX),. Mult.: A ₂ /A ₀ =0.12 3, A ₄ /A ₀ =0.03 3 for (374 γ)(172 γ)(θ) (1995Bu14).
185.1 5	185.1	126	M1+E2	-0.25 6	0.062 3	Mult., δ : from A ₂ /A ₀ =-0.16 2, A ₄ /A ₀ =0.01 3 for (473 γ)(185 γ)(θ) (2008Go18). Other value: δ (E2/M1)=-2.0 4 (2008Go18).
222.7 5	407.8	49	M1+E2	-0.35 6	0.0396 15	Mult., δ : A ₂ /A ₀ =-0.20 3, A ₄ /A ₀ =-0.03 2 for (540.7 γ)(222.7 γ)(θ) (2008Go18). Other value: δ (E2/M1)=-1.8 4 (2008Go18).
223.7 5	777.3	2.3				
250.1 5	657.9	17				
290.6 5	948.5	9.0				
307.8 5	1256.3	2.3				
314.7 5	619.5	14				
328.8 5	2693.2	2.0				E γ : other: 314.2 keV (1973Ho22).
332.5 5	332.5	17.9				
343.9 5	1600.2	0.8				
368.5 5	553.6	31.1				

Continued on next page (footnotes at end of table)

^{252}Cf SF Decay 2009Di12,2008Di11,1995Bu14 (continued) $\gamma(^{109}\text{Ru})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. ‡	α	Comments
369.5 5	777.3	14.1	(M1)	0.00971	Mult.: $A_2/A_0=-0.08$ 7, $A_4/A_0=-0.06$ 11 for 369.5 γ (407.8 γ)(θ) (2008Di11). E γ : others: 374.2 keV (1973Ho22) and 374 keV (1969WiZX),. Mult.: $A_2/A_0=0.12$ 3, $A_4/A_0=0.03$ 3 for (374 γ)(172 γ)(θ) and $A_2/A_0=0.12$ 2, $A_4/A_0=-0.01$ 2 (541 γ)(374 γ)(θ) (1995Bu14).
374.7 5	679.5	36	(E2)	0.01295	
388.9 5	619.5	8.8			
398.2 5	1056.1	6.6			Mult.: $A_2/A_0=-0.08$ 7, $A_4/A_0=-0.06$ 11 for 369.5 γ (407.8 γ)(θ) (2008Di11).
402.2 5	1350.7	3.0			
407.8 5	407.8	144	(E2)	0.00991	
411.7 5	2011.9	1.0			
420.8 5	1677.1	1.4			
444.8 5	777.3	10.4			
472.8 5	657.9	31			
502.5 5	1056.1	7.4			
505.1 5	1184.6	3.6			
540.7 5	948.5	22			
541.6 5	1221.1	14	(E2)	0.00424	Mult.: $A_2/A_0=0.19$ 5, $A_4/A_0=-0.05$ 5 for (691 γ)(541 γ)(θ) and $A_2/A_0=0.12$ 2, $A_4/A_0=-0.01$ 2 for (541 γ)(374 γ)(θ) (1995Bu14).
565.1 5	1184.6	6.7			
573.4 5	1350.7	11.8			Mult.: $A_2/A_0=0.19$ 5, $A_4/A_0=-0.05$ 5 for (691 γ)(541 γ)(θ) (1995Bu14).
598.4 5	1256.3	16			
621.0 5	1677.1	4.8			
630.4 5	2994.8	1.7			
648.3 5	1056.1	4.7			
651.6 5	2328.7	1.7			
651.7 5	1600.2	14			
661.2 5	2011.9	4.7			
666.1 5	2994.8	0.7			
670.1 5	1891.2	0.5			
681.3 5	2693.2	1.5			
691.0 5	1912.1	5.2	(E2)	0.00218	
692.8 5	1350.7	1.8			
697.8 5	3391.0	0.7			
706.6 5	1891.2	6.0			
709.7 5	1966.0	5.1			
728.5 5	2328.7	5.5			
728.6 5	1677.1	5.7			
755.6 5	2011.9	0.7			
764.2 5	2364.4	4.9			
776.3 5	4167.3	0.3			
803.5 5	2715.6	0.1			
807.4 5	2773.4	1.5			
815.0 5	3179.4	1.1			
822.0 5	2734.1	2.4			
824.4 5	2715.6	2.0			
843.2 5	4022.6	0.3			
889.0 5	3662.4	0.1			
920.9 5	3636.5	0.5			
933.1 5	3667.2	1.5			

 † From 2009Di12, $\Delta E\gamma=0.5$ keV assigned by evaluators. ‡ From angular correlation data in 2008Di11, 2008Go18 and 1995Bu14.

²⁵⁴Cf SF Decay ¹⁹⁸¹SeZW

Parent ²⁵⁴Cf: E=0.0; J π =0+; T_{1/2}=60.5 d 2; %SF decay=99.69 2.

¹⁹⁸¹SeZW: ²⁵⁴Cf spontaneous fission source experiment carried at the Weizmann Institute of Science in Rehovot, Israel. Detectors: 2 fission fragment detectors (SSD) and one Ge (Li) detector (2 cm³). Measured: E γ , I γ , $\gamma\gamma$ -coin, coincident events between light and heavy fission products. Deduced level, T_{1/2}, γ -ray branching ratios.

Level scheme proposed by ¹⁹⁸¹SeZW differs than that from the Adopted Levels. Evaluators have re-arranged the placements of γ -ray transitions based on Adopted Levels.

¹⁰⁹Ru Levels

E(level) [†]	J π [‡]	T _{1/2} [§]
0.0#	(5/2+)	
96.2@ 2	(5/2-)	
131.8@ 5	(7/2-)	1.0 ns 2
230.0@ 7	(9/2-)	0.95 ns 5
304.2@ 7	(11/2-)	0.70 ns 5
678.4@ 9	(15/2-)	≈0.15 ns

[†] From a least-squares fit to E γ .

[‡] From Adopted Levels.

[§] From ¹⁹⁸¹SeZW, using the time-of-flight method.

(A): K π =5/2+, a mixture between v5/2+[413] and v5/2+[402] Nilsson orbitals.

@ (B): K π =5/2- band, v5/2[532] Nilsson orbital.

$\gamma(^{109}\text{Ru})$

E γ [†]	E(level)	I γ [†]
74.2 5	304.2	53 5
98.3 5	230.0	100
131.8 5	131.8	34 7
172.3 5	304.2	14 5
374.2 5	678.4	13 4

[†] From ¹⁹⁸¹SeZW. $\Delta E\gamma$ =0.5 keV assumed by evaluators.

²³⁸U(α ,F γ) ²⁰⁰⁶Wu01

²⁰⁰⁶Wu01: E(α)=30 MeV, cyclotron facility at Lawrence Berkeley National Laboratory (LBNL), USA. Target:=300 $\mu\text{g}/\text{cm}^2$

²³⁸U with a =30 $\mu\text{g}/\text{cm}^2$ carbon backing. Detectors: Gammasphere array, CHICO (Fission fragments detectors, highly segmented heavy-ion detector array). Measured: E γ , I γ , p-p- γ - γ .

¹⁰⁹Ru Levels

E(level) [†]	J π [‡]	E(level) [†]	J π [‡]	E(level) [†]	J π [‡]
0.0§	5/2+	1183.0# 14	17/2-	3093.4§ 21	25/2+
96.0# 8	5/2-	1219.3# 17	19/2-	3635.1# 22	29/2-
132.0# 8	7/2-	1255.6§ 14	15/2+	3662.6§ 23	27/2+
185.0§ 8	7/2+	1599.4§ 15	17/2+	3665.3# 24	31/2-
228.9# 11	9/2-	1889.1# 17	21/2-	3907.4§ 23	29/2+
304.2# 11	11/2-	1910.3# 20	23/2-	4622.6§ 25	31/2+
407.8§ 8	9/2+	1966.6§ 17	19/2+	4638.1# 25	33/2-
618.0# 12	13/2-	2328.4§ 18	21/2+	4692# 3	35/2-
657.6§ 10	11/2+	2714.1# 20	25/2-	4750.4§ 25	33/2+
678.3# 14	15/2-	2732.3# 22	27/2-	5803# 3	39/2-
948.4§ 11	13/2+	2773.6§ 20	23/2+		

[†] From a least-squares fit to E γ .

[‡] From ²⁰⁰⁶Wu01 based on the observed band structure.

§ (A): K π =5/2+ band, a mixture between v5/2+[413] and v5/2+[402] Nilsson orbitals.

(B): K π =5/2- band, v5/2[532] Nilsson orbital.

$^{238}\text{U}(\alpha, \text{F}\gamma)$ 2006Wu01 (continued) $\gamma(^{109}\text{Ru})$

E(level)	$E\gamma$	$I\gamma^\dagger$	Comments
96.0	96.2 § 2		
132.0	35.7 § 2		
	131.8 § 2		
185.0	185.1 ‡ 5		
228.9	134.2 ‡ 5		
304.2	74.2 ‡ 5		
	172.3 ‡ 5		
407.8	222.7 10	72 6	
	407.8 10	100	
618.0	313.9 10	74 8	
	389.1 10	100	
657.6	249.8 10	31 9	
	472.5 10	100	
678.3	374 1		
948.4	290.8 10	14 13	I γ : 0.14(1.3) in table I of 2006Wu01 is a misprint.
	540.6 10	100	
1183.0	504.7 10	66 10	
	565.1 10	100	
1219.3	541 1		
1255.6	598 1		
1599.4	651 1		
1889.1	706 1		
1910.3	691 1		
1966.6	711 1		
2328.4	729 1		
2714.1	825 1		
2732.3	822 1		
2773.6	807 1		
3093.4	765 1		
3635.1	921 1		
3662.6	889 1		
3665.3	933 1		
3907.4	814 1		
4622.6	960 1		
4638.1	1003 1		
4692	1027 1		
4750.4	843 1		
5803	1111 1		

† From 2006Wu01. The quoted uncertainty is statistical, the systematic uncertainty could be up to 30%.

‡ Observed, but energy not given by 2006Wu01. Value given from Adopted Gammas.

§ Not observed in 2006Wu01. Value given from Adopted Gammas.

Adopted Levels, GammasQ(β^-)=2607 4; S(n)=8039 15; S(p)=8630 10; Q(α)=-5130 4 2012Wa38. **^{109}Rh Levels****Cross Reference (XREF) Flags**

A ^{109}Ru β^- Decay
 B (HI,xn γ)
 C $^{110}\text{Pd}(\text{pol t},\alpha)$ E=17 MeV
 D $^{110}\text{Pd}(\text{d},^3\text{He})$

E(level) [†]	J π	XREF	T _{1/2}	Comments
0.0 ^{\$}	7/2+	ABCD	80.8 s 7	% β^- =100. J π : L(pol t, α)=4 and L-1/2 from analyzing power fits. T _{1/2} : weighted average of 80 s 2 (using $\beta(t)$, 326.8 $\gamma(t)$, 426.1 $\gamma(t)$ in 1978Ka10), 79.8 s 10 (using 178.0 $\gamma(t)$, 291.4 $\gamma(t)$, 326.7 $\gamma(t)$, 426.1 $\gamma(t)$ in 1978Fr16 1976KaYO), 82 s 1 (using strong $\gamma(t)$ in 1977Ba57), 81.2 s 29 (using 326 $\gamma(t)$ in 1969WiZX); Other: 114 s (using 326 $\gamma(t)$ in 1975Fe12). configuration: K π =7/2+, π 7/2[413] Nilsson orbital.
206.250 ^{\$} 20	9/2+	ABCD	<41 ps	J π : L(pol t, α)=4 and L+1/2 transfer from analyzing power fits; 206.29 γ M1 to 7/2+. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay); Other: < 0.5 ns using β -206 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, centroid shift method).
225.873 [@] 19	3/2+	AB	1.66 μ s 4	J π : 225.98 γ E2 to 7/2+, 148.12 γ from 1/2-. T _{1/2} : from (116 γ)(226 γ)(t) in 1987Ka29 (^{109}Ru β^- decay, slope method). configuration: K π =1/2+, π 1/2[431] Nilsson orbital.
257.66 3	(3/2)+	AB	28.7 ns 15	J π : 31.80 γ M1+E2 to 3/2+, 220.64 γ M1+E2 from 5/2+. T _{1/2} : from (221 γ)(32 γ)(t) in 1987Ka29 (^{109}Ru β^- decay, slope method).
358.584 16	3/2+	A	114.4 ps 13	J π : 358.79 γ E2 to 7/2+, 101.1 γ to 1/2+. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay); Other: < 0.5 NS from β -359 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, centroid shift method).
373.99 [#] 3	1/2-	ABCD	33.5 ns 14	J π : L(pol t, α)=1 and L-1/2 transfer from analyzing power fits. T _{1/2} : weighted average of 33 ns 2 from (194 γ)(116 γ)(t) in 1987Ka29 (^{109}Ru β^- decay, slope method) and 34 ns 2 from β -374 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, slope method). configuration: K π =1/2-, π 1/2[301] Nilsson orbital.
409.74 [@] 3	7/2+	AB	0.49 ns 3	J π : 183.85 γ E2 to 3/2+, 203.6 γ to 9/2+. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay); Other: 0.43 ns 23 from β -183.85 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, centroid shift method).
426.759 19	5/2+	A CD	<53 ps	XREF: C(424). J π : L(d, ^3He)=2, L(pol t, α)=(2) and L+1/2 transfer from analyzing power fits; 68.07 γ M1 to 3/2+. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay); Others: <0.5 ns 427 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, centroid shift) and 8 ns 1 in 1987Ka29 (^{109}Ru β^- decay, close to timing resolution of Ge(Li) detectors).
478.28 3	(5/2)+	A	174 ps 5	J π : 252.45 γ to 3/2+ and 272.1 γ to 9/2+, 220.64 γ M1+E2 to (3/2)+. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay); Other: <0.6 ns from β -221 $\gamma(t)$ in 1998Lh02 (^{109}Ru β^- decay, centroid shift method).
530.66 ^{\$} 7 568.10 [#] 4	11/2+ 3/2-	AB A CD		J π : 324.4 γ to 9/2+, 530.7 γ to 7/2+; band assignment. XREF: C(566)D(570). J π : L(pol t, α)=(1) and L+1/2 transfer from analyzing power fit, L(d, ^3He)=1; band assignment. T _{1/2} : < 0.83 PS from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay), but BM1(W.u.)>3.4 exceeds RUL(IV)=3.
623.12 [#] 4	5/2-	AB D	223 ps 8	J π : 55.01 γ to 3/2-, 249.2 γ to 1/2-; systematics and analogy of decay patterns with $^{103,105,107}\text{Rh}$. L=(1+3) in (d, ^3He), but authors suggested that L=1 component is probably due to the tail of strong 540 peak; band assignment. T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
641.98 ^{&} 5	(11/2+)	AB		J π : 435.72 γ to 9/2+; band assignment. configuration: Possible K π =11/2+, π 7/2[413]@2+.

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Adopted Levels, Gammas (continued) ^{109}Rh Levels (continued)

E(level) [†]	J π	XREF	T _{1/2}	Comments
671.876 22	(5/2+)	A	<57 ps	J π : 245.09 γ (E2) to 5/2+, 465.65 γ to 9/2+; direct feeding in ^{109}Ru β^- decay ($J^\pi=(5/2+)$). Note, that if 245.09 γ is E1+M2, then $J^\pi=7/2-$ could be also consistent.
740.80 4	3/2-	A CD	<57 ps	T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). XREF: C(743)D(737). J π : L(pol t, α)=L(d, ^3He)=1 and L+1/2 transfer from analyzing power fits; 117.67 γ to 5/2- and 366.81 γ to 1/2-.
745.4 ^{\$} 6	13/2+	B		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
767.7 [@] 10	(11/2+)	B		J π : 215 γ to 11/2+, 539 γ to 9/2+; band assignment.
855.99 4	5/2-	A CD	<51 ps	J π : 358 γ to 7/2+; band assignment. XREF: C(852)D(856). J π : L(pol t, α)=(d, ^3He)=3 and L-1/2 transfer from analyzing power fits, 482.0 γ to 1/2-.
861.00 8	(9/2+)	A		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). J π : 382.8 γ to (5/2)+, 451.2 γ to 7/2+, 860.09 γ to 7/2+. Not populated in β^- decay ($J^\pi=(5/2+)$).
890.23 4	(9/2+)	A		J π : 890.3 γ to 7/2+, 684.0 γ to 9/2+, 463.4 γ to 5/2+. Not populated in β^- decay ($J^\pi=(5/2+)$).
926.76 4	5/2-	A CD	107 ps 13	XREF: C(923)D(928). J π : L(pol t, α)=(3) and L-1/2 transfer from analyzing power fits, L(d, ^3He)=3.
973.29 [#] 19	(7/2-)	A		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
980.71 4	(1/2)	A	<69 ps	J π : 350.2 γ to 5/2-, 405.0 γ to 3/2-; band assignment. J π : 239.90 γ to 3/2-, 606.7 γ to 1/2-, 621.9 γ to 3/2+, no γ to J=5/2, 7/2 and 9/2 levels.
1011.60 4	(3/2)+	A cd		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). XREF: c(1006)d(1017). J π : L(d, ^3He)=2 could correspond to both 1011 and 1026 level, 584.8 γ to 5/2+, 1011.7 γ to 7/2+, no γ to 9/2+.
1026.46 3	(5/2, 7/2)+	A cd	<42 ps	XREF: c(1006)d(1017). J π : L(d, ^3He)=2 could correspond to both 1011 and 1026 level, 820.20 γ to 9/2+, 800.5 γ to 3/2+.
1051.20 5	(1/2, 3/2, 5/2-)	A	27 ps 12	T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). J π : 310.39 γ to 3/2-, 677.2 γ to 1/2-, 692.5 γ to 3/2+.
1053.26 4	5/2+, 7/2+	A		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). J π : 827.0 γ to 3/2+, 847.0 γ to 9/2+.
1062.1 [#] 10	(9/2-)	B		J π : 439 γ to 5/2-; band assignment.
1073.1 ^{&} 7	(13/2+)	B		J π : 431 γ to (11/2+); band assignment.
1096.25 4	(9/2)+	A CD		XREF: C(1091)D(1097). J π : L(pol t, α)=L(d, ^3He)=4 and L+1/2 transfer from analyzing power fits; 454.6 γ to (11/2+), 1096.30 γ to 7/2+; Not populated in β^- decay ($J^\pi=(5/2+)$).
1162.19 19	(3/2-)	A CD		J π : L(pol t, α)=(1) and L+1/2 transfer from analyzing power fits. XREF: C(1162)D(1155).
1176.97 11	3/2+, 5/2, 7/2+	A		J π : 750.2 γ to 5/2+, 818.3 γ to 3/2+, 1177.0 γ to 7/2+, direct feeding from (5/2+) in ^{109}Ru β^- decay.
1202.6 ^{\$} 7	(15/2+)	B		J π : 457 γ to (13/2+), 672 γ to (11/2+); band assignment.
1214.19 16	(3/2)-	A CD		XREF: C(1207)D(1220). J π : L(d, ^3He)=1, L(pol t, α)=(1) and L+1/2 transfer from analyzing power fits.
1229.48 7	(7/2+)	A		J π : 699.0 γ to (11/2+), 802.7 γ to 5/2+, direct feeding in ^{109}Ru β^- decay ($J^\pi=5/2+$).
1283.86 6	(7/2-)	A CD		XREF: C(1272). J π : L(pol t, α)=(3); 1077.6 γ to 9/2+.
1291.7 [@] 15	(15/2+)	B		J π : 524 γ to (11/2+); band assignment.
1310.72 3	(3/2+)	A	54 ps 10	J π : 638.9 γ to (7/2)+, 952.00 γ to 3/2+, no γ to 9/2+.
1331 [‡] 10	(5/2)+	CD		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). XREF: D(1339). J π : L(d, ^3He)=2, L(pol t, α)=2 and L+1/2 transfer from analyzing power fits.
1412.53 9	(1/2+)	A		J π : 985.8 γ to 5/2+, 1054.0 γ to 3/2+, no γ 's to J=7/2 and 9/2; Not populated in β^- decay ($J^\pi=(5/2+)$).
1430 10		C		

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Adopted Levels, Gammas (continued) ^{109}Rh Levels (continued)

E(level) [†]	J π	XREF	T _{1/2}	Comments
1444.5 [§] 9	(17/2+)	B		J π : 242 γ to (15/2+), 699 γ to (13/2+); band assignment.
1455.0 ^{&} 7	(15/2+)	B		J π : 382 γ to (13/2+), 813 γ to (11/2+); band assignment.
1459 [‡] 10	(9/2)+	CD		XREF: D(1457). J π : L(d, ³ He)=4, L(pol t, α)=(4) and L+1/2 transfer from analyzing power fits.
1511.512 25	7/2+	A	<23 ps	J π : 499.94 γ to (3/2)+, 869.5 γ to (11/2+); strong direct feeding in ^{109}Ru β^- decay (J^π =from (5/2+)).
1513 [‡]	(1/2-)	CD		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). XREF: D(1522).
1576.33 4	5/2+, 7/2+	A	<80 ps	J π : L(pol t, α)=(1) and L-1/2 transfer from analyzing power fits. J π : 265.61 γ to (3/2)+, 480.1 γ to 9/2+; direct feeding in ^{109}Ru β^- decay (J^π =from (5/2+)).
1637.97 17	(3/2)-	A CD		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). XREF: C(1631)D(1627).
1652.1 [#] 15	(13/2-)	B		J π : L(d, ³ He)=1; L(pol t, α)=(1,2) and analyzing power.
1676.0 ^{&} 10	(17/2+)	B		J π : 590 γ to (9/2-); band assignment.
1753 [‡] 10	1/2-, 3/2-	CD		J π : 603 γ to (13/2+); band assignment. XREF: D(1746).
1929.07 3	7/2+	A CD	<32 ps	J π : L(d, ³ He)=1. XREF: C(1914)D(1915).
1959.7 [@] 18	(19/2+)	B		J π : strong direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 1570.4 γ to 3/2+, 1287.0 γ to (11/2+).
1963.40 5	(5/2)+	A D	<32 ps	T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay). J π : 668 γ to (15/2+); band assignment. XREF: D(1953).
1971.87 12	(5/2)+	A		J π : strong direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 652.5 γ to (3/2+), 1757.1 γ to 9/2+; no γ 's to 11/2+.
1975.6 [§] 10	(19/2+)	B		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
2015.41 8	(3/2)	A cD		J π : direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 960.5 to (3/2)+, 1765.7 γ to 9/2+; no γ 's to 11/2+.
2045.54 15	(3/2)-	A cD		J π : 531 γ to (17/2+), 773 γ to (15/2+); band assignment. XREF: c(2019)D(2002).
2093.91 4	(3/2+)	A D	<40 ps	J π : 1641.5 γ to 1/2-, 1588.7 γ to 5/2+, no γ to 9/2+; direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)). XREF: c(2019)D(2037).
2098.59 12	(5/2+, 7/2)	A		J π : L=(d, ³ He)=1, L(pol t, α)=(1), 1567.2 γ to (5/2)+.
2098.9 ^a 8	(17/2-)	B		XREF: D(2091).
2117.00 12	(3/2+)	A		J π : strong direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 1720.0 γ to 1/2-, 2094.3 γ to 7/2+, no γ 's to 9/2+.
2182.87 10	(5/2+, 7/2)	A		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
2184.72 7	(3/2+, 5/2)	A		J π : 1002.5 γ to 9/2+; direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
2190.50 7	(3/2+)	A	<40 ps	J π : 423 γ to (17/2+), 644 γ to (15/2+); band assignment.
2193.74 11	(3/2+, 5/2)	A		J π : 2117.3 γ to 7/2+, 1891.4 γ to 3/2+, no γ 's to 9/2+ direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
2208.45 8	(5/2+, 7/2)	A		J π : 1756.0 γ to 5/2+, 1976.6 γ to 9/2+, direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
2209.40 10	(3/2+, 5/2)	A		J π : direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 1616.5 γ to 3/2-, 2184.7 γ to 7/2+, no γ 's to 1/2 and 9/2+ levels.
2237.92 10	(3/2+, 5/2)	A		J π : direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 1816.5 γ to 1/2-, 1763 γ to 5/2+.
2247.07 14	(5/2+, 7/2)	A		T _{1/2} : from $\beta\gamma\gamma(t)$ in 2011BuZZ (^{109}Ru β^- decay).
2250.5 [§] 13	(21/2+)	B		J π : direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)); 1767.0 γ to 5/2+, 2193.8 γ to 7/2+, no γ 's to 1/2 and 9/2+ levels.
				J π : 1585.1 γ to 5/2-, 1347.5 γ to (9/2+); direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
				J π : 1537.5 γ to (7/2)+, 1850.8 γ to 3/2+, no γ 's to 1/2 and 9/2+ levels direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
				J π : 1879.3 γ to 3/2+, 1811.4 γ to 5/2+; no γ 's to 1/2 and 9/2+ levels direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
				J π : 2040.8 γ to 9/2+; direct feeding in ^{109}Ru β^- decay (J^π =(5/2+)).
				J π : 806 γ to (17/2+); band assignment.

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Adopted Levels, Gammas (continued)

¹⁰⁹Rh Levels (continued)

E(level) [†]	J π	XREF	Comments
2270.1 3	(5/2+, 7/2)	A C	XREF: C(2261). J π : 1860.3 γ to 7/2+, 2063.8 γ to 9/2+; direct feeding in ¹⁰⁹ Ru β^- decay (J π =(5/2+)).
2297.9 ^a 13	(19/2-)	B	J π : 199 γ to (17/2-); band assignment.
2335.1 [#] 18	(17/2-)	B	J π : 316 γ to (13/2-); band assignment.
2558.9 ^a 17	(21/2-)	B	J π : 261 γ to (19/2-); band assignment.
2720.5 17		B	
2874.9 ^a 20	(23/2-)	B	J π : 316 γ to (21/2-); band assignment.
3000.5 20		B	
3345.5 22		B	

[†] From a least-squares fit to E γ .

[‡] From ¹¹⁰Pd(pol t, α) E=17 MeV.

[§] (A): K π =7/2+, π 7/2[413] band.

[#] (B): K π =1/2-, π 1/2[301] band.

[@] (C): K π =1/2+, π 1/2[431] band.

[&] (D): Possible K π =11/2+, π 7/2[413] $\otimes$ 2+ band.

^a (E): Band based on the (17/2-), 2099-keV level (2002Ve08).

$\gamma(^{109}\text{Rh})$

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
206.250	206.29 3	100	M1		0.0476	Mult.: $\alpha(\text{K})_{\text{exp}}=0.041\ 7$ (1992PeZX in ¹⁰⁹ Ru β^- decay). B(M1)(W.u.)>0.058.
225.873	225.98 3	100	E2		0.0741	Mult.: $\alpha(\text{K})_{\text{exp}}=0.062\ 11$ (1992PeZX), 0.07 1 (1987Ka29), and 0.09 4 (1977Ba57) in ¹⁰⁹ Ru β^- decay. B(E2)(W.u.)=0.0174 5.
257.66	31.80 3	100	M1+E2	0.60 9	29 5	Mult., δ : $\alpha(\text{exp})=29\ 3$ (1987Ka29), $\alpha(\text{K})_{\text{exp}}=13\ 4$ (1987Ka29), $\alpha(\text{K})_{\text{exp}}=17\ +10-6$ (1992PeZX) in ¹⁰⁹ Ru β^- decay. B(M1)(W.u.)=0.00058 12; B(E2)(W.u.)=170 50.
358.584	101.1 1	0.18 5	[M1]		0.333	B(M1)(W.u.)=0.00032 10.
	132.79 3	1.48 11	[M1]		0.1560	B(M1)(W.u.)=0.00118 11.
	358.429 21	100 5	E2		0.01573	E γ : From 1979Bo26. Mult.: $\alpha(\text{K})_{\text{exp}}=0.013\ 3$ (1992PeZX in ¹⁰⁹ Ru β^- decay). B(E2)(W.u.)=26.1 19.
373.99	116.32 3	100 5	[E1]		0.0945	B(E1)(W.u.)=5.1 $\times 10^{-6}$ 5.
	148.12 3	1.76 14	[E1]		0.0472	B(E1)(W.u.)=4.3 $\times 10^{-8}$ 5.
409.74	183.85 3	100 5	E2		0.1530	Mult.: $\alpha(\text{K})_{\text{exp}}=0.13\ 3$ (1992PeZX in ¹⁰⁹ Ru β^- decay). B(E2)(W.u.)=131 12.
	203.6 1	6.3 13	[M1]		0.0492	B(M1)(W.u.)=0.00025 6.
	409.7 1	13.8 13	[M1]		0.00826	B(M1)(W.u.)=6.6 $\times 10^{-5}$ 8.
426.759	68.07 3	28.1 15	M1		1.023	Mult.: $\alpha(\text{K})_{\text{exp}}=0.7\ 2$ (1992PeZX in ¹⁰⁹ Ru β^- decay). B(M1)(W.u.)>0.22.
	200.9 3	1.3 4	[M1]		0.0510	B(M1)(W.u.)>0.00040.
	220.6 3	5.7 7	[E2]		0.0806	B(E2)(W.u.)>23.
	426.84 5	100 5	[M1]		0.00748	B(M1)(W.u.)>0.0032.
478.28	119.60 5	6.2 6	[M1]		0.208	B(M1)(W.u.)=0.0025 4.
	220.64 5	100 13	M1+E2	1.4 7	0.067 14	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.057\ 11$ (1992PeZX in ¹⁰⁹ Ru β^- decay). B(M1)(W.u.)=0.0022 15; B(E2)(W.u.)=70 30.
	252.45 5	57 4	[M1]		0.0280	B(M1)(W.u.)=0.0024 3.
	272.1 1	4.5 18	[E2]		0.0392	B(E2)(W.u.)=1.7 7.
	478.4 1	6.6 7	[M1]		0.00567	B(M1)(W.u.)=4.1 $\times 10^{-5}$ 6.
530.66	324.4 1	100 11				
	530.7 1	26 3				
568.10	194.10 5	100	[M1]		0.0559	
623.12	55.01 3	12.9 11	[M1]		1.89	B(M1)(W.u.)=0.054 8.
	249.2 1	100 15	[E2]		0.0529	B(E2)(W.u.)=60 12.
641.98	435.72 5	100 5				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Rh})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. ‡	α	Comments
671.876	245.09 3	100 7	(E2)	0.0560	Mult.: from $\alpha(K)\text{exp}=0.07\ 2$ (1992PeZX in ^{109}Ru β^- decay), but E1+M2 with $\delta=1.0\ +4-3$ is also possible.
	465.65 3	97 5	[E2]	0.00698	B(E2)(W.u.)>150.
	671.93 5	36 3	[M1]	0.00254	B(E2)(W.u.)>5.9.
740.80	117.67 5	3.7 18	[M1]	0.218	B(M1)(W.u.)>0.00019.
	172.71 3	26.8 16	[M1]	0.0763	B(M1)(W.u.)>0.0065.
	366.81 3	100 7	[M1]	0.01086	B(M1)(W.u.)>0.015.
745.4	215# 1				B(M1)(W.u.)>0.0058.
	539# 1				
767.7	358# 1	100#			
855.99	115.17 5	12 6	[M1]	0.231	B(M1)(W.u.)>0.017.
	232.87 3	100 7	[M1]	0.0346	B(M1)(W.u.)>0.017.
	287.89 5	58 5	[M1]	0.0200	B(M1)(W.u.)>0.0053.
	482.0 1	20 20	[E2]	0.00630	B(E2)(W.u.)>1.4.
861.00	382.8 1	100 14	[E2]	0.01276	
	451.2 2	23 5	[M1]	0.00653	
	860.9 3	14 4	[M1]	1.45×10^{-3}	
890.23	218.36 5	16.2 13			
	463.4 1	10 4			
	684.0 1	9.4 12			
	890.3 3	100 10			
926.76	185.95 3	36 8	[M1]	0.0626	B(M1)(W.u.)=0.0053 16.
	303.64 5	100 23	[M1]	0.01747	B(M1)(W.u.)=0.0034 11.
	358.7 5	77 23	[M1]	0.01148	B(M1)(W.u.)=0.0016 6.
973.29	350.2 2	100			
	405.0 5	80			
980.71	239.90 3	100 6			
	606.7 1	10 4			
	621.9 3	44.9 14			
	723.0 2	9.8 18			
	754.85 5	21.6 22			
1011.60	584.8 1	5.5 7	[M1]	0.00351	
	1011.7 1	100 6	[E2]	9.19×10^{-4}	
1026.46	354.5 3	3.0 10	[M1]	0.01183	B(M1)(W.u.)>0.00022.
	599.66 5	8.3 6	[M1]	0.00331	B(M1)(W.u.)>0.00013.
	616.7 1	5.0 5	[M1]	0.00310	B(M1)(W.u.)> 6.9×10^{-5} .
	667.5 3	5.8 6	[M1, E2]	0.00258	
	800.5 2	3.0 5	[M1, E2]	1.70×10^{-3}	
	820.20 5	100 6	[M1, E2]	1.61×10^{-3}	
	1026.49 5	35.9 20	[M1]	9.80×10^{-4}	B(M1)(W.u.)>0.00011.
1051.20	310.39 5	33 3			
	677.2 1	100 8			
	692.5 5	7 3			
1053.26	381.4 1	24 6			
	575.0 1	11.6 18			
	626.4 1	33 3			
	643.50 5	57 4			
	827.3 3	54 4			
	847.0 1	100 20			
	1053.4 1	82 6			
1062.1	439# 1	100#			
1073.1	328# 1				
	431# 1				
1096.25	454.6 3	9 5			
	565.7 3	41 14			
	890.1 3	68 18			
	1096.30 5	100 18			
1162.19	803.5 5	100			
1176.97	750.2 5	55 18			
	818.3 2	100 12			
	1177.0 3	46 12			
1202.6	457# 1				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Rh})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	α	Comments
1202.6	672 [#] 1				
1214.19	646.0 5	52 26			
	840.2 3	100 30			
1229.48	699.0 5	15 8			
	751.0 5	26 14			
	802.7 2	25 17			
	819.8 5	21 8			
	1023.2 1	100 13			
	1229.5 1	69 11			
1283.86	612.2 2	11.6 22			
	874.0 3	8 3			
	1077.6 1	100 10			
	1283.9 1	65 5			
1291.7	524 [#] 1	100 [#]			
1310.72	638.9 2	5.9 17	[E2]	0.00285	B(E2)(W.u.)=0.12 5.
	832.5 2	10.9 24	[M1]	1.56×10^{-3}	B(M1)(W.u.)= 5.0×10^{-5} 15.
	883.94 5	36 4	[M1]	1.36×10^{-3}	B(M1)(W.u.)=0.00014 4.
	952.00 5	100 7	[M1]	1.16×10^{-3}	B(M1)(W.u.)=0.00031 7.
1412.53	985.8 2	73 13			
	1054.0 5	100 38			
	1155.0 5	75 38			
	1186.7 3	38 13			
1444.5	242 [#] 1				
	699 [#] 1				
1455.0	382 [#] 1				
	813 [#] 1				
1511.512	200.74 3	9.1 9	[E2]	0.1122	B(E2)(W.u.)>110.
	415.34 5	5.4 23	[M1]	0.00799	B(M1)(W.u.)>0.00035.
	458.3 2	1.4 4	[M1]	0.00629	B(M1)(W.u.)> 6.7×10^{-5} .
	485.04 5	4.9 4	[M1]	0.00548	B(M1)(W.u.)>0.00020.
	499.94 5	14.2 11	[E2]	0.00566	B(E2)(W.u.)>1.7.
	621.3 3	16.3 5	[M1]	0.00305	B(M1)(W.u.)>0.00031.
	839.8 3	15 4	[M1]	1.53×10^{-3}	B(M1)(W.u.)>0.00012.
	869.5 2	2.3 5	[E2]	1.31×10^{-3}	B(E2)(W.u.)>0.018.
	980.8 2	3.6 5	[E2]	9.86×10^{-4}	B(E2)(W.u.)>0.015.
	1033.2 1	2.3 4	[M1]	9.66×10^{-4}	B(M1)(W.u.)> 9.6×10^{-6} .
	1084.7 1	9.1 14	[M1]	8.70×10^{-4}	B(M1)(W.u.)> 3.3×10^{-5} .
	1152.9 1	8.4 8	[E2]	6.92×10^{-4}	B(E2)(W.u.)>0.016.
	1305.3 1	100 5	[M1]	6.08×10^{-4}	B(M1)(W.u.)>0.00021.
	1511.7 1	14.0 22	[M1]	5.07×10^{-4}	B(M1)(W.u.)> 1.9×10^{-5} .
1576.33	265.61 3	96 6	[M1]	0.0246	B(M1)(W.u.)>0.0027.
	480.1 2	32 3	[M1, E2]	0.00562	
	564.5 5	43 13	[M1, E2]	0.00382	
	686.1 1	89 7	[M1]	0.00242	B(M1)(W.u.)>0.00015.
	904.6 2	74 3	[M1]	1.30×10^{-3}	B(M1)(W.u.)> 5.3×10^{-5} .
	1098.0 2	38 7	[M1]	8.47×10^{-4}	B(M1)(W.u.)> 1.5×10^{-5} .
	1166.5 2	16 4	[M1]	7.47×10^{-4}	B(M1)(W.u.)> 5.4×10^{-6} .
	1370.1 1	100 9	[M1, E2]	5.65×10^{-4}	
	1576.5 5	26 13	[M1]	4.94×10^{-4}	B(M1)(W.u.)> 3.5×10^{-6} .
1637.97	1279.3 3	100 15			
1652.1	590 [#] 1	100 [#]			
1676.0	603 [#] 1	100 [#]			
1929.07	352.9 1	1.7 3	[M1]	0.01196	B(M1)(W.u.)>0.00016.
	618.5 5	0.7 4	[E2]	0.00311	B(E2)(W.u.)>0.026.
	645.3 1	1.5 2	[E1]	9.94×10^{-4}	B(E1)(W.u.)> 3.1×10^{-7} .
	875.8 1	1.6 3	[M1]	1.39×10^{-3}	B(M1)(W.u.)> 9.8×10^{-6} .
	902.6 1	3.6 3	[M1]	1.30×10^{-3}	B(M1)(W.u.)> 2.0×10^{-5} .
	917.5 1	5.0 4	[E2]	1.15×10^{-3}	B(E2)(W.u.)>0.026.
	1038.8 1	2.1 2	[M1]	9.55×10^{-4}	B(M1)(W.u.)> 7.7×10^{-6} .
	1068.0 5	0.7 3	[M1]	8.99×10^{-4}	B(M1)(W.u.)> 2.4×10^{-6} .
	1257.2 1	7.1 5	[M1]	6.48×10^{-4}	B(M1)(W.u.)> 1.5×10^{-5} .
	1287.0 1	1.98 24	[E2]	5.69×10^{-4}	B(E2)(W.u.)>0.0019.
	1398.6 3	1.16 21	[E2]	5.11×10^{-4}	B(E2)(W.u.)>0.00074.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Rh})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. ‡	α	Comments
1929.07	1450.5 2	1.3 5	[M1]	5.26×10^{-4}	B(M1)(W.u.) $>1.8 \times 10^{-6}$.
	1502.28 5	29.5 18	[M1]	5.09×10^{-4}	B(M1)(W.u.) $>3.6 \times 10^{-5}$.
	1570.4 2	1.32 24	[E2]	4.76×10^{-4}	B(E2)(W.u.) >0.00047 .
	1722.8 1	7.7 7	[M1]	4.86×10^{-4}	B(M1)(W.u.) $>6.2 \times 10^{-6}$.
	1929.06 5	100 5	[M1]	5.10×10^{-4}	B(M1)(W.u.) $>5.7 \times 10^{-5}$.
1959.7	668 [#] 1	100 [#]			
1963.40	652.5 1	1.2 6	[M1]	0.00272	B(M1)(W.u.) $>1.0 \times 10^{-5}$.
	1073.2 1	22.3 18	[E2]	8.06×10^{-4}	B(E2)(W.u.) >0.031 .
	1291.5 1	14.1 18	[M1]	6.18×10^{-4}	B(M1)(W.u.) $>1.5 \times 10^{-5}$.
	1485.0 5	3.5 18	[M1]	5.14×10^{-4}	B(M1)(W.u.) $>2.5 \times 10^{-6}$.
	1536.7 1	100 18	[M1]	5.01×10^{-4}	B(M1)(W.u.) $>6.5 \times 10^{-5}$.
	1757.1 1	85 5	[E2]	4.85×10^{-4}	B(E2)(W.u.) >0.0099 .
	1963.5 1	66 5	[M1]	5.17×10^{-4}	B(M1)(W.u.) $>2.1 \times 10^{-5}$.
1971.87	960.5 5	3.7 19			
	1081.5 5	8 4			
	1545.0 2	13.9 20			
	1765.7 3	100 20			
	1971.9 2	26 3			
1975.6	531 [#] 1				
	773 [#] 1				
2015.41	838.4 2	15 6			
	1274.6 4	9 4			
	1537.0 5	28 12			
	1588.7 2	24 6			
	1641.5 3	9 4			
	1656.8 1	100 9			
	1789.5 3	38 5			
2045.54	1567.2 2	100 9			
	1819.7 2	67 7			
2093.91	455.9 2	10.1 14	[E1]	0.00223	B(E1)(W.u.) $>1.1 \times 10^{-6}$.
	681.4 1	31.4 25	[M1]	0.00246	B(M1)(W.u.) $>7.7 \times 10^{-5}$.
	879.7 2	10.1 14	[E1]	5.18×10^{-4}	B(E1)(W.u.) $>1.6 \times 10^{-7}$.
	931.7 2	4.8 23	[E1]	4.62×10^{-4}	B(E1)(W.u.) $>6.2 \times 10^{-8}$.
	1042.7 2	34 5			
	1082.2 1	19 3	[M1]	8.74×10^{-4}	B(M1)(W.u.) $>1.2 \times 10^{-5}$.
	1113.2 1	86 5			
	1237.9 1	37 7	[E1]	3.32×10^{-4}	B(E1)(W.u.) $>2.0 \times 10^{-7}$.
	1353.2 2	11.9 18	[E1]	3.65×10^{-4}	B(E1)(W.u.) $>5.0 \times 10^{-8}$.
	1471.0 5	27 11	[E1]	4.17×10^{-4}	B(E1)(W.u.) $>8.9 \times 10^{-8}$.
	1615.7 1	62 5	[M1]	4.90×10^{-4}	B(M1)(W.u.) $>1.1 \times 10^{-5}$.
	1667.1 1	49 4	[M1]	4.86×10^{-4}	B(M1)(W.u.) $>8.2 \times 10^{-6}$.
	1720.0 1	100 7	[E1]	5.63×10^{-4}	B(E1)(W.u.) $>2.1 \times 10^{-7}$.
	1735.2 1	85 5	[M1]	4.87×10^{-4}	B(M1)(W.u.) $>1.3 \times 10^{-5}$.
	1836.2 1	99 10	[M1]	4.95×10^{-4}	B(M1)(W.u.) $>1.2 \times 10^{-5}$.
	1868.0 2	35 3	[M1]	5.00×10^{-4}	B(M1)(W.u.) $>4.2 \times 10^{-6}$.
	2094.3 3	6.8 12	[E2]	5.62×10^{-4}	B(E2)(W.u.) >0.00011 .
2098.59	1002.5 5	26 13			
	1208.1 3	21 4			
	1237.8 5	21 11			
	1620.2 3	7.4 21			
	1689.0 5	5 3			
	1892.4 3	21 8			
	2098.6 2	100 7			
2098.9	423 [#] 1				
	644 [#] 1				
	896 [#] 1				
2117.00	1105.6 5	12 6			
	1690.0 2	59 6			
	1859.3 2	100 9			
	1891.4 3	35 6			
	2117.3 4	6 3			
2182.87	1756.0 5	100 42			
	1976.6 1	92 11			

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Rh})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	α	Comments
2184.72	1007.7 2	15 4			
	1133.5 2	10.9 24			
	1512.9 1	100 13			
	1616.5 5	22 7			
	1758.0 5	28 11			
	1825.9 2	35 7			
	1958.8 3	20 3			
	2184.7 2	16.1 24			
2190.50	1139.2 2	23 3			
	1209.6 3	33 4			
	1334.5 2	19 3	[E1]	3.59×10^{-4}	B(E1)(W.u.) $>2.3 \times 10^{-7}$.
	1449.8 2	26 11	[E1]	4.06×10^{-4}	B(E1)(W.u.) $>2.5 \times 10^{-7}$.
	1712.3 3	11 3	[M1]	4.86×10^{-4}	B(M1)(W.u.) $>4.7 \times 10^{-6}$.
	1763.8 3	28 6	[M1]	4.88×10^{-4}	B(M1)(W.u.) $>1.1 \times 10^{-5}$.
	1816.5 5	15 4	[E1]	6.23×10^{-4}	B(E1)(W.u.) $>7.3 \times 10^{-8}$.
	1831.9 1	100 19	[M1]	4.95×10^{-4}	B(M1)(W.u.) $>3.5 \times 10^{-5}$.
2193.74	1521.7 3	13 4			
	1715.4 2	23 5			
	1767.0 2	100 50			
	2193.8 2	70 7			
2208.45	1347.5 1	88 9			
	1585.1 2	100 12			
	1798.7 1	53 8			
2209.40	1537.5 5	44 17			
	1850.8 1	100 11			
2237.92	1759.5 3	100 17			
	1811.4 3	54 12			
	1879.3 1	89 13			
2247.07	1150.7 3	76 10			
	1357.0 5	100 50			
	1575.2 5	86 36			
	2040.8 2	65 11			
	2247.1 3	55 9			
2250.5	806# 1	100#			
2270.1	1860.3 5	100 41			
	2063.8 3	59 13			
2297.9	199# 1	100#			
2335.1	683# 1	100#			
2558.9	261# 1	100#			
2720.5	470# 1	100#			
2874.9	316# 1	100#			
3000.5	280# 1	100#			
3345.5	345# 1	100#			

[†] From ^{109}Ru β^- decay (1987Ka29), unless otherwise noted.[‡] From $\alpha(\text{exp})$ and $\alpha(\text{K})\text{exp}$ data in ^{109}Ru β^- decay (1987Ka29).[§] Deduced by evaluators from $\alpha(\text{K})\text{exp}$ and $\alpha(\text{exp})$ in ^{109}Ru β^- decay (1987Ka29) using the BrIccMixing program. If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.# From (HI,xn γ) (2002Ve08). $\Delta(E_{\gamma})=1$ keV assumed by evaluators.

Adopted Levels, Gammas (continued)

^{109}Ru β^- Decay 1987Ka29

Parent ^{109}Ru : $E=0.0$; $J\pi=(5/2+)$; $T_{1/2}=34.4$ s 2; $Q(\text{g.s.})=4264$ 10; % β^- decay=100.

^{109}Ru -J, $T_{1/2}$: From Adopted Levels of ^{109}Ru .

^{109}Ru -Q(β^-): From 2012Wa38.

1987Ka29: Activity were produced using $^{249}\text{Cf}(\text{n,f})$ $E=\text{th.}$, ≈ 300 μg source, TRIGA Mainz reactor, neutron flux density 6×10^{11} neutron/cm². Detectors: 1 cm³ Ge X-ray (FWHM=200 eV at 5.9 keV), 32cm³ Ge(Li) (FWHM=1.8 keV at 1332 keV), 120cm³ Ge(Li) (FWHM=1.9 keV at 1332 keV). Measured: K x ray, $E\gamma$, $T_{1/2}$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(t)$, $\alpha(K)\text{exp.}$

Others: 1992PeZX, 1992Sh35, 1978Fr16.

 ^{109}Rh Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}^\S$	Comments
0.0	7/2+	80.8 s 7	$T_{1/2}$: From Adopted Levels.
206.250 20	9/2+	<41 ps	$T_{1/2}$: Other: <0.5 ns using β -206 $\gamma(t)$ in 1998Lh02 (centroid shift method).
225.873 19	3/2+	1.66 μs 4	$T_{1/2}$: from (116 γ)(226 γ)(t) in 1987Ka29.
257.66 3	(3/2)+	28.7 ns 15	$T_{1/2}$: from (221 γ)(32 γ)(t) in 1987Ka29.
358.584 16	3/2+	114.4 ps 13	$T_{1/2}$: Others: <0.5 ns from β -359 $\gamma(t)$ in 1998Lh02 (centroid shift method) and ≤ 5 ns in 1987Ka29.
373.99 3	1/2-	33.5 ns 14	$T_{1/2}$: weighted average of 33 ns 2 from (194 γ)(116 γ)(t) in 1987Ka29 (slope method) and 34 ns 2 from β -374 $\gamma(t)$ in 1998Lh02 (slope method).
409.74 3	7/2+	0.49 ns 3	$T_{1/2}$: Other: 0.43 ns 23 from β -183.85 $\gamma(t)$ in 1998Lh02 (centroid shift method).
426.759 19	5/2+	<53 ps	$T_{1/2}$: Others: <0.5 ns 427 $\gamma(t)$ in 1998Lh02 (centroid shift) and 8 ns 1 in 1987Ka29 (close to timing resolution of Ge(Li) detectors).
478.28 3	(5/2)+	174 ps 5	$T_{1/2}$: Other: <0.6 ns from β -221 $\gamma(t)$ in 1998Lh02 (centroid shift method).
530.66 7	11/2+		
568.10 4	3/2-	<0.83 ps	
623.12 4	5/2-	223 ps 8	
641.98 5	(11/2)+		
671.876 22	(5/2)+	<57 ps	
740.80 4	3/2-	<57 ps	
855.99 4	5/2-	<51 ps	
861.00 8	(9/2+)		
890.23 4	(9/2+)		
926.76 4	5/2-	107 ps 13	
973.29 19	(7/2-)		
980.71 4	(1/2)	<69 ps	
1011.60 4	(3/2)+		
1026.46 3	(5/2, 7/2)+		
1051.20 5	(1/2, 3/2, 5/2-)	27 ps 12	
1053.26 4	5/2+, 7/2+		
1096.25 4	(9/2)+		
1162.19 19	(3/2-)		
1176.97 11	3/2+, 5/2, 7/2+		
1214.19 16	(3/2)-		
1229.48 7	(7/2+)		
1283.86 6	(7/2-)		
1310.72 3	(3/2+)	54 ps 10	
1412.53 9	(1/2+)		
1511.512 25	7/2+	<23 ps	
1576.33 4	5/2+, 7/2+	<80 ps	
1637.97 17	(3/2)-		
1929.07 3	7/2+	<32 ps	
1963.40 5	(5/2)+	<32 ps	
1971.87 12	(5/2)+		
2015.41 8	(3/2)		
2045.54 15	(3/2)-		
2093.91 4	(3/2+)	<40 ps	
2098.59 12	(5/2+, 7/2)		
2117.00 12	(3/2+)		
2182.87 10	(5/2+, 7/2)		
2184.72 7	(3/2+, 5/2)		
2190.50 7	(3/2+)	<40 ps	
2193.74 11	(3/2+, 5/2)		
2208.45 8	(5/2+, 7/2)		
2209.40 10	(3/2+, 5/2)		
2237.92 10	(3/2+, 5/2)		
2247.07 14	(5/2+, 7/2)		

Continued on next page (footnotes at end of table)

^{109}Ru β^- Decay 1987Ka29 (continued) ^{109}Rh Levels (continued)

$E(\text{level})^\dagger$	$J\pi^\ddagger$
2270.1 3	(5/2+, 7/2)

† From a least-squares fit to $E\gamma$ energies.

‡ From Adopted Levels.

§ From $\beta\gamma\gamma(t)$ in 2011BuZZ, unless otherwise stated.

 β^- radiations

The decay scheme is incomplete (pandemonium). This is particularly evident from the low feeding intensities to the 225-, 258- and 359-keV levels. Thus, the $I\beta$ and $\log ft$ values are tentative.

$E\beta^-$	$E(\text{level})$	$I\beta^-^\dagger$	$\log ft$	Comments
(1994 10)	2270.1	0.12 4	6.98 15	
(2017 10)	2247.07	1.03 19	6.07 8	
(2026 10)	2237.92	0.59 7	6.32 6	
(2055 10)	2209.40	0.50 7	6.42 7	
(2056 10)	2208.45	0.84 8	6.19 5	
(2070 10)	2193.74	0.9 3	6.18 15	
(2074 10)	2190.50	2.3 3	5.77 6	
(2079 10)	2184.72	2.16 21	5.80 5	
(2081 10)	2182.87	0.70 17	6.29 11	
(2147 10)	2117.00	1.37 12	6.06 4	
(2165 10)	2098.59	1.47 18	6.04 6	
(2170 10)	2093.91	9.9 7	5.22 4	
(2218 10)	2045.54	0.63 6	6.45 5	
(2249 10)	2015.41	1.37 14	6.14 5	
(2292 10)	1971.87	2.3 4	5.95 8	
(2301 10)	1963.40	9.5 8	5.34 4	$E\beta^-$: E=2295 210 (1989Gr23).
(2335 10)	1929.07	19.9 13	5.05 3	$E\beta^-$: E=2280 80 (1989Gr23).
(2626 10)	1637.97	0.06 4	7.8 3	
(2688 10)	1576.33	2.11 17	6.28 4	
(2752 10)	1511.512	8.8 7	5.70 4	$E\beta^-$: E=2600 110 (1989Gr23).
(2953 10)	1310.72	0.24 10	7.39 19	
(2980 10)	1283.86	1.42 14	6.64 5	
(3035 10)	1229.48	0.58 7	7.06 6	
(3050 10)	1214.19	0.08 6	7.9 4	
(3087 10)	1176.97	0.19 8	7.58 19	
(3102 10)	1162.19	0.10 7	7.9 3	
(3211 10)	1053.26	3.3 3	6.41 4	
(3213 10)	1051.20	0.24 11	7.55 20	
(3238 10)	1026.46	5.5 5	6.20 4	$E\beta^-$: E=3100 110 (1989Gr23).
(3252 10)	1011.60	0.67 18	7.12 12	
(3291 10)	973.29	0.18 6	7.72 15	
(3337 10)	926.76	0.55 9	7.26 8	
(3408 10)	855.99	0.27 16	7.6 3	
(3523 10)	740.80	0.31 19	7.6 3	
(3592 10)	671.876	1.0 4	7.14 18	
(3641 10)	623.12	<0.5	>7.5	
(3696 10)	568.10	<0.4	>7.6	
(3786 10)	478.28	0.7 4	7.39 25	
(3837 10)	426.759	1.1 9	7.2 4	
(3854 10)	409.74	0.77 13	7.38 8	
(3890 10)	373.99	<0.6	>9.1 ^{1u}	
(3905 10)	358.584	<1.4	>7.1	$E\beta^-$: E=3655 200 (1989Gr23).
(4006 10)	257.66	<3	>6.9	
(4038 10)	225.873	<2.8	>6.9	
(4264 10)	0.0	8 6	6.6 4	

† Deduced by evaluators from $I(\gamma+\text{ce})$ intensity balance at each level.

^{109}Ru β^- Decay 1987Ka29 (continued) $\gamma(^{109}\text{Rh})$

I γ normalization: weighted average of 0.199 14 and 0.219 17, deduced from % γ /fission of 0.411% 10 (116.3 γ) and 0.805% 40 (358.8 γ) from 1969WiZX and the cumulative fission yield of 5.96% 24 for ^{109}Ru from JEFF3.1.1 data library.

E $\gamma^{\dagger}$	E(level)	I $\gamma^{\ddagger\#}$	Mult. ‡	$\delta^{\ddagger\S}$	α	Comments
31.80 3	257.66	2.11 12	M1+E2	0.60 9	29 5	%I γ =0.44 3, using the calculated normalization. Mult., δ : α (exp) 29 3 (1987Ka29), α (K)exp=13 4 (1987Ka29) and α (K)exp=17 +10-6 (1992PeZX).
55.01 3	623.12	0.85 7	[M1]		1.89	%I γ =0.176 17, using the calculated normalization.
68.07 3	426.759	13.4 7	M1		1.023	%I γ =2.77 20, using the calculated normalization. Mult.: α (K)exp=0.7 2 (1992PeZX).
101.1 1	358.584	0.11 3	[M1]		0.333	%I γ =0.023 7, using the calculated normalization.
115.17 5	855.99	0.30 15	[M1]		0.231	%I γ =0.06 4, using the calculated normalization.
116.32 3	373.99	34.7 17	[E1]		0.0945	%I γ =7.2 5, using the calculated normalization.
117.67 5	740.80	0.30 15	[M1]		0.218	%I γ =0.06 4, using the calculated normalization.
119.60 5	478.28	0.68 7	[M1]		0.208	%I γ =0.141 16, using the calculated normalization.
132.79 3	358.584	0.92 7	[M1]		0.1560	%I γ =0.190 18, using the calculated normalization.
148.12 3	373.99	0.61 5	[E1]		0.0472	%I γ =0.126 12, using the calculated normalization.
172.71 3	740.80	2.20 13	[M1]		0.0763	%I γ =0.45 4, using the calculated normalization.
183.85 3	409.74	8.0 4	E2		0.1530	%I γ =1.65 12, using the calculated normalization. Mult.: α (K)exp=0.13 3 (1992PeZX).
185.95 3	926.76	0.47 10	[M1]		0.0626	%I γ =0.097 22, using the calculated normalization.
194.10 5	568.10	9.0 13	[M1]		0.0559	%I γ =1.9 3, using the calculated normalization.
200.74 3	1511.512	2.0 2	[E2]		0.1122	%I γ =0.41 5, using the calculated normalization.
200.9 3	426.759	0.6 2	[M1]		0.0510	%I γ =0.12 5, using the calculated normalization.
203.6 1	409.74	0.5 1	[M1]		0.0492	%I γ =0.103 22, using the calculated normalization.
206.29 3	206.250	100 5	M1		0.0476	%I γ =20.7 13, using the calculated normalization. Mult.: α (K)exp=0.041 7 (1992PeZX).
218.36 5	890.23	1.55 12	[E2]		0.0836	%I γ =0.32 3, using the calculated normalization.
220.6 3	426.759	2.7 7	[E2]		0.0806	%I γ =0.56 15, using the calculated normalization.
220.64 5	478.28	11.0 14	M1+E2	1.4 7	0.067 14	%I γ =2.3 3, using the calculated normalization. Mult.: α (K)exp=0.057 11 (1992PeZX).
225.98 3	225.873	89 5	E2		0.0741	%I γ =18.4 12, using the calculated normalization. Mult.: α (K)exp=0.062 11 (1992PeZX), 0.07 1 (1987Ka29), 0.09 4 (1977Ba57).
232.87 3	855.99	2.53 18	[M1]		0.0346	%I γ =0.52 5, using the calculated normalization.
239.90 3	980.71	4.9 3				%I γ =1.01 8, using the calculated normalization.
245.09 3	671.876	11.7 8	(E2)		0.0560	%I γ =2.42 20, using the calculated normalization. Mult.: α (K)exp=0.07 2 (1992PeZX), but E1+M2 with $\delta=1.0$ +4-3 is also possible.
249.2 1	623.12	6.6 10	[E2]		0.0529	%I γ =1.36 22, using the calculated normalization.
252.45 5	478.28	6.3 4	[M1]		0.0280	%I γ =1.30 11, using the calculated normalization.
265.61 3	1576.33	2.25 14	[M1]		0.0246	%I γ =0.47 4, using the calculated normalization.
272.1 1	478.28	0.5 2	[E2]		0.0392	%I γ =0.10 5, using the calculated normalization.
287.89 5	855.99	1.46 13	[M1]		0.0200	%I γ =0.30 3, using the calculated normalization.
303.64 5	926.76	1.3 3	[M1]		0.01747	%I γ =0.27 7, using the calculated normalization.
310.39 5	1051.20	1.24 12	[M1]		0.01652	%I γ =0.26 3, using the calculated normalization.
324.4 1	530.66	2.20 24				%I γ =0.45 6, using the calculated normalization.
350.2 2	973.29	0.5 2	[M1]		0.01219	%I γ =0.10 5, using the calculated normalization.
352.9 1	1929.07	1.07 16	[M1]		0.01196	%I γ =0.22 4, using the calculated normalization.
354.5 3	1026.46	0.6 2	[M1]		0.01183	%I γ =0.12 5, using the calculated normalization.
358.429 21	358.584	62 3	E2		0.01568	E γ : From 1979Bo26. %I γ =12.8 9, using the calculated normalization. Mult.: α (K)exp=0.013 3 (1992PeZX).
358.7 5	926.76	1.0 3	[M1]		0.01148	%I γ =0.21 7, using the calculated normalization.
366.81 3	740.80	8.2 6	[M1]		0.01086	%I γ =1.69 15, using the calculated normalization.
381.4 1	1053.26	1.2 3	[M1]		0.00986	%I γ =0.25 7, using the calculated normalization.
382.8 1	861.00	2.2 3	[E2]		0.01276	%I γ =0.45 7, using the calculated normalization.
405.0 5	973.29	0.4 2	[E2]		0.01069	%I γ =0.08 5, using the calculated normalization.

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^{109}Ru β^- Decay $^{1987}\text{Ka29}$ (continued) $\gamma(^{109}\text{Rh})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger$	Mult. ‡	α	Comments
409.7 1	409.74	1.1 1	[M1]	0.00826	%I γ =0.227 24, using the calculated normalization.
415.34 5	1511.512	1.2 5	[M1]	0.00799	%I γ =0.25 11, using the calculated normalization.
426.84 5	426.759	47.7 24	[M1]	0.00748	%I γ =9.9 7, using the calculated normalization.
435.72 5	641.98	2.1 1	[M1]	0.00711	%I γ =0.43 3, using the calculated normalization.
451.2 2	861.00	0.5 1	[M1]	0.00653	%I γ =0.103 22, using the calculated normalization.
454.6 3	1096.25	0.2 1	[M1]	0.00641	%I γ =0.041 21, using the calculated normalization.
455.9 2	2093.91	0.74 10	[E1]	0.00223	%I γ =0.153 22, using the calculated normalization.
458.3 2	1511.512	0.3 1	[M1]	0.00629	%I γ =0.062 21, using the calculated normalization.
463.4 1	890.23	1.0 4	[E2]	0.00708	%I γ =0.21 9, using the calculated normalization.
465.65 3	671.876	11.4 6	[E2]	0.00698	%I γ =2.36 17, using the calculated normalization.
478.4 1	478.28	0.73 8	[M1]	0.00567	%I γ =0.151 18, using the calculated normalization.
480.1 2	1576.33	0.75 8	[M1, E2]	0.0060 4	%I γ =0.155 19, using the calculated normalization.
482.0 1	855.99	0.5 5	[E2]	0.00630	%I γ =0.10 11, using the calculated normalization.
485.04 5	1511.512	1.09 10	[M1]	0.00548	%I γ =0.225 24, using the calculated normalization.
499.94 5	1511.512	3.13 25	[E2]	0.00566	%I γ =0.65 6, using the calculated normalization.
530.7 1	530.66	0.58 7			%I γ =0.120 16, using the calculated normalization.
564.5 5	1576.33	1.0 3	[M1, E2]	0.00391 11	%I γ =0.21 7, using the calculated normalization.
565.7 3	1096.25	0.9 3	[M1]	0.00380	%I γ =0.19 7, using the calculated normalization.
575.0 1	1053.26	0.59 9	[M1]	0.00366	%I γ =0.122 20, using the calculated normalization.
584.8 1	1011.60	0.67 9	[M1]	0.00351	%I γ =0.138 20, using the calculated normalization.
599.66 5	1026.46	1.65 13	[M1]	0.00331	%I γ =0.34 4, using the calculated normalization.
606.7 1	980.71	0.5 2			%I γ =0.10 5, using the calculated normalization.
612.2 2	1283.86	0.52 10	[E1]	1.12 $\times 10^{-3}$	%I γ =0.107 22, using the calculated normalization.
616.7 1	1026.46	0.90 10	[M1]	0.00310	%I γ =0.186 23, using the calculated normalization.
618.5 5	1929.07	0.45 23	[E2]	0.00311	%I γ =0.09 5, using the calculated normalization.
621.3 3	1511.512	3.60 11	[M1]	0.00305	%I γ =0.74 5, using the calculated normalization.
621.9 3	980.71	2.2 7			%I γ =0.45 15, using the calculated normalization.
626.4 1	1053.26	1.69 14	[M1]	0.00299	%I γ =0.35 4, using the calculated normalization.
638.9 2	1310.72	0.25 7	[E2]	0.00285	%I γ =0.052 15, using the calculated normalization.
643.50 5	1053.26	2.9 2	[M1]	0.00281	%I γ =0.60 5, using the calculated normalization.
645.3 1	1929.07	0.92 12	[E1]	9.94 $\times 10^{-4}$	%I γ =0.19 3, using the calculated normalization.
646.0 5	1214.19	0.4 2	[M1]	0.00278	%I γ =0.08 5, using the calculated normalization.
652.5 1	1963.40	0.2 1	[M1]	0.00272	%I γ =0.041 21, using the calculated normalization.
667.5 3	1026.46	1.14 11	[M1, E2]	0.00256 5	%I γ =0.24 3, using the calculated normalization.
671.93 5	671.876	4.2 3	[M1]	0.00254	%I γ =0.87 8, using the calculated normalization.
677.2 1	1051.20	3.8 3			%I γ =0.79 8, using the calculated normalization.
681.4 1	2093.91	2.29 18	[M1]	0.00246	%I γ =0.47 5, using the calculated normalization.
684.0 1	890.23	0.90 11	[M1]	0.00244	%I γ =0.186 25, using the calculated normalization.
686.1 1	1576.33	2.08 17	[M1]	0.00242	%I γ =0.43 4, using the calculated normalization.
692.5 5	1051.20	0.26 13			%I γ =0.05 3, using the calculated normalization.
699.0 5	1229.48	0.18 9	[E2]	0.00225	%I γ =0.037 19, using the calculated normalization.
723.0 2	980.71	0.48 9			%I γ =0.099 20, using the calculated normalization.
750.2 5	1176.97	0.6 2			%I γ =0.12 5, using the calculated normalization.
751.0 5	1229.48	0.31 16	[M1]	0.00197	%I γ =0.06 4, using the calculated normalization.
754.85 5	980.71	1.06 11			%I γ =0.22 3, using the calculated normalization.
800.5 2	1026.46	0.60 10	[M1, E2]	0.00165 6	%I γ =0.124 22, using the calculated normalization.
802.7 2	1229.48	0.3 2	[M1]	1.69 $\times 10^{-3}$	%I γ =0.06 5, using the calculated normalization.
803.5 5	1162.19	0.9 3	[E1]	6.22 $\times 10^{-4}$	%I γ =0.19 7, using the calculated normalization.
818.3 2	1176.97	1.09 13			%I γ =0.23 3, using the calculated normalization.
819.8 5	1229.48	0.25 10	[M1]	1.61 $\times 10^{-3}$	%I γ =0.052 21, using the calculated normalization.
820.20 5	1026.46	19.8 12	[M1, E2]	0.00156 6	%I γ =4.1 4, using the calculated normalization.
827.3 3	1053.26	2.77 22	[M1, E2]	0.00153 6	%I γ =0.57 6, using the calculated normalization.
832.5 2	1310.72	0.46 10	[M1]	1.56 $\times 10^{-3}$	%I γ =0.095 22, using the calculated normalization.
838.4 2	2015.41	0.5 2			%I γ =0.10 5, using the calculated normalization.
839.8 3	1511.512	3.3 8	[M1]	1.53 $\times 10^{-3}$	%I γ =0.68 17, using the calculated normalization.
840.2 3	1214.19	0.77 23	[M1]	1.53 $\times 10^{-3}$	%I γ =0.16 5, using the calculated normalization.
847.0 1	1053.26	5.1 10	[M1, E2]	0.00145 6	%I γ =1.05 21, using the calculated normalization.
860.9 3	861.00	0.30 9	[M1]	1.45 $\times 10^{-3}$	%I γ =0.062 19, using the calculated normalization.
869.5 2	1511.512	0.50 10	[E2]	1.31 $\times 10^{-3}$	%I γ =0.103 22, using the calculated normalization.
874.0 3	1283.86	0.36 14	[E1]	5.25 $\times 10^{-4}$	%I γ =0.07 3, using the calculated normalization.
875.8 1	1929.07	1.01 20	[M1]	1.39 $\times 10^{-3}$	%I γ =0.21 5, using the calculated normalization.
879.7 2	2093.91	0.74 10	[E1]	5.18 $\times 10^{-4}$	%I γ =0.153 22, using the calculated normalization.
883.94 5	1310.72	1.51 15	[M1]	1.36 $\times 10^{-3}$	%I γ =0.31 4, using the calculated normalization.

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^{109}Ru β^- Decay 1987Ka29 (continued) $\gamma(^{109}\text{Rh})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$	Mult. ‡	α	Comments
890.1 3	1096.25	1.5 4	[M1]	1.34×10^{-3}	%I γ =0.31 9, using the calculated normalization.
890.3 3	890.23	9.6 10	[M1]	1.34×10^{-3}	%I γ =1.98 23, using the calculated normalization.
902.6 1	1929.07	2.23 20	[M1]	1.30×10^{-3}	%I γ =0.46 5, using the calculated normalization.
904.6 2	1576.33	1.73 7	[M1]	1.30×10^{-3}	%I γ =0.358 23, using the calculated normalization.
917.5 1	1929.07	3.08 23	[E2]	1.15×10^{-3}	%I γ =0.64 6, using the calculated normalization.
931.7 2	2093.91	0.35 17	[E1]	4.62×10^{-4}	%I γ =0.07 4, using the calculated normalization.
952.00 5	1310.72	4.2 3	[M1]	1.16×10^{-3}	%I γ =0.87 8, using the calculated normalization.
960.5 5	1971.87	0.29 15	[M1]	1.13×10^{-3}	%I γ =0.06 4, using the calculated normalization.
980.8 2	1511.512	0.79 11	[E2]	9.86×10^{-4}	%I γ =0.163 24, using the calculated normalization.
985.8 2	1412.53	0.58 10	[E2]	9.75×10^{-4}	%I γ =0.120 22, using the calculated normalization.
1002.5 5	2098.59	1.0 5			%I γ =0.21 11, using the calculated normalization.
1007.7 2	2184.72	0.67 20			%I γ =0.14 5, using the calculated normalization.
1011.7 1	1011.60	12.1 7	[E2]	9.19×10^{-4}	%I γ =2.50 19, using the calculated normalization.
1023.2 1	1229.48	1.18 15	[M1]	9.87×10^{-4}	%I γ =0.24 4, using the calculated normalization.
1026.49 5	1026.46	7.1 4	[M1]	9.80×10^{-4}	%I γ =1.47 11, using the calculated normalization.
1033.2 1	1511.512	0.50 10	[M1]	9.66×10^{-4}	%I γ =0.103 22, using the calculated normalization.
1038.8 1	1929.07	1.33 14	[M1]	9.55×10^{-4}	%I γ =0.27 4, using the calculated normalization.
1042.7 2	2093.91	2.5 4			%I γ =0.52 9, using the calculated normalization.
1053.4 1	1053.26	4.2 3	[M1]	9.27×10^{-4}	%I γ =0.87 8, using the calculated normalization.
1054.0 5	1412.53	0.8 3	[M1]	9.25×10^{-4}	%I γ =0.17 7, using the calculated normalization.
1068.0 5	1929.07	0.4 2	[M1]	8.99×10^{-4}	%I γ =0.08 5, using the calculated normalization.
1073.2 1	1963.40	3.8 3	[E2]	8.06×10^{-4}	%I γ =0.79 8, using the calculated normalization.
1077.6 1	1283.86	4.5 5	[E1]	3.50×10^{-4}	%I γ =0.93 12, using the calculated normalization.
1081.5 5	1971.87	0.6 3	[E2]	8.75×10^{-4}	%I γ =0.12 7, using the calculated normalization.
1082.2 1	2093.91	1.40 21	[M1]	8.74×10^{-4}	%I γ =0.29 5, using the calculated normalization.
1084.7 1	1511.512	2.0 3	[M1]	8.70×10^{-4}	%I γ =0.41 7, using the calculated normalization.
1096.30 5	1096.25	2.2 4	[M1]	8.50×10^{-4}	%I γ =0.45 9, using the calculated normalization.
1098.0 2	1576.33	0.90 16	[M1]	8.47×10^{-4}	%I γ =0.19 4, using the calculated normalization.
1105.6 5	2117.00	0.4 2	[M1]	8.35×10^{-4}	%I γ =0.08 5, using the calculated normalization.
1113.2 1	2093.91	6.3 4			%I γ =1.30 11, using the calculated normalization.
1133.5 2	2184.72	0.50 11			%I γ =0.103 24, using the calculated normalization.
1139.2 2	2190.50	1.06 13			%I γ =0.22 3, using the calculated normalization.
1150.7 3	2247.07	1.06 14			%I γ =0.22 3, using the calculated normalization.
1152.9 1	1511.512	1.85 18	[E2]	6.92×10^{-4}	%I γ =0.38 5, using the calculated normalization.
1155.0 5	1412.53	0.6 3	[M1]	7.62×10^{-4}	%I γ =0.12 7, using the calculated normalization.
1166.5 2	1576.33	0.38 10	[M1]	7.47×10^{-4}	%I γ =0.079 21, using the calculated normalization.
1177.0 3	1176.97	0.50 13			%I γ =0.10 3, using the calculated normalization.
1186.7 3	1412.53	0.3 1	[M1]	7.21×10^{-4}	%I γ =0.062 21, using the calculated normalization.
1208.1 3	2098.59	0.79 15			%I γ =0.16 4, using the calculated normalization.
1209.6 3	2190.50	1.57 20			%I γ =0.32 5, using the calculated normalization.
1229.5 1	1229.48	0.82 13	[M1]	6.74×10^{-4}	%I γ =0.17 3, using the calculated normalization.
1237.8 5	2098.59	0.8 4			%I γ =0.17 9, using the calculated normalization.
1237.9 1	2093.91	2.7 5	[E1]	3.32×10^{-4}	%I γ =0.56 11, using the calculated normalization.
1257.2 1	1929.07	4.4 3	[M1]	6.48×10^{-4}	%I γ =0.91 8, using the calculated normalization.
1274.6 4	2015.41	0.29 12			%I γ =0.060 25, using the calculated normalization.
1279.3 3	1637.97	1.01 15	[E1]	3.42×10^{-4}	%I γ =0.21 4, using the calculated normalization.
1283.9 1	1283.86	2.91 24	[E1]	3.43×10^{-4}	%I γ =0.60 6, using the calculated normalization.
1287.0 1	1929.07	1.23 15	[E2]	5.69×10^{-4}	%I γ =0.25 4, using the calculated normalization.
1291.5 1	1963.40	2.4 3	[M1]	6.18×10^{-4}	%I γ =0.50 7, using the calculated normalization.
1305.3 1	1511.512	22.1 12	[M1]	6.08×10^{-4}	%I γ =4.6 4, using the calculated normalization.
1334.5 2	2190.50	0.89 14	[E1]	3.59×10^{-4}	%I γ =0.18 3, using the calculated normalization.
1347.5 1	2208.45	1.61 17			%I γ =0.33 4, using the calculated normalization.
1353.2 2	2093.91	0.87 13	[E1]	3.65×10^{-4}	%I γ =0.18 3, using the calculated normalization.
1357.0 5	2247.07	1.4 7			%I γ =0.29 15, using the calculated normalization.
1370.1 1	1576.33	2.34 21	[M1, E2]	5.43×10^{-4}	23 %I γ =0.48 5, using the calculated normalization.
1398.6 3	1929.07	0.72 13	[E2]	5.11×10^{-4}	%I γ =0.15 3, using the calculated normalization.
1449.8 2	2190.50	1.2 5	[E1]	4.06×10^{-4}	%I γ =0.25 11, using the calculated normalization.
1450.5 2	1929.07	0.8 3	[M1]	5.26×10^{-4}	%I γ =0.17 7, using the calculated normalization.
1471.0 5	2093.91	2.0 8	[E1]	4.17×10^{-4}	%I γ =0.41 17, using the calculated normalization.
1485.0 5	1963.40	0.6 3	[M1]	5.14×10^{-4}	%I γ =0.12 7, using the calculated normalization.
1502.28 5	1929.07	18.3 11	[M1]	5.09×10^{-4}	%I γ =3.8 3, using the calculated normalization.
1511.7 1	1511.512	3.1 5	[M1]	5.07×10^{-4}	%I γ =0.64 11, using the calculated normalization.
1512.9 1	2184.72	4.6 6			%I γ =0.95 14, using the calculated normalization.

Continued on next page (footnotes at end of table)

¹⁰⁹Ru β⁻ Decay 1987Ka29 (continued)

γ(¹⁰⁹Rh) (continued)

Eγ [†]	E(level)	Iγ [†] #	Mult. [‡]	α	Comments
1521.7 3	2193.74	0.31 10			%Iγ=0.064 21, using the calculated normalization.
1536.7 1	1963.40	17 3	[M1]	5.01×10 ⁻⁴	%Iγ=3.5 7, using the calculated normalization.
1537.0 5	2015.41	0.9 4			%Iγ=0.19 9, using the calculated normalization.
1537.5 5	2209.40	0.8 3			%Iγ=0.17 7, using the calculated normalization.
1545.0 2	1971.87	1.10 16	[M1]	5.00×10 ⁻⁴	%Iγ=0.23 4, using the calculated normalization.
1567.2 2	2045.54	1.96 18	[E1]	4.71×10 ⁻⁴	%Iγ=0.41 5, using the calculated normalization.
1570.4 2	1929.07	0.82 15	[E2]	4.76×10 ⁻⁴	%Iγ=0.17 4, using the calculated normalization.
1575.2 5	2247.07	1.2 5			%Iγ=0.25 11, using the calculated normalization.
1576.5 5	1576.33	0.6 3	[M1]	4.94×10 ⁻⁴	%Iγ=0.12 7, using the calculated normalization.
1585.1 2	2208.45	1.84 22			%Iγ=0.38 5, using the calculated normalization.
1588.7 2	2015.41	0.76 18			%Iγ=0.16 4, using the calculated normalization.
1615.7 1	2093.91	4.5 4	[M1]	4.90×10 ⁻⁴	%Iγ=0.93 10, using the calculated normalization.
1616.5 5	2184.72	1.0 3			%Iγ=0.21 7, using the calculated normalization.
1620.2 3	2098.59	0.28 8			%Iγ=0.058 17, using the calculated normalization.
1641.5 3	2015.41	0.28 14			%Iγ=0.06 3, using the calculated normalization.
1656.8 1	2015.41	3.2 3			%Iγ=0.66 7, using the calculated normalization.
1667.1 1	2093.91	3.6 3	[M1]	4.86×10 ⁻⁴	%Iγ=0.74 8, using the calculated normalization.
1689.0 5	2098.59	0.2 1			%Iγ=0.041 21, using the calculated normalization.
1690.0 2	2117.00	2.0 2	[M1]	4.86×10 ⁻⁴	%Iγ=0.41 5, using the calculated normalization.
1712.3 3	2190.50	0.54 15	[M1]	4.86×10 ⁻⁴	%Iγ=0.11 4, using the calculated normalization.
1715.4 2	2193.74	0.55 11			%Iγ=0.114 24, using the calculated normalization.
1720.0 1	2093.91	7.3 5	[E1]	5.63×10 ⁻⁴	%Iγ=1.51 13, using the calculated normalization.
1722.8 1	1929.07	4.8 4	[M1]	4.86×10 ⁻⁴	%Iγ=0.99 10, using the calculated normalization.
1735.2 1	2093.91	6.2 4	[M1]	4.87×10 ⁻⁴	%Iγ=1.28 11, using the calculated normalization.
1756.0 5	2182.87	1.9 8			%Iγ=0.39 17, using the calculated normalization.
1757.1 1	1963.40	14.4 9	[E2]	4.85×10 ⁻⁴	%Iγ=2.98 24, using the calculated normalization.
1758.0 5	2184.72	1.3 5			%Iγ=0.27 11, using the calculated normalization.
1759.5 3	2237.92	1.27 22			%Iγ=0.26 5, using the calculated normalization.
1763.8 3	2190.50	1.3 3	[M1]	4.88×10 ⁻⁴	%Iγ=0.27 7, using the calculated normalization.
1765.7 3	1971.87	7.9 16	[E2]	4.86×10 ⁻⁴	%Iγ=1.6 4, using the calculated normalization.
1767.0 2	2193.74	2.4 12			%Iγ=0.50 25, using the calculated normalization.
1789.5 3	2015.41	1.23 16			%Iγ=0.25 4, using the calculated normalization.
1798.7 1	2208.45	0.97 15			%Iγ=0.20 4, using the calculated normalization.
1811.4 3	2237.92	0.68 15			%Iγ=0.14 4, using the calculated normalization.
1816.5 5	2190.50	0.71 17	[E1]	6.23×10 ⁻⁴	%Iγ=0.15 4, using the calculated normalization.
1819.7 2	2045.54	1.32 13	[E1]	6.24×10 ⁻⁴	%Iγ=0.27 3, using the calculated normalization.
1825.9 2	2184.72	1.6 3			%Iγ=0.33 7, using the calculated normalization.
1831.9 1	2190.50	4.7 9	[M1]	4.95×10 ⁻⁴	%Iγ=0.97 19, using the calculated normalization.
1836.2 1	2093.91	7.2 7	[M1]	4.95×10 ⁻⁴	%Iγ=1.49 16, using the calculated normalization.
1850.8 1	2209.40	1.80 20			%Iγ=0.37 5, using the calculated normalization.
1859.3 2	2117.00	3.4 3	[M1]	4.99×10 ⁻⁴	%Iγ=0.70 7, using the calculated normalization.
1860.3 5	2270.1	0.39 16			%Iγ=0.08 4, using the calculated normalization.
1868.0 2	2093.91	2.52 23	[M1]	5.00×10 ⁻⁴	%Iγ=0.52 6, using the calculated normalization.
1879.3 1	2237.92	1.13 16			%Iγ=0.23 4, using the calculated normalization.
1891.4 3	2117.00	1.15 16	[M1]	5.03×10 ⁻⁴	%Iγ=0.24 4, using the calculated normalization.
1892.4 3	2098.59	0.8 3			%Iγ=0.17 7, using the calculated normalization.
1929.06 5	1929.07	62 3	[M1]	5.10×10 ⁻⁴	%Iγ=12.8 9, using the calculated normalization.
1958.8 3	2184.72	0.91 13			%Iγ=0.19 3, using the calculated normalization.
1963.5 1	1963.40	11.3 9	[M1]	5.17×10 ⁻⁴	%Iγ=2.34 22, using the calculated normalization.
1971.9 2	1971.87	2.04 22	[M1]	5.18×10 ⁻⁴	%Iγ=0.42 5, using the calculated normalization.
1976.6 1	2182.87	1.76 21			%Iγ=0.36 5, using the calculated normalization.
2040.8 2	2247.07	0.91 15			%Iγ=0.19 4, using the calculated normalization.
2063.8 3	2270.1	0.23 5			%Iγ=0.048 11, using the calculated normalization.
2094.3 3	2093.91	0.50 9	[E2]	5.62×10 ⁻⁴	%Iγ=0.103 20, using the calculated normalization.
2098.6 2	2098.59	3.8 3			%Iγ=0.79 8, using the calculated normalization.
2117.3 4	2117.00	0.22 9	[E2]	5.69×10 ⁻⁴	%Iγ=0.045 19, using the calculated normalization.
2184.7 2	2184.72	0.74 11			%Iγ=0.153 24, using the calculated normalization.
2193.8 2	2193.74	1.69 17			%Iγ=0.35 4, using the calculated normalization.
2247.1 3	2247.07	0.77 12			%Iγ=0.16 3, using the calculated normalization.

[†] From 1987Ka29.

[‡] From Adopted Gammas.

[§] If no value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.

[#] For absolute intensity per 100 decays, multiply by 0.207 11.

^{109}Ru β^- Decay 1987Ka29 (continued)

Decay Scheme

 Intensities: relative I_γ

 $^{109}\text{Rh}_{64}$

^{109}Ru β^- Decay 1987Ka29 (continued)

Decay Scheme (continued)

 Intensities: relative I_γ

$^{109}\text{Ru} \beta^-$ Decay 1987Ka29 (continued)

Decay Scheme (continued)

$^{109}\text{Ru} \beta^-$ Decay 1987Ka29 (continued)

Decay Scheme (continued)

 Intensities: relative I_γ

$^{109}\text{Ru} \beta^-$ Decay 1987Ka29 (continued)

Decay Scheme (continued)

¹⁰⁹Ru β⁻ Decay 1987Ka29 (continued)

Decay Scheme (continued)

Intensities: relative I_γ

$^{110}\text{Pd}(\text{d}, ^3\text{He})$ 1987Ka29

Target $J\pi(^{110}\text{Pd})=0+$.

1987Ka29: $E(\text{d})=50$ MeV from KVI cyclotron at Groningen. Target: $\approx 300 \mu\text{g}/\text{cm}^2$ with $\approx 35 \mu\text{g}/\text{cm}^2$ carbon backing, 99%

Enriched ^{110}Pd . Detectors: Magnetic spectrometer (FWHM=30 keV). Measured: $\sigma(\theta)$ (9 angles ranging from 4° to 30°).

Deduced: Levels, $J\pi$, L, spectroscopic factors.

 ^{109}Rh Levels

$E(\text{level})^\dagger$	$L^\ddagger$	$C^2S^\S$	$E(\text{level})^\dagger$	$L^\ddagger$	$C^2S^\S$	$E(\text{level})^\dagger$	$L^\ddagger$	$C^2S^\S$
0.0	4	0.19	928	3	0.66	1522		
206	4	3.4	1017	2	0.13, 0.097	1631	1	0.47
374	1	0.84	1097	4	1.8	1753	1	0.13, 0.094
426	2	0.22	1162	(1, 2)		1915		
570	1	0.56	1220	1	0.083	1953		
624	1+3		1280	(3, 4)		2002		
743	1	1.1	1339	2	0.060	2037	1	0.26
856	3	2.0	1457	4	0.44	2091		

† From 1987Ka29, $\Delta E=5-10$ keV.

‡ From comparisons of experimental cross-section data with the DWBA predictions (1987Ka29).

§ From 1987Ka29, $S=(2j+1)/N \times (d\sigma/d\Omega)_{\text{exp}}/\sigma_{\text{DWBA}}$, N is the normalization factor and j is the angular momentum of transferred particle.

 $^{110}\text{Pd}(\text{pol } t, \alpha)$ E=17 MeV 1981F102

Target $J\pi(^{110}\text{Pd})=0+$.

1981F102: $E(^3\text{H})=17$ MeV, polarized beam with 0.75 polarization, Los Alamos Tandem Van de Graaff facility. Target: $152 \mu\text{g}/\text{cm}^2$ of ^{110}Pd (isotopic purity >95%). Detectors: quadrupole-three-dipole (Q3D) spectrometer (FWHM=20 keV),

1-m helical focal plane detector (Proportional chamber and a scintillator detector). Measured: $\sigma(\theta)$ (Angular distributions from 10° to 45°), analyzing powers. Deduced: levels, $J\pi$, L, spectroscopic factors.

 ^{109}Rh Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$L^\S$	$C^2S^\#$	$E(\text{level})^\dagger$	$J\pi^\ddagger$	$L^\S$	$C^2S^\#$
0.0	7/2+	4	0.05	1207 7	(3/2-)	(1)	(0.10)
206 3	9/2+	4	3.7	1272 10	(5/2-)	(3)	(0.33)
374 3	1/2-	1	1.4	1331 10	(5/2+)	(2)	(0.11)
424 3	(5/2+)	(2)	(0.21)	1430 10			
566 3	(3/2-)	(1)	(0.85)	1459 10	(9/2+)	(4)	(0.40)
737 5	3/2-	1	1.7	1513 10	(1/2-)	(1)	(0.18)
852 5	5/2-	3	2.3	1627 10	(5/2+, 3/2-)	(2, 1)	0.44, 0.83
923 5	(5/2-)	(3)	(0.72)	1746 10			
1006 5				1914 10			
1091 5	9/2+	4	1.90	2019 10	(1/2-)	(1)	(0.58)
1155 5	(3/2-)	(1)	(0.19)	2261 10			

† From 1981F102.

‡ From 1981F102 based on L+1/2 or L-1/2 transfers from analyzing power fits to measured cross-sections spectroscopic factors.

§ From comparisons of experimental cross-section data with the DWBA predictions (1981F102).

$^\#$ From 1981F102, $S=(2j+1)/N \times (d\sigma/d\Omega)_{\text{exp}}/\sigma_{\text{DWBA}}$, N=23 and j is the angular momentum of transferred particle.

(HI,xnγ) 1999Ve12,2002Ve08

1999Ve12: ¹⁷⁶Yb(²⁸Si,Fγ) E(²⁸Si)=145 MeV, the beam was delivered by the Vivitron accelerator at Strasbourg. Target: 1.5 mg/cm² of ¹⁷⁶Yb with 15 mg/cm² Au backing. Detectors: EUROGAM2 array (54 escape-suppressed Ge detectors), identification through the detection of complementary fragment. Measured: Eγ, γγ, γγγ.
 2002Ve08: ²⁰⁸Pb(¹⁸O,Fγ), E(¹⁸O)=85 MeV, beam by Vivitron accelerator of IReS at Strasbourg. Target: 20 mg/cm² of ²⁰⁸Pb. Detectors: Euroball IV array (15 cluster Ge detectors, 26 clover Ge detectors and 30 single-crystal Ge detectors). Measured Eγ, Iγ, γγ, γγγ.

¹⁰⁹Rh Levels

E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]
0.0 §	7/2+	768.0 [@] 18	(11/2+)	1975.1 § 13	(19/2+)
206.0 § 8	9/2+	1063.0 [#] 23	(9/2-)	2098.5 ^a 12	(17/2-)
226.0 [@] 10	3/2+	1072.8 ^{&} 11	(13/2+)	2250.1 § 15	(21/2+)
258.0 15	(1/2)+	1202.2 § 10	(15/2+)	2297.5 ^a 16	(19/2-)
374.0 [#] 18	1/2-	1292.0 [@] 20	(15/2+)	2336 [#] 3	(17/2-)
410.0 [@] 15	(7/2+)	1444.1 § 11	(17/2+)	2558.5 ^a 19	(21/2-)
530.0 § 8	(11/2+)	1454.7 ^{&} 12	(15/2+)	2720.1 18	
623.0 [#] 20	(5/2-)	1653.0 [#] 25	(13/2-)	2874.5 ^a 21	(23/2-)
641.8 ^{&} 11	(11/2+)	1675.7 ^{&} 13	(17/2+)	3000.1 21	
745.0 § 10	(13/2+)	1960.0 [@] 23	(19/2+)	3345.1 23	

[†] From a least-squares fit to γ-ray energies.

[‡] From 2002Ve08 based on band structure, unless otherwise stated.

§ (A): πg_{9/2} band.

(B): π1/2[301] band.

@ (C): π(g_{7/2} or d_{5/2}) band.

& (D): Band based on (11/2+).

a (E): ΔJ=1 band based on (17/2-).

γ(¹⁰⁹Rh)

Eγ [†]	E(level)	Eγ [†]	E(level)	Eγ [†]	E(level)
32 [‡]	258.0	328 1	1072.8	539 1	745.0
116 1	374.0	345 1	3345.1	590 1	1653.0
184 1	410.0	358 1	768.0	603 1	1675.7
199 1	2297.5	382 1	1454.7	644 1	2098.5
206 1	206.0	423 1	2098.5	668 1	1960.0
215 1	745.0	431 1	1072.8	672 1	1202.2
226 [‡]	226.0	436 1	641.8	683 1	2336
242 1	1444.1	440 1	1063.0	699 1	1444.1
249 1	623.0	457 1	1202.2	773 1	1975.1
261 1	2558.5	470 1	2720.1	806 1	2250.1
280 1	3000.1	524 1	1292.0	813 1	1454.7
316 1	2874.5	530 1	530.0	896 1	2098.5
324 1	530.0	531 1	1975.1		

[†] From 2002Ve08, Δ(Eγ)=1 keV assumed by evaluators.

[‡] Rounded value from Adopted Gammas.

Adopted Levels, Gammas

Q(β⁻)=1113.3 14; S(n)=6153.59 15; S(p)=9864 14; Q(α)=-4099.0 28 2012Wa38.

¹⁰⁹Pd Levels

Cross Reference (XREF) Flags

A ¹⁰⁹Rh β⁻ Decay
B ¹⁰⁹Pd IT Decay (4.703 min)
C ¹⁰⁸Pd(n,γ) E=thermal
D ¹⁰⁸Pd(n,γ) E=res: Av
E ¹⁰⁸Pd(n,γ) E=2.96 eV
F ¹⁰⁸Pd(d,p)
G ¹¹⁰Pd(d,t)
H ¹⁷⁶Yb(³⁰Si,Fγ)

E(level) [†]	Jπ	XREF	T _{1/2} [‡]	Comments
0.0&	5/2+§	ABCDEFGH	13.59 h 12	%β ⁻ =100. Jπ: L(d,p)=L(d,t)=2 and direct β ⁻ -feeding to Jπ=7/2+ in ¹⁰⁹ Ag. T _{1/2} : using the Limitation of Relative Statistical Weight method and 13.45 h 1 (2015Kr07), 13.7012 h 24 (1990Ab06), 13.404 h 8 (1988Ba60), 13.85 h 17 (1983Ch42), 13.427 h 14 (1977Gil1), 13.67 h 7 (1970Bo22), 13.47 h 1 (1962Br15), 13.45 h 1 (1959St28). Others: 13.99 h 16 (1958Gu09), and 14.1 h 3 (1948Mo33). configuration: a mixture between v5/2+[413] and v5/2+[402] Nilsson configurations.
113.4000 14	1/2+	A CDEFG	380 ns 50	Jπ: L(d,p)=L(d,t)=0. 113.4γ E2 to 5/2+. T _{1/2} : from (178.0γ)(113.4γ)(t) measurements by 1978Ka10 in ¹⁰⁹ Rh β ⁻ decay. configuration: Kπ=1/2+, v1/2[411] Nilsson configuration. Assignment is tentative.
188.9903# 10	11/2-§	BCDEFGH	4.703 min 9	%IT=100. Jπ: L(d,p)=L(d,t)=5, 188.990γ E3 to 5/2+. T _{1/2} : using the Limitation of Relative Statistical Weight method and 4.694 m 2 (2015Kr07), 4.696 m 3 (1990Ab06), 4.750 min 4 (1992An19), 4.663 min 11 (1992KaZM), 4.6 min 4 (1970Bo22), 4.7 min 1 (1967Na18), 4.69 min 1 (1959St28), and 4.75 min 5 (1957St87). configuration: Most likely the Kπ=3/2-, v3/2-[541] (h _{11/2}) Nilsson configuration.
245.0807 16	(7/2)-	A CDE	1.528 ns 56	Jπ: average resonance capture; 245.080γ E1 to 5/2+.
248.01 11	9/2+	C FG		XREF: F(245)G(243). Jπ: L(d,p)=L(d,t)=4; 59.4γ to 11/2-, 247.96γ to 5/2+.
266.3424 15	1/2+	A CDEFG		Jπ: L(d,p)=L(d,t)=0; 152.942γ M1 to 1/2+, 266.346γ E2 to 5/2+.
276.289 ^a 3	7/2+§	A CDE H	11.3 ps 34	Jπ: 276.296γ M1+E2 to 5/2+; av res capture.
287.250 [@] 3	9/2-§	CDE H		Jπ: 98.258γ M1 to 11/2-, 317.255γ from 5/2-.
291.4339 16	3/2+	A CDEFG	136.5 ps 23	Jπ: L(d,p)=L(d,t)=2, 178.034γ M1 to 1/2+.
325.2836 16	3/2+	A CDEfg	39.6 ps 35	Jπ: L(d,t)=2, L(d,p)=0+2, 211.884γ M1(+E2) to 1/2+.
326.8689 22	5/2+	A CDEfg	0.832 ns 27	Jπ: direct feeding in ¹⁰⁹ Rh β ⁻ decay (Jπ=7/2+); L(d,t)=2, L(d,p)=0+2; average res rules out 7/2+ and 9/2+; 35.34γ M1 to 3/2+, 81.78γ E1(+M2) to (7/2)-. T _{1/2} : Other: 0.57 ns 15 from 1998Lh02 using the centroid-shift method of delayed-coincidence.
339.5299 17	5/2-	CDE G		Jπ: 339.528γ E1(+M2) to 5/2+, 94.450γ M1+E2 to Jπ=(7/2)-; av res capture.
370 4	(1/2-, 3/2-)	F		Jπ: L(d,p)=(1).
382 4	1/2+, 3/2+, 5/2+	F		Jπ: L(d,p)=0,2.
404 4	1/2+	F		Jπ: L(d,p)=0.
426.140 3	7/2+	A CDEFG	73.6 ps 42	Jπ: L(d,p)=L(d,t)=4, 426.135γ M1 to 5/2+.
433.5630 17	3/2+	CDE		Jπ: 320.164γ M1 to 1/2+, 433.552γ M1 to 5/2+.
491.589 3	3/2+	A CDEFG	62.9 ps 42	Jπ: L(d,p)=L(d,t)=2, 5/2+ is ruled out from av res capture.
540.6753 19	5/2+	A CDEFG	29.3 ps 43	Jπ: L(d,p)=L(d,t)=2, av res capture rules out 3/2+.
597.1& 5	(9/2+)+§	A GH		Jπ: L(d,t)=4.
604.5118 24	5/2-	CDE		Jπ: 264.980γ M1+E2 to 5/2-, av res capture.
623.4813 23	1/2+	CDEFG		Jπ: L(d,p)=0.
625.0# 9	(15/2-)+§	H		Jπ: 436γ to 11/2-.
645.96 4	7/2+, 9/2+	CDEFG		Jπ: L(d,p)=L(d,t)=4, inconsistent with Jπ=5/2-, 7/2 from av res capture.
673.4878 24	3/2-	CDEFG		Jπ: L(d,p)=L(d,t)=1, 333.964γ M1(+E2) to 5/2-.
712 4	(7/2+, 9/2+)	G		Jπ: L(d,t)=(4).

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Adopted Levels, Gammas (continued) ^{109}Pd Levels (continued)

E(level) [†]	J π	XREF	Comments
718.1@ 7	(13/2-) [§]	H	J π : 431 γ to 9/2-, 529 γ to 11/2-.
722.043 3	3/2+, 5/2+	CDEF	XREF: F(719). J π : L(d,p)=2.
729 4	3/2+, 5/2+	G	J π : L(d,t)=2.
742 4	1/2+	F	J π : L(d,p)=0.
791.425 5	5/2+, 3/2+	CDEFG	J π : L(d,p)=L(d,t)=2.
810.592 4	3/2+	CDEFG	J π : L(d,p)=L(d,t)=2, av res capture.
846.1 5	5/2+	CDEFG	J π : from L(d,p)=L(d,t)=2, av res capture.
883 4	9/2-, 11/2-	G	J π : L(d,t)=5.
907.2 ^a 7	(11/2+) [§]	H	
911.253 12	5/2+	CDEFG	J π : L(d,p)=L(d,t)=2, av res capture.
941.098 3	3/2-	CDEF	J π : L(d,p)=1, 336.584 γ M1 to 5/2-.
944.967 6	1/2+	CDE G	J π : L(d,t)=0.
954.164 9	1/2+	CDEFG	XREF: G(960). J π : L(d,p)=0.
981.755 10	5/2+	A CDEFG	J π : L(d,t)=2, av res capture.
1006 4		F	
1053.627 20	3/2+	CDEFG	J π : L(d,p)=L(d,t)=2, av res capture.
1065.8 5	1/2+	CD G	J π : L(d,t)=0.
1091.0 5	5/2+	CDEFG	J π : L(d,p)=L(d,t)=2, av res capture.
1111.8 5	1/2, 3/2	CD	J π : from av res capture.
1134.693 6	1/2, 3/2	CDE	J π : from av res capture.
1147.7 5	3/2+	CD FG	J π : L(d,p)=L(d,t)=2 and av res capture.
1176 4	5/2-, 7/2-	F	J π : L(d,p)=3.
1232.794 22	1/2+	CDEFG	J π : L(d,p)=L(d,t)=0.
1241 4	5/2-, 7/2-	F	J π : L(d,p)=3.
1243.9 5	1/2, 3/2	CD	J π : from av res capture.
1267.2 ^{&} 9	(13/2+) [§]	H	
1269.5 5	5/2+, 3/2+	CDEFG	XREF: F(1263)G(1269). J π : L(d,p)=L(d,t)=2.
1289.0 [#] 13	(19/2-) [§]	H	
1308 4		F	
1317.23 19		A	
1328.4 5	5/2	CDE	J π : from av res capture.
1329 4	(1/2-, 3/2-)	F	J π : L(d,p)=1.
1347.7 5	1/2+	CD FG	J π : L(d,p)=L(d,t)=0.
1359.410 8	1/2, 3/2	CDE	J π : from av res capture.
1361.1@ 10	(17/2-) [§]	H	
1371.1 5	5/2+	CDE G	J π : L(d,t)=2 and av res capture.
1377.7 8	1/2, 3/2	CD	J π : from av res capture.
1399.0 5	1/2, 3/2	CDE	J π : from av res capture.
1448 4	3/2+, 5/2+	G	J π : L(d,t)=2.
1478.7 5	1/2+	C EFG	J π : L(d,p)=L(d,t)=0.
1484.9 5	(1/2, 3/2, 5/2+)	C F	J π : primary- γ from 1/2+ capture state.
1499 4		F	
1537.3 5	1/2+	C G	XREF: G(1539). J π : L(d,t)=0.
1540.3 5	3/2	C EF	J π : from $\gamma(0)$ in 296 eV res capture.
1601.7 5	(1/2+)	C G	J π : L(d,t)=(0).
1615.8 5	(1/2, 3/2, 5/2+)	C	J π : primary- γ from 1/2+ capture state.
1623.9 5	(1/2, 3/2, 5/2+)	E	J π : primary- γ from 1/2+ capture state.
1635.2 ^a 13	(15/2+) [§]	H	
1644.6 5	(3/2+, 5/2+)	C FG	J π : L(d,t)=(2).
1647.8 5	(1/2, 3/2, 5/2+)	C E	J π : primary- γ from 1/2+ capture state.
1656? 4	(1/2+)	G	J π : L(d,t)=0.
1664 4		F	
1683.5 5	1/2+	C F	J π : L(d,p)=0.
1692 4	1/2+	G	J π : L(d,t)=0.
1710.2 5	(1/2, 3/2, 5/2+)	C	J π : primary- γ from 1/2+ capture state.
1737 4		F	
1773 4	5/2-, 7/2-	F	J π : L(d,p)=3.
1789 4	1/2+	C FG	XREF: C(?)G(1785). J π : L(d,t)=0.

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Adopted Levels, Gammas (continued) ^{109}Pd Levels (continued)

E(level) [†]	J π	XREF	Comments
1800 4	1/2+	FG	XREF: G(1792). J π : L(d,p)=0.
1819 4		F	
1836 4	5/2-, 7/2-	C F	XREF: C(?). J π : L(d,p)=3.
1846 4		F	J π : L(d,p)=(1,2).
1848 4	1/2+	G	J π : L(d,t)=0.
1863 4	(5/2-, 7/2-)	F	J π : L(d,p)=(3).
1873.2& 13	(17/2+) §	H	
1877 4	1/2-, 3/2-	F	J π : L(d,p)=1.
1878 4	3/2+, 5/2+	G	J π : L(d,t)=2.
1915 4	1/2-, 3/2-	C F	XREF: C(?). J π : L(d,p)=1.
1923 4	1/2-, 3/2-	C FG	XREF: C(?)G(1927). J π : L(d,p)=L(d,t)=1.
1941 4	5/2-, 7/2-	F	J π : L(d,p)=3.
1954 4		F	
1972 4	5/2-, 7/2-	F	J π : L(d,p)=3.
1977 4	1/2-, 3/2-	G	J π : L(d,t)=1.
1999 4		C G	XREF: C(?). J π : L(d,t)=(1,2).
2014 4	1/2+	G	J π : L(d,t)=0.
2021 4	1/2-, 3/2-	C F	J π : L(d,p)=1.
2053 4		F	
2091 4	3/2+, 5/2+	C F	XREF: C(?). J π : L(d,p)=2.
2101 4	(3/2+, 5/2+)	G	J π : L(d,t)=(2).
2103.0# 17	(23/2-) §	H	
2117 4	1/2-, 3/2-	F	J π : L(d,p)=1.
2120 4	1/2+	C G	XREF: C(?). J π : L(d,t)=0.
2135 4	(1/2-, 3/2-)	F	J π : L(d,pt)=(1).
2155.1@ 14	(21/2-) §	H	
2160 4	1/2-, 3/2-	C F	XREF: C(?). J π : L(d,p)=1.
2174 4	3/2+, 5/2+	G	J π : L(d,t)=2.
2188 4	1/2+	C G	XREF: C(?). J π : L(d,t)=0.
2209 4	5/2-, 7/2-	F	J π : L(d,p)=3.
2240 4	(3/2+, 5/2+)	C G	XREF: C(?). J π : L(d,t)=(2).
2245 4	1/2-, 3/2-	F	J π : L(d,p)=1.
2259 4	1/2-, 3/2-	F	J π : L(d,p)=1.
2280 4	3/2+, 5/2+	F	J π : L(d,p)=2.
2282 4	1/2+	G	J π : L(d,t)=0.
2295 4	1/2-, 3/2-	G	J π : L(d,t)=1.
2301 4	(1/2-, 3/2-)	F	J π : L(d,p)=(1).
2320 4	3/2+, 5/2+	G	J π : L(d,t)=2.
2346 4	(5/2-, 7/2-)	F	J π : L(d,p)=(3).
2357 4	(1/2-, 3/2-)	F	J π : L(d,p)=(1).
2364.2 ^a 16	(19/2+) §	H	
2371 4		FG	XREF: G(2371). J π : L(d,p)=3 and L(d,t)=2 indicate a possible doublet.
2380 4	1/2+	G	J π : L(d,t)=0.
2391 4	5/2-, 7/2-	F	J π : L(d,p)=3.
2415 4	1/2-, 3/2-	C F	XREF: C(?). J π : L(d,p)=1.
2465 4	5/2-, 7/2-	F	J π : L(d,p)=3.
2473 4	1/2-, 3/2-	FG	XREF: G(2479). J π : L(d,p)=1.
2478.2& 17	(21/2+) §	H	
2493 4	(5/2-, 7/2-)	F	J π : L(d,p)=(3).
2522 4	3/2+, 5/2+	F	J π : L(d,p)=2.

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Adopted Levels, Gammas (continued) ^{109}Pd Levels (continued)

E(level) [†]	J π	XREF
2541 4		F
3030.0# 20	(27/2-) [§]	H
3975.0# 22	(31/2-) [§]	H
4958.0# 24	(35/2-) [§]	H

[†] From a least-squares fit to $E\gamma$.[‡] From ^{109}Rh β^- decay (2015Bu15) using $\beta\gamma\gamma(t)$, unless otherwise noted.[§] Band structure.# (A): Most likely the $K\pi=3/2-$, $\nu 3/2-[541]$ ($h_{11/2}$), $\alpha=-1/2$ band.@ (B): Most likely the $K\pi=3/2-$, $\nu 3/2-[541]$ ($h_{11/2}$), $\alpha=+1/2$ band.& (C): $K\pi=5/2+$ band, $\alpha=+1/2$. A mixture between $\nu 5/2+[413]$ and $\nu 5/2+[402]$ Nilsson configurations. Assignment is tentative.a (D): $K\pi=5/2+$ band, $\alpha=-1/2$. A mixture between $\nu 5/2+[413]$ and $\nu 5/2+[402]$ Nilsson configurations. Assignment is tentative. $\gamma(^{109}\text{Pd})$

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
113.4000	113.401 2	100	E2		0.891	Mult.: $\alpha(K)\text{exp}=0.7$ 2 in ^{109}Rh β^- decay (1977Ba57); $\alpha(K)\text{exp}=0.56$ 8, $\alpha(L1)\text{exp}=0.053$ 8, $\alpha(L2)\text{exp}=0.031$ 4, $\alpha(L3)\text{exp}=0.039$ 6, $\alpha(M)\text{exp}=0.010$ 2 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02). B(E2)(W.u.)=1.36 18.
188.9903	188.990 1	100	E3		0.783	Mult.: $\alpha(K)\text{exp}=0.52$ 4 (1964We09), 0.60 1 (1957St87) in ^{109}Rh β^- decay; $\alpha(K)\text{exp}=0.50$ 5, $\alpha(L1)\text{exp}=0.049$ 7, $\alpha(L2)\text{exp}=0.055$ 9, $\alpha(L3)\text{exp}=0.046$ 8, $\alpha(M)\text{exp}=0.022$ 5 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02). B(E3)(W.u.)=0.000397 3.
245.0807	245.080 2	100	E1		0.01200	Mult.: $\alpha(K)\text{exp}=0.010$ 1, $\alpha(L1)\text{exp}=0.0015$ 3 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02). B(E1)(W.u.)= 1.30×10^{-5} 5.
248.01	59.4 3	98 49				$E\gamma, I\gamma$: seen only by 2008Kr05 in (n,γ) E=thermal.
	247.96 11	100 17				$E\gamma, I\gamma$: seen only by 2008Kr05 in (n,γ) E=thermal.
266.3424	152.942 1	100 6	M1		0.1170	$I\gamma$: weighted average of 100 11 in (n,γ) E=thermal, 100 10 in (n,γ) E= 2.96 eV, and 100 8 in ^{109}Rh β^- decay. Mult.: $\alpha(K)\text{exp}=0.095$ 10, $\alpha(L1)\text{exp}=0.010$ 2, $\alpha(M)\text{exp}=0.002$ 5 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02).
	266.346 3	31 2	E2		0.0441	$I\gamma$: weighted average of 29 3 in (n,γ) E=thermal, 31 3 in (n,γ) E=2.96 eV, and 42 8 in ^{109}Rh β^- decay. Mult.: $\alpha(K)\text{exp}=0.040$ 4 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02).
276.289	276.296 5	100	M1+E2	0.5 3	0.027 3	Mult., δ : $\alpha(K)\text{exp}=0.024$ 2 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02). B(M1)(W.u.)=0.07 3; B(E2)(W.u.)=200 200.
287.250	98.258 3	100	M1		0.399	Mult.: $\alpha(K)\text{exp}=0.29$ 5, $\alpha(L1)\text{exp}=0.044$ 10 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02).
291.4339	178.034 1	100 4	M1		0.0776	$I\gamma$: weighted average of 100 10 in (n,γ) E=thermal, 100 10 in (n,γ) E=2.96 eV, and 100 5 in ^{109}Rh β^- decay. Mult.: $\alpha(K)\text{exp}=0.063$ 6, $\alpha(L1)\text{exp}=0.006$ 1 in $^{108}\text{Pd}(n,\gamma)$ E=thermal (1980Ca02). B(M1)(W.u.)=0.0143 9.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Pd})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
291.4339	291.430 4	90 6	M1+E2	0.6 4	0.024 3	$I\gamma$: weighted average of 83 8 in (n, γ) E=thermal, 82 8 in (n, γ) E=2.96 eV, and 99 6 in ^{109}Rh β^- decay. Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.021$ 2, $\alpha(\text{L1})_{\text{exp}}=0.004$ 2 (1980Ca02). B(M1)(W.u.)=0.0022 8; B(E2)(W.u.)=8 8.
325.2836	211.884 3	27 3	M1 (+E2)	0.3 +2-3	0.053 6	$I\gamma$: weighted average of 28 3 in (n, γ) E=thermal, 25 3 in (n, γ) E=2.96 eV, and 44 8 in ^{109}Rh β^- decay. Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.044$ 5, $\alpha(\text{L1})_{\text{exp}}=0.007$ 2 in $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal (1980Ca02).
	325.284 4	100 7	M1 (+E2)	0.5 +3-5	0.0174 14	$I\gamma$: weighted average of 100 10 in (n, γ) E=thermal, 100 10 in (n, γ) E=2.96 eV, and 100 19 in ^{109}Rh β^- decay. Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.015$ 1, $\alpha(\text{L1})_{\text{exp}}=0.002$ 1 in $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal (1980Ca02).
326.8689	35.34 10	2.4 3	M1		7.65 13	$I\gamma$: from ^{109}Rh β^- decay. Mult.: $\alpha(\text{K})_{\text{exp}}=9$ 5 in ^{109}Rh β^- decay (1978Ka10). B(M1)(W.u.)=0.0117 19.
	81.78 5	1.3 1	E1 (+M2)	0.3 +2-3	0.9 10	$I\gamma$: from ^{109}Rh β^- decay. Mult., δ : D+Q from $\alpha(\text{K})_{\text{exp}}=0.7$ 6 in ^{109}Rh β^- decay (1978Ka10), change in parity between two levels indicates E1(+M2). 1978Ka10 report M1(+E2).
	326.868 4	100 10	E2 (+M1)			$E\gamma$: Note 326.450 10 in ^{109}Rh β^- decay (1979Bo26) is discrepant with the value from the $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal data. $I\gamma$: from ^{109}Rh β^- decay. Mult.: $\alpha(\text{K})_{\text{exp}}=0.020$ 2 in $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal (1980Ca02).
339.5299	94.450 1	31 3	M1+E2	0.33 +13-17	0.57 10	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.43$ 9, $\alpha(\text{L1})_{\text{exp}}=0.044$ 6, $\alpha(\text{L2})_{\text{exp}}=0.014$ 6, $\alpha(\text{L3})_{\text{exp}}=0.018$ 8, $\alpha(\text{M})_{\text{exp}}=0.018$ 8 in $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal (1980Ca02).
	339.528 4	100 10	E1 (+M2)	0.12 +8-12	0.0058 14	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.005$ 1 in $^{108}\text{Pd}(\text{n},\gamma)$ E=thermal (1980Ca02).
426.140	149.854 3	7.6 5				$I\gamma$: weighted average of 8.5 9 in (n, γ) E=thermal, 6.7 8 in (n, γ) E=2.96 eV, and 7.7 7 in ^{109}Rh β^- decay.
	426.135 4	100 6	M1		0.00822	$I\gamma$: weighted average of 100 10 in (n, γ) E=thermal, 100 11 in (n, γ) E=2.96 eV, and 100 9 in ^{109}Rh β^- decay. B(M1)(W.u.)=0.0036 4.
433.5630	106.694 3	1.8 3				$I\gamma$: weighted average of 1.7 3 in (n, γ) E=thermal and 2.5 9 in (n, γ) E=2.96 eV (1980Ca02).
	108.280 1	7.4 9				$I\gamma$: weighted average of 8.3 10 in (n, γ) E=thermal and 6.6 9 in (n, γ) E=2.96 eV (1980Ca02).
	320.164 5	51 4	M1		0.01677	$I\gamma$: weighted average of 47 5 in (n, γ) E=thermal and 54 5 in (n, γ) E=2.96 eV (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.013$ 3 in (n, γ) E=thermal(1980Ca02).
	433.552 4	100 7	M1		0.00788	$I\gamma$: weighted average of 100 10 in (n, γ) E=thermal and 100 9 in (n, γ) E=2.96 eV (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0065$ 8 in (n, γ) E=thermal (1980Ca02).
491.589	166.306 8	8.2 18				$I\gamma$: weighted average of 9.1 17 in (n, γ) E=thermal, 10.7 23 in (n, γ) E=2.96 eV, and 4.4 22 in ^{109}Rh β^- decay.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Pd})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
491.589	200.153 4	45 5	M1		0.0567	I_{γ} : weighted average of 49 5 in (n, γ) E=thermal, 55 6 in (n, γ) E=2.96 eV, and 39 4 in ^{109}Rh β^{-} decay. Mult.: $\alpha(\text{K})_{\text{exp}}=0.041$ 10 in (n, γ) E=thermal (1980Ca02). B(M1)(W.u.)=0.0101 14.
	378.191 5	100 6	E2		0.01395	I_{γ} : weighted average of 100 10 in (n, γ) E=thermal, 100 10 in (n, γ) E=2.96 eV, and 100 9 in ^{109}Rh β^{-} decay. Mult.: $\alpha(\text{K})_{\text{exp}}=0.012$ 3 in (n, γ) E=thermal (1980Ca02). B(E2)(W.u.)=19.4 20.
	491.575 10	37 3				I_{γ} : weighted average of 40 4 in (n, γ) E=thermal, 40 4 in (n, γ) E=2.96 eV, and 30 4 in ^{109}Rh β^{-} decay.
540.6753	213.806 4	8.5 8				I_{γ} : weighted average of 9.3 16 in (n, γ) E=thermal, 7.9 11 in (n, γ) E=2.96 eV, and 9.3 19 in ^{109}Rh β^{-} decay.
	215.390 2	31.2 15	M1		0.0467	I_{γ} : weighted average of 35 4 in (n, γ) E=thermal, 33 3 in (n, γ) E=2.96 eV, and 29.6 19 in ^{109}Rh β^{-} decay. Mult.: $\alpha(\text{K})_{\text{exp}}=0.039$ 5 in (n, γ) E=thermal (1980Ca02). B(M1)(W.u.)=0.0139 22.
	249.238 11	100 5	M1		0.0319	I_{γ} : weighted average of 100 10 in (n, γ) E=thermal, 100 10 in (n, γ) E=2.96 eV, and 100 6 in ^{109}Rh β^{-} decay. Mult.: $\alpha(\text{K})_{\text{exp}}=0.027$ 3 in (n, γ) E=thermal (1980Ca02). B(M1)(W.u.)=0.029 5.
	264.378 11	6.7 14				I_{γ} : weighted average of 7.2 21 in (n, γ) E=thermal, 5 5 in (n, γ) E=2.96 eV, and 6.5 19 in ^{109}Rh β^{-} decay.
	274.328 7	3.0 4				I_{γ} : weighted average of 3.1 5 in (n, γ) E=thermal, 3.9 11 in (n, γ) E=2.96 eV, and 1.9 9 in ^{109}Rh β^{-} decay.
	295.597 3	5.5 6				I_{γ} : weighted average of 7.2 16 in (n, γ) E=thermal, 4.5 11 in (n, γ) E=2.96 eV, and 5.6 9 in ^{109}Rh β^{-} decay.
	540.697 10	8.7 13				I_{γ} : weighted average of 16 4 in (n, γ) E=thermal, 15 8 in (n, γ) E=2.96 eV, and 8.3 9 in ^{109}Rh β^{-} decay.
597.1	320 1	50 25				E_{γ}, I_{γ} : from ^{109}Rh β^{-} decay (1978Ka10).
	597.3 5	100 50				E_{γ}, I_{γ} : from ^{109}Rh β^{-} decay (1978Ka10).
604.5118	264.980 3	18.5 14	M1+E2	0.9 +10-6	0.035 7	I_{γ} : weighted average of 19.4 19 in (n, γ) E=thermal and 17.5 19 in (n, γ) E=2.96 eV (1980Ca02). Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.030$ 5 in (n, γ) E=thermal (1980Ca02).
	317.255 6	2.8 5				I_{γ} : weighted average of 2.6 6 in (n, γ) E=thermal and 3.4 9 in (n, γ) E=2.96 eV (1980Ca02).
	359.426 6	100 10	M1		0.01253	Mult.: $\alpha(\text{K})_{\text{exp}}=0.010$ 1 in (n, γ) E=thermal (1980Ca02).
	604.530 6	8.0 8				I_{γ} : weighted average of 8 1 in (n, γ) E=thermal and 8.1 13 in (n, γ) E=2.96 eV (1980Ca02).
623.4813	189.920 3	23 3				I_{γ} : weighted average of 22 3 in (n, γ) E=thermal and 25 4 in (n, γ) E=2.96 eV (1980Ca02).
	197.333 8	4.9 8				I_{γ} : weighted average of 4.8 8 in (n, γ) E=thermal and 5.7 28 in (n, γ) E=2.96 eV (1980Ca02).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Pd})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
623.4813	298.197 5	100 7	M1 (+E2)	<3	0.025 5	I γ : weighted average of 100 10 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02). Mult., δ : α (K)exp=0.019 6 in (n, γ) E=thermal (1980Ca02). I γ : weighted average of 25 5 in (n, γ) E=thermal and 30 4 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 14.3 24 in (n, γ) E=thermal and 9.4 19 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 49 8 in (n, γ) E=thermal and 47 5 in (n, γ) E=2.96 eV (1980Ca02).
	332.050 5	28 3				
	347.192 6	11.3 24				
	357.148 9	4.8 8				
	623.468 16	48 4				
625.0	436 1	100				
645.96	645.96 4	100				
673.4878	333.964 3	100 9	M1 (+E2)	0.5 +4-5	0.0162 15	Mult., δ : α (K)exp=0.014 1 in (n, γ) E=thermal (1980Ca02). I γ : 4.0 8 from (n, γ) E=2.96 eV. I γ : 28 3 from (n, γ) E=2.96 eV. Mult.: α (K)exp=0.008 1 in (n, γ) E=thermal (1980Ca02). I γ : 5.2 12 from (n, γ) E=2.96 eV.
	346.622 6	0.94 16				
	428.396 3	30 3	E2		0.00948	
718.1	673.607 40	1.6 5				
	431 1					
	529# 1					
722.043	230.453 2	20.2 17				I γ : weighted average of 20 2 in (n, γ) E=thermal and 20.6 30 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 15.7 22 in (n, γ) E=thermal and 19 5 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 20.7 29 in (n, γ) E=thermal and 26 5 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 73 7 in (n, γ) E=thermal and 75 7 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 55 6 in (n, γ) E=thermal and 62 6 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 100 10 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 11 5 in (n, γ) E=thermal and 11.3 28 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 28 5 in (n, γ) E=thermal and 35 6 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 100 14 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 25 5 in (n, γ) E=thermal and 37 9 in (n, γ) E=2.96 eV (1980Ca02). I γ : from (n, γ) E=thermal, 58 6 from (n, γ) E=2.96 eV (1980Ca02) (n, γ) E=2.96 eV (1980Ca02). I γ : weighted average of 61 9 in (n, γ) E=thermal and 68 7 in (n, γ) E=2.96 eV (1980Ca02).
	288.480 5	16.2 20				
	395.171 17	22.0 25				
	396.758 11	74 5				
	455.702 5	59 4				
	722.025 27	100 7				
791.425	365.295 7	11.2 25				
	464.541 9	31 4				
	515.128 13	100 8				
	525.078 16	28 5				
	678.040 35	28 5				
	791.429 31	65 6				
810.592	187.115 4	6.9 7				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Pd})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	$\delta^{\S}$	α	Comments
810.592	377.004 13	11.4 19				I_{γ} : weighted average of 12.4 21 in (n, γ) E=thermal and 8 4 in (n, γ) E=2.96 eV (1980Ca02).
	485.311 7	37 3				I_{γ} : weighted average of 35 4 in (n, γ) E=thermal and 41 6 in (n, γ) E=2.96 eV (1980Ca02).
	810.547 13	100 8				I_{γ} : weighted average of 100 15 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02).
907.2	310 1					
	631 1					
911.253	584.505 51	9 4				
	585.908 15	28 6				
	619.939 28	100 17				
	911.283 24	74 13				
941.098	267.610 5	11 2				
	336.584 3	100 7	M1 (+E2)	0.1 +8-1	0.0148 25	I_{γ} : weighted average of 100 10 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02).
						Mult., δ : $\alpha(K)\text{exp}=0.013$ 2 in (n, γ) E=thermal (1980Ca02).
	601.575 6	68 6				I_{γ} : weighted average of 74 9 in (n, γ) E=thermal and 65 7 in (n, γ) E=2.96 eV (1980Ca02).
	649.650 29	3 1				
	674.725 30	15 3				I_{γ} : weighted average of 14.3 19 in (n, γ) E=thermal and 22 5 in (n, γ) E=2.96 eV (1980Ca02).
	695.949 32	10.7 14				I_{γ} : weighted average of 10.5 14 in (n, γ) E=thermal and 13 5 in (n, γ) E=2.96 eV (1980Ca02).
944.967	222.922 6	4.9 8				I_{γ} : weighted average of 5.1 9 in (n, γ) E=thermal and 4.4 17 in (n, γ) E=2.96 eV (1980Ca02).
	653.504 36	7 3				I_{γ} : 30 3 in (n, γ) E=2.96 eV (1980Ca02).
	678.673 41	10 3				I_{γ} : 23 2 in (n, γ) E=2.96 eV (1980Ca02).
	831.571 15	100 8				I_{γ} : weighted average of 100 15 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02).
954.164	520.597 10	93 13				
	628.887 18	59 9				
	840.759 27	100 31				
981.755	555.614 13	32 4				I_{γ} : weighted average of 41 7 in (n, γ) E=thermal and 30 3 in (n, γ) E=2.96 eV (1980Ca02).
	654.892 16	37 4				I_{γ} : weighted average of 43 9 in (n, γ) E=thermal and 36 4 in (n, γ) E=2.96 eV (1980Ca02).
	690.300 26	100 7				I_{γ} : weighted average of 100 11 in (n, γ) E=thermal and 100 10 in (n, γ) E=2.96 eV (1980Ca02).
	705.433 47	17 3				I_{γ} : weighted average of 18 7 in (n, γ) E=thermal and 16 3 in (n, γ) E=2.96 eV (1980Ca02).
1053.627	726.740 24	100 8				I_{γ} : weighted average of 100 11 in (n, γ) E=thermal and 100 12 in (n, γ) E=2.96 eV (1980Ca02).
	787.314 34	33 6				I_{γ} : weighted average of 42 9 in (n, γ) E=thermal and 29 6 in (n, γ) E=2.96 eV (1980Ca02).
1134.693	461.194 7	100 10				
	530.202 10	20 3				
1232.794	799.265 51	65 8				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Pd})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Comments
1232.794	966.439 24	100 10	
1267.2	360 1		
	670 1		
1289.0	664 1		
1317.23	1041.7 5	100 25	E_{γ}, I_{γ} : from ^{109}Rh β^- decay.
	1317.1 2	100 50	E_{γ}, I_{γ} : from ^{109}Rh β^- decay.
1359.410	224.717 7	2.2 4	
	685.909 24	84 9	
	754.908 22	100 11	
	1019.868 27	46 5	
1361.1	643 1		
	736 1		
1635.2	728 1	100	
1873.2	606 1	100	
2103.0	814 1	100	
2155.1	794 1	100	
2364.2	729 1	100	
2478.2	605 1	100	
3030.0	927 1	100	
3975.0	945 1	100	
4958.0	983 1	100	

 † From (n, γ) E=thermal, unless otherwise stated. ‡ From ce data in (n, γ) E=thermal (1980Ca02). § From ce data in (n, γ) E=thermal using the BrIccMixing program.

Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

¹⁰⁹Rh β⁻ Decay 1978Ka10,1977Ba57,1978Fr21

Parent ¹⁰⁹Rh: E=0.0; Jπ=7/2⁺; T_{1/2}=80.8 s 7; Q(g.s.)=2607 4; %β⁻ decay=100.

¹⁰⁹Rh-J,T_{1/2}: From Adopted Levels of ¹⁰⁹Rh.

¹⁰⁹Rh-Q(β⁻): From 2012Wa38.

1978Ka10: ¹⁰⁹Rh sources were produced by the (γ,p) reaction on 97.7% enriched metallic ¹¹⁰Pd using bremsstrahlung from the electron linear accelerator of the Japan Atomic Energy Research Institute. Low-energy γ rays were detected with a 25 mm2×5 mm pure Ge detector (FWHM=500 eV at Eγ=133 keV) and high energy γ rays were detected with a 40 cm³ coaxial Ge(Li) detector (FWHM=2.5 keV at Eγ=1333 keV); β rays were detected with a 2-cm-thick×5-cm dia. anthracene scintillator. Measured Eγ, Iγ, γγ-coin, γ(t), Eβ, Iβ. Deduced decay scheme, Jπ, γ- and β-branching ratios, half-lives, α.

1977Ba57: ¹⁰⁹Rh sources were produced by activating a sample of 50 mg ¹¹⁰Pd metallic powder (96.98%) at the pulsed bremsstrahlung beam of the Giessen linear accelerator. γ rays were detected by a low energy photon Ge detector (FWHM=195 eV at 5.9 keV) or a Ge(Li) detector (FWHM=2.3 keV at 1333 keV). Measured Eγ, Iγ, γγ-coin, γ(t), E(x-ray), I(x-ray). Deduced decay scheme, Jπ, γ- and β-ray branching ratios, half-lives, α.

1978Fr21: ¹⁰⁹Rh sources were produced by thermal-neutron induced fission of ²³⁹Pu. γ rays were detected with two Ge(Li) detectors of 35 cm³ active volume (FWHM=2.15 keV at 1333 keV). Measured Eγ, Iγ, γγ-coin. Deduced decay scheme, Jπ, γ-ray branching ratios.

2015Bu15: mass=109 nuclides up to ¹⁰⁹Mo were produced via U(p,f) reaction with E=30 MeV proton beam provided by the K-130 cyclotron at Jyvaskyla, incident on a 15 mg/cm² uranium target. Fission fragments were separated using the Ion-Guide Isotope Separator On-Line (IGISOL) method and deposited onto an aluminum catcher. β particles were detected with a plastic scintillator and a pair of LaBr₃(Ce) detectors; γ rays were detected with two HPGe detectors. Measured Eγ, Iγ, Eβ, βγγ(t). Deduced levels, half-lives, transition strengths.

1969WiZX: ¹⁰⁹Rh nuclides were produced from ²⁵²Cf fissions. Measured T_{1/2}, Eγ, fission yields.

Others: 1975Fe12, 1971Ri02, 1959Pi49.

The decay scheme is proposed by 1977Ba57, 1978Fr21 and 1978Ka10. Discrepancies exist for the placements of some γ-ray transitions. Due to the use of high-resolution Ge detector, 1978Ka10 resolve the doublets (and even a triplet of 211.9+213.8+215.3) that can not be resolved in 1977Ba57 and 1978Fr21. The evaluators thus have adopted the decay scheme that proposed by 1978Ka10, as are the γ-energies, intensities, and coincidence relations.

1978Ka10 measured the α(K)exp for three low-energy gammas. The results indicate M1(+E2) for the gammas. To calculate total transition intensity, the evaluators have assumed an M1 multipolarity for the 50.6 and 59.0 gammas and ignored the conversion for other gammas (all over 100 keV in energy). Since nearly all the low-energy gammas must be M1 and/or E2, the conversion can be ignored for Eγ>200 keV when compared to the normalization uncertainty. For gammas in the 150-keV energy range the conversion increases the transition intensity by ≈15%.

The total average radiation energy released by ¹⁰⁹Rh is 2684 keV 232 (calculated by evaluators using the computer program radlst). This value agrees with Q(β⁻)=2607 keV 4 (2012Wa38).

¹⁰⁹Pd Levels

E(level) [†]	Jπ [†]	T _{1/2} [‡]	Comments
0.0	5/2 ⁺	13.59 h 12	T _{1/2} : from Adopted Levels.
113.4000 14	1/2 ⁺	380 ns 50	T _{1/2} : from (178.0γ)(113.4γ)(t) measurements by 1978Ka10.
245.0807 16	(7/2) ⁻	1.528 ns 56	
266.3424 15	1/2 ⁺		
276.289 3	7/2 ⁺	11.3 ps 34	
291.4339 16	3/2 ⁺	136.5 ps 23	
325.2836 16	3/2 ⁺	39.6 ps 35	
326.8689 22	5/2 ⁺	0.832 ns 27	
426.140 3	7/2 ⁺	73.6 ps 42	
491.589 3	3/2 ⁺	62.9 ps 42	
540.6753 19	5/2 ⁺	29.3 ps 43	
597.1 5	(9/2) ⁺		
667.3?			
981.755 10			
1317.23 19			

[†] From Adopted Levels.

[‡] From 2015Bu15 using the delayed coincidence βγγ(t), unless otherwise noted. The same values are adopted in Adopted Levels.

¹⁰⁹Rh β⁻ Decay 1978Ka10,1977Ba57,1978Fr21 (continued)

β⁻ radiations

Eβ ⁻	E(level)	Iβ ^{-†‡}	Log <i>ft</i>	Comments
(1290 4)	1317.23	0.22 7	6.36 14	
(2010 4)	597.1	0.16 7	7.26 19	
(2066 4)	540.6753	9.7 10	5.53 5	
(2115 4)	491.589	2.2 3	6.21 6	
(2181 4)	426.140	8.3 11	5.69 6	
(2280 4)	326.8689	67 7	4.86 5	Eβ ⁻ : Eβ=2250 50.
(2331 4)	276.289	1.1 3	6.69 12	
(2607 4)	0.0	13 8	5.8 3	

† Deduced from I(γ+ce) intensity balances. g.s. feeding is from Σ(β⁻+γ+ce) to g.s.=100%.

‡ Absolute intensity per 100 decays.

γ(¹⁰⁹Pd)

1969WiZX report photons per 100 ²⁵²Cf fissions for four γ rays at 151.4, 177.92, 215.1 and 326.8 keV, with values of 0.124 22, 0.675 16, 0.102 2 and 3.42 50, respectively.

Iγ normalization: weighted average of 0.52 6, derived from the g.s. β⁻ feeding of 16% 10, based on

Iβ(total)/I(326.83γ) measured in 1978Ka10 and by assuming the Σ(β⁻+γ+ce) to g.s.=100% and 0.57 9, derived from the fraction of 3.42% 50 per ²⁵²Cf fission for 326.83γ in 1969WiZX and the cumulative yield of 5.96% 24 for ¹⁰⁹Rh produced in ²⁵²Cf fissions from the JEFF library.

Eγ [†]	E(level)	Iγ ^{‡&}	Mult.#	δ#@	α	Comments
25.1 ^a	291.4339	0.06 5	[M1+E2]	≤0.9	21	%Iγ=0.03 3, using the calculated normalization. Eγ: this γ was not observed in the singles spectra but was inferred from γγ-coincidence measurements (1978Ka10). Mult.: measurements by 1978Ka10 indicate the 25.1γ may be M1 (+0-50% E2).
35.34 10	326.8689	2.4 3	M1		7.65 13	%Iγ=1.30 19, using the calculated normalization. Eγ: 35.34 10 (1978Ka10). Iγ: others: 2.8 10 (1978Fr21), 0.7 2 (1977Ba57).
50.6 ^a 3	326.8689	0.06 2	[M1]		2.68 6	Mult.: α(K)exp=9 5 (1978Ka10). %Iγ=0.032 12, using the calculated normalization.
59.0 ^a 3	325.2836	0.06 2	[M1]		1.71 4	Eγ: from 1978Ka10 only. %Iγ=0.032 12, using the calculated normalization.
81.78 5	326.8689	1.3 1	E1(+M2)	0.3 +2-3	0.9 10	Eγ: from 1978Ka10 only. %Iγ=0.70 9, using the calculated normalization. Eγ: 81.78 5 (1978Ka10). Iγ: others: 1.3 1 (1978Fr21), 1.1 2 (1977Ba57).
*98.2 5		0.19 2				Mult.: α(K)exp=0.7 6 (1978Ka10). δ: the authors report M1(+E2) with δ=0.3 +21-3 which is not compatible with change in parity between the two levels. %Iγ=0.103 15, using the calculated normalization.
113.401 2	113.4000	10.5 6	E2		0.891	Eγ,Iγ: observed only by 1978Fr21 and placed from the E=426.1 keV 7/2+ level. A 98.258γ de-excites a 9/2- level at E=287.25 in Adopted Levels. %Iγ=5.7 6, using the calculated normalization. Eγ: 113.35 5 (1978Ka10). Iγ: others: 10.0 7 (1978Fr21), 12.0 11 (1977Ba57). Mult.: α(K)exp=0.7 2 (1977Ba57).

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^{109}Rh β^- Decay 1978Ka10,1977Ba57,1978Fr21 (continued) $\gamma(^{109}\text{Pd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger\&$	Mult.#	$\delta^\# @$	α	Comments
$\times 114.0$ 2		<1				%I γ =0.3 3, using the calculated normalization. E γ ,I γ : observed only by 1977Ba57 and placed from the E=540.7 keV 5/2+ level.
149.854 3	426.140	1.1 1				%I γ =0.59 8, using the calculated normalization. E γ : 149.82 7 (1978Ka10). E γ : placed by 1977Ba57 from a level at E=263.1 keV that is not in Adopted Levels. I γ : others: 1.1 1 (1978Fr21), 1.1 3 (1977Ba57).
152.942 1	266.3424	1.2 1	M1		0.1170	%I γ =0.65 8, using the calculated normalization. E γ : 152.91 7 (1978Ka10). E γ : placed by 1977Ba57 and 1978Fr21 from a level at E=694 keV that is not in Adopted Levels. I γ : others: 1.0 1 (1978Fr21), 1.3 3 (1977Ba57).
166.306 8	491.589	0.10 5				%I γ =0.05 3, using the calculated normalization. E γ : 166.3 5 (1978Ka10).
178.034 1	291.4339	14.1 7	M1		0.0776	%I γ =7.6 8, using the calculated normalization. E γ : 178.03 5 (1978Ka10). I γ : others: 12.1 8 (1978Fr21), 14.7 8 (1977Ba57).
200.153 4	491.589	0.9 1	M1		0.0567	%I γ =0.49 7, using the calculated normalization. E γ : 200.13 7 (1978Ka10). I γ : others: 0.83 7 (1978Fr21), 0.9 2 (1977Ba57).
211.884 3	325.2836	1.2 2	M1 (+E2)	0.3 +2-3	0.053 6	%I γ =0.65 13, using the calculated normalization. E γ : 211.88 10 (1978Ka10).
213.806 4	540.6753	1.0 2				%I γ =0.54 12, using the calculated normalization. E γ : 213.81 10 (1978Ka10). E γ : placed by 1977Ba57 and 1978Fr21 from the 326.7-keV level. I γ : others: 0.97 9 (1978Fr21), 4.4 14 (1977Ba57).
215.390 2	540.6753	3.2 2	M1		0.0467	%I γ =1.73 20, using the calculated normalization. E γ : 215.28 7 (1978Ka10). I γ : others: 2.9 2 (1978Fr21), 4.5 14 (1977Ba57).
245.080 2	245.0807	2.4 2	E1		0.01200	%I γ =1.30 16, using the calculated normalization. E γ : 245.03 7 (1978Ka10). I γ : others: 2.1 2 (1978Fr21), 2.5 3 (1977Ba57).
249.238 11	540.6753	10.8 6	M1		0.0319	%I γ =5.8 7, using the calculated normalization. E γ : 249.16 5 (1978Ka10). I γ : others: 9.1 6 (1978Fr21), 11.3 11 (1977Ba57).

Continued on next page (footnotes at end of table)

^{109}Rh β^- Decay $^{1978}\text{Ka}10,^{1977}\text{Ba}57,^{1978}\text{Fr}21$ (continued) $\gamma(^{109}\text{Pd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger\&$	Mult.#	$\delta^\# @$	α	Comments
264.378 11	540.6753	0.7 2				%I γ =0.38 12, using the calculated normalization. E γ : 264.33 10 (1978Ka10). E γ : 1977Ba57 place a transition of E γ =263.1 2 from a level at E=263.1 keV level that is not in Adopted Levels. I γ : others: 0.59 7 (1978Fr21), 0.9 2 (1977Ba57).
266.346 3	266.3424	0.5 1	E2		0.0441	%I γ =0.27 6, using the calculated normalization. E γ : 266.26 10 (1978Ka10). E γ : placed by 1978Fr21 from a level at E=806.8 keV that is not in Adopted Levels. I γ : others: 0.48 7 (1978Fr21), 0.9 2 (1977Ba57).
274.328 7	540.6753	0.2 1				%I γ =0.11 6, using the calculated normalization. E γ : 274.21 10 (1978Ka10).
276.296 5	276.289	4.0 3	M1+E2	0.5 3	0.027 3	%I γ =2.2 3, using the calculated normalization. E γ : 276.26 7 (1978Ka10). E γ : placed by 1977Ba57 from a level at E=389.7 keV that is not in Adopted Levels. I γ : others: 3.9 3 (1978Fr21), 4.3 6 (1977Ba57).
291.430 4	291.4339	13.9 8	M1+E2	0.6 4	0.024 3	%I γ =7.5 8, using the calculated normalization. E γ : 291.36 7 (1978Ka10). I γ : others: 13.2 9 (1978Fr21), 12.8 14 (1977Ba57).
295.597 3	540.6753	0.6 1				%I γ =0.32 7, using the calculated normalization. E γ : 295.54 10 (1978Ka10). I γ : others: 0.60 7 (1978Fr21), 0.9 2 (1977Ba57).
^x 298.0 5		0.05 3				%I γ =0.027 17, using the calculated normalization. E γ , I γ : observed only by 1978Fr21 and placed from a level at E=624.7 keV. A 298.197 γ de-excites a 1/2+ level at E=623.48 in Adopted Levels.
320 1	597.1	0.10 5				%I γ =0.05 3, using the calculated normalization. E γ : from 1978Ka10. A 320.164 γ de-excites a 3/2+ level at E=433.56 in Adopted Levels.
325.284 4	325.2836	2.7 5	M1(+E2)	0.5 +3-5	0.0174 14	%I γ =1.5 3, using the calculated normalization. E γ : 325.43 20 (1978Ka10).
326.868 4	326.8689	100	E2(+M1)		0.019 4	%I γ =54 5, using the calculated normalization. E γ : 326.450 10 (1979Bo26) and 326.83 5 (1978Ka10).
^x 338.2 4		0.19 2				%I γ =0.103 15, using the calculated normalization. E γ : not observed in 1978Ka10. Placed by 1977Ba57 from a level at E=338 keV and by 1978Fr21 from a level at E=765.2 keV, with both levels not in Adopted Levels. I γ : weighted average of 0.18 2 (1978Fr21) and 0.3 1 (1977Ba57).

Continued on next page (footnotes at end of table)

^{109}Rh β^- Decay 1978Ka10,1977Ba57,1978Fr21 (continued) $\gamma(^{109}\text{Pd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger\&$	Mult.#	α	Comments
$^x361.8\ 5$		$0.24\ 4$			%I γ =0.130 25, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21 and placed from a level at E=361.8 keV that is not in Adopted Levels.
$378.191\ 5$	491.589	$2.3\ 2$	E2	0.01395	%I γ =1.24 16, using the calculated normalization. E γ : 378.05 7 (1978Ka10). I γ : others: 1.7 2 (1978Fr21), 1.9 3 (1977Ba57).
$389.8^a\ 3$	667.3?	$0.10\ 5$			%I γ =0.05 3, using the calculated normalization. E γ : weighted average of 391 1 (1978Ka10) and 389.7 2 (1977Ba57). 1977Ba57 place this γ ray from a E=389.7 keV level. I γ : others: 0.8 2 (1977Ba57).
$^x420.8\ 5$		$0.05\ 3$			%I γ =0.027 17, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21 and placed from a level at E=712.2 keV. A level at 712 is in Adopted Levels and observed in (d,t).
$426.135\ 4$	426.140	$14.3\ 13$	M1	0.00822	%I γ =7.7 10, using the calculated normalization. E γ : 426.14 7 (1978Ka10). I γ : others: 15.2 11 (1978Fr21), 14.0 14 (1977Ba57).
$427.3^a\ 9$	540.6753	<0.5			%I γ =0.14 14, using the calculated normalization. E γ : from 1978Ka10.
$^x474.5\ 5$		$0.10\ 5$			%I γ =0.05 3, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21.
$^x489.0\ 5$		$0.03\ 3$			%I γ =0.016 17, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21 and placed from a level at E=765.2 keV that is not in Adopted Levels.
$491.575\ 10$	491.589	$0.7\ 1$			%I γ =0.38 7, using the calculated normalization. E γ : 491.7 2 (1978Ka10). I γ : others: 0.95 8 (1978Fr21), 0.7 2 (1977Ba57).
$^x515.0\ 5$		<0.03			%I γ =0.008 9, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21. A 515.128 γ de-excites a J π =3/2+,5/2+ at E=791.43 in Adopted Levels.
$540.697\ 10$	540.6753	$0.9\ 1$			%I γ =0.49 7, using the calculated normalization. E γ : 540.7 2 (1978Ka10). I γ : others: 2.4 2 (1978Fr21), 1.4 3 (1977Ba57).
$555.614^{\S}\ 13$	981.755	$0.06^{\S}\ 3$			%I γ =0.032 17, using the calculated normalization. I γ : normalized to I γ (690.3 γ)=0.2 1 based on I γ (555.614 γ)/I γ (630.3 γ)=32 4/100 7 in Adopted Gammas.
$^x586.1\ 2$		$0.7\ 3$			%I γ =0.38 17, using the calculated normalization. E γ ,I γ : observed only by 1977Ba57 and placed from a level at E=975.2 keV that is not in Adopted Levels. A 585.908 γ de-excites a 5/2+ level at E=911.25 in Adopted Levels.
$597.3\ 5$	597.1	$0.2\ 1$			%I γ =0.11 6, using the calculated normalization. E γ : 597.3 5 (1978Ka10).
$^x617.9\ 10$		$0.2\ 1$			%I γ =0.11 6, using the calculated normalization. E γ ,I γ : from 1978Ka10.
$654.892^{\S}\ 16$	981.755	$0.07^{\S}\ 4$			%I γ =0.038 22, using the calculated normalization. I γ : normalized to I γ (690.3 γ)=0.2 1 based on I γ (654.892 γ)/I γ (630.3 γ)=37 4/100 7 in Adopted Gammas.
$690.30^a\ 3$	981.755	$0.2\ 1$			%I γ =0.11 6, using the calculated normalization. E γ : 690.6 5 from weighted average of 692 2 (1978Ka10) and 690.5 5 (1978Fr21). I γ : others: 0.23 1 (1978Fr21).
$705.43^{\S}\ 5$	981.755	$0.03^{\S}\ 2$			%I γ =0.016 11, using the calculated normalization. I γ : normalized to I γ (690.3 γ)=0.2 1 based on I γ (705.43 γ)/I γ (630.3 γ)=17 3/100 7 in Adopted Gammas.
$^x777.9\ 5$		$0.30\ 15$			%I γ =0.16 9, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21.
$^x975.2\ 2$		$1.0\ 3$			%I γ =0.54 17, using the calculated normalization. E γ ,I γ : observed only by 1978Fr21 and placed from a level at E=975.2 keV that is not in Adopted Levels.
$1041.7\ 5$	1317.23	$0.20\ 5$			%I γ =0.11 3, using the calculated normalization. E γ : 1041.7 5 (1978Ka10).

Continued on next page (footnotes at end of table)

¹⁰⁹Rh β⁻ Decay 1978Ka10,1977Ba57,1978Fr21 (continued)

γ(¹⁰⁹Pd) (continued)

Eγ [†]	E(level)	Iγ ^{‡&}	Comments
x1072.4 2		0.10 5	%Iγ=0.05 3, using the calculated normalization. Eγ: from 1977Ba57, placed from a level at E=1612.8 keV that is not in Adopted Levels. 1072 1 from 1978Ka10. Iγ: others: 0.4 2 (1977Ba57).
1317.1 2	1317.23	0.2 1	%Iγ=0.11 6, using the calculated normalization. Eγ: 1317.1 2 (1978Ka10). Eγ: weighted average of 1318 1 (1978Ka10) and 1317.1 2 (1977Ba57). 1977Ba57 place this γ ray from a level at E=1857.8 keV. Iγ: others: 0.4 2 (1977Ba57).
x1612.8 2		0.9 3	%Iγ=0.49 17, using the calculated normalization. Eγ,Iγ: observed only by 1977Ba57 and placed from a level at E=1612.8 keV that is not in Adopted Levels.

[†] From Adopted Gammas, unless otherwise noted. Values from this dataset are given in comments. Unplaced γ rays are from this dataset.

[‡] From 1978Ka10, unless otherwise noted. Iγ are normalized to Iγ(326.8)=100. Iγ from 1977Ba57 and 1978Fr21 are in comments.

[§] Not observed in this dataset and data are taken from Adopted Gammas. Iγ is normalized to absolute value of the strongest transition from each level in this dataset based on relative intensities in Adopted Gammas.

From Adopted Gammas, unless otherwise noted. ce data in this dataset are from α(K)exp based on Iγ/K x ray ratio in coincidence spectra (1978Ka10, 1977Ba57).

@ If no value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multiplicities.

& For absolute intensity per 100 decays, multiply by 0.54 5.

^a Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

Decay Scheme

¹⁰⁹Pd IT Decay (4.703 min)

Parent ¹⁰⁹Pd: E=188.9 I; J π =11/2-; T_{1/2}=4.703 min 9; %IT decay=100.

1990Ab06: ¹⁰⁹Pd sample was produced by (n, γ) reaction using thermal neutrons. γ rays were detected with a 85 cm³ coaxial HPGe detector (FWHM=1.8 keV at E γ =1333 keV). Measured γ (t). Deduced half-life of the isomeric state. See also 1992An19 (same group).

1992KaZM: ¹⁰⁹Pd sample was produced from thermal neutron capture. Measured γ (t) using Ge detectors. Deduced half-life.

OtherS: 1969Sc12, 1968Be22, 1967Na18, 1964We09, 1959St28, 1958Sc03, 1957St87, 1951Ka46.

¹⁰⁹Pd Levels

E(level)	J π [†]	T _{1/2} [†]
0.0	5/2+	13.59 h 12
188.9 I	11/2-	4.703 min 9

[†] From Adopted Levels.

γ (¹⁰⁹Pd)

E γ	E(level)	I γ [†]	Mult.	α	Comments
188.9 I	188.9	56.0 3	E3	0.785	E γ : weighted average of 188.9 I (1969Sc12) and 189.1 3 (1967Na18). Other: 188 5 (1957St87). I γ : deduced from I(γ +ce)=100 and α =0.785. Mult.: α (K)exp=0.52 4 (1964We09), 0.60 I (1957St87).

[†] Absolute intensity per 100 decays.

Decay Scheme

Intensity: I(γ +ce) per
100 decays by this
branch
%IT=100

¹⁰⁸Pd(n,γ) E=thermal 1980Ca02

S(n)=6153.59 15 from 2012Wa38.

1980Ca02: Thermal neutron beam was produced by the Brookhaven National Laboratory High Flux Beam Reactor (HFBR).

Target is 5.52 g ¹⁰⁸Pd enriched to 98.11%. γ rays were detected with Ge(Li) detectors (FWHM=7 keV at E_γ=6 MeV). A separate study of primary transitions was performed with a three crystal pair spectrometer and a 7.7 g enriched target. Another study of low energy γ rays with high energy-precision and conversion electrons was performed with curved crystal spectrometers (FWHM=2–25 eV) for γ rays and the BILL spectrometer for electrons (resolution=ΔE/E = 10⁻³ at the Institute Laue Langevin (ILL) in Grenoble, France. Measured E_γ, I_γ, ce. Deduced levels, J_π, γ multiplicities.

2008Kr05: Thermal neutron beams was produced from the 10-MW Budapest Reactor. Target is a 1.6 g PdCl₂ with a thickness of 0.4 g/cm². γ rays were detected by a 25% efficient coaxial HPGe detector with Compton suppression by a BGO scintillator. Measured E_γ, I_γ, absolute cross section. Deduced levels, J_π.

Other measurement: 1977Ba87.

¹⁰⁹Pd Levels

E(level) [†]	J _π [#]	E(level) [†]	J _π [#]	E(level) [†]	J _π [#]
0.0	5/2+	944.967 6	1/2+	1683.5 8	1/2+
113.4000 14	1/2+	954.164 9	1/2+	1709.7 8	(1/2, 3/2, 5/2+)
188.9903 10	11/2-	981.755 10	5/2+	1728.1 [‡] 6	
245.0808 16	(7/2)-	1053.628 19	3/2+	1789.0 [‡] 7	
248.01 [§] 11	9/2+	1065.8 5	1/2+	1840.8 [‡] 5	
266.3424 15	1/2+	1091.0 5	5/2+	1914.9 [‡] 6	
276.289 3	7/2+	1111.8 8	1/2, 3/2	1923.4 [‡] 6	
287.250 3	9/2-	1134.694 6	1/2, 3/2	1996.7 [‡] 7	
291.4339 16	3/2+	1147.2 5	3/2+	2024.3 [‡] 5	
325.2835 16	3/2+	1232.796 22	1/2+	2087.4 [‡] 6	
326.8690 22	5/2+	1243.9 8	1/2, 3/2	2119.5 [‡] 6	
339.5299 17	5/2-	1268.1 8	3/2+, 5/2+	2158.1 [‡] 7	
426.140 3	7/2+	1328.4 5	5/2, (3/2)	2192.4 [‡] 9	
433.5630 16	3/2+	1347.7 5	1/2, 3/2, 5/2+	2227.9 [‡] 7	
491.5892 24	3/2+	1359.411 8	1/2, 3/2	2241.9 [‡] 6	
540.6753 19	5/2+	1371.1 5	5/2+	2363.0 [‡] 6	
604.5118 24	5/2-	1377.7 8	1/2, 3/2	2414.7 [‡] 6	
623.4813 23	3/2+	1399.0 5	1/2, 3/2	2569.9 [‡] 6	
645.9 5	7/2+, 9/2+	1479.3 8	1/2+	2589.9 [‡] 7	
673.4879 24	3/2-	1484.9 8	(1/2, 3/2, 5/2+)	2763.5 [‡] 10	
722.043 3	3/2+, 5/2+	1536.9 8	1/2+	2885.6 [‡] 9	
791.425 5	3/2+, 5/2+	1540.3 [‡] 5	3/2	2924.4 [‡] 7	
810.592 4	3/2+	1601.3 8	(1/2+)	2984.8 [‡] 8	
846.1 5	5/2+	1615.4 8	(1/2, 3/2, 5/2+)	(6153.51 10)	1/2+ [@]
911.250 12	5/2	1644.2 8	(3/2+, 5/2+)		
941.098 3	3/2-	1647.8 5	(1/2, 3/2, 5/2+)		

[†] From a least-squares fit to γ-ray energies.

[‡] Seen only by 1977Ba87.

[§] Seen only by 2008Kr05.

[#] From Adopted Levels.

[@] s-wave capture in J_π=0+ ¹⁰⁸Pd g.s.

γ(¹⁰⁹Pd)

Conversion electron intensities per 1000 captures from 1980Ca02 are given under comments.

E _γ [†]	E(level)	I _γ [@]	Mult.&	δ ^a	α ^b	Comments
59.4 [§] 3	248.01					I _γ : 5 3 from σ=0.04 b 2 in 2008Kr05.
94.450 1	339.5299	35 4	M1+E2	0.33 +13-17	0.57 10	I _γ : 19.6 17 from σ=0.145 b 8 in 2008Kr05. I(ce)(K)=15.0 23, I(ce)(L1)=1.53 15, I(ce)(L2)=0.49 19, I(ce)(L3)=0.63 25, I(ce)(M)=0.63 25 (1980Ca02). Mult.: α(K)exp=0.43 9, α(L1)exp=0.044 6, α(L2)exp=0.014 6, α(L3)exp=0.018 8, α(M)exp=0.018 8.

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$^{108}\text{Pd}(\text{n},\gamma)$ E=thermal 1980Ca02 (continued) $\gamma(^{109}\text{Pd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I_{\gamma}^{\oplus}$	Mult.&	δ^a	α^b	Comments
98.258# 3	287.250	16.5 17	M1		0.399	I γ : 11.1 11 from $\sigma=0.082$ b 6 in 2008Kr05. I(ce)(K)=4.7 7 I(ce)(L1)=0.73 15 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.29$ 5, $\alpha(\text{L1})_{\text{exp}}=0.044$ 10 (1980Ca02).
106.694 3	433.5630	1.0 2				I γ : 1.5 10 from $\sigma=0.011$ b 7 in 2008Kr05.
108.280# 1	433.5630	4.9 6				I γ : 3.9 11 from $\sigma=0.029$ b 8 in 2008Kr05.
113.401 2	113.4000	300 30	E2		0.891	I γ : 171 12 from $\sigma=1.266$ b 19 in 2008Kr05. I(ce)(K)=166 17, I(ce)(L1)=15.7 16, I(ce)(L2)=9.21 92, I(ce)(L3)=11.6 12, I(ce)(M1)=2.97 30, I(ce)(M2+M3)=4.16 42 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.56$ 8, $\alpha(\text{L1})_{\text{exp}}=0.053$ 8, $\alpha(\text{L2})_{\text{exp}}=0.031$ 4, $\alpha(\text{L3})_{\text{exp}}=0.039$ 6, $\alpha(\text{M})_{\text{exp}}=0.010$ 2 (1980Ca02).
149.854 3	426.140	1.0 1				I γ : 0.15 4 from $\sigma=0.0011$ b 3 in 2008Kr05.
152.942 1	266.3424	95 10	M1		0.1170	I γ : 74 5 from $\sigma=0.549$ b 8 in 2008Kr05. I(ce)(K)=9.04 45, I(ce)(L1)=0.952 95, I(ce)(M)=0.190 32 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.095$ 10, $\alpha(\text{L1})_{\text{exp}}=0.010$ 2, $\alpha(\text{M})_{\text{exp}}=0.002$ 5 (1980Ca02).
166.306 4	491.5892	2.2 4				I γ : 2.1 3 from $\sigma=0.0159$ b 23 in 2008Kr05.
^x 170.561 1		2.4 2				
178.034 1	291.4339	72 7	M1		0.0776	I γ : 56 4 from $\sigma=0.413$ b 8 in 2008Kr05. I(ce)(K)=4.54 14, I(ce)(L1)=0.432 86 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.063$ 6, $\alpha(\text{L1})_{\text{exp}}=0.006$ 1 (1980Ca02).
187.115 4	810.592	1.0 1				I γ : 0.81 from $\sigma=0.0060$ b in 2008Kr05.
188.990 1	188.9903	16.5 17	E3		0.783	I γ : 13.9 12 from $\sigma=0.103$ b 6 in 2008Kr05. I(ce)(K)=8.32 25, I(ce)(L1)=0.809 81, I(ce)(L2)=0.91 14, I(ce)(L3)=0.76 12, I(ce)(M)=0.363 73 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.50$ 5, $\alpha(\text{L1})_{\text{exp}}=0.049$ 7, $\alpha(\text{L2})_{\text{exp}}=0.055$ 9, $\alpha(\text{L3})_{\text{exp}}=0.046$ 8, $\alpha(\text{M})_{\text{exp}}=0.022$ 5 (1980Ca02).
189.920 3	623.4813	2.8 4				I γ : 2.30 from $\sigma=0.017$ b in 2008Kr05.
197.333 8	623.4813	0.6 1				
200.153 4	491.5892	12.0 12	M1		0.0567	I γ : 9.9 10 from $\sigma=0.073$ b 5 in 2008Kr05. I(ce)(K)=0.49 10 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.041$ 10 (1980Ca02).
^x 202.971 13		0.3 1				
^x 207.697 3		0.3 1				
211.884 3	325.2835	34 3	M1(+E2)	0.3 +2-3	0.053 6	I γ : 27.6 21 from $\sigma=0.204$ b 7 in 2008Kr05. I(ce)(K)=1.48 6, I(ce)(L1)=0.235 71 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.044$ 5, $\alpha(\text{L1})_{\text{exp}}=0.007$ 2 (1980Ca02).
213.806 4	540.6753	1.8 3				I γ : 1.49 from $\sigma=0.011$ b in 2008Kr05.
215.390 2	540.6753	6.7 7	M1		0.0467	I γ : 7.8 9 from $\sigma=0.058$ b 5 in 2008Kr05. I(ce)(K)=0.261 26 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.039$ 5 (1980Ca02).
^x 216.487 9		0.5 1				
222.922 6	944.967	0.6 1				I γ : 0.51 from $\sigma=0.0038$ b in 2008Kr05.
224.717 7	1359.411	0.6 1				I γ : 0.54 from $\sigma=0.0040$ b in 2008Kr05.
^x 228.194 4		0.7 1				
230.453 2	722.043	2.8 3				I γ : 3.0 6 from $\sigma=0.022$ b 4 in 2008Kr05.
245.080 2	245.0808	154 15	E1		0.01200	I γ : 128 9 from $\sigma=0.945$ b 15 in 2008Kr05. I(ce)(K)=1.54 5, I(ce)(L1)=0.231 46 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.010$ 1, $\alpha(\text{L1})_{\text{exp}}=0.0015$ 3 (1980Ca02).
247.96§ 11	248.01					I γ : 5.5 10 from $\sigma=0.041$ b 7 in 2008Kr05.

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$^{108}\text{Pd}(\text{n},\gamma)$ E=thermal 1980Ca02 (continued) $\gamma(^{109}\text{Pd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\oplus}$	Mult.&	δ^a	α^b	Comments
249.238 11	540.6753	19.4 19	M1		0.0319	I γ : 17.3 16 from $\sigma=0.128$ b 8 in 2008Kr05. I(ce)(K)=0.524 42 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.027$ 3 (1980Ca02).
^x 263.403 6		2.0 4				I γ : 1.20 from $\sigma=0.0089$ b in 2008Kr05.
264.378 11	540.6753	1.4 4				I γ : 11.4 9 from $\sigma=0.084$ b 3 in 2008Kr05.
264.980 3	604.5118	13.4 13	M1+E2	0.9 +10-6	0.035 7	I(ce)(K)=0.402 60 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.030$ 5 (1980Ca02). I γ : 26.4 19 from $\sigma=0.195$ b 4 in 2008Kr05. I(ce)(K)=1.10 3 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.040$ 4 (1980Ca02). I γ : 1.89 from $\sigma=0.014$ b in 2008Kr05. I γ : 0.351 from $\sigma=0.0026$ b in 2008Kr05.
266.346 3	266.3424	28 3	E2		0.0441	I γ : 28.6 22 from $\sigma=0.212$ b 7 in 2008Kr05. I(ce)(K)=0.782 23 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.024$ 2 (1980Ca02). I γ : 2.4 6 from $\sigma=0.018$ b 4 in 2008Kr05.
267.610 5	941.098	2.2 4				I γ : 53 4 from $\sigma=0.393$ b 8 in 2008Kr05.
274.328 7	540.6753	0.6 1				I(ce)(K)=1.27 4, I(ce)(L1)=0.24 12 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.021$ 2, $\alpha(\text{L1})_{\text{exp}}=0.004$ 2 (1980Ca02).
276.296 5	276.289	33 3	M1+E2	0.5 3	0.027 3	I γ : 1.4 4 from $\sigma=0.010$ b 3 in 2008Kr05. I γ : 9.7 10 from $\sigma=0.072$ b 6 in 2008Kr05. I(ce)(K)=0.239 72 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.019$ 6 (1980Ca02).
288.480 5	722.043	2.2 3				I γ : 1.6 6 from $\sigma=0.012$ b 4 in 2008Kr05.
291.430 4	291.4339	60 6	M1+E2	0.6 4	0.024 3	I γ : 20 6 from $\sigma=0.15$ b 4 in 2008Kr05. I(ce)(K)=0.361 65 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.013$ 3 (1980Ca02).
295.597 3	540.6753	1.4 3				I γ : 106 7 from $\sigma=0.786$ b 11 in 2008Kr05. I(ce)(K)=1.83 6, I(ce)(L1)=0.244 41 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.015$ 1, $\alpha(\text{L1})_{\text{exp}}=0.002$ 1 (1980Ca02).
298.197 5	623.4813	12.6 13	M1(+E2)	<3	0.025 5	I γ : 41 3 from $\sigma=0.300$ b 8 in 2008Kr05. I(ce)(K)=0.978 39 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.020$ 2 (1980Ca02). I γ : 2.43 from $\sigma=0.018$ b in 2008Kr05.
^x 299.119 5		1.9 3				I γ : 29.7 23 from $\sigma=0.220$ b 9 in 2008Kr05. I(ce)(K)=0.897 27 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.014$ 1 (1980Ca02). I γ : 17.4 15 from $\sigma=0.129$ b 7 in 2008Kr05. I(ce)(K)=0.273 19 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.013$ 2 (1980Ca02).
317.255# 6	604.5118	1.8 4				I γ : 100 7 from $\sigma=0.737$ b 11 in 2008Kr05. I(ce)(K)=0.570 57 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.005$ 1 (1980Ca02).
320.164 5	433.5630	28 3	M1		0.01677	I γ : 0.257 from $\sigma=0.0019$ b in 2008Kr05. I γ : 1.49 from $\sigma=0.011$ b in 2008Kr05.
^x 321.082 15		0.9 5				I γ : 0.49 from $\sigma=0.0036$ b in 2008Kr05.
325.284 4	325.2835	122 12	M1(+E2)	0.5 +3-5	0.0174 14	I γ : 61 4 from $\sigma=0.453$ b 11 in 2008Kr05. I(ce)(K)=0.687 27 (1980Ca02). Mult.: $\alpha(\text{K})_{\text{exp}}=0.010$ 1 (1980Ca02). I γ : 1.35 from $\sigma=0.010$ b in 2008Kr05.
326.868 4	326.8690	50 5	E2		0.0223	I γ : 1.35 from $\sigma=0.010$ b in 2008Kr05.
332.050 5	623.4813	3.2 6				
333.964 3	673.4879	64 6	M1(+E2)	0.5 +4-5	0.0162 15	
336.584 3	941.098	21.0 21	M1(+E2)	0.1 +8-1	0.0148 25	
^x 337.828 5		1.2 3				
339.528 4	339.5299	114 11	E1(+M2)	0.12 +8-12	0.0058 14	
^x 343.869 9		1.9 4				
346.622 6	673.4879	0.6 1				
347.192 6	623.4813	1.8 3				
^x 355.694 6		1.5 5				
357.148 9	623.4813	0.6 1				
^x 358.697 10		8.5 11				
359.426 6	604.5118	69 7	M1		0.01253	
365.295 7	791.425	0.6 3				
^x 371.125 10		2.4 4				
377.004 13	810.592	1.8 3				

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¹⁰⁸Pd(n,γ) E=thermal 1980Ca02 (continued)

γ(¹⁰⁹Pd) (continued)

Eγ [†]	E(level)	I _γ [@]	Mult.&	α ^b	Comments
378.191 5	491.5892	24.3 24	E2	0.01395	I _γ : 20.9 18 from σ=0.155 b 8 in 2008Kr05. I(ce)(K)=0.292 58 (1980Ca02). Mult.: α(K)exp=0.012 3 (1980Ca02).
^x 386.75 4		1.1 3			
^x 392.395 25		0.4 1			
395.171 17	722.043	2.9 4			I _γ : 3.4 10 from σ=0.025 b 7 in 2008Kr05.
396.758 11	722.043	10.2 10			I _γ : 11.8 17 from σ=0.087 b 11 in 2008Kr05.
^x 407.124 10		1.5 4			
^x 414.342 7		6.0 6			
^x 416.738 20		0.4 1			
^x 418.298 7		1.8 3			
^x 421.049 11		1.5 3			
426.135 4	426.140	11.7 12	M1	0.00822	I _γ : 8.1 11 from σ=0.060 b 7 in 2008Kr05. I(ce)(K)=0.064 16 (1980Ca02). Mult.: α(K)exp=0.0055 20 (1980Ca02).
428.396 3	673.4879	19.0 19	E2	0.00948	I _γ : 1.4 3 from σ=0.010 b 2 in 2008Kr05. I(ce)(K)=0.152 15 (1980Ca02). Mult.: α(K)exp=0.008 1 (1980Ca02).
433.552 4	433.5630	59 6	M1	0.00788	I _γ : 50 4 from σ=0.367 b 11 in 2008Kr05. I(ce)(K)=0.383 31 (1980Ca02). Mult.: α(K)exp=0.0065 8 (1980Ca02).
^x 436.185 11		0.6 1			
^x 438.160 12		1.4 3			
^x 441.839 9		2.3 5			
^x 452.524 16		0.8 1			
455.702 5	722.043	7.7 8			I _γ : 7.2 8 from σ=0.053 b 5 in 2008Kr05.
461.194 7	1134.694	13.1 13			I _γ : 11.8 10 from σ=0.087 b 5 in 2008Kr05.
464.541 9	791.425	1.6 3			I _γ : 3.38 from σ=0.025 b in 2008Kr05.
^x 466.511 10		2.2 5			
^x 467.333 12		1.0 5			
485.311 7	810.592	5.1 6			I _γ : 6.2 8 from σ=0.046 b 5 in 2008Kr05.
491.575 10	491.5892	9.6 10			I _γ : 2.35 17 from σ=0.0174 b 5 in 2008Kr05.
515.128 13	791.425	5.7 8			I _γ : 12.2 14 from σ=0.090 b 8 in 2008Kr05.
520.597 10	954.164	4.3 6			I _γ : 5.3 8 from σ=0.039 b 5 in 2008Kr05.
525.078 16	791.425	1.4 3			I _γ : 3.11 from σ=0.023 b in 2008Kr05.
^x 526.411 21		0.5 1			
530.202 10	1134.694	2.6 4			I _γ : 3.5 6 from σ=0.026 b 4 in 2008Kr05.
^x 539.35 3		0.6 3			
540.697 10	540.6753	3.1 7			I _γ : 2.03 from σ=0.015 b in 2008Kr05.
^x 554.59 4		0.8 3			
555.614 13	981.755	1.8 3			I _γ : 4.2 6 from σ=0.031 b 4 in 2008Kr05.
^x 566.672 20		0.4 3			
^x 579.90 3		0.8 3			
584.51 5	911.250	0.5 2			I _γ : 6.5 from σ=0.048 b in 2008Kr05.
585.908 15	911.250	1.5 3			I _γ : 2.2 8 from σ=0.016 b 6 in 2008Kr05.
601.575 6	941.098	15.6 18			I _γ : 16.5 15 from σ=0.122 b 7 in 2008Kr05.
604.530 6	604.5118	5.5 7			I _γ : 6.6 16 from σ=0.049 b 11 in 2008Kr05.
^x 608.672 9		1.8 4			
^x 612.047 12		2.1 4			
619.94 [#] 3	911.250	5.4 9			I _γ : 7.0 13 from σ=0.052 b 9 in 2008Kr05.
^x 620.441 16		5.2 8			
623.468 16	623.4813	6.2 10			I _γ : 7 4 from σ=0.05 b 3 in 2008Kr05.
628.887 18	954.164	2.7 4			I _γ : 3.0 10 from σ=0.022 b 7 in 2008Kr05.
^x 632.363 18		1.6 3			
^x 634.907 23		2.9 5			
645.96 4	645.9	0.8 3			
649.65 3	941.098	0.5 2			I _γ : 0.51 from σ=0.0038 b in 2008Kr05.
653.50 4	944.967	0.8 3			I _γ : 0.68 from σ=0.0050 b in 2008Kr05.
654.892 16	981.755	1.9 4			I _γ : 5.0 8 from σ=0.037 b 5 in 2008Kr05.
^x 655.501 16		3.1 5			
^x 657.57 3		4.4 5			
^x 660.13 3		0.6 3			
^x 670.09 6		0.7 4			

Continued on next page (footnotes at end of table)

¹⁰⁸Pd(n,γ) E=thermal 1980Ca02 (continued)

γ(¹⁰⁹Pd) (continued)

Eγ [†]	E(level)	I _γ [@]	Comments
673.61# 4	673.4879	1.0 3	I _γ : 0.47 from σ=0.0035 b in 2008Kr05.
674.73 3	941.098	3.0 4	I _γ : 0.46 9 from σ=0.0034 b 6 in 2008Kr05.
678.04 4	791.425	1.6 3	I _γ : 3.38 from σ=0.025 b in 2008Kr05.
678.67 4	944.967	1.2 3	I _γ : 0.97 from σ=0.0072 b in 2008Kr05.
^x 680.97 3		1.8 3	
685.909 24	1359.411	22.8 23	I _γ : 22 4 from σ=0.16 b 3 in 2008Kr05.
690.30 3	981.755	4.4 5	I _γ : 4.2 10 from σ=0.031 b 7 in 2008Kr05.
695.95 3	941.098	2.2 3	I _γ : 3.9 10 from σ=0.029 b 7 in 2008Kr05.
705.43 5	981.755	0.8 3	I _γ : 0.76 from σ=0.0056 b in 2008Kr05.
^x 711.40 6		1.3 4	
^x 713.389 20		3.8 5	
722.02 3	722.043	14.0 14	I _γ : 11.8 12 from σ=0.087 b 7 in 2008Kr05.
726.740 24	1053.628	5.5 6	I _γ : 7.3 11 from σ=0.054 b 7 in 2008Kr05.
754.908 22	1359.411	27 3	I _γ : 24.2 19 from σ=0.179 b 7 in 2008Kr05.
^x 772.096 20		4.4 6	
787.31 3	1053.628	2.3 5	I _γ : 4.5 9 from σ=0.033 b 6 in 2008Kr05.
791.43 3	791.425	3.5 5	I _γ : 3.6 7 from σ=0.027 b 5 in 2008Kr05.
^x 793.570 23		3.4 5	
799.26# 5	1232.796	5.1 6	I _γ : 5.8 9 from σ=0.043 b 6 in 2008Kr05.
810.547# 13	810.592	14.5 22	I _γ : 11.2 17 from σ=0.083 b 11 in 2008Kr05.
^x 815.228 24		3.6 8	
^x 820.242 25		3.3 7	
831.571 15	944.967	11.7 18	I _γ : 9.7 9 from σ=0.072 b 5 in 2008Kr05.
840.76 3	954.164	4.6 14	I _γ : 6.8 8 from σ=0.050 b 5 in 2008Kr05.
^x 846.328 13		11 3	
^x 902.98 4		3.4 5	
911.283 24	911.250	4.0 7	I _γ : 5.4 8 from σ=0.040 b 5 in 2008Kr05.
966.439# 24	1232.796	7.8 8	I _γ : 9.9 12 from σ=0.073 b 7 in 2008Kr05.
1019.87 3	1359.411	12.5 13	I _γ : 11.4 from σ=0.084 b in 2008Kr05.
3168.7# 8	(6153.51)	6.7 15	
3229.1# 7	(6153.51)	10.2 25	
3267.9# 9	(6153.51)	3.7 20	
3390# 1	(6153.51)	5.4 7	
3563.5# 7	(6153.51)	5.4 15	
3583.5# 6	(6153.51)	3.0 7	
3738.7# 6	(6153.51)	19.3 20	
3790.4# 6	(6153.51)	5.0 7	
3911.5# 6	(6153.51)	13.2 15	
3925.5# 7	(6153.51)	8.5 15	
3961.0# 9	(6153.51)	4.2 7	
3995.3# 7	(6153.51)	5.4 7	
4033.9# 5	(6153.51)	14.5 7	
4066.0# 5	(6153.51)	10.0 15	
4129.1# 4	(6153.51)	10.0 7	
4156.7# 7	(6153.51)	3.7 7	
4230.0# 5	(6153.51)	10.0 7	
4238.5# 6	(6153.51)	8.5 7	
4312.6# 4	(6153.51)	13.3 7	
4364.4# 7	(6153.51)	4.2 7	
4425.3# 5	(6153.51)	8.5 7	
4443.7 8	(6153.51)	8 3	
4469.9 8	(6153.51)	4.2 17	
4509.2 8	(6153.51)	11 4	
4538.0 8	(6153.51)	6.5 19	
4552.1 8	(6153.51)	6.0 15	
4616.5 8	(6153.51)	5.1 25	
4668.5 8	(6153.51)	2.1 4	
4674.1 8	(6153.51)	6.6 15	
4775.7 8	(6153.51)	12 4	
4793.81 23	(6153.51)	68.3	I _γ : 57 7 from σ=0.42 b 4 in 2008Kr05. E _γ : weighted average of 4794.0 8 (1980Ca02) and 4793.79 24 (2008Kr05).
4885.3 8	(6153.51)	0.7 4	
4909.5 8	(6153.51)	4.3 15	

Continued on next page (footnotes at end of table)

¹⁰⁸Pd(n,γ) E=thermal 1980Ca02 (continued)

γ(¹⁰⁹Pd) (continued)

Eγ [†]	E(level)	Iγ [@]	Comments
4920.2 3	(6153.51)	17.8 20	Iγ: 16.4 19 from σ=0.121 b 11 in 2008Kr05. Eγ: weighted average of 4920.3 8 (1980Ca02) and 4920.2 3 (2008Kr05).
5006.2 4	(6153.51)	6.4 6	Iγ: 6.1 15 from σ=0.045 b 11 in 2008Kr05. Eγ: weighted average of 5006.1 8 (1980Ca02) and 5006.3 5 (2008Kr05).
5018.9 5	(6153.51)	5.8 6	Iγ: 7.3 16 from σ=0.054 b 11 in 2008Kr05. Eγ: weighted average of 5018.9 8 (1980Ca02) and 5018.8 6 (2008Kr05).
5041.6 8	(6153.51)	2.5 11	
5100.0 5	(6153.51)	7.5 6	Iγ: 3.5 15 from σ=0.026 b 11 in 2008Kr05. Eγ: weighted average of 5099.7 8 (1980Ca02) and 5100.1 6 (2008Kr05).
5171.6 8	(6153.51)	3.0 12	
5211.8 3	(6153.51)	27 3	Iγ: 31 3 from σ=0.231 b 19 in 2008Kr05. Eγ: weighted average of 5211.8 8 (1980Ca02) and 5211.8 3 (2008Kr05).
5431.9 4	(6153.51)	11.7 14	Iγ: 8.6 16 from σ=0.064 b 11 in 2008Kr05. Eγ: weighted average of 5431.7 8 (1980Ca02) and 5432.0 5 (2008Kr05).
5479.8 3	(6153.51)	12.9 14	Iγ: 7.4 13 from σ=0.055 b 9 in 2008Kr05. Eγ: weighted average of 5480.3 8 (1980Ca02) and 5479.7 3 (2008Kr05).
5612.9 8	(6153.51)	0.9 4	
5661.9 8	(6153.51)	1.8 13	
5719.5 3	(6153.51)	21.2 20	Iγ: 16.4 23 from σ=0.121 b 15 in 2008Kr05. Eγ: weighted average of 5720.3 8 (1980Ca02) and 5719.4 3 (2008Kr05).
5829.0 3	(6153.51)	19.1 20	Iγ: 16.4 19 from σ=0.121 b 11 in 2008Kr05. Eγ: weighted average of 5828.6 8 (1980Ca02) and 5829.0 3 (2008Kr05).
5887.3 5	(6153.51)	7.5 14	Iγ: 6 3 from σ=0.042 b 19 in 2008Kr05. Eγ: weighted average of 5887.5 8 (1980Ca02) and 5887.2 7 (2008Kr05).
6152.9 8	(6153.51)	1.1 2	

[†] From 1980Ca02, unless otherwise noted. Secondary γ-ray transitions were measured with high-precision curved crystal spectrometers while the primary transitions were measured by a Ge(Li) detector.

[‡] Seen only by 1977Ba87.

[§] Seen only by 2008Kr05.

[#] Tentative placement by 1980Ca02.

[@] From 1980Ca02, normalized to I(4794γ)=68.3 78 per 1000 neutron captures, which is deduced by 1980Ca02 from the adopted absolute intensities Iγ=0.049, 0.32 and 0.244 per 1000 ¹⁰⁹Pd decays for 309.1, 311.4 and 647.3 keV γ rays, respectively. 2008Kr05 give cross sections for γ-ray transitions and deduce a total cross section of 7.4 b 5 including thermal captures to both g.s. (7.2 b 5) and the 11/2- isomer (0.185 b 11) after correction for internal conversion, and simulated level feedings. Based on the total cross section, the evaluators have normalized the cross sections to photons per 1000 captures, as given in the comments.

[&] From ce data in 1980Ca02.

^a Deduced from ce data using the BrIccMixing program.

^b From BrIcc v2.3 (29-Mar-2013) 2008Ki07, "Frozen Orbitals" appr.

^x γ ray not placed in level scheme.

¹⁰⁸Pd(n,γ) E=res: Av 1980Ca02

1980Ca02: E=2 and 24 keV resonance neutrons were produced at the Brookhaven National Laboratory. Target is 7.7 g ¹⁰⁸Pd enriched to 98.11%. γ rays were detected with a three crystal pair spectrometer. Measured averaged primary γ-ray intensities. Deduced levels, Jπ.

¹⁰⁹Pd Levels

E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]
0.0	5/2+	326.869	5/2, 5/2+, 1/2, 3/2	673.491	1/2, 3/2, (5/2+)
113.400	1/2, 3/2	339.530	5/2-	722.043	1/2, 3/2, 5/2+
188.990	≥7/2	426.140	(5/2-), 7/2	791.426	1/2, 3/2, 5/2+
245.081	(5/2-), 7/2	433.562	1/2, 3/2	810.595	1/2, 3/2
266.343	1/2, 3/2	491.590	1/2, 3/2	846.1	5/2+
276.290	≥7/2	540.676	5/2+	911.303	5/2
287.250	≥7/2	604.513	5/2-	941.100	1/2, 3/2
291.434	1/2, 3/2	623.482	1/2, 3/2	944.967	1/2, 3/2
325.285	5/2, 5/2+, 1/2, 3/2	645.9	5/2-, 7/2	954.163	1/2, 3/2

Continued on next page (footnotes at end of table)

$^{108}\text{Pd}(\text{n},\gamma)$ E=res: Av 1980Ca02 (continued) **^{109}Pd Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$
981.755	5/2	1147.7	1/2, 3/2	1359.413	1/2, 3/2
1053.628	1/2, 3/2	1232.795	1/2, 3/2, 5/2+	1371.1	$\geq 5/2$
1065.8	1/2, 3/2	1243.9	1/2, 3/2	1378.1	1/2, 3/2
1091.0	5/2+	1269.5	1/2, 3/2, 5/2+	1399.0	1/2, 3/2
1111.8	1/2, 3/2	1328.4	5/2		
1134.696	1/2, 3/2	1347.7	1/2, 3/2, 5/2+		

[†] Level scheme is deduced by 1980Ca02 based on the primary γ -ray transitions seen in average resonance neutron capture.

[‡] From 1980Ca02 on the basis of differences in the averaged intensity of E1 and M1 primary transitions following s- and p-wave capture. See 1980Ca02 for their guidelines for $J\pi$ derivations using the $I\gamma/E\gamma^5$ values.

 $^{108}\text{Pd}(\text{n},\gamma)$ E=2.96 eV 1980Ca02

S(n)=6153.59 15 from 2012Wa38.

1980Ca02: E=2.96 eV resonance neutrons were produced by the Brookhaven National Laboratory High Flux Beam Reactor (HFBR) via Bragg diffraction from a large Be crystal. Target is 5.52 g ^{108}Pd enriched to 98.11%. γ rays were detected with Ge(Li) detectors (FWHM=7 keV at $E\gamma=6$ MeV). Measured $E\gamma$, $I\gamma$, $\gamma(0)$ at 90° and 135°. Deduced levels, $J\pi$.

 ^{109}Pd Levels

E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$
0.0		540.8 7		1053.8 10	5/2, (3/2)
113.4 6	1/2	604.4 8		1091.0 16	5/2
188.9 13		623.5 7	3/2, 5/2	1134.6 13	
245.0 8		646.0 16		1232.8 12	
266.4 7		673.4 7		1269.8 16	
276.3 8		722.1 7		1328.4 16	(3/2)
287.2 14		791.4 7	5/2	1359.1 9	
291.4 7	3/2	810.6 10		1371.1 16	5/2
325.3 6		847.4		1399.2 16	
326.9 6	3/2, 5/2 [§]	911.3 8	5/2	1477.6 16	
339.3 8		941.0 9		1540.3 16	3/2
426.2 8		945.0 8	3/2	1623.9 16	
433.6 6	3/2, (5/2)	954.3 9	1/2, 5/2	1647.9 16	
491.6 7		981.8 8	5/2	6154.2 6	

[†] From a least-squares fit to γ -ray energies.

[‡] From 1980Ca02 based on $\gamma(0)$.

[§] 1980Ca02 suggests that the 326 level is populated, but the 325 level is not ruled out.

$^{108}\text{Pd}(\text{n},\gamma)$ E=2.96 eV 1980Ca02 (continued) $\gamma(^{109}\text{Pd})$

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger$	$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger$	$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger$
94.5 15	339.3	15.4 15	378.2 15	491.6	17.7 18	685.9 15	1359.1	3.4 3
98.3# 15	287.2	21.8 22	395.2 15	722.1	1.8 3	690.3 15	981.8	15.3 15
106.7 15	433.6	0.8 3	396.8 15	722.1	5.1 5	696.0 15	941.0	0.8 3
108.3# 15	433.6	2.1 3	$\times 407.1$ 15		1.6 3	705.4 15	981.8	2.5 4
113.4 15	113.4	187 19	$\times 414.3$ 15		4.0 4	$\times 713.4$ 15		4.1 4
149.9 15	426.2	1.8 2	$\times 416.7$ 15		1.4 3	722.0 15	722.1	6.8 7
152.9 15	266.4	42 4	$\times 418.3$ 15		3.5 4	726.7 15	1053.8	5.1 6
166.3 15	491.6	1.9 4	$\times 421.0$ 15		3.2 3	754.9 15	1359.1	3.2 4
$\times 170.6$ 15		2.9 6	426.1 15	426.2	27 3	$\times 772.1$ 15		1.3 3
178.0 15	291.4	61 6	428.4 15	673.4	7.1 7	787.3 15	1053.8	1.5 3
189.0 15	188.9	19.2 19	433.6 15	433.6	32 3	791.4 15	791.4	4.8 5
189.9 15	623.5	2.6 4	$\times 441.8$ 15		3.2 5	$\times 793.6$ 15		1.8 3
197.3 15	623.5	0.6 3	455.7 15	722.1	4.2 4	799.3# 15	1232.8	4.1 4
200.2 15	491.6	9.8 10	461.2 15	1134.6	4.0 4	810.5# 15	810.6	7.4 7
$\times 203.0$ 15		0.7 2	464.5 15	791.4	2.5 4	$\times 815.2$ 15		2.8 3
$\times 207.7$ 15		0.7 2	$\times 466.5$ § 15		3.2§ 3	$\times 820.2$ 15		1.8 3
211.9 15	325.3	17.7 18	$\times 467.3$ § 15		3.2§ 4	831.6 15	945.0	18.2 18
213.8 15	540.8	1.4 2	485.3 15	810.6	3.0 4	840.8 15	954.3	5.7 6
215.4 15	540.8	5.9 6	491.6 15	491.6	7.0 7	$\times 846.3$ 15		15.8 16
$\times 216.5$ 15		0.3 2	515.1 15	791.4	7.1 7	911.3 15	911.3	14.4 14
222.9 15	945.0	0.8 3	520.6 15	954.3	6.7 7	966.4# 15	1232.8	1.9 4
$\times 228.2$ 15		1.7 2	525.1 15	791.4	2.6 6	1019.9 15	1359.1	1.7 3
230.5 15		1.4 2	$\times 526.4$ 15		1.7 6	4506.2 15	6154.2	6.3 10
245.1 15	245.0	83 8	530.2 15	1134.6	0.9 6	4530.1 15	6154.2	9.1 10
249.2 15	540.8	17.8 18	$\times 539.4$ 15		1.7 15	4613.7 15	6154.2	12.1 10
$\times 263.4$ 15		0.6 4	540.7 15	540.8	2.6 14	4676.4 15	6154.2	5.1 5
264.4 15	540.8	0.9 8	$\times 554.6$ § 15		4.6§ 5	4754.8 15	6154.2	0.6 2
265.0 15	604.4	5.6 6	555.6§ 15	981.8	4.6§ 5	4782.9 15	6154.2	7.2 6
266.3 15	266.4	12.9 13	$\times 579.9$ 15		1.3 3	4795.5 15	6154.2	4.4 13
274.3 15	540.8	0.7 2	584.5§ 15	911.3	2.7§ 4	4825.6 15	6154.2	4.4 5
276.3 15	276.3	70 7	585.9§ 15	911.3	2.7§ 4	4884.2 15	6154.2	5.1 6
288.5 15	722.1	1.3 3	601.6 15	941.0	3.9 4	5063.0 15	6154.2	15.7 13
291.4 15	291.4	50 5	604.5 15	604.4	2.6 4	5100.0 15	6154.2	9.1 13
295.6 15	540.8	0.8 2	$\times 608.7$ 15		1.7 3	5172.2 15	6154.2	30 3
298.2 15	623.5	10.6 11	$\times 612.0$ 15		1.2 3	5199.7 15	6154.2	17.8 18
317.3# 15	604.4	1.1 3	619.9§# 15	911.3	8.9§ 9	5209.1 15	6154.2	16.1 16
320.2 15	433.6	17.2 17	$\times 620.4$ § 15		8.9§ 9	5242.7 15	6154.2	28.2 23
325.3 15	325.3	71 7	623.5 15	623.5	5.0 5	5307 4	6154.2	1.3 6
326.9 15	326.9	41 4	628.9 15	954.3	3.0 4	5362.6 15	6154.2	13.1 13
332.1 15	623.5	3.2 4	$\times 632.4$ 15		1.1 3	5480.6 15	6154.2	4.7 6
334.0 15	673.4	25 3	$\times 634.9$ 15		8.2 8	5508.0 15	6154.2	1.0 4
336.6 15	941.0	6.0 6	646.0 15	646.0	1.4 4	5530 3	6154.2	12.8 13
$\times 337.8$ 15		0.9 5	653.5 15	945.0	5.5 6	5612.6 15	6154.2	1.7 4
339.5 15	339.3	50 5	654.9§ 15	981.8	5.5§ 6	5662.3 15	6154.2	4.4 5
$\times 343.9$ 15		1.5 3	$\times 655.5$ § 15		5.5§ 6	5720.3 15	6154.2	4.7 5
346.6 15	673.4	1.0 2	$\times 657.6$ § 15		6.4§ 6	5815.0 15	6154.2	2.1 2
347.2 15	623.5	1.0 2	673.6§# 15	673.4	1.3§ 3	5827.2 15	6154.2	6.5 7
359.4 15	604.4	32 3	674.7§ 15	941.0	1.3§ 3	5862.7 15	6154.2	7.5 8
365.3 15	791.4	0.8 2	678.0§ 15	791.4	4.1§ 4	6040.5 15	6154.2	33.6
$\times 371.1$ 15		1.4 3	678.7§ 15	945.0	4.1§ 4	6154 4	6154.2	0.6 2
377.0 15	810.6	0.6 3	$\times 681.0$ 15		2.0 3			

† 1980Ca02 only lists values for the primary γ rays for the measurement of E=2.96 eV resonance capture and assign $\Delta E=1.5$ keV for most of them. For those low energy secondary γ rays also observed in this measurement, the evaluators have taken rounded-off values from the thermal capture measurement in 1980Ca02 and assign $\Delta E=1.5$ keV.

‡ From 1980Ca02, normalized to $I(6040.5\gamma)=33.6$ per 1000 neutron captures (accurate to 24%), which is deduced by 1980Ca02 from the adopted absolute intensities $I\gamma=0.049, 0.32$ and 0.244 per 1000 ^{109}Pd decays for 309.1, 311.4 and 647.3 keV γ rays, respectively.

§ Multiplet lines not resolved in this resonance capture but resolved in the thermal capture measurement (1980Ca02). Values of $E\gamma$ are taken as the average of the multiplet and values of $I\gamma$ are the sum of the multiplet.

Tentative placement by 1980Ca02.

$\times$ γ ray not placed in level scheme.

$^{108}\text{Pd}(\text{d},\text{p})$ 1967Co24

Target ^{108}Pd $J\pi(\text{g.s.})=0+$.

1967Co24: E=12 MeV deuteron beam was produced from the University of Pittsburgh cyclotron. Target is 40 $\mu\text{g}/\text{cm}^2$ 98% enriched ^{108}Pd . Reaction products were momentum analyzed by a Enge split-pole spectrograph (FWHM=7 keV) and detected in photographic plates. Measured $\sigma(E_p, \theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis.

Also see 1968Co32 with E=17 MeV beam and 1963Cu02 with E=15 MeV beam and spectrometer FWHM=30 keV.

 ^{109}Pd Levels

E(level) [†]	L [‡]	(2J+1)×S [‡]	Comments
0.0	2	1.06	
112 4	0	0.60	
188 4	5	3.36	
245 4	4	3.52 [§]	
262 4	0	0.11	
291 4	2	1.32	
324 4	2, 0	0.18	(2J+1)×S: 0.018 for L=0.
370 4	(1)	0.0084	
382 4	0, 2	0.0064	(2J+1)×S: 0.035 for L=2.
404 4	0	0.008	
427 4	4	1.6 [§]	
489 4	2	0.416	
539 4	2	0.162	
623 4	0	0.106	
644 4	4	0.96 [§]	
671 4	1	0.038	
719 4	2	0.068	
742 4	0	0.0124	
788 4	2	0.212	
808 4	2	0.132	
844 4	2	0.248	
908 4	2	0.90	
940 4	1	0.056	
954 4	0	0.021	
981 4			
1006 4			
1051 4	2	0.10	
1093 4	2	0.64	
1145 4	2	0.26	
1176 4	3	0.053	
1231 4	0	0.018	
1241 4	3	0.052	
1263 4	2	0.035	
1308 4			
1329 4	(1)	0.12	
1344 4	0	0.042	
1474 4	0	0.022	
1484 4	2, (1)	0.064	(2J+1)×S: 0.019 for L=1.
1499 4			
1541 4	(3, 2)	0.064	(2J+1)×S: 0.044 for L=2.
1561 4			
1644 4			
1664 4	2, (1)	0.084	(2J+1)×S: 0.029 for L=1.
1682 4	0	0.068	
1737 4	2, (1)	0.068	(2J+1)×S: 0.22 for L=1.
1773 4	3	0.037	
1789 4	(1, 2)	0.021	(2J+1)×S: 0.072 for L=2.
1800 4	0	0.018	
1819 4			
1836 4	3	0.058	
1846 4	(1, 2)	0.03	(2J+1)×S: 0.11 for L=2.
1863 4	(3)	0.050	
1877 4	1	0.030	
1915 4	1	0.035	
1923 4	1	0.088	
1941 4	3	0.144	
1954 4			

Continued on next page (footnotes at end of table)

$^{108}\text{Pd}(\text{d,p})$ $^{1967}\text{Co}24$ (continued) **^{109}Pd Levels (continued)**

$E(\text{level})^\dagger$	$L^\ddagger$	$(2J+1)\times S^\S$	Comments
1972 4	3	0.24	
2021 4	1	0.0056	
2053 4			
2091 4	2	0.12	
2117 4	1	0.072	
2135 4	(1)	0.018	
2160 4	1	0.064	
2209 4	3	0.144	
2245 4	1	0.044	
2259 4	1	0.038	
2280 4	2	0.084	
2301 4	(1)	0.0039	
2346 4	(3)	0.112	
2357 4	(1)	0.038	
2371 4	3	0.168	
2391 4	3	0.088	
2415 4	1	0.030	
2465 4	3	0.224	
2473 4	1	0.072	
2493 4	(3)	0.176	
2522 4	2	0.088	
2541 4	(3,0)	0.096	(2J+1)×S: 0.028 for L=0.

† From 1967Co24. Authors do not give uncertainty. Evaluators estimate $\Delta E=4$ keV from the proton spectrum.

‡ From DWBA analysis in 1967Co24. Spectroscopic factor S is deduced using $d\sigma/d\Omega(\text{exp})=N\times(2J+1)\times S\times d\sigma/d\Omega(\text{DWBA})$, where $N=1.5$ for (d,p) transfer reaction.

§ 1968Co32 obtain $(2J+1)\times S=1.76, 1.76$ and 0.72 for $E=245, 427$ and 644 keV $J\pi=7/2+$ levels, respectively, with beam energy=17 MeV. They claim that the strong variations of $S(E=12\text{ MeV})/S(E=17\text{ MeV})$ could arise from a breakdown of the basic stripping theory.

¹¹⁰Pd(d,t) 1970Di05

Target ¹¹⁰Pd J π (g.s.)=0+.

1970Di05: E=17 MeV deuteron beam was produced from the University of Pittsburgh three-stage Van de Graaff accelerator. Targets are 50–100 $\mu\text{g}/\text{cm}^2$ 99% enriched ¹¹⁰Pd on 30 $\mu\text{g}/\text{cm}^2$ carbon foils. Reaction products were momentum analyzed by a Enge split-pole spectrograph (FWHM=8–10 keV) and detected in photographic plates. Measured $\sigma(E_t, \theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis using the code JULIE. Also see 1968Co32 with E=17 MeV beam.

1980Sc23: E=50 MeV deuterons are from the KVI cyclotron. Targets are 500 $\mu\text{g}/\text{cm}^2$ self-supporting metallic palladium. Reaction products were detected with ΔE -E solid-state detector telescopes. Measured $\sigma(E_t, \theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis using the code DWUCK.

¹⁰⁹Pd Levels

E(level) [†]	J π	L ‡	S ‡	Comments
0.0	5/2+	2	1.16	S: 1.30 from 1980Sc23.
113 4		0	0.43	S: 0.29 from 1980Sc23.
188 4		5	2.6	S: 3.42 from 1980Sc23.
243 4		4	2.3 $\S$	
266 4		0	0.156	
291 4		2	0.60	
324 4		2	0.063	
339 4				
426 4		4	4.0 $\S$	S: 3.89 from 1980Sc23.
491 4		2	0.28	
540 4		2	0.47	
596 4		4	0.4	
623 4		0	0.056	
644 4		4	0.46 $\S$	
671 4		1	0.049	
712 4		(4)	0.2	
729 4		2	0.035	
789 4		2	0.179	
809 4		2	0.27	
842 4		(2)	0.10	
883 4		5	0.31	
910 4		2	0.195	
946 4		0	0.034	
960 4		(0)	0.050	
982 4		2	0.122	
1054 4		2	0.092	
1065 4		0	0.046	
1091 4		2	0.079	
1146 4		2	0.073	
1235 4		0	0.022	
1269 4		2	0.114	
1346 4		0	0.033	
1371 4		2	0.076	
1448 4		2	0.058	
1478 4		0	0.043	
1539 4		0	0.049	
1600 4		(0)	0.009	
1643? 4		(2)	0.012	
1656? 4		(0)	0.006	
1692 4		0	0.017	
1785? 4		0	0.006	
1792 4		(0, 2)	0.006, 0.01	
1848 4		0	0.04	
1878 4		2	0.03	
1927 4		1	0.056	
1977 4		1	0.063	
1999 4		(1, 2)	0.018, 0.033	
2014 4		0	0.052	
2101 4		(2)	0.029	
2122 4		0	0.046	
2174 4		2	0.025	
2188 4		0	0.011	
2240 4		(2)	0.030	

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¹¹⁰Pd(d,t) 1970Di05 (continued)

¹⁰⁹Pd Levels (continued)

E(level) [†]	L [‡]	S [‡]
2282 4	0	0.018
2295 4	1	0.063
2320 4	2	0.033
2371 4	2	0.029
2380 4	0	0.014
2479 4	1	0.038

[†] From 1970Di05. Authors do not give uncertainty. Evaluators estimate ΔE=4 keV from the proton spectrum.

[‡] From DWBA analysis in 1970Di05 using the code JULIE. Spectroscopic factor S is deduced using $d\sigma/d\Omega(\text{exp})=N \times S \times d\sigma/d\Omega(\text{DWBA})$, where $N=3.33$ for (d,t) transfer reaction.

[§] 1968Co32 obtain S=1.52, 4.72 and 0.64 for E=243, 426 and 644 keV $J\pi=7/2+$ levels, respectively, with beam energy=17 MeV. They claim that the strong variations of S(d,p)/S(d,t) could arise from a breakdown of the basic stripping theory.

$^{176}\text{Yb}(^{30}\text{Si},\text{F}\gamma)$ 1998Ku22,1999Ho25,2012St13

1998Ku22: $^{176}\text{Yb}(^{28}\text{Si},\text{F}\gamma)$ and $^{176}\text{Yb}(^{30}\text{Si},\text{F}\gamma)$ E=145 MeV ^{28}Si , ^{30}Si beam was produced from the Vivitron accelerator at Strasbourg. Target was a 1.5 mg/cm² ^{176}Yb on a 15 mg/cm² Au backing. γ rays were detected with the EUROAM2 array of 54 Compton suppressed HPGe detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$. Deduced levels, band structures.

1999Ho25: $^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ E=90 MeV ^{12}C beam was produced from the INFN tandem at Legnaro, Italy. Target was a 47 mg/cm² thick ^{238}U . γ rays were detected with the Euroball III array of 15 clusters, 26 clovers and 30 tapered Ge detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$. Deduced levels, band structures.

2012St13: $^{168}\text{Er}(^{30}\text{Si},\text{F}\gamma)$ E=142 MeV ^{30}Si beam was produced the XTU tandem accelerator at the Legnaro National Laboratory. Target was a 1.15 mg/cm² ^{168}Er foil evaporated on a 9 mg/cm² Au backing. γ rays were detected with the EUROBALL III array. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$. Deduced levels, band structures.

 ^{109}Pd Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$E(\text{level})^\dagger$	$J\pi^\ddagger$	$E(\text{level})^\dagger$	$J\pi^\ddagger$
0.0&	5/2+§	907.0 ^a 10	(11/2+)	2155 [@] 1	(21/2-)
189#	11/2-§	1267.0& 11	(13/2+)	2364.0 ^a 17	(19/2+)
276.0 ^a 8	7/2+§	1289# 1	(19/2-)	2479.0& 18	(21/2+)
287 [@] 1	9/2-	1361 [@] 1	(17/2-)	3030# 1	(27/2-)
597.0& 8	(9/2+)	1635.0 ^a 14	(15/2+)	3975# 1	(31/2-)
625# 1	(15/2-)	1873.0& 15	(17/2+)	4958# 1	(35/2-)
718 [@] 1	(13/2-)	2103# 1	(23/2-)		

[†] From a least-squares fit to $E\gamma$.

[‡] Based on the systematics and observed band structures, unless otherwise noted.

§ From Adopted Levels.

(A): Most likely the v3/2-[541] ($h_{11/2}$), $\alpha=-1/2$ band.

@ (B): Most likely the v3/2-[541] ($h_{11/2}$), $\alpha=+1/2$ band.

& (C): $K\pi=5/2+$ band, $\alpha=+1/2$. Most likely a mixture between v5/2+[413] and v5/2+[402] Nilsson configurations.

^a (D): $K\pi=5/2+$ band, $\alpha=-1/2$. Most likely a mixture between v5/2+[413] and v5/2+[402] Nilsson configurations.

 $\gamma(^{109}\text{Pd})$

$E\gamma^\dagger$	$E(\text{level})$	$E\gamma^\dagger$	$E(\text{level})$	$E\gamma^\dagger$	$E(\text{level})$
98 1	287	597 1	597.0	729 1	2364.0
276 1	276.0	605 1	2479.0	736 1	1361
310 1	907.0	606 1	1873.0	794 1	2155
321 1	597.0	631 1	907.0	814 1	2103
360 1	1267.0	643 1	1361	927 1	3030
431 1	718	664 1	1289	945 1	3975
436 1	625	670 1	1267.0	983 1	4958
529 [‡] 1	718	728 1	1635.0		

[†] Transitions from positive-parity states are observed only in 2012St13 with $\Delta E\gamma=1$ keV. The others are observed in 1998Ku22 and 1999Ho25 but without uncertainties given. The evaluators assigned $\Delta E\gamma=1$ keV for these γ -ray energies based on comparisons of the γ -ray spectra with that in 2012St13.

[‡] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Q(β⁻)=-215.5 18; S(n)=9184.5 27; S(p)=6484.5 14; Q(α)=-3294.2 28 2012Wa38.

¹⁰⁹Ag Levels

Cross Reference (XREF) Flags

A ¹⁰⁹Pd β⁻ Decay
B ¹⁰⁹Cd ε Decay
C ⁹⁶Zr(¹⁸O,p4nγ)
D ¹⁰⁰Mo(¹³C,p3nγ)

E ¹⁰⁷Ag(t,p)
F ¹⁰⁸Pd(³He,d)
G ¹⁰⁹Ag(γ,γ)
H ¹⁰⁹Ag(p,p')

I ¹⁰⁹Ag(α,α')
J ¹¹⁰Cd(d,³He)
K ¹¹²Cd(p,α)
L Coulomb Excitation

E(level) [†]	Jπ ^a	XREF	T _{1/2}	Comments
0.0	1/2-	ABCDEFGHIJKL	stable	Jπ: from atomic beam (1937Ja01,1950Cr26); π=+ from L(³ He,d)=L(d, ³ He)=L(p,α)=1, L(t,p)=0 and μ. μ=-0.1306906 2 (1974Sa25). μ: by means of the NMR method. Other: -0.13056 2 (1954So05). configuration: π(p _{1/2}) ⁻¹ . %IT=100.
88.0337 10	7/2+	ABCD G KL	39.79 s 21	Jπ: 88.0336γ E3 to 1/2-; atomic beam (1965St18). T _{1/2} : weighted average of 40 s 2 (1940Al01), 40.4 s 2 (1945Wi11), 39.2 s 2 (1947Br05), 40 s 1 (1951Wo15), 39.80 s 10 (1967Mi11), 39.3 s 3 (1967Ab07) and 38.0 s 12 (2000Yo07). Other: 35 s 5 (1973Co10). μ=+4.400 6 (1985Ed01); Q=(+)1.02 12 (1986Be01). μ: by means of the NMR method. Q: by means of the Level Mixing Resonance on Oriented Nuclei method. configuration: π(g _{9/2}) ⁻¹ .
132.762 ^c 8	9/2+	A CD F JKL	2.60 ns 12	Jπ: L(³ He,d)=(d, ³ He)=L(p,α)=4; 44.77γ M1+E2 to 7/2+; 602.5γ E2 from 5/2+.
311.378 6	3/2-	A EF HIJKL	5.9 ps 4	T _{1/2} : from γγ(t) in ¹⁰⁹ Pd β ⁻ decay (1972Ja01). Jπ: L(³ He,d)=(d, ³ He)=L(p,α)=1; 311.36γ M1+E2 to 1/2-; 103.9γ M1+E2 from 5/2-. B(E2) [†] =0.228 12. B(E2) [†] : weighted average of 0.222 19 (1970Ro14), 0.210 18 (1973Co10) and 0.249 17 (1958Mc02) in Coulomb Excitation. T _{1/2} : weighted average of 5.9 ps 7, using Recoil Distance Method in Coulomb Excitation (1974Mi02) and 5.9 ps 5 from BE2=0.228 12 and δ(311.3γ)=0.192 7 in Coulomb Excitation. Others: 6.9 ps 7 by RDM (1970MiZS) and 6.3 ps 18 (1970Ro14). μ=+1.10 9. Q: -0.54 10, -0.64 10, -0.81 10 or -0.91 10, depending on the relative sign of the matrix elements (1972Th16). μ: from g=+0.73 6. g-factor (transition field method): +0.73 6, weighted average of 0.79 12 (1984Ba72), +0.77 10 (1984Wo08) and 0.66 10 (1986Ba14). Other: 0.58 24 (1970RoZS).
415.193 8	5/2-	A EFGHI KL	33.4 ps 13	Jπ: L(t,p)=2, L(p,α)=3; 415.17γ E2 to 1/2-. B(E2) [†] =0.317 18. B(E2) [†] : weighted average of 0.320 26 (1970Ro14) and 0.315 24 (1973Co10). Other: 0.377 26 (1958Mc02). T _{1/2} : weighted average of 32.6 ps 16 (1989Lo08) and 34.7 ps 21 (1974Mi02), using the RDM method. Others: 35 ps 4 (1970MiZS,RDM), 40 ps 3 (1970Ro14), 40.2 ps 23 from B(E2)=0.317 18 and δ(103.5γ)=-0.039 17. μ=+0.85 8. μ: from g=+0.34 3. g-factor (transition field method): +0.34 3, weighted average of 0.36 6 (1984Ba72), +0.36 5 (1984Wo08) and 0.29 6 (1986Ba14). Q: -0.16, -0.26, -0.33, or -0.43, depending on the relative sign of the matrix elements (1972Th16). Jπ: L=(d, ³ He)=(4). XREF: G(680).
420 [‡] 10 697.38? 14	(7/2+, 9/2+)	A G J		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

¹⁰⁹Ag Levels (continued)

E(level) [†]	Jπ ^a	XREF	T _{1/2}	Comments
701.877 9	3/2-	A E H JKL	0.27 ps 7	B(E2) [†] =0.00087 19 (1970Ro14). Jπ: L(d, ³ He)=L(p,α)=1; 701.85γ M1+E2 to 1/2-. T _{1/2} : weighted average of 0.24 ps 7 (1974Er05) and 0.5 ps 2 (1970Ro14), using the DSAM method.
706 [§] 5	1/2+	F		Jπ: L(³ He,d)=0.
706.971 10	(3/2, 5/2-)	A		Jπ: 707.05γ to 1/2-; probable feeding in ¹⁰⁹ Pd β ⁻ decay.
724.381 6	3/2+	A	3.2 ns 8	Jπ: 413.02γ E1+M2 to 3/2-, 636.29γ E2 to 7/2+. γγ(θ) for 413.02γ in ¹⁰⁹ Pd β ⁻ decay (1977Bo04) is also consistent with J=3/2. T _{1/2} : from delayed coincidence in ¹⁰⁹ Pd β ⁻ decay (1982Br19). Jπ: L(³ He,d)=L(d, ³ He)=2, 423.99γ E1+M2 to 3/2-, 647.27γ M1 to 7/2+.
735.320 7	5/2+	A F J		Jπ: 640.6γ M1+E2 to 9/2+.
773.42 ^c 12	11/2+	CD		
789? [#] 11		K		
811.74? 19		A		
862.633 9	5/2-	A E GH JKL	1.39 ps 19	XREF: G(855)J(870)K(868). B(E2) [†] =0.0173 17 (1970Ro14). Jπ: L(t,p)=2; L(p,α)=3; 862.82γ E2 to 1/2-; 551.4γ(θ) and 862.82γ(θ) in Coulomb excitation (1970Ro14) are only consistent with J=5/2. T _{1/2} : weighted average of 1.42 ps 21 from BE2=0.0173 17 (1970Ro14) and 1.3 ps 4 from DSAM (1970Ro14). Other: 1.3 ps +8-4 (1974Er05,DSAM).
869.426 6	5/2+	A F I		XREF: F(866). Jπ: L(³ He,d)=2; 736.64γ E2 to 9/2+, 558.1γ E1+M2 to 3/2-.
890 [‡] 10	(7/2+, 9/2+)	J		Jπ: L(d, ³ He)=(4).
910.902 11	7/2+	A F h		Jπ: L(³ He,d)=L(t,p)=4; 778.24γ M1 to 9/2+; possible feeding in ¹⁰⁹ Pd β ⁻ decay (Jπ=5/2+).
912.205 25	7/2-	A E h L		B(E2) [†] <0.018. Jπ: L(t,p)=4; γ(θ) in Coulomb excitation (1989Lo08) is consistent with J=7/2, 601.1γ to 3/2-.
929 [#] 8	(9/2+)	K		Jπ: proposed by 1977SmZM in (p,α) based on DWBA analysis.
930.75 ^c 10	13/2+	CD		Jπ: 798.0γ E2 to 9/2+ and band structure in ⁹⁶ Zr(¹⁸ O,p4nγ) and ¹⁰⁰ Mo(¹³ C,p3nγ).
1070 [#]		I K		
1090.7 5	9/2-	E H L	1.9 ps 3	B(E2) [†] <0.006. Jπ: L(p,p')=4; γ(θ) in Coulomb excitation is consistent with J=9/2 (1989Lo08); 675.5γ E2 to 5/2-.
1099.11 4	(5/2, 7/2-)	A		T _{1/2} : from RDM in Coulomb excitation (1989Lo08). Jπ: 966.19γ to 9/2+; 787.6γ to 3/2-; possible feeding in ¹⁰⁹ Pd β ⁻ decay (Jπ=5/2+).
1200 [‡] 10	(7/2+, 9/2+)	FG JK		XREF: K(1230). Jπ: L(d, ³ He)=(4).
1260 [@] 2	1/2-	EF HI		XREF: F(1255)I(1280). Jπ: L(t,p)=L(p,p')=0 from 1/2-.
1310 [‡] 10	1/2-, 3/2-	F J		Jπ: L(d, ³ He)=1.
1324.2 7	3/2-	E H KL	0.31 ps 9	XREF: K(1331). Jπ: L(t,p)=2; 1012.9γ(θ) in Coulomb excitation is consistent with J=3/2 or, with smaller probability, J=5/2 (1970Ro14). 1970Ro14 suggest J=3/2 based on spin of analogous level in ¹⁰⁷ Ag.
1430 [§] 10	1/2+	F		T _{1/2} : from DSAM in Coulomb excitation (1970Ro14). Jπ: L(³ He,d)=0.
1490 [§]	3/2+, 5/2+	Fg		E(level): unresolved multiplet; 1480 10 from (γ,γ'). Jπ: L(³ He,d)=2.
1500 [@] 5	3/2-	E gHI Jk		XREF: H(1510)J(1510). Jπ: L=(t,p)=2, L(d, ³ He)=1.
1524 [@] 5	(3/2, 5/2)-	E k		Jπ: L(t,p)=2.
1599 [@] 5		EF		
1613 [@] 5	1/2-	E H		XREF: H(1610). Jπ: L(t,p)=0.
1658 [§] 10	1/2+	F		Jπ: L(³ He,d)=0.
1675? 10		G		E(level): proposed only from (γ,γ).

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Adopted Levels, Gammas (continued)

¹⁰⁹Ag Levels (continued)

E(level) [†]	Jπ ^a	XREF	T _{1/2}	Comments
1702.9 ^c 3	15/2+	CD		
1736 [@] 5	(3/2, 5/2)-	EF		XREF: F(1750). Jπ: L(t,p)=2.
1792 [@] 5	(7/2, 9/2)-	E		Jπ: L(t,p)=4.
1815 [@] 5	(3/2, 5/2)-	E		Jπ: L(t,p)=2.
1839 [@] 5	(5/2)-	E K		XREF: K(1844). E(level): from (t,p), J=5/2-, 7/2- based on DWBA analysis in (p,α) (1977SmZM). Jπ: L(t,p)=2.
1841 [§] 10	3/2+, 5/2+	F		Jπ: L(³ He,d)=2.
1860 [‡] 10	(7/2+, 9/2+)	J		Jπ: L(d, ³ He)=(4).
1891 [@] 5	(7/2, 9/2)-	E K		XREF: K(1887). Jπ: L(t,p)=4.
1894.28 ^c 14	17/2+	CD	0.57 ps ^b 5	XREF: K(1940).
1950 [@] 5	(7/2, 9/2)-	E K		E(level): Possible multiplet in (p,α) (1977SmZM). Jπ: L(t,p)=4. J=(9/2+) based on DWBA analysis in (p,α) is inconsistent.
1970 [§] 10	3/2+, 5/2+	F		Jπ: L(³ He,d)=2.
1993 [@] 5	(3/2, 5/2)-	EF		XREF: F(?). Jπ: L(t,p)=2.
2043 [#] 11	(9/2+)	F K		XREF: F(?). Jπ: based on DWBA analysis in (p,α) (1977SmZM).
2062 [@] 10	(7/2, 9/2)-	EF		XREF: F(?). Jπ: L(t,p)=4.
2093 [@] 10	(3/2, 5/2)-	E		Jπ: L(t,p)=2.
2124 [@] 10	(5/2, 7/2)+	EF H		XREF: H(2150). Jπ: L(t,p)=3, L(³ He,d)=4(+2).
2185 [@] 10	(9/2+)	E I K		XREF: I(2173)K(2171). E(level): Possible multiplet in (p,α) (1977SmZM). Jπ: based on DWBA analysis in (p,α) (1977SmZM).
2199 [@] 10	(7/2-, 9/2-)	E		Jπ: L(t,p)=(4).
2206.46 ^d 22	15/2-	C		
2222 [@] 10	(7/2-, 9/2-)	E		Jπ: L(t,p)=(4).
2230 5	(5/2, 7/2)+	F H K		XREF: F(2220). E(level): from (p,p'). Jπ: L(p,p')=3, L(³ He,d)=(2+4).
2256 [@] 10	(9/2, 11/2)+	E		Jπ: L(t,p)=5.
2267 [@] 10	(5/2, 7/2)+	E		Jπ: L(t,p)=3.
2314 [@] 10	(3/2-, 5/2-)	E		Jπ: L(t,p)=(2).
2320 [§] 5	1/2+	F K		XREF: K(2350). Jπ: multiplet, but major component has L(³ He,d)=0.
2364 [@] 10	(9/2, 11/2)+	EF		XREF: F(2400). Jπ: L(t,p)=5.
2419.96 ^d 25	17/2-	C		
2434 [@] 10	(7/2, 9/2)-	E		Jπ: L(t,p)=4.
2466 [@] 10	(7/2, 9/2)-	E		Jπ: L(t,p)=4.
2471 [#] 6	1/2+	F K		XREF: F(2470). Jπ: multiplet, but major component has L(³ He,d)=0.
2479.9 ^e 4	17/2-	C		
2537 [@] 10	(9/2, 11/2)+	E K		XREF: K(2522). Jπ: L(t,p)=5.
2567.39 ^c 18	19/2+	CD	0.39 ps ^b 4	
2568.4 ^e 3	19/2-	C		
2569 [@] 10	(9/2+, 11/2+)	E		Jπ: L(t,p)=(5).
2614 [@] 10		E		
2659 [@] 10		E		
2660.5 ^d 4	19/2-	C		
2740.6 ^e 3	21/2-	C		
2840.79 ^c 16	21/2+	CD	0.82 ps ^b 8	
2940.2 ^d 4	(21/2-)	C		
2988.7 ^e 3	23/2-	C		
3090.19 ^c 19	23/2+	CD	1.53 ps ^b 16	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

¹⁰⁹Ag Levels (continued)

E(level) [†]	Jπ ^a	XREF	T _{1/2}	Comments
3203.5 ^d 5	(23/2-)	C		
3275 [§] 10	3/2+, 5/2+	F		Jπ: L(³ He,d)=2.
3276.39 ^c 22	25/2+	CD	1.87 ps ^b 21	
3316.7 ^e 4	25/2-	C		
3575.19 ^c 24	27/2+	CD	0.71 ps ^b 8	
3968.7 ^c 3	29/2+	CD	0.37 ps ^b 4	
4375.8 ^c 3	31/2+	CD	0.291 ps ^b 35	
4886.4 ^c 4	33/2+	CD	0.180 ps ^b 21	
5414.5 ^c 5	(35/2+)	CD	0.222 ps ^b 28	
5998.3 ^c 8	(37/2+)	CD		

[†] From a least-squares fit to E_γ, unless otherwise noted.

[‡] From ¹¹⁰Cd(d,³He).

[§] From ¹⁰⁸Pd(³He,d).

[#] From ¹¹²Cd(p,α).

[@] From ¹⁰⁷Ag(t,p).

^a Values without comments are based on band consideration and/or γ multiplicities deduced from DCO ratios in ⁹⁶Zr(¹⁸O,p4nγ) and ¹⁰⁰Mo(¹³C,p3nγ).

^b From DSAM in ¹⁰⁰Mo(¹³C,p3nγ) (2008Da12).

^c (A): Band 1: πg_{9/2} band. Above Jπ=21/2+, it changes to πg_{9/2}⊗v(h_{11/2})².

^d (B): Band 2: build upon the Jπ=15/2- level at 2206.5 keV.

^e (C): Band 3: build upon the Jπ=17/2- level at 2479.9 keV.

γ(¹⁰⁹Ag)

E(level)	E _γ [†]	I _γ [†]	Mult. [@]	δ@&	α	Comments
88.0337	88.0336 10	100	E3		26.3	E _γ : From ¹⁰⁹ Cd ε decay (2000He14). Mult.: from ce data in ¹⁰⁹ Pd β ⁻ decay. α(K)exp=10.6 5 (1970Ba37); α(K)exp=11.6, K:L:M:N=(0.98 5):1:(0.20 1):(0.050 5), L1:L2:L3=(0.185 15):1:(1.163 27) (1978Sh08) and ce data in ¹⁰⁹ Cd ε decay. I _γ : Double photon decay: I(γγ)/I(γ)<6×10 ⁻⁷ (1988Il01). B(E3)(W.u.)=0.0387 6. Mult.: α(K)exp=3.6 5, α(L)exp=0.7 3 (1978Sh08). δ: From 1984ShZL; Other: 0.35 15 (1996Po07).
132.762	44.77 13	100	M1+E2	0.14 6	4.6 5	Mult.: from γ(θ): A ₂ =-0.395 16 (1970Ro14), -0.39 2 (1955Mc51), -0.388 7 (1958Mc02), A ₂ =-0.710 7 (1970RoZS), -0.654 36 (1989Lo08) in Coulomb Excitation and α(K)exp=0.019 2 from ¹⁰⁹ Pd β ⁻ decay (1970Ba37). δ: weighted average of 0.193 10 (1970RoZS), -0.196 27 (1970Ro14), and 0.19 1 (1958Mc02). Others: 0.19 (1955Mc51) in Coulomb Excitation and δ=0.35 5 from γγ(θ) in ¹⁰⁹ Pd β ⁻ decay (1975El10).
311.378	311.390 10	100	M1+E2	-0.192 7	0.0200	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Ag})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. @	$\delta @ \&$	α	Comments
415.193	103.827 23	5.9 3	M1+E2	-0.039 17	0.379	I γ : Others: 5.1 4 in Coulomb Excitation (weighted average of 5.4 5 (1989Lo08), 4.9 5 1970Ro14 and 4.6 11, deduced from I(γ +ce) in 1973Co10). Mult.: $\alpha(K)_{\text{exp}}=0.44$ 5 in ^{109}Pd β^- decay (1970Ba37); $A_2=-0.239$ 17 in Coulomb Excitation (1970Ro14). δ : From $\gamma(\theta)$ in Coulomb excitation. E γ : From level energy differences. I γ : From Coulomb Excitation. E γ : From level energy differences. I γ : From Coulomb Excitation. B(E1)(W.u.)= 9.2×10^{-7} 24.
	282.431 ^a 11	≤ 0.05	[M2]		0.1164	Mult.: $\alpha(K)_{\text{exp}}=0.010$ 1 from ^{109}Pd β^- decay (1970Ba37); $A_2=+0.124$ 23 (1970Ro14), $A_2=+0.248$ 4, $A_4=-0.039$ 9 (1955Mc51) in Coulomb excitation. B(E2)(W.u.)=40.5 17.
	327.159 ^a 8	0.40 10	[E1]		0.00582	
	415.222 7	100.0 11	E2		0.01099	
697.38?	564.3 ^a 3	100 16				
	609.37 ^a 17	≤ 6.8				
701.877	286.644 24	5.2 4	[M1]		0.0244	B(M1)(W.u.)=0.14 4.
	390.515 18	26.4 11	M1+E2	+0.21 4	0.01126 17	Mult.: $\alpha(K)_{\text{exp}}=0.095$ 2 (1970Ba37); $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay. δ : weighted average of $\delta=0.19$ 6 (1977Bo04) and +0.23 5 (1988Br31) using $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay. Mult.: $\alpha(K)_{\text{exp}}=0.0023$ 5 from ^{109}Pd β^- decay (1970Ba37); $A_2=-0.32$ 6 ($\gamma(\theta)$) in Coulomb excitation (1970Ro14). δ : from $\gamma(\theta)$ in Coulomb excitation (1970Ro14).
	701.876 10	100.0 8	M1+E2	0.029 7	0.00273	
706.971	395.590 28	4.5 4				$\alpha(K)_{\text{exp}}=0.0020$ 6 (1970Ba37).
	706.964 10	100.0 10				Mult.: $\alpha(K)_{\text{exp}}=0.006$ 1 from ^{109}Pd β^- decay (1970Ba37). δ : $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay (1988Br31). Mult.: $\alpha(K)_{\text{exp}}=0.0030$ 3 (1970Ba37) and $\gamma\gamma(\theta)$ (1977Bo04) in ^{109}Pd β^- decay. δ : $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay (1977Bo04). Mult.: $\alpha(K)_{\text{exp}}=0.0026$ 5 from ^{109}Pd β^- decay (1970Ba37). B(E2)(W.u.)=0.027 7.
724.381	309.182 10	38.4 5	E1(+M2)	+0.03 6	0.0068 6	
	413.010 10	64.9 7	E1+M2	0.18 5	0.0042 6	
	636.342 10	100.0 9	E2		0.00323	
735.320	724.372 14	0.56 7				
	423.942 12	3.83 6	E1(+M2)	+0.08 8	0.0032 6	Mult.: $\alpha(K)_{\text{exp}}=0.0030$ 5 (1970Ba37) and $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay. δ : from $\gamma\gamma(\theta)$ in 1988Br31; Other: $\delta=-0.27$ 3 in (1977Bo04). Mult.: $\alpha(K)_{\text{exp}}=0.0030$ 5 from ^{109}Pd β^- decay (1970Ba37). Mult.: $\alpha(K)_{\text{exp}}=0.0027$ 4 from ^{109}Pd β^- decay (1970Ba37). Mult., δ : from anisotropy A=0.30 9 in $^{96}\text{Zr}(^{18}\text{O}, p4n\gamma)$.
	602.568 10	33.6 3	E2		0.00374	
	647.272 10	100	M1		0.00330	
773.42	640.6 $\frac{1}{2}$ 2	100	M1+E2	$>+0.3\frac{1}{2}$	0.00327 11	
811.74?	114.26 ^a 19	100 32				
	500.6 ^a 3	72 16				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Ag})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult. @	$\delta@&$	α	Comments
862.633	447.426 14	100.0 16	M1+E2	-0.16 4	0.00801	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.0070$ 8 from ^{109}Pd β^- decay (1970Ba37); $A_2=+0.124$ 23 (1970Ro14), $A_2=+0.32$ 10, $A_4=-0.11$ 15 (1989Lo08). δ : From $\gamma(\theta)$ in Coulomb excitation (1970Ro14); Other: -0.12 14 in Coulomb excitation (1988Br31).
	551.258 14	75.4 11	M1+E2	-0.28 3	0.00482	Mult.: $A_2=-0.441$ 29 in Coulomb excitation (1970Ro14); ; $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay (1988Br31). δ : weighted average of -0.28 4 from $\gamma(\theta)$ in Coulomb excitation (1970Ro14), -0.28 4 (1977Bo04) and -0.26 7 (1988Br31) from $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay.
	862.637 14	18.24 21	E2		1.51×10^{-3}	Mult.: $A_2=+0.28$ 13 in Coulomb excitation (1970Ro14). B(E2)(W.u.)=2.6 4.
869.426	134.107 18	12.7 3	M1+E2	0.44 +13-15	0.24 3	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.20$ 2 from ^{109}Pd β^- decay (1970Ba37).
	145.039 14	8.22 15	M1+E2	0.13 2	0.1531 25	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.15$ 2 (1970Ba37) and $\delta=0.13$ 2 from $\gamma\gamma(\theta)$ (1975El10) in ^{109}Pd β^- decay.
	162.37 4	0.88 9				
	454.269 14	3.67 13	E1 (+M2)	-0.14 +36-17	0.0030 17	Mult., δ : from $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay (1988Br31).
	558.040 10	22.32 21	E1+M2	-0.20 4	0.00205 21	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.0012$ 3 (1970Ba37) and $\delta=-0.26$ 5 from $\gamma\gamma(\theta)$ (1977Bo04) in ^{109}Pd β^- decay.
	736.652 10	14.53 15	E2		0.00222	Mult.: $\alpha(\text{K})_{\text{exp}}=0.0012$ 3 from ^{109}Pd β^- decay (1970Ba37).
	781.394 10	100.0 11	M1+E2		0.00213	Mult.: $\alpha(\text{K})_{\text{exp}}=0.0017$ 5 from ^{109}Pd β^- decay (1970Ba37).
	869.415 25	0.13 6	[M2]		0.00427	
910.902	778.140 14	100.0 12	M1		0.00215	Mult., δ : $\alpha(\text{K})_{\text{exp}}=0.0018$ 5 from ^{109}Pd β^- decay (1970Ba37).
	822.862 14	17.69 19	[M1]		0.00190	
912.205	497.010 23	100 4	(M1+E2)		0.00619	Mult.: $A_2=-0.51$ 6 (1989Lo08). I γ : from Coulomb excitation. E γ , I γ : from Coulomb excitation.
	601.1 7	25 4	(E2)		0.00377	Mult.: $A_2=+0.8$ 3, $A_4=+0.6$ 3 (1989Lo08).
930.75	157.3 $\frac{1}{2}$ 1	8 $\frac{1}{2}$ 1				
	798.0 $\frac{1}{2}$ 1	100 $\frac{1}{2}$ 1	E2		0.00182	Mult.: based on measured anisotropy in $^{96}\text{Zr}(^{18}\text{O}, \text{p4n}\gamma)$ (1996Po07).
1090.7	675.5 5	100	E2		0.00276	E γ : from Coulomb excitation. Mult.: $A_2=+0.48$ 5, $A_4=-0.26$ 7 from Coulomb excitation (1989Lo08). B(E2)(W.u.)=68 11.
1099.11	402.05 ^a 9	31 11				
	787.6 ^a 3	100 63				
	966.29 4	18.1 9				
	1011.16 5	11.5 6				
1324.2	909 ^{§a} 1	8 [§] 4	[M1]		1.52×10^{-3}	B(M1)(W.u.)=0.006 4.
	1012.9 [§] 10	100 [§] 4	M1+E2	-0.09 [§] 3	1.19×10^{-3}	Mult., δ : $A_2=+0.20$ 5 $\gamma(\theta)$ in Coulomb excitation (1970Ro14) consistent with J to J transition.
	1324.2 [§] 10	16 [§] 4	[M1]		6.92×10^{-4}	B(M1)(W.u.)=0.0039 16.
1702.9	772.3 $\frac{1}{2}$ 3	100 $\frac{1}{2}$ 16	M1+E2	+1.0 $\frac{1}{2}$ +10-5	0.00208 8	Mult., δ : from anisotropy A=0.50 21 in $^{96}\text{Zr}(^{18}\text{O}, \text{p4n}\gamma)$.
	930.6 $\frac{1}{2}$ 8	24 $\frac{1}{2}$ 9	[E2]		1.26×10^{-3}	
1894.28	191.3 [#]					

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Ag})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult.@	$\delta\&$	α	Comments
1894.28	963.5 $\frac{1}{2}$ 1	100	E2		1.17×10^{-3}	Mult.: based on measured anisotropy in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$. B(E2)(W.u.)=39 4.
2206.46	1275.7 $\frac{1}{2}$ 2	100	E1(+M2)	+0.02 $\frac{1}{2}$ 8	3.73×10^{-4} 13	Mult., δ : from anisotropy A=-0.21 12 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2419.96	213.5 $\frac{1}{2}$ 1	100	M1+E2	-0.09 $\frac{1}{2}$ 8	0.0530 12	Mult., δ : from anisotropy A=-0.36 12 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2479.9	273.4 $\frac{1}{2}$ 3	100				
2567.39	673.4 $\frac{1}{2}$ 2	92 $\frac{1}{2}$ 23	M1+E2	+0.31 $\frac{1}{2}$ 20	0.00299	Mult., δ : from anisotropy A=0.20 19 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	864.9 $\frac{1}{2}$ 4	100 $\frac{1}{2}$ 31	E2		1.50×10^{-3}	Mult.: from measured anisotropy A=0.61 29 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$. B(E2)(W.u.)=50 20.
2568.4	88.5 $\frac{1}{2}$					
	148.4 $\frac{1}{2}$ 1	100	M1(+E2)	+0.05 $\frac{1}{2}$ 11	0.141 6	Mult., δ : from anisotropy A=-0.16 19 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2660.5	240.5 $\frac{1}{2}$ 2	100	M1(+E2)	-0.05 $\frac{1}{2}$ 9	0.0385 7	Mult., δ : from anisotropy A=-0.31 16 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2740.6	172.2 $\frac{1}{2}$ 1	100	M1(+E2)	+0.01 $\frac{1}{2}$ 8	0.0935 16	Mult., δ : from anisotropy A=-0.23 14 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2840.79	273.5 $\frac{1}{2}$ 1	43 $\frac{1}{2}$ 6	M1(+E2)	+0.03 $\frac{1}{2}$ 8	0.0276 5	Mult., δ : from anisotropy A=-0.18 13 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	946.4 $\frac{1}{2}$ 1	100 $\frac{1}{2}$ 3	E2		1.21×10^{-3}	Mult.: from measured anisotropy A=0.34 11 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$. B(E2)(W.u.)=20.4 23.
2940.2	279.7 $\frac{1}{2}$ 2	100	M1+E2	+0.13 $\frac{1}{2}$ 9	0.0262 6	Mult., δ : from anisotropy A=-0.02 15 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
2988.7	248.1 $\frac{1}{2}$ 1	100	M1(+E2)	+0.02 $\frac{1}{2}$ 8	0.0355 6	Mult., δ : from anisotropy A=-0.20 12 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
3090.19	249.4 $\frac{1}{2}$ 1	100	M1+E2	+0.05 $\frac{1}{2}$ 4	0.0350	Mult., δ : from anisotropy A=-0.16 7 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	522.7 $\#$					
3203.5	263.3 $\frac{1}{2}$ 2	100	M1+E2	-0.14 $\frac{1}{2}$ 9	0.0307 7	Mult., δ : from anisotropy A=-0.46 16 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
3276.39	186.2 $\frac{1}{2}$ 1	100	M1(+E2)	-0.05 $\frac{1}{2}$ 5	0.0760 13	Mult., δ : from anisotropy A=-0.31 10 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	435.6 $\#$					
3316.7	328.0 $\frac{1}{2}$ 1	100	M1+E2	+0.06 $\frac{1}{2}$ 4	0.01733	Mult., δ : from anisotropy A=-0.13 13 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
3575.19	298.8 $\frac{1}{2}$ 1	100	M1+E2	-0.07 $\frac{1}{2}$ 5	0.0220 4	Mult., δ : from anisotropy A=-0.35 9 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	485.0 $\#$					
3968.7	393.5 $\frac{1}{2}$ 1	100	M1+E2	+0.06 $\frac{1}{2}$ 4	0.01097	Mult., δ : from anisotropy A=-0.13 10 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	692.3 $\#$					
4375.8	407.1 $\frac{1}{2}$ 1	100	M1(+E2)	0.00 $\frac{1}{2}$ 6	0.01008	Mult., δ : from anisotropy A=-0.22 11 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	800.6 $\#$					
4886.4	510.6 $\frac{1}{2}$ 2	100	M1+E2	-0.14 $\frac{1}{2}$ 8	0.00580	Mult., δ : from anisotropy A=-0.46 15 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	917.7 $\#$					
5414.5	528.1 $\frac{1}{2}$ 3	100	M1+E2	+0.20 $\frac{1}{2}$ 14	0.00535	Mult., δ : from anisotropy A=0.10 19 in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$.
	1038.7 $\#$					
5998.3	583.8 $\S$					
	1111.9 $\S$					

 $\dagger$ From ^{109}Pd β^- decay, unless otherwise noted. $\frac{1}{2}$ From $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$. $\S$ From Coulomb excitation. $\#$ From $^{100}\text{Mo}(^{13}\text{C},\text{p3n}\gamma)$.@ From ce data and $\gamma\gamma(\theta)$ in ^{109}Pd β^- decay, anisotropy in $^{96}\text{Zr}(^{18}\text{O},\text{p4n}\gamma)$, and $\gamma(\theta)$ in Coulomb excitation, unless otherwise noted.& If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multiplicities.

a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

 $^{109}_{47}\text{Ag}_{62}$

¹⁰⁹Pd β⁻ Decay 2015Kr07

Parent ¹⁰⁹Pd: E=0.0; Jπ=5/2⁺; T_{1/2}=13.59 h 12; Q(g.s.)=1113.3 14; %β⁻ decay=100.
 2015Kr07: ¹⁰⁹Pd source was produced in neutron irradiations at the.
 Oregon State University TRIGA Reactor on a natural Pd target. γ rays were detected by Ge(Li) detectors. Measured E_γ, I_γ, T_{1/2}.
 1968Be22: ¹⁰⁹Pd source were prepared by irradiating samples of metallic enriched ¹⁰⁸Pd (85–95%). γ rays were detected by Ge(Li) detectors (FWHM=2.0 keV at E_γ=662) and NaI(Tl) detectors. Measured E_γ, I_γ, γγ-coin. Deduced levels, γ-ray branching ratios.
 1968Gr02: ¹⁰⁹Pd source were prepared by irradiating 4 mg samples of enriched metallic ¹⁰⁸Pd (94.2%) at the MIT reactor or at the Institute of Technology, Finland reactor. γ rays were detected by Ge(Li) detectors (FWHM=2.5 or 4 keV at E_γ=662) and a NaI(Tl) detector. Measured E_γ, I_γ, γγ-coin. Deduced levels, γ-ray branching ratios.
 1969Sc12: ¹⁰⁹Pd source were prepared by irradiating 4 mg samples of enriched metallic ¹⁰⁸Pd (94.2%) at the Ames Laboratory Research Reactor. γ rays were detected by Ge(Li) (FWHM=1.8 keV at E_γ=100 and 2.8 keV at E_γ=1000) and NaI(Tl) detectors. Measured E_γ, I_γ, γγ-coin. Deduced levels, γ-ray branching ratios.
 1970Ba37: ¹⁰⁹Pd source were prepared by irradiating samples of metallic enriched ¹⁰⁸Pd (94%). γ rays were detected by a 2.5 cm³ Ge(Li) detector (FWHM=2.0 keV at E_γ=661) and conversion electrons were detected by a high resolution iron-free double focusing beta-ray spectrometer. Measured E_γ, I_γ, E(ce), I(ce). Deduced levels, γ-ray transition multipolarities, γ-ray branching ratios, conversion coefficients.
 1975El10: ¹⁰⁹Pd source were prepared by irradiating 4 mg samples of natural metallic ¹⁰⁸Pd at the are reactor. γ rays were detected by Ge(Li) and NaI(Tl) detectors. Measured E_γ, I_γ, γγ-coin, γγ(θ). Deduced levels, Jπ, γ-ray branching ratios and mixing ratios.
 1978Pr08: ¹⁰⁹Pd source were prepared by irradiating samples of metallic enriched ¹⁰⁸Pd (95%) at the Rez inr reactor. γ rays were detected by Ge(Li) coaxial detectors (FWHM=2.5 keV at E_γ=1333 and 1.8 keV at E_γ=662). Measured E_γ, I_γ, γγ-coin. Deduced levels, γ-ray branching ratios.
 1982Aw03: ¹⁰⁹Pd source were prepared by irradiating samples of metallic enriched ¹⁰⁸Pd (94%) at the Inchass reactor. γ rays were detected by Ge(Li) detectors (FWHM=2.7 keV at E_γ=1332.6 and 0.56 keV at E_γ=122). Measured E_γ, I_γ. Deduced levels, γ-ray branching ratios.
 1988Br31: ¹⁰⁹Pd source were prepared by irradiating 225 mg samples of enriched ¹⁰⁸Pd (98.79%) in the Oregon State University triga reactor for a period of 2 hours. γ rays were detected by Ge detectors. Measured E_γ, I_γ, γγ(θ), ce. Deduced levels, Jπ, γ-ray multipolarities, branching ratios and mixing ratios.
 Other measurements: 1953Av25, 1953Nu04, 1954Mo38, 1957Ma16, 1957Wa05, 1959St28, 1962Br15, 1962Ec02, 1967DiZZ, 1967Na18, 1968BaZY, 1970Be79, 1973ChZN, 1973ChWJ, 1973BuZX, 1976GaZQ, 1977ChYJ, 1977Bo04, 1978Sh08, 1982Br19, 1983BaZT, 1983Ch42, 1985Ed01.

¹⁰⁹Ag Levels

E(level) [†]	Jπ [‡]	T _{1/2} [‡]	Comments
0.0	1/2 ⁻	stable	
88.0338 10	7/2 ⁺	39.79 s 21	μ=+4.400 6 (1985Ed01).
132.764 8	9/2 ⁺	2.60 ns 12	T _{1/2} : from delayed coincidence in 1972Ja01. Other: 1968BeZV.
311.381 6	3/2 ⁻	5.9 ps 7	
415.205 7	5/2 ⁻	33.4 ps 13	1973Co10 observed 327γ (5/2 ⁻ to 7/2 ⁺) and 282 (5/2 ⁻ to 9/2 ⁺) gammas through Coulomb excitation measurements. These gammas have branching ratios of 0.37% 9 and 0.05% 3, respectively. See ¹⁰⁹ Ag Coulomb excitation. The 327γ is also seen by 1983Ch42.
697.38? 14			
701.879 9	3/2 ⁻	0.27 ps 7	
706.972 10	(3/2 ⁻ , 5/2 ⁻)		
724.385 6	3/2 ⁺	3.2 ns 8	T _{1/2} : from delayed coincidence in 1982Br19.
735.322 7	5/2 ⁺		
811.74? 19			
862.638 9	5/2 ⁻	1.39 ps 21	
869.429 6	5/2 ⁺		
910.903 11	7/2 ⁺		
912.217 24	7/2 ⁻		
1099.11 4	(5/2 ⁻ , 7/2 ⁻)		

[†] From a least-squares fit to E_γ.

[‡] From Adopted Levels, unless otherwise stated.

^{109}Pd β^- Decay 2015Kr07 (continued) β^- radiations

$E\beta^-$	E(level)	$I\beta^{-\dagger\dagger}$	Log ft	Comments
(14.2 14)	1099.11	0.000062 5	6.41 14	
(202.4 14)	910.903	0.00132 4	8.609 17	
(243.9 14)	869.429	0.0202 6	7.683 16	
(250.7 14)	862.638	0.00189 6	8.750 17	
(301.6 15)	811.74?	0.000112 24	10.24 10	
(378.0 14)	735.322	0.0339 10	8.079 15	
(388.9 14)	724.385	0.0215 6	8.318 14	
(406.3 14)	706.972	0.00161 5	9.508 15	
(411.4 14)	701.879	0.00458 14	9.072 15	
(415.9 14)	697.38?	0.00005 3	11.0 3	
(698.1 14)	415.205	0.00650 23	9.710 17	
(801.9 14)	311.381	0.0208 7	9.421 16	
(1025.3 14)	88.0338	100 4	6.130 18	$E\beta^-$: 1028 keV 2 in 1962Br15. Other measurements: 1959St28, 1954Mo38.

$\dagger$ Deduced from $I(\gamma+\text{ce})$ intensity balances by assuming no β^- feeding g.s.

$\ddagger$ Absolute intensity per 100 decays.

 $\gamma(^{109}\text{Ag})$

$I\gamma$ normalization: from $\Sigma(I(\gamma+\text{ce}))$ to g.s.=100 by assuming no β^- feeding to g.s.

$E\gamma^\dagger$	E(level)	$I\gamma^{\ddagger\#}$	Mult. ‡	$\delta^{\ddagger\S}$	α	Comments
44.77 13	132.764	4.7 4	M1+E2	0.14 6	4.6 5	<p>$E\gamma$: weighted average of 44.7 2 (1968Be22), 44.8 6 (1968Gr02), 44.8 4 (1970Ba37), 44.0 5 (1975El10) and 44.98 21 (1982Aw03). Other: 45.8 2 (1978Sh08).</p> <p>$I\gamma$: weighted average of 5.5 17 (1968Gr02), 4.8 5 (1970Ba37) and 4.5 6 (1982Aw03). Other: 4.5 (1968Be22).</p> <p>δ: From 1984ShZL.</p> <p>Mult.: $\alpha(\text{K})_{\text{exp}}=3.6$ 5, $\alpha(\text{L})_{\text{exp}}=0.7$ 3 (1978Sh08).</p>
88.0336 10	88.0338	14100 300	E3		26.3	<p>$E\gamma$: From adopted gammas. Others in ^{109}Pd β^- decay: 88.022 10 (2015Kr07), 88.04 5 (1969Sc12), 88.04 10 (1982Aw03), 88.06 2 (1978Sh08), 88.1 2 (1968Be22), 88.2 5 (1968Gr02), 88.0 4 (1970Ba37), 88.1 5 (1975El10), and 88 1 (1978Pr08).</p> <p>$I\gamma$: Others: 1.37E4 16 (1968Gr02), 1.48E4 18 (1969Sc12), 1.17E4 12 (1970Ba37), 1.43E4 19 (1975El10), 1.46E4 13 (1978Pr08) and 1.20E4 8 (1982Aw03).</p> <p>Mult.: From adopted gammas. ce data in ^{109}Pd β^- decay: $\alpha(\text{K})_{\text{exp}}=10.6$ 5 (1970Ba37); $\alpha(\text{K})_{\text{exp}}=11.6$, K:L:M:N=(0.98 5):1:(0.20 1):(0.050 5), L1:L2:L3=(0.185 15):1:(1.163 27) (1978Sh08).</p> <p>Double K-shell vacancy per K-shell internal conversion: 13.0×10^{-5} 11 (1979Va04).</p>

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$^{109}\text{Pd} \beta^-$ Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	Mult. ‡	$\delta^{\S}$	α	Comments
103.827 23	415.205	2.57 12	M1+E2	-0.039 17	0.379	E γ : Others: 103.7 2 (1968Be22), 103.6 7 (1968Gr02), 103.9 4 (1969Sc12), 103.6 4 (1970Ba37), 103.5 5 (1975El10), 103.6 2 (1978Pr08) and 103.73 25 (1982Aw03). I γ : Others: 3.4 11 (1968Gr02), 3.8 12 (1969Sc12), 1.9 2 (1970Ba37), 2.7 6 (1975El10), 2.8 5 (1978Pr08) and 2.7 5 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.44$ 5 (1970Ba37). E γ : Weighted average of 114.2 3 (1975El10) and 114.30 25 (1982Aw03). Seen only in 1975El10 and 1982Aw03. I γ : from 1975El10. 2.8 6 from 1982Aw03.
114.26@ 19	811.74?	0.25 8				
134.107 18	869.429	5.92 12	M1+E2	0.44 +13-15	0.24 3	E γ : Others: 134.3 2 (1968Be22), 134.7 7 (1968Gr02), 134.2 2 (1969Sc12), 134.5 3 (1970Ba37), 134.4 2 (1975El10), 134.0 2 (1978Pr08) and 134.1 2 (1982Aw03). I γ : Others: 4.9 15 (1968Gr02), 5.4 18 (1969Sc12), 4.0 4 (1970Ba37), 4.7 7 (1975El10), 6.1 9 (1978Pr08) and 5.7 6 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.20$ 2 (1970Ba37). E γ : Others: 145.4 3 (1968Be22), 145.9 7 (1968Gr02), 145.1 2 (1969Sc12), 145.5 3 (1970Ba37), 145.4 2 (1975El10), 145.0 2 (1978Pr08) and 145.20 21 (1982Aw03). I γ : Others: 4.2 13 (1968Gr02), 4.6 14 (1969Sc12), 3.1 3 (1970Ba37), 3.5 5 (1975El10), 3.8 8 (1978Pr08) and 3.9 5 (1982Aw03). δ : 0.13 2 from $\gamma\gamma(\theta)$ in 1975El10. Mult.: $\alpha(\text{K})_{\text{exp}}=0.15$ 2 (1970Ba37).
145.039 14	869.429	3.83 7	M1+E2	0.13 2	0.1531 25	
162.37 4	869.429	0.41 4				
282.441@ 11	415.205	≤ 0.022	[M2]		0.1163	E γ : From level energy differences. I γ : From adopted gammas, relative to $I\gamma(415.222\gamma)$.
286.644 24	701.879	0.695 48	[M1]		0.0244	E γ : Others: 286.3 5 (1969Sc12), 286.0 5 (1975El10), 286.8 2 (1978Pr08) and 286.5 3 (1982Aw03). I γ : Others: 0.6 2 (1969Sc12), 0.8 1 (1975El10) and 0.5 1 (1978Pr08). 1.7 5 from 1982Aw03.
309.182 10	724.385	16.3 2	E1(+M2)	+0.03 6	0.0068 6	E γ : Others: 309.3 5 (1968Be22), 309.1 5 (1969Sc12), 309.1 7 (1970Ba37), 109.0 5 (1975El10), 309.3 4 (1978Pr08) and 309.30 15 (1982Aw03). I γ : Others: 19 8 (1969Sc12), 21.0 9 (1970Ba37), 16.4 16 (1975El10), 20 6 (1978Pr08) and 20 2 (1982Aw03). δ : $\gamma\gamma(\theta)$ in 1988Br31. Mult.: $\alpha(\text{K})_{\text{exp}}=0.006$ 1 (1970Ba37).

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^{109}Pd β^- Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	Mult. ‡	$\delta^{\ddagger\S}$	α	Comments
311.390 10	311.381	130 1	M1+E2	-0.192 7	0.0200	E γ : Others: 311.3 1 (1968Be22), 311.5 5 (1968Gr02), 311.4 1 (1969Sc12), 311.4 2 (1970Ba37), 311.0 2 (1975El10), 311.4 1 (1978Pr08) and 311.4 1 (1982Aw03). I γ : Others: 154 12 (1968Gr02), 91 8 (1970Ba37), 123 12 (1975El10), 124 6 (1978Pr08) and 121 9 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.019$ 2 (1970Ba37). δ : Other: 0.35 5 from $\gamma\gamma(\theta)$ in 1975El10.
327.171 [@] 7	415.205	0.18 4	[E1]		0.00582	E γ : From level energy differences. I γ : From adopted gammas, relative to $I\gamma(415.222\gamma)$.
390.515 18	701.879	3.51 14	M1+E2	+0.21 4	0.01126 17	E γ : Others: 390.5 3 (1968Be22), 390.9 8 (1968Gr02), 390.6 2 (1969Sc12), 390.7 5 (1970Ba37), 391.0 3 (1975El10), 390.6 2 (1978Pr08) and 390.4 2 (1982Aw03). I γ : Others: 3.9 8 (1968Gr02), 3.8 12 (1969Sc12), 3.2 3 (1970Ba37), 3.9 6 (1975El10), 3.6 3 (1978Pr08). 8.1 11 from 1982Aw03. δ : 0.19 6 from $\gamma\gamma(\theta)$ in 1977Bo04, +0.23 5 from $\gamma\gamma(\theta)$ in 1988Br31. Mult.: $\alpha(\text{K})_{\text{exp}}=0.095$ 2 (1970Ba37).
395.590 28	706.972	0.282 24				E γ : Others: 395.6 5 (1969Sc12), 395.6 3 (1975El10), 395.8 9 (1978Pr08) and 396.3 3 (1982Aw03). I γ : Others: 0.27 13 (1969Sc12), 0.7 3 (1975El10), 0.27 5 (1978Pr08) and 0.50 5 (1982Aw03).
402.05 [@] 9	1099.11	0.25 9				E γ : weighted average of 402.2 5 (1975El10) and 402.0 3 (1982Aw03). Seen only in 1975El10 and 1982Aw03. I γ : from 1975El10. 1.9 5 from 1982Aw03.
413.010 10	724.385	27.6 3	E1+M2	0.18 5	0.0042 6	E γ : Others: 413.0 1 (1968Be22), 413.5 10 (1968Gr02), 413.0 4 (1969Sc12), 413.2 2 (1970Ba37), 413.0 1 (1975El10), 413.0 1 (1978Pr08) and 413.05 10 (1982Aw03). I γ : Others: 40 12 (1968Gr02), 27 8 (1969Sc12), 23 2 (1970Ba37), 29 3 (1975El10), 29 2 (1978Pr08) and 24 3 (1982Aw03). δ : from $\gamma\gamma(\theta)$ in 1977Bo04. Mult.: $\alpha(\text{K})_{\text{exp}}=0.0030$ 3 (1970Ba37).
415.222 10	415.205	43.9 5	E2		0.01098	E γ : Others: 415.0 1 (1968Be22), 415.2 6 (1968Gr02), 415.2 3 (1969Sc12), 415.1 2 (1970Ba37), 415.2 1 (1975El10), 415.19 7 (1978Pr08) and 415.3 1 (1982Aw03). I γ : Others: 35 11 (1968Gr02), 43 12 (1969Sc12), 45 4 (1970Ba37), 43 4 (1975El10), 42 3 (1978Pr08) and 48 6 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.010$ 1 (1970Ba37).

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$^{109}\text{Pd} \beta^-$ Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	Mult. ‡	$\delta^{\S}$	α	Comments
423.942 12	735.322	3.83 6	E1(+M2)	+0.08 8	0.0032 6	E γ : Others: 423.9 3 (1968Be22), 424.7 8 (1968Gr02), 423.9 2 (1969Sc12), 424.0 4 (1970Ba37), 424.1 3 (1975El10), 424.0 2 (1978Pr08) and 424.0 2 (1982Aw03). I γ : Others: 2.8 7 (1968Gr02), 3.8 12 (1969Sc12), 3.9 3 (1970Ba37), 3.8 5 (1975El10), 3.5 3 (1978Pr08) and 3.4 5 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0030$ 5 (1970Ba37). δ : from $\gamma\gamma(\theta)$ in 1988Br31; Other: -0.27 3 from $\gamma\gamma(\theta)$ in 1977Bo04.
447.426 14	862.638	3.74 6	M1+E2	-0.16 4	0.00801	E γ : Others: 447.5 2 (1968Be22), 448.2 8 (1968Gr02), 447.6 2 (1969Sc12), 447.4 3 (1970Ba37), 447.8 3 (1975El10), 447.5 2 (1978Pr08) and 447.02 20 (1982Aw03). I γ : Others: 4 1 (1968Gr02), 3.3 12 (1969Sc12), 3.3 3 (1970Ba37), 3.0 5 (1975El10), 3.5 3 (1978Pr08) and 3.0 5 (1982Aw03). δ : -0.12 14 from $\gamma\gamma(\theta)$ in 1988Br31. Mult.: $\alpha(\text{K})_{\text{exp}}=0.0070$ 8 (1970Ba37).
454.269 14	869.429	1.71 6	E1(+M2)	-0.14 +36-17	0.0030 17	E γ : Others: 454.3 2 (1968Be22), 454.3 3 (1969Sc12), 454.1 3 (1970Ba37), 454.0 3 (1975El10), 454.2 2 (1978Pr08) and 454.40 25 (1982Aw03). I γ : Others: 2.2 11 (1969Sc12), 2.3 2 (1970Ba37), 2.2 4 (1975El10), 1.7 2 (1978Pr08) and 2.2 5 (1982Aw03). δ : -0.14 +36-17 from $\gamma\gamma(\theta)$ in 1988Br31.
497.010 23	912.217	0.319 23	(M1+E2)		0.00619	E γ : Others: 496.9 5 (1968Be22), 496.7 7 (1970Ba37), and 496.9 6 (1978Pr08). I γ : Others: 0.15 3 (1970Ba37) and 0.31 6 (1978Pr08).
500.6@ 3	811.74?	0.18 4				E γ : Weighted average of 500.6 5 (1975El10) and 500.6 3 (1982Aw03). Seen only in 1975El10 and 1982Aw03. I γ : from 1975El10. 1.2 3 from 1982Aw03.
551.258 14	862.638	2.82 4	M1+E2	-0.28 3	0.00482	E γ : Others: 551.3 2 (1968Be22), 551.3 8 (1968Gr02), 551.4 4 (1969Sc12), 551.2 3 (1970Ba37), 551.2 5 (1975El10), 551.2 1 (1978Pr08) and 551.2 2 (1982Aw03). I γ : Others: 2.3 8 (1968Gr02), 2.5 9 (1969Sc12), 2.5 3 (1970Ba37), 2.6 5 (1975El10), 2.7 2 (1978Pr08) and 3.1 3 (1982Aw03). δ : -0.28 4 from $\gamma\gamma(\theta)$ in 1977Bo04, -0.26 7 from $\gamma\gamma(\theta)$ in 1988Br31.

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$^{109}\text{Pd} \beta^-$ Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	Mult. ‡	$\delta^{\S}$	α	Comments
558.040 10	869.429	10.4 1	E1+M2	-0.20 4	0.00205 21	<p>Eγ: Others: 558.1 1 (1968Be22), 557.8 5 (1968Gr02), 558.1 2 (1969Sc12), 558.5 2 (1970Ba37), 558.0 3 (1975El10), 558.05 7 (1978Pr08) and 558.10 15 (1982Aw03).</p> <p>Iγ: Others: 9.5 14 (1968Gr02), 10 3 (1969Sc12), 9.6 9 (1970Ba37), 10.7 16 (1975El10), 9.9 7 (1978Pr08) and 11.0 7 (1982Aw03).</p> <p>δ: -0.26 5 from $\gamma\gamma(\theta)$ in 1977Bo04, -0.026 23 from $\gamma\gamma(\theta)$ in 1988Br31.</p> <p>Mult.: $\alpha(\text{K})_{\text{exp}}=0.0012$ 3 (1970Ba37).</p> <p>Eγ: Weighted average of 564.4 5 (1975El10) and 564.2 3 (1982Aw03). Seen only in 1975El10 and 1982Aw03.</p> <p>Iγ: weighted average of 0.43 7 (1975El10) and 0.8 5 (1982Aw03).</p>
564.3@ 3	697.38?	0.44 7				
601.1 7	912.217	0.06 2	(E2)		0.00377	<p>Eγ, Iγ: From adopted gammas. Iγ relative to Iγ(496γ).</p>
602.568 10	735.322	33.6 3	E2		0.00374	<p>Eγ: Others: 602.5 1 (1968Be22), 602.4 5 (1968Gr02), 602.5 1 (1969Sc12), 602.4 2 (1970Ba37), 602.3 5 (1975El10), 602.49 9 (1978Pr08) and 602.6 1 (1982Aw03).</p> <p>Iγ: Others: 33 4 (1968Gr02), 33 8 (1969Sc12), 34 3 (1970Ba37), 35 4 (1975El10), 35 2 (1978Pr08) and 31 3 (1982Aw03).</p> <p>Mult.: $\alpha(\text{K})_{\text{exp}}=0.0030$ 5 (1970Ba37).</p> <p>Eγ: Weighted average of 609.2 4 (1975El10), 609.40 21 (1982Aw03) and 609.5 5 (1969Sc12). It is not placed in 1969Sc12 and evaluators have assigned it to this level.</p> <p>Iγ: Others: 0.7 5 (1975El10) and 0.6 3 (1969Sc12).</p>
609.37@ 17	697.38?	0.015 15				
636.342 10	724.385	42.5 4	E2		0.00323	<p>Eγ: Others: 636.4 2 (1968Be22), 636.1 5 (1968Gr02), 636.3 1 (1969Sc12), 636.3 3 (1970Ba37), 636.5 4 (1975El10), 636.25 9 (1978Pr08) and 636.3 1 (1982Aw03).</p> <p>Iγ: Others: 42 6 (1968Gr02), 41 10 (1969Sc12), 41 4 (1970Ba37), 40 4 (1975El10), 42 3 (1978Pr08) and 42.6 21 (1982Aw03).</p> <p>Mult.: $\alpha(\text{K})_{\text{exp}}=0.0026$ 5 (1970Ba37).</p> <p>Eγ: Others: 647.3 1 (1968Be22), 647.3 6 (1968Gr02), 647.3 1 (1969Sc12), 647.3 2 (1970Ba37), 647.21 7 (1978Pr08) and 647.3 1 (1982Aw03). 646.4 1 from 1975El10.</p> <p>Mult.: $\alpha(\text{K})_{\text{exp}}=0.0027$ 4 (1970Ba37).</p>
647.272 10	735.322	100	M1		0.00330	

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^{109}Pd β^- Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	Mult. ‡	$\delta^{\S}$	α	Comments
701.876 10	701.879	13.3 1	M1+E2	0.029 7	0.00273	E γ : Others: 702.0 2 (1968Be22), 701.8 8 (1968Gr02), 701.9 2 (1969Sc12), 702.0 3 (1970Ba37), 701.9 3 (1975El10), 701.8 1 (1978Pr08) and 701.80 15 (1982Aw03). I γ : Others: 14.2 19 (1968Gr02), 13 3 (1969Sc12), 14.7 12 (1970Ba37), 13.8 14 (1975El10), 13.5 18 (1978Pr08) and 14.2 12 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0023$ 5 (1970Ba37). E γ : Others: 706.9 3 (1968Be22), 707.0 2 (1969Sc12), 707.1 4 (1970Ba37), 707.1 2 (1975El10), 706.9 1 (1978Pr08) and 707.7 2 (1982Aw03). I γ : Others: 6.5 18 (1969Sc12), 7.1 7 (1970Ba37), 7.1 10 (1975El10), 6.3 9 (1978Pr08) and 5.3 6 (1982Aw03). $\alpha(\text{K})_{\text{exp}}=0.0020$ 6 (1970Ba37). E γ : Others: 724.6 3 (1968Be22), 724.4 3 (1969Sc12), 724.4 5 (1970Ba37), 724.6 2 (1975El10), 724.1 3 (1978Pr08) and 724.4 3 (1982Aw03). I γ : Others: 0.8 3 (1969Sc12), 1.1 1 (1970Ba37), 1.0 3 (1975El10), 0.4 4 (1978Pr08) and 1.1 3 (1982Aw03). E γ : Others: 736.7 2 (1968Be22), 736.7 7 (1968Gr02), 736.7 2 (1969Sc12), 736.8 4 (1970Ba37), 736.7 2 (1975El10), 736.6 1 (1978Pr08) and 736.50 25 (1982Aw03). I γ : Others: 7.7 11 (1968Gr02), 6.9 19 (1969Sc12), 7.7 7 (1970Ba37), 7.5 12 (1975El10), 6.8 9 (1978Pr08) and 7.5 6 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0018$ 5 (1970Ba37). E γ : Others: 778.3 5 (1968Be22), 778.3 5 (1969Sc12), 778.4 7 (1970Ba37), 778.2 2 (1975El10), 778.2 3 (1978Pr08), 778.3 5 (1982Aw03) and 778.3 5 (1988Br31). I γ : Others: 6.2 25 (1969Sc12), 4.0 4 (1970Ba37), 5.8 9 (1975El10), 7.3 25 (1978Pr08) and 4.0 5 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0018$ 5 (1970Ba37). E γ : Others: 781.4 2 (1968Be22), 781.8 7 (1968Gr02), 781.4 2 (1969Sc12), 781.5 3 (1970Ba37), 782.1 4 (1975El10), 781.3 1 (1978Pr08) and 781.4 1 (1982Aw03). I γ : Others: 51 6 (1968Gr02), 45 12 (1969Sc12), 50 4 (1970Ba37), 49 7 (1975El10), 48 3 (1978Pr08) and 43 3 (1982Aw03). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0017$ 5 (1970Ba37). E γ , I γ : from 1982Aw03. 1975El10 give E γ =790.2 5 with I γ =0.09 1.
706.964 10	706.972	6.33 6				
724.372 14	724.385	0.24 3				
736.652 10	869.429	6.77 7	E2		0.00222	
778.140 14	910.903	4.29 5	M1		0.00215	
781.394 10	869.429	46.6 5	M1+E2		0.00213	
787.6@ 3	1099.11	0.8 5				

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^{109}Pd β^- Decay 2015Kr07 (continued) $\gamma(^{109}\text{Ag})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\ddagger$	Mult. §	α	Comments
822.862 14	910.903	0.759 8	[M1]	0.00190	E γ : Others: 822.9 3 (1968Be22), 822.9 4 (1969Sc12), 822.7 5 (1970Ba37), 823.1 2 (1975El10), 822.8 2 (1978Pr08) and 822.9 3 (1982Aw03). I γ : Others: 0.77 22 (1969Sc12), 0.5 1 (1970Ba37), 0.77 11 (1978Pr08) and 0.8 5 (1982Aw03). 1.5 4 from 1975El10.
862.637 14	862.638	0.682 8	E2	1.51×10^{-3}	E γ : Others: 862.8 5 (1968Be22), 862.5 4 (1969Sc12), 863.0 7 (1970Ba37), 862.9 1 (1975El10), 862.5 3 (1978Pr08) and 862.6 3 (1982Aw03). I γ : Others: 0.54 18 (1969Sc12), 0.3 1 (1970Ba37), 0.5 2 (1975El10), 0.66 11 (1978Pr08) and 0.44 5 (1982Aw03).
869.415 25	869.429	0.06 3	[M2]	0.00427	E γ : Other: 868.8 10 (1969Sc12). I γ : Other: 0.15 8 (1969Sc12).
966.29 4	1099.11	0.145 7			E γ : Others: 966.3 5 (1968Be22), 966.4 7 (1970Ba37), 966.2 3 (1975El10), 966.2 5 (1978Pr08) and 966.1 3 (1982Aw03). I γ : Others: 0.37 13 (1975El10), 0.25 4 (1978Pr08) and 0.43 5 (1982Aw03).
1011.16 5	1099.11	0.092 5			E γ : Others: 1010.5 5 (1968Be22), 1010.6 9 (1970Ba37), 1010.0 3 (1975El10), 1010.8 6 (1978Pr08) and 1010.5 3 (1982Aw03). I γ : Others: 0.25 8 (1975El10), 0.11 4 (1978Pr08) and 0.38 4 (1982Aw03).

 † From 2015Kr07, unless otherwise stated $I\gamma$ values are normalized to $I\gamma(647.27)=100$. ‡ From Adopted Gammas, unless otherwise stated. § If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities. $^\#$ For absolute intensity per 100 decays, multiply by 0.000260 7. $^\circ$ Placement of transition in the level scheme is uncertain.

^{109}Pd β^- Decay 2015Kr07 (continued)

Decay Scheme

¹⁰⁹Cd ε Decay

Parent ¹⁰⁹Cd: E=0.0; Jπ=5/2+; T_{1/2}=461.9 d 4; Q(g.s.)=215.5 18; %ε decay=100.

¹⁰⁹Ag Levels

E(level)	Jπ	T _{1/2}	Comments
0.0	1/2-	stable	
88.0341 11	7/2+	39.79 s 21	T _{1/2} : from Adopted Levels of ¹⁰⁹ Ag.

β⁺,ε Data

Eε	E(level)	Iε [†]	Log ft
(127.5 18)	88.0341	100	5.987 15

[†] Absolute intensity per 100 decays.

γ(¹⁰⁹Ag)

There have been many precise measurements of the decay of ¹⁰⁹Cd to the 88.032 level of ¹⁰⁹Ag. Tabulated below are the measured values for Eγ, Iγ(88γ), α_T, K x ray/γ(88), εL/εK, εL+/εK and εM+/εL.

Eγ	Reference
88.008 42	1966Fr12
88.035 6	1967DiZZ
88.05 5	1967Li10
88.033 42	1967Pi05
88.041 87	1967Sc22
88.09 3	1968Fo03
88.21 3	1968Fu05
88.036 8	1969HeZY
88.036 8	1970Gr13
88.035 6	1970Ra37
88.023 8	1976Dr07
88.0341 11	1978He21
88.035 4	1978Mo22
88.0336 10	2000He14

Other Eγ measurements: 1947Br05, 1950Co60, 1954Mo38, 1954Wa15, 1966En05, and 1968Ea01.

Iγ(88γ)	α _T	Reference
3.57 31	27.0 24	1953Br73
3.89 7	24.7 5	1965Le03
3.97 22	24.2 14	1965Se08
3.29 23	29.4 21 a	1968Fo03
3.65 5	26.4 4	1973Le29
3.79 7	25.4 5	1976Dr07
3.65 4	26.4 3	1979Pl04
3.62 2	26.82 14	UVVVR &
3.65 3	26.40 23	IER &
3.59 11	26.9 9	IMM &
3.70 6	26.0 5	KSRI &
3.60 2	26.78 8	LMRI &
3.57 10	27.0 8	NPL &
3.65 8	26.4 6	OMH &
3.675 18	26.21 15	1988Ba60 &
3.66 5	26.3 4	1989Hi01 &
3.68 4	26.2 5	1992ScZZ &
3.663 33	26.30 25	2006Ko27

& from intra-lab comparisons in 1994Ra37
a from α_K=12.7 9 and K/(L+M+N)=0.76 2

Other ce measurement: 1947Br05.

Continued on next page (footnotes at end of table)

¹⁰⁹Cd ε Decay (continued)

 $\gamma(^{109}\text{Ag})$ (continued)

K x ray / $\gamma(88)$

23.8 7	1957Wa05
26.2 6	1965Le06
29.0 10	1966En05
22.2 6	1966Ja01
29.1 10	1966Fr12
30 4	1968Fo03
25.6 9	1972Ca16
27.0 3	1976Dr07
27.3 6	1979Pl04
27.3 3	1982HoZF

$\epsilon\text{L} / \epsilon\text{K}$	$\epsilon\text{L}+ / \epsilon\text{K}$	$\epsilon\text{M}+ / \epsilon\text{L}$	Reference
0.28 3			1953De26
0.32 4			1954Be41
	0.24 4		1957Wa05
0.195 5	0.228 3	0.17 5	1965Le06
0.232 15		0.205 20	1965Mo06
	0.26 4		1966Du01
0.193 3	0.226 3	0.17 4	1970Go39

$E\gamma$	E(level)	$I\gamma^\dagger$	Mult.	α	$I(\gamma+\text{ce})^\dagger$	Comments
88.0336 10	88.0341	3.644 16	E3	26.3 4	100	<p>$E\gamma$: from relative wavelength measurement in 2000He14. Other values are given in the table above.</p> <p>$I\gamma$: From $I(\gamma+\text{ce})=100$ and $\alpha=26.3$ 4. Other values are given in the table above.</p> <p>Mult.: from ce data listed in the table above. Others: L1:L2:L3=0.148 7:0.86 2:1 (1980Da23); $\alpha(\text{K})\text{exp}=11.4$ 3 (1979Pl04); L1:L2:L3=0.159 13:0.860 20:1 and K/L/M/N=0.98 5:1:0.20 1:0.050 5 (1978Sh08); $\alpha(\text{K})\text{exp}=11.4$ 3, $\alpha(\text{L1})\text{exp}=0.63$ 13, $\alpha(\text{L2})\text{exp}=5.48$ 18, $\alpha(\text{L3})\text{exp}=6.11$ 20, $\alpha(\text{M})\text{exp}=2.40$ 8 (1976Dr07); L1:L2=0.994 12, L1:L3=1.020 14 and L2:L3=0.99 2 (1975Ma32); L1:L2:L3=0.132 8:0.830 20:1 (1972Br02); $\alpha(\text{K})\text{exp}=10.6$ 5 (1970Ba37); K/(L+M+N)=0.76 2 (1969Pl08); $\alpha(\text{K})\text{exp}=12.7$ 9, and K/(L+M)=0.76 2 (1968Fo03); $\alpha(\text{K})\text{exp}=11.3$ 4 K/(L+M)=0.866 27 (1965Se08); $\alpha(\text{K})\text{exp}=11.0$ 3, $\alpha(\text{L})\text{exp}=11.7$ 8 and $\alpha(\text{M})\text{exp} + \alpha(\text{N})\text{exp}=2.0$ 11 (1965Le06); K/L=0.95 3 (1964Bo12); $\alpha(\text{K})\text{exp}=10.3$ 5 (1957Wa05); $\alpha(\text{K})\text{exp}=9.5$ 1 and K/(L+M+N)=0.80 4 (1954Wa15); $\alpha(\text{K})\text{exp}=8.6$ 1 (1953Av25); $\alpha(\text{K})\text{exp}=12.4$ 10 and K/(L+M+N)=0.85 2 (1953Br73).</p> <p>Double K-shell vacancy per K-shell internal conversion: 2.8×10^{-5} 7 (1977Va05), 1.02×10^{-5} 36 (1977Va05) and 1.53×10^{-4} 24 (1975Na01).</p> <p>Double photon decay: $I(\gamma\gamma)/I(\gamma) < 6 \times 10^{-7}$ (1988Il01).</p>

[†] Absolute intensity per 100 decays.

¹⁰⁹Cd ε Decay (continued)

⁹⁶Zr(¹⁸O,p4nγ) 1996Po07,2007TiZZ

1996Po07: Experiments were carried out at both the University of Pennsylvania Tandem Van de Graaff Accelerator and the Tandem Accelerator Superconducting Cyclotron "TASCC" Facility at Chalk River. At both facilities, the nuclides of interest were populated via fusion-evaporation reactions with 56–80 MeV ¹⁸O beams incident on thin ⁹⁶Zr targets (1 mg/cm² at Penn, 600 mg/cm² at Chalk River), enriched to 85% ⁹⁶Zr, with ⁹⁰Zr comprising the bulk of the remainder. At Penn, γ rays were detected by two Compton compressed 25% efficient Ge detectors at 45° and 90° and charged particles were detected and identified by the Penn 4π array; at Chalk River, γ rays were detected by the 8π spectrometer and charged particles by an array of 24 CsI(Tl) detectors. Measured E_γ, I_γ, γγ-coin, charged particles-γγ coin, γγ(θ), substate alignment. Deduced levels, J^π, band structures, γ-ray branching ratios, multipolarities, mixing ratios. Comparisons with cranked shell model and total Routhian surface calculations.

2007TiZZ: ¹⁸O beam was produced at iThemba LABS and incident on ⁹⁶Zr target. γ rays were detected by the AFRODITE array of 8 clover detectors and identified by detecting charged particles with the DIAMANT charged-particle detector array. Measured E_γ, I_γ, particle-γγ-coin. Deduced level scheme.

¹⁰⁹Ag Levels

E(level) [†]	J ^π [§]	E(level) [†]	J ^π [§]	E(level) [†]	J ^π [§]
0.0	1/2- [#]	2660.6 ^{& 11}	19/2-	3968.8 ^{@ 11}	29/2+
88.0 ¹⁰	7/2+ [#]	2740.7 ^{a 11}	21/2-	4015.7 ^{?& 14}	(27/2-) [‡]
132.8 ^{@ 10}	9/2+	2840.8 ^{@ 11}	21/2+	4283.8 ^{?& 14}	(29/2-) [‡]
773.5 ^{@ 11}	11/2+	2940.3 ^{& 11}	(21/2-)	4375.9 ^{@ 11}	31/2+
930.8 ^{@ 10}	13/2+	2988.8 ^{a 11}	23/2-	4475.7 ^{?& 17}	(29/2-) [‡]
1703.0 ^{@ 11}	15/2+	3090.2 ^{@ 11}	23/2+	4880.8 ^{?& 16}	(31/2-) [‡]
1894.3 ^{@ 11}	17/2+	3203.6 ^{& 11}	(23/2-)	4886.5 ^{@ 11}	33/2+
2206.5 ^{& 11}	15/2-	3276.4 ^{@ 11}	25/2+	5414.7 ^{@ 11}	(35/2+)
2420.0 ^{& 11}	17/2-	3316.8 ^{a 11}	25/2-	5485.8 ^{?& 16}	(33/2-) [‡]
2479.9 ^{a 11}	17/2-	3558.6 ^{?& 14}	(25/2-) [‡]	5999.6 ^{?& 13}	(37/2+) [‡]
2567.4 ^{@ 11}	19/2+	3575.3 ^{@ 11}	27/2+	6091.8 ^{?& 19}	(35/2-) [‡]
2568.5 ^{a 11}	19/2-	3757.8 ^{?& 14}	27/2- [‡]	6640.6 ^{?& 17}	(39/2+) [‡]

[†] From a least-squares fit to E_γ. For E_γ without uncertainties, ΔE_γ=1 keV was assumed in the fit.

[‡] From 2007TiZZ.

[§] From 1996Po07 based on γ-ray transition multipolarities, band structure and systematics, unless otherwise noted.

[#] From Adopted Levels.

[@] (A): Band 1, πg_{9/2} band. Above J^π=21/2+, it changes to πg_{9/2}⊗v(h_{11/2})².

[&] (B): Band 2.

^a (C): Band 3.

⁹⁶Zr(¹⁸O,p4n γ) 1996Po07,2007TiZZ (continued)

 $\gamma(^{109}\text{Ag})$

E $\gamma^\dagger$	E(level)	I $\gamma^\dagger$ #	Mult.&	$\delta\&$	Comments
44.8 1	132.8		M1+E2	0.35 15	
88.0	88.0				
88.5	2568.5				
148.4 1	2568.5	9@ 1	M1 (+E2)	+0.05 11	anisotropy A=-0.16 19.
157.3 1	930.8	8@ 1			
172.2 1	2740.7	18 3	M1 (+E2)	+0.01 8	anisotropy A=-0.23 14.
186.2 1	3276.4	34@ 1	M1 (+E2)	-0.05 5	anisotropy A=-0.31 10.
192.0 $\frac{1}{2}$ a	1894.3				
213.5 1	2420.0	17 2	M1+E2	-0.09 8	anisotropy A=-0.36 12.
240.5 2	2660.6	8 2	M1 (+E2)	-0.05 9	anisotropy A=-0.31 16.
248.1 1	2988.8	18 4	M1 (+E2)	+0.02 8	anisotropy A=-0.20 12.
249.4 1	3090.2	49 5	M1+E2	+0.05 4	anisotropy A=-0.16 7.
263.3 $\frac{1}{2}$ § 2	3203.6	8 3	M1+E2	-0.14 9	anisotropy A=-0.46 16.
273.4 3	2479.9	9 3			
273.5 1	2840.8	15 2	M1 (+E2)	+0.03 8	anisotropy A=-0.18 13.
279.7 $\frac{1}{2}$ § 2	2940.3	9 2	M1+E2	+0.13 9	anisotropy A=-0.02 15.
298.8 1	3575.3	33@ 1	M1+E2	-0.07 5	anisotropy A=-0.35 9.
328.0 1	3316.8	11 3	M1+E2	+0.06 4	anisotropy A=-0.13 13.
355.0 $\frac{1}{2}$ a	3558.6?				
393.5 1	3968.8	29@ 1	M1+E2	+0.06 4	anisotropy A=-0.13 10.
407.1 1	4375.9	21 2	M1 (+E2)	0.00 6	anisotropy A=-0.22 11.
441.0 $\frac{1}{2}$ a	3757.8?				
455.0 $\frac{1}{2}$ a	2660.6				
457.0 $\frac{1}{2}$ a	4015.7?				
460.0 $\frac{1}{2}$ a	4475.7?				
486.0 $\frac{1}{2}$ a	3575.3				
510.6 2	4886.5	15 2	M1+E2	-0.14 8	anisotropy A=-0.46 15.
526.0 $\frac{1}{2}$ a	4283.8?				
528.1 3	5414.7	11 2	M1+E2	+0.20 14	anisotropy A=0.10 19.
585.0 $\frac{1}{2}$ a	5999.6?				
597.0 $\frac{1}{2}$ a	4880.8?				
605.0 $\frac{1}{2}$ a	5485.8?				
606.0 $\frac{1}{2}$ a	6091.8?				
640.6 2	773.5	24@ 1	M1+E2	>+0.3	anisotropy A=0.30 9.
641.0 $\frac{1}{2}$ a	6640.6?				
673.4 2	2567.4	12 3	M1+E2	+0.31 20	anisotropy A=0.20 19.
675.0 $\frac{1}{2}$ a	2568.5				
693.0 $\frac{1}{2}$ a	3968.8				
699.0 $\frac{1}{2}$ a	4015.7?				
772.3 3	1703.0	32 5	M1+E2	+1.0 +10-5	anisotropy A=0.50 21.
798.0 1	930.8	100@ 1	E2		anisotropy A=0.22 6.
801.0 $\frac{1}{2}$ a	4375.9				
864.9 4	2567.4	13 4	E2		anisotropy A=0.61 29.
919.0 $\frac{1}{2}$ a	4886.5				
930.6 8	1703.0	8 3			
946.4 1	2840.8	35@ 1	E2		anisotropy A=0.34 11.
963.5 1	1894.3	60@ 1	E2		anisotropy A=0.43 9.
967.0 $\frac{1}{2}$ a	4283.8?				
1039.0 $\frac{1}{2}$ a	5414.7				
1113.0 $\frac{1}{2}$ a	5999.6?				
1202.0 $\frac{1}{2}$ a	5485.8?				
1275.7 2	2206.5	29@ 1	E1 (+M2)	+0.02 8	anisotropy A=-0.21 12. Mult.: assigned as E1 by 1996Po07.

 $\dagger$ From 1996Po07, unless otherwise noted.

 $\ddagger$ From 2007TiZZ.

 $\S$ 2007TiZZ placed these two transitions as 280-264 cascade from E=3204 level, making a level at E=2925.

 $\#$ From coincidence data in 1996Po07, unless otherwise noted.

 $@$ From singles data in 1996Po07.

 $\&$ From measured anisotropies in 1996Po07, which is defined as $A=2[(I_{\gamma_{37^\circ}}-I_{\gamma_{79^\circ}})/(I_{\gamma_{37^\circ}}+I_{\gamma_{79^\circ}})]$. Typical anisotropies in this measurement were $A=0.3$ for $\Delta I=-2$ quadrupoles, $A=-0.3$ for $\Delta I=-1$ dipoles, $-1 < A < 1$ for mixed $\Delta I=-1$ transitions. Values of anisotropies are given in comments.

 a Placement of transition in the level scheme is uncertain.

¹⁰⁰Mo(¹³C,p3nγ) 2008Da12

2008Da12: E=65 MeV beam was provided by 15-UD Pelletron accelerator at Inter-University Accelerator Centre. Target is 1 mg/cm² enriched ¹⁰⁰Mo on a 9 mg/cm² natural Pb backing. γ rays were detected by the Indian National Gamma Array (INGA) of 8 Compton suppressed clover detectors in two rings at 79° and 130° and were identified by proton-γ-coincidence method with a 4π charge particle detector array (CPDA) of 10 phoswich plastic scintillators. Measured Eγ, Iγ, proton-γγ-coin, Doppler shift. Deduced levels, Jπ, T_{1/2}, band structures. Comparisons with projected shell-model calculations.

Other: 1996Po07.

¹⁰⁹Ag Levels

E(level) [†]	Jπ [‡]	T _{1/2} [#]	E(level) [†]	Jπ [‡]	T _{1/2} [#]	E(level) [†]	Jπ [‡]	T _{1/2} [#]
0.0	1/2-§		1894.7@ 9	17/2+	0.57 ps 5	3969.3@ 11	29/2+	0.37 ps 4
88.0 5	7/2+§		2568.1& 9	19/2+	0.39 ps 4	4376.4& 11	31/2+	0.291 ps 35
132.8@ 7	9/2+		2841.4@ 10	21/2+	0.82 ps 8	4887.0@ 11	33/2+	0.180 ps 21
773.3& 8	11/2+		3090.8& 10	23/2+	1.53 ps 16	5415.1& 12	35/2+	0.222 ps 28
930.9@ 8	13/2+		3277.0@ 10	25/2+	1.87 ps 21	5998.9@ 13	37/2+	
1703.4& 9	15/2+		3575.8& 10	27/2+	0.71 ps 8			

[†] From a least-squares fit to Eγ by assuming an uncertainty of 0.5 keV.

[‡] From 2008Da12 based on band structure, unless otherwise noted.

§ From Adopted Levels.

From DSAM in 2008Da12.

@ (A): πg_{9/2}, α=+1/2. above 21/2+, this band changes to πg_{9/2}⊗v(h_{11/2})².

& (B): πg_{9/2}, α=-1/2. above 21/2+, this band changes to πg_{9/2}⊗v(h_{11/2})².

γ(¹⁰⁹Ag)

Eγ	E(level)	Eγ	E(level)	Eγ	E(level)
44.8	132.8	435.6	3277.0	798.0	930.9
88.0	88.0	485.0	3575.8	800.6	4376.4
157.3	930.9	510.6	4887.0	864.9	2568.1
186.2	3277.0	522.7	3090.8	917.7	4887.0
191.3	1894.7	528.1	5415.1	930.6	1703.4
249.4	3090.8	583.8	5998.9	946.5	2841.4
273.5	2841.4	640.6	773.3	963.5	1894.7
298.8	3575.8	673.4	2568.1	1038.7	5415.1
393.5	3969.3	692.3	3969.3	1111.9 [†]	5998.9
407.1	4376.4	772.3	1703.4		

[†] Placement of transition in the level scheme is uncertain.

¹⁰⁷Ag(t,p) 1977An01

Target ¹⁰⁷Ag Jπ(g.s.)=1/2-.

1977An01: E=17 MeV triton beam was produced from the Los Alamos Scientific Laboratory FN tandem Van de Graaff accelerator. Targets was metallic Ag samples (>98% enriched, 129 μg/cm²) evaporated onto 20 μg/cm² carbon backings. Reaction products were momentum analyzed with a Q3D magnetic spectrometer (FWHM=10-15 keV) and detected by a plastic scintillator. Measured σ(θ). Deduced levels, Jπ, L from DWBA analysis. Comparisons with coupling model.

¹⁰⁹Ag Levels

E(level) [‡]	L [§]	E(level) [‡]	L [§]	E(level) [‡]	L [§]
0.0	0	1613 5	0	2199 10	(4)
311 [†]	2	1736 5	2	2222 10	(4)
415 [†]	2	1792 5	4	2256 10	5
702 [†]	2	1815 5	2	2267 10	3
863 [†]	2	1839 5	2	2314 10	(2)
912 [†]	4	1891 5	4	2364 10	5
1091 [†]	5, 4	1950 5	4	2434 10	4
1260 2	0	1993 5	2	2466 10	4
1324 [†]	2	2062 10	4	2537 10	5
1500 5	2	2093 10	2	2569 10	(5)
1524 5	2	2124 10	3	2614 10	(4)
1599 5	(3, 4)	2185 10	(4)	2659 10	

[†] Assumed energy for calibration in 1977An01.

[‡] Authors of 1977An01 quote uncertainties between 2 keV for the low-lying states to 10 keV at the upper end of the proton spectrum, but do not assign an uncertainty to each level. Uncertainties shown on level energies are assigned by evaluators.

[§] From DWBA analysis in 1977An01.

¹⁰⁸Pd(³He,d) 1973Au07

Target ¹⁰⁸Pd Jπ(g.s.)=0+.

1973Au07: E=27 MeV ³He beam was produced from the Oak Ridge isochronous cyclotron. Target is 170 μg/cm² 98% enriched ¹⁰⁸Pd evaporated onto 20 μg/cm² carbon foil. Reaction products were momentum analyzed by a broad-range magnetic spectrograph (FWHM=25 keV) and detected by nuclear emulsions. Measured σ(θ). Deduced levels, Jπ, L, spectroscopic factors from DWBA analysis using the JULIE code.

¹⁰⁹Ag Levels

E(level) [†]	Jπ [†]	L [§]	C ² S' [†]	E(level) [†]	Jπ [†]	L [§]	C ² S' [†]
0.0	1/2	1	0.86	1658 10	1/2	0	0.20
131 2	9/2	4	2.4	1750? [‡]			
311 2	3/2	1	0.43	1841 10	5/2	2	0.93
412 10	5/2	(3)	=0.2	1970 10	5/2	2	0.23
706 5	1/2	0	0.29	2000?			
731 5	3/2, 5/2	2	1.9, 1.4	2030?			
866 7	5/2	2	0.75	2070?			
910 10	7/2	4	2.7	2130 10	7/2, (5/2)	4(+2)	1.1, (0.007)
1200 10		(2+4)		2220 [‡]	(5/2, 7/2)	(2+4)	(0.66, 3)
1255 10		(1)	0.02	2320 [‡]	1/2	0	0.10
1310 [‡]		#	@	2400 [‡]	(5/2, 11/2)	(2+5)	(0.13, 1.6)
1430 10	1/2	0	0.03	2470 [‡]	1/2	0	0.15
1490 [‡]	5/2	2	0.36	3275 10	5/2	2	0.10
1600?							

[†] From 1973Au07. C²S'=(dσ/dΩ)_{exp}/[4.42×(dσ/dΩ)_{DWBA}].

[‡] Unresolved multiplet.

[§] From DWBA analysis in 1973Au07.

L=(1+2+4).

@ 0.02 if J=3/2, 0.06 if J=5/2, 1.0 if J=7/2.

$^{109}\text{Ag}(\gamma, \gamma)$ 1969Bo29, 2000Yo07

2000Yo07: ^{109}Ag isomer was photoactivated by 10 kCi ^{60}Co γ rays. γ -rays were detected by a low-background Ge detector. Measured $\gamma(t)$. Deduced $T_{1/2}$.

1969Bo29: ^{109}Ag was photoactivated by γ rays from x-ray bremsstrahlung. Measured $\sigma(E)$. Deduced levels.

 ^{109}Ag Levels

E(level) [†]	$T_{1/2}$
0.0	
88 $\frac{1}{2}$	38.0 s $\frac{1}{2}$ 12
410 2	
680 30	
855 5	
1210 10	
1480 10	
1675 10	

[†] From 1969Bo29, unless otherwise noted.

$\frac{1}{2}$ From 2000Yo07.

 $\gamma(^{109}\text{Ag})$

E_γ	E(level)
88.0	88

 $^{109}\text{Ag}(\text{p}, \text{p}')$ 1970Fo01, 1969Sh06

1970Fo01: E=13 MeV proton beam was produced from the Oak Ridge National Laboratory Tandem Van de Graaff. Target is a self-supporting 1 mg/cm² foil enriched to 99.8% in ^{109}Ag . Scattered particles were detected by two surface barrier silicon detectors, FWHM=20–30 keV. Measured $\sigma(\theta)$. Deduced levels, L, deformation parameter from DWBA analysis.

1969Sh06: E=5.9–7.25 MeV proton beams were produced from the University of Texas EN Tandem Van de Graaff accelerator. Targets are enriched self-supporting silver with thicknesses from 130–450 $\mu\text{g}/\text{cm}^2$. Scattered particles were detected by a surface barrier detector (FWHM=30 keV). Measured $\sigma(\theta)$. Deduced levels.

Other measurements: 1987Wa27, 1973IsZT, 1967Br07, 1977ChYZ (p, p' γ).

 ^{109}Ag Levels

E(level) [†]	L [§]	β_L	Comments
0.0			
311	2	0.135	E(level): 309 (1969Sh06).
415	2	0.165	E(level): 414 (1969Sh06).
702	2		E(level): 702 (1969Sh06).
863	2		E(level): 862 (1969Sh06).
912			
1091	4		
1260	0		
1324			
1510 $\frac{1}{2}$ 10	4		
1610 5			
2150 5	3	0.077	
2230 5	3	0.066	

[†] From 1970Fo01. Excitation energies for levels through 1324 keV are taken by the authors from 1970Ro14. The remaining level energies are from the (p, p') measurement in 1970Fo01.

$\frac{1}{2}$ Possible doublet or triplet.

[§] From DWBA analysis in 1970Fo01.

¹⁰⁹Ag(α, α') 1968St17

1968St17: E α =42 MeV beam was produced from the 60-in. NASA Lewis cyclotron. Targets are self-supporting silver. Scattered α particles were detected by lithium-drifted silicon detectors, FWHM=80-100 keV. Measured $\sigma(\theta)$. Deduced levels.
Other measurement: 1960Cr05.

¹⁰⁹Ag Levels

E(level)	β_L
0.0	
311 [†]	0.12
415 [†]	0.15
870	
1070	
1280	
1500	
2173	

[†] The 311-keV and 415-keV peaks are poorly resolved in the experiment. The energy of the composite peak is 380 keV and β of composite is 0.19.

Coulomb Excitation 1970Ro14

1970Ro14: ¹⁰⁹Ag($\alpha, \alpha'\gamma$), E=10 MeV, 10.7 MeV; ¹⁰⁹Ag(¹⁶O, ¹⁶O' γ), E=45.5 MeV. α and ¹⁶O beams were produced from the Oak Ridge 6 MV Van de Graaff accelerator. Targets are 98.4% enriched ¹⁰⁹Ag on 0.013 cm thick Ni discs. γ rays were detected with Ge(Li) detectors and NaI crystal. Measured E γ , I γ , $\gamma(\theta)$, $\gamma\gamma$ -coin, Doppler-shift. Deduced levels, J π , T_{1/2}, B(E2), γ -ray multipolarity, branching ratio and mixing ratio.
1967Bl08: ¹⁰⁹Ag(¹⁶O, ¹⁶O' γ), E=40, 42 MeV beams were produced from the Stanford University FN Tandem accelerator. >99.5% isotopically enriched ¹⁰⁹Ag targets. γ rays were detected with Ge(Li) and NaI detectors. Measured E γ , I γ , $\gamma(\theta)$, $\gamma\gamma$ -coin. Deduced levels, J π , B(E2), γ -ray branching ratio.
1989Lo08: ¹⁰⁹Ag(Ar, Ar' γ), E=127 MeV beam was produced from the CYCLONE cyclotron of Louvain-la-Neuve. Target was 1 mg/cm² natural Ag. γ rays were detected by 60 cm³ Ge(Li) spectrometers. Measured E γ , I γ , $\gamma(\theta)$, $\gamma\gamma$ -coin. Deduced levels, J π , T_{1/2} by the Recoil Distance Method (RDM).
Other measurements:
1955Mc51, 1958Mc02: ¹⁰⁹Ag(p, p' γ), E=3 MeV.
1969Ro03: ¹⁰⁹Ag($\alpha, \alpha'\gamma$), E=9.5-10 MeV.
1970RoZS: ¹⁰⁹Ag(¹⁶O, ¹⁶O' γ).
1973Co10: ¹⁰⁹Ag($\alpha, \alpha'\gamma$), E=4.8-7.2 MeV.
1974Mi02: ¹⁰⁹Ag(³⁵Cl, ³⁵Cl' γ), E=64 MeV.
1984Ba72: ¹⁰⁹Ag(³²S, ³²S' γ), E=90 MeV.
1984Wo08: ¹⁰⁹Ag(³²S, ³²S' γ), E=100 MeV.
1986Ba14: ¹⁰⁹Ag(³²S, ³²S' γ), E=80 MeV.

¹⁰⁹Ag Levels

E(level) [†]	J π [§]	T _{1/2}	Comments
0.0	1/2-		
88.032	7/2+	39.79 s 21	J π , T _{1/2} : From adopted levels.
132.74	9/2+	2.60 ns 12	
311.33 23	3/2-	5.9 ps 4	B(E2) $\uparrow$ =0.228 12. B(E2) $\uparrow$: weighted average of 0.222 19 (1970Ro14), 0.210 18 (1973Co10) and 0.249 17 (1958Mc02). T _{1/2} : weighted average of 5.9 ps 7, using Recoil Distance Method in Coulomb Excitation (1974Mi02) and 5.9 ps 5 from BE2=0.228 12 and $\delta(311.3\gamma)=0.192$ 7 in Coulomb Excitation. Others: 6.9 ps 7 by RDM (1970MiZS) and 6.3 ps 18 (1970Ro14). Q=-0.54 10, -0.64 10, -0.81 10 or -0.91 10, depending on the relative sign of matrix elements (1972Th16). g-factor: +0.73 6, weighted average of 0.79 12 (1984Ba72), +0.77 10 (1984Wo08) and 0.66 10 (1986Ba14). Other: 0.58 24 (1970RoZS).

Continued on next page (footnotes at end of table)

Coulomb Excitation 1970Ro14 (continued)

¹⁰⁹Ag Levels (continued)

E(level) [†]	Jπ [§]	T _{1/2}	Comments
415.08 24	5/2-	33.4 ps 13	B(E2) [†] =0.317 18. B(E2) [†] : weighted average of 0.320 26 (1970Ro14) and 0.315 24 (1973Co10). Other: 0.377 26 (1958Mc02). T _{1/2} : weighted average of 32.6 ps 16 (1989Lo08) and 34.7 ps 21 (1974Mi02), using the RDM method. Others: 35 ps 4 (1970MiZS,RDM), 40 ps 3 (1970Ro14), 40.2 ps 23 from B(E2)=0.317 18 and δ(103.5γ)=-0.039 17. g-factor: +0.34 3, weighted average of 0.36 6 (1984Ba72), +0.36 5 (1984Wo08) and 0.29 6 (1986Ba14). Q=-0.16, -0.26, -0.33, or -0.43, depending on the relative sign of matrix elements (1972Th16).
702.0 4	3/2-	0.27 ps 7	B(E2) [†] =0.00087 19 (1970Ro14). T _{1/2} : weighted average of 0.24 ps 7 (1974Er05) and 0.5 ps 2 (1970Ro14), using the DSAM method.
862.4 3	5/2-	1.39 ps 19	B(E2) [†] =0.0173 17 (1970Ro14). T _{1/2} : weighted average of 1.42 ps 21 from BE2=0.0173 17 (1970Ro14) and 1.3 ps 4 from DSAM (1970Ro14). Other: 1.3 ps +8-4 (1974Er05,DSAM).
912.3 [‡] 4	7/2-		B(E2) [†] <0.018. Jπ: from γ(θ) in 1989Lo08.
1090.6 [‡] 6	9/2-	1.9 ps 3	B(E2) [†] <0.006. Jπ: from γ(θ) in 1989Lo08. T _{1/2} : from RDM in 1989Lo08.
1324.2 8	3/2-	0.31 ps 9	B(E2) [†] =0.0123 18 (1970Ro14). T _{1/2} : from 1970Ro14 by DSAM. Jπ: 1012.9γ(θ) results are consistent with J=3/2 or, with smaller probability, J=5/2 (1970Ro14). 1970Ro14 suggest J=3/2 based on spin of analogous level in ¹⁰⁷ Ag.

[†] From a least-squares fit to γ-ray energies.

[‡] Level is weakly excited by α bombardment but strongly observed with ¹⁶O excitation (1970Ro14). Thus, the direct E2 excitation of the level is small, and the B(E2) value given is an upper limit for direct E2 excitation.

[§] From deduced γ-ray transition multipolarities based on γ(θ) in 1970Ro14, unless otherwise noted.

γ(¹⁰⁹Ag)

E(level)	Eγ [†]	Iγ [†]	Mult. [§]	δ [§]	α	I(γ+ce)	Comments
88.032	88.0336 10		E3				Eγ,Mult.: From adopted gammas.
132.74	44.77 13		M1+E2	0.14 6			Eγ,Mult.,δ: From adopted gammas.
311.33	311.3 3	100	M1+E2	-0.192 7	0.0200		Mult.: from γ(θ): A ₂ =-0.395 16 (1970Ro14), -0.39 2 (1955Mc51), -0.388 7 (1958Mc02), A ₂ =-0.710 7 (1970RoZS), and -0.654 36 (1989Lo08). δ: weighted average of 0.193 10 (1970RoZS), -0.196 27 (1970Ro14), and 0.19 1 (1958Mc02). Others: 0.19 (1955Mc51).
415.08	103.5 5	4.6 [‡] 11	M1+E2	-0.039 17	0.382 8	6.4 [‡] 15	Iγ: Others: I(103.5γ)/I(415.1γ)=0.054 5 from 1989Lo08, 0.09 1 from 1967Bl08; I(103.5γ)=4.9 5 and I(415.1γ)=95.3 5 from 1970Ro14. δ: from γ(θ) in 1970Ro14. Mult.: A ₂ =-0.239 17 (1970Ro14). Eγ: from level energy difference, very weak branch observed by 1973Co10.
	282 [#]	≤0.05 [‡]	[M2]		0.1169	0.05 [‡]	Eγ: from level energy difference, very weak branch observed by 1973Co10.
	327 [#]	0.37 [‡] 9	[E1]		0.00583	0.37 [‡] 9	Eγ: from level energy difference, weak branch seen by 1973Co10. Iγ: 1970Ro14 set upper limit for branching of this γ as <0.2%.

Continued on next page (footnotes at end of table)

Coulomb Excitation 1970Ro14 (continued)

$\gamma(^{109}\text{Ag})$ (continued)

E(level)	E $\gamma^\dagger$	I $\gamma^\dagger$	Mult.§	$\delta^\S$	α	I(γ +ce)	Comments
415.08	415.1 3	93.2 $\frac{2}{3}$ 15	E2		0.01099	93.2 $\frac{2}{3}$ 15	Mult.: A ₂ =+0.124 23 (1970Ro14), A ₂ =+0.248 4, A ₄ =-0.039 9 (1955Mc51). Other values: A ₂ =+0.556 15, A ₄ =-0.432 28 (1989Lo08), A ₂ =-0.515 10, A ₄ =-0.401 11 (1970RoZS).
702.0	285 [#]	4 4					
	390.9 6	16 3					
	701.9 5	80 5	M1+E2	0.029 7	0.00273		Mult., δ : from A2=-0.32 6 (γ (θ)) in 1970Ro14.
862.4	447.3 3	50 3	M1+E2	-0.16 4	0.00801		I γ : Other: 43 3 (1967Bl08). Mult.: A ₂ =+0.124 23 (1970Ro14), A ₂ =+0.32 10, A ₄ =-0.11 15 (1989Lo08). δ : From γ (θ) in 1970Ro14; Other: -0.12 14 (1988Br31). I γ : other: 49 2 (1967Bl08). Mult.: A ₂ =-0.441 29 (1970Ro14). I γ : other: 8 1 (1967Bl08). Mult.: A ₂ =+0.28 13 (1970Ro14). I γ : other: 82 2 (1967Bl08). A ₂ =-0.51 6 (1989Lo08). I γ : other: 18 2 (1967Bl08). A ₂ =+0.8 3, A ₄ =+0.6 3 (1989Lo08). A ₂ =+0.48 5, A ₄ =-0.26 7 (1989Lo08). E γ ,I γ : seen in 1967Bl08 only with I(781 γ)/I(675.5 γ)=0.39 3.
	551.1 3	41 2	M1+E2	-0.28 3	0.00482		
	862.8 8	9 1	E2		1.51 $\times 10^{-3}$		
912.3	497.2 4	80 3					
	601.1 7	20 3					
1090.6	675.5 5	100					
	781 [#]						
1324.2	909 [#]	6 3					
	1012.9 10	81 3	M1+E2	-0.09 3	1.19 $\times 10^{-3}$		Mult.: A ₂ =+0.20 5 (1970Ro14).
	1324.2 10	13 3					

[†] From 1970Ro14, unless otherwise noted.

[‡] From 1973Co10. Values of I γ are deduced from I(γ +ce) using calculated conversion coefficients by BrIcc.

[§] From γ (θ) in 1970Ro14, unless otherwise noted.

[#] Placement of transition in the level scheme is uncertain.

¹¹⁰Cd(d,³He) 1976Va25

Target ¹¹⁰Cd J π (g.s.)=0+.

1976Va25: E=50 MeV deuteron beam was produced from the AVF cyclotron of the KVI. Targets were isotopically enriched metallic ¹¹⁰Cd (500 and 100 $\mu\text{g}/\text{cm}^2$) evaporated onto thin carbon backings. Reaction products were detected with $\Delta\text{E-E}$ solid state counter telescopes (FWHM=40-60 keV). Measured $\sigma(\theta)$. Deduced levels, J π , L spectroscopic factors from DWBA analysis.

¹⁰⁹Ag Levels

E(level) [§]	J π &	L@	C ² S [#]	E(level) [§]	J π &	L@	C ² S [#]	E(level) [§]	J π &	L@	C ² S [#]
0 10	1/2-	1	1.3	700 10	3/2-	1	0.6	1210 10	(9/2+)	(4)	0.5
130 10	9/2+	4	5.6	740 10	5/2+	2	0.2	1310 10	3/2-	1	0.7
320 10	3/2-	1	0.8	870 $\frac{2}{3}$ 10	(5/2-)	(3)	0.7	1510 10	3/2-	1	0.4
420 [†] 10	(9/2+)	(4)	0.5	890 10	(9/2+)	(4)	0.7	1860 10	(9/2+)	(4)	1.2

[†] Possible multiplet.

[‡] Not well resolved from other states.

[§] 1976Va25 do not give uncertainty. Evaluators estimates 10 keV.

[#] From 1976Va25, calculated using finite-range DWBA with normalization factor N=2.95 and proton parameters radius=1.20 fm, diffuseness=0.625 fm, and spin-orbit-coupling strength=25. Authors estimate $\approx 20\%$ uncertainty.

@ From DWBA fits to measured $\sigma(\theta)$ (1976Va25).

& Assignment used to obtain C²S in 1976Va25.

 $^{112}\text{Cd}(\text{p},\alpha)$ 1977SmZX,1978Ta06

Target ^{112}Cd $J\pi(\text{g.s.})=0+$.

1977SmZX: E=22 MeV polarized proton beam at KVI; semiconductor detectors, $\text{FWHM}\leq 35$ keV. Measured $\sigma(\theta)$. Deduced levels.

1978Ta06: E=22 MeV polarized proton beam was produced from a tandem accelerator at the University of Tsukuba. Target was $300\text{ }\mu\text{g}/\text{cm}^2$ CdO (96% enriched). Reaction products were momentum analyzed by a magnetic spectrograph and detected by a solid-state detector in the focal plane. Measured $\sigma(\theta)$, analyzing powers. Deduced levels, J dependence from DWBA analysis.

Other measurements: 1966WeZZ, 1988Ku25.

 ^{109}Ag Levels

E(level) [†]	$J\pi^{\S}$	L [#]	E(level) [†]	E(level) [†]
0 . 0	1 / 2-	1	929 8	1940 [‡] 10
88 3			1070 ?	2043 [‡] 11
133 3	9 / 2+	4	1230 ?	2171 [‡] 14
312 4	3 / 2-	1	1331 6	2228 7
415 5	5 / 2-	3	1515 5	2350 10
704 6	3 / 2-	1	1570 ?	2471 6
789 11			1844 7	2522 6
868 6	5 / 2-	3	1887 6	

[†] From 1977SmZX.

[‡] Possible multiplet.

[§] From analyzing powers with L+1/2 or L-1/2 transfers in 1978Ta06.

[#] From DWBA analysis in 1978Ta06.

Adopted Levels, Gammas

Q(β⁻)=-2016 4; S(n)=7323.1 18; S(p)=8186.6 28; Q(α)=-2511.5 19 2012Wa38.

¹⁰⁹Cd Levels

Cross Reference (XREF) Flags

A ¹⁰⁹In ε Decay
B ¹⁰⁹Cd IT Decay (11.8 μs)
C ¹⁰⁹Cd IT Decay (10.6 μs)
D ⁹⁶Zr(¹⁶O,3nγ)
E ⁹⁶Zr(¹⁸O,5nγ)
F ¹⁰⁰Mo(¹³C,4nγ)
G ¹⁰⁸Pd(α,3nγ)
H ¹⁰⁹Ag(p,nγ)
I ¹¹⁰Cd(d,t)

E(level) [†]	Jπ	XREF		T _{1/2} ^h	Comments
0.0	5/2+	ABCDEFGH		461.9 d 4	%ε=100. Jπ: optical-double resonance (1976Fu06); direct ε to 7/2+ level in ¹⁰⁹ Ag; L(d,t)=2. T _{1/2} : using the Limitation of Relative Statistical Weight method and 462.3 d 8 (2014Un01), 462.36 d 33 and 461.92 d 76 (2011Va02), 459.6 d 17 (2004Sc04), 460.2 d 4 (1997Ma75), 463.1 d 4 (1982La25), 461.9 d 3 (1981Va11), 450 d 5 (1968Re04), 459 d 6 (1968Ea01), 453 d 2 (1965Le06) and 470 d 8 (1950Gu54). Other: 330 d (1947Br05). Values of 463.2 6 (1982HoZJ), 463.26 63 (1992Un01,2002Un02) and 462.6 6 (2012Fi12) are superseded by 2014Un01. μ=-0.8278461 15; Q=+0.604 25. μ: from 2014StZZ, based on 1972Sp09 and 1963By02 data. Q: from 2013Yo02 by collinear laser spectroscopy. Other: +0.69 7 from 1969La06 by optical double resonance. configuration: a mixture between vd _{5/2} and vg _{7/2} orbitals.
59.60 7	1/2+	AB	HI	11.8 μs 16	%IT=100. Jπ: L(d,t)=0; 59.6γ E2 to 5/2+. T _{1/2} : weighted average of 11.7 μs 18 (1968Iv02) and 12 μs 3 (1956Pe56) in ¹⁰⁹ Cd IT decay. configuration: vs _{1/2} . Jπ: L(d,t)=4, 203.5γ M1 to 5/2+. T _{1/2} : from microwave modulation of beam and lens spectrometer (1969Be37). configuration: vg _{7/2} . Jπ: L(d,t)=2, 288.1γ E2 to 1/2+. Jπ: L(d,t)=2; 426.3γ M1+E2 to 5/2+; 679.5γ from 9/2+. %IT=100. Jπ: L(d,t)=5, 259.7γ M2 to 7/2+. T _{1/2} : weighted average of 10.4 μs 6 (1964Br27), 10.4 μs 10 (1966Mc06), 10.8 μs 16 (1968Iv02), and 10.8 μs 7 in 1975Me22. Q=-0.92; μ=-1.096 2. μ: from a measurement by the Stroboscopic Observation of Perturbed Angular Distribution (SOPAD) method (2014StZZ). Q: from 1978Sp09 by the Time Dependent Perturbed Angular Distribution (TDPAD) method. Value measured relative to Q for ¹⁰⁷ Cd and ¹¹¹ Cd and by assuming that the magnitude of Q follows the relative h _{11/2} shell filling with an increasing neutron number. configuration: vh _{11/2} . Jπ: L(d,t)=4, 623.8γ M1 to 5/2+. T _{1/2} : from DSAM (1988Ch35) in (p,nγ). Jπ: L(d,t)=2; 613.6γ M1 to 1/2+. Jπ: L(d,t)=2; J=3/2 is ruled out based on measured 721.8γ(θ) compared with theoretical values using the χ ² fits method in (p,nγ). Jπ: L(d,t)=2. Jπ: 618.5γ M1 to 7/2+, 822.0γ E2 to 5/2+.
203.40 5	7/2+	A	CDEFGHI	36 ps +6-1	
347.51 6	5/2+	A	HI		
426.42 6	5/2+	A	HI		
463.10 [‡] 11	11/2-	A	CDEFGHI	10.6 μs 4	
623.88 7	7/2+	A	HI	41 fs +25-15	
673.41 8	3/2+	A	HI	55 fs +15-12	
721.67 7	5/2+	A	HI	76 fs +21-13	
818 5	3/2+, 5/2+		I		
822.04 7	9/2+	A	EFGH	90 fs +49-28	

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Adopted Levels, Gammas (continued) ^{109}Cd Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} ^h	Comments
891.25 7	3/2+, 5/2+	A HI	36 fs +8-6	J π : L(d,t)=2.
929.38 8	5/2+	HI		J π : L(d,t)=2; measured C ² S=1.3 in (d,t) is considered too large for J=3/2 assignment based on comparisons with theoretical values of neighbouring nuclei by 1975Ch07 in (d,t).
985.51 [±] 15	15/2-	DEFGH	10.0 ps 4	J π : 522.4 γ E2 to 11/2-; band assignment.
997.50 8	7/2+	A H	64 fs +20-12	J π : direct ϵ decay from 9/2+, 650.0 γ to 5/2+, 324.4 γ to 3/2+.
1066.09 11	11/2+	A EFGH		J π : 862.9 γ E2 to 7/2+. Level considered as member of 7/2+ band.
1105 5	3/2+, 5/2+	I		J π : L(d,t)=2.
1105.83 9	9/2+	A F H	73 fs +38-24	J π : 1105.9 γ (E2) to 5/2+; direct EC decay from 9/2+; absence of γ 's to 3/2+.
1121.21 8	(1/2+, 3/2, 5/2+)	H		J π : 1061.5 γ to 1/2+, 773.7 γ to 5/2+.
1132.91 21	7/2+	A H	61 fs +32-18	J π : possible EC feeding from 9/2+; J=7/2 from measured 929.5 γ (0) compared with theoretical values using the χ^2 fits method in (p,n γ).
1173.48 14	3/2+, 5/2+	A HI		J π : L(d,t)=2.
1219.01 18		A H		
1318.10 12	3/2+, 5/2+	HI		J π : L(d,t)=2.
1352.15 7	(7/2)+	A H		J π : strong direct EC feeding from 9/2+, 1352.2 γ to 5/2+, 678.6 γ to 3/2+.
1388.56 13	(7/2+, 9/2+)	A H		J π : direct ϵ feeding from 9/2+, 1388.6 γ to 5/2+.
1417.96 18	1/2+	HI		J π : L(d,t)=0.
1425.2 ^a 3	(13/2-)	EFGH		J π : 962.3 γ (M1+E2) to 11/2-, band assignment.
1430.1 4	(7/2, 9/2+)	A		J π : possible EC feeding from 9/2+, 1430.1 γ to 5/2+.
1458.75 15		H		
1475.69 9	(7/2, 9/2)+	A H		J π : strong direct EC feeding from 9/2+, 1475.6 γ to 5/2+.
1479.77 20		H		
1539.37 16	(7/2+, 9/2+)	A H		J π : direct EC feeding from 9/2+, 1539.3 γ to 5/2+.
1563.1 3	11/2(+)	F H		J π : 939.6 γ Q to 7/2+, 740.3 γ D+Q to 9/2+.
1580.71 18		H		
1593.3 3		H		
1622.46 8	(7/2)+	A H		J π : strong direct EC feeding from 9/2+, 1622.3 γ to 5/2+, 948.9 γ to 3/2+.
1633.55 23		H		
1729.99 19		H		
1772.79 10	(7/2, 9/2)+	A H		J π : strong direct EC feeding from 9/2+, 1772.5 γ to 5/2+.
1787.36 10		H		
1813.42 12		H		
1821.50 [±] 17	19/2-	DEFG	0.59 ps 14	J π : 836.0 γ E2 γ to 15/2-.
1854.0 4	(13/2+)	EF H		J π : 1031.8 γ (E2) to 9/2+, 788.0 γ (M1) to 11/2+.
1861.42 10	(7/2+, 9/2+)	A		J π : direct EC decay from 9/2+, 1861.4 γ to 5/2+.
1869.23 19		H		
1937.5 3		H		
1944.03 20		H		
1956.0 6		H		
1989.0 3		H		
2033.78 17		A H		
2046.4 3		H		
2064.67 9		F H		XREF: F(?).
2111.65 19		H		J π : 1717.0 γ to 5/2+, 1861.4 γ to 7/2+.
2141.41 22	15/2+	EFGH		J π : 1075.3 γ E2 to 11/2+.
2165.94 ^a 23	(17/2-)	EFGH	0.5 ps 3	J π : 740.8 γ (E2) to (13/2-), 1180.2 γ (M1+E2) to 15/2-, band assignment.
2166.48 17		H		
2198.92 17		H		
2234.22 22		H		
2271.3 5		H		
2282.46 25		H		
2325.8 4		H		
2372.3 3		H		

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Adopted Levels, Gammas (continued)
¹⁰⁹Cd Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} ^h	Comments
2391.85 24		H		
2589.8 5	19/2-	EF	0.8 ps 4	J π : 1604.5 γ E2 to 15/2-.
2687.1 [§] 4	(17/2+)	EF		J π : 1701.8 γ (E1) to 15/2-.
2700.5 ^b 4	(19/2-)	EF		J π : 1715.0 γ (E2) to 15/2-, band assignment.
2862.20 [‡] 19	23/2-	DEFG	<1.2 ps	J π : 1040.7 γ E2 to 19/2-.
2866.70 ^d 20	(21/2+)	EFG	1.26 ns 19	J π : 1045.2 γ (E1) to 19/2-, band assignment.
2942.0 [#] 3	19/2+	EFG	<3.5 ps	J π : 800.5 γ E2 to 15/2+.
2974.0 ^c 3	(21/2-)	EF	<7.6 ps	J π : 807.8 γ (E2) to (17/2-).
3042.6 ^a 4	(21/2-)	EF	<3.5 ps	J π : 876.7 γ (E2) to (17/2-).
3058.78 [§] 19	(21/2+)	DEFG	0.8 ps 5	J π : 371.8 γ (E2) to (17/2+).
3256.5 11		E		
3282.4 5	(21/2+)	EF		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
3343.2 6	(25/2-)	D		J π : 481.0 γ (M1+E2) to 23/2-.
3354.0 ^f 4	(21/2-)	EF		J π : 491.8 γ (M1) to 23/2-, 1188.0 γ to (17/2-).
3369.9 4	23/2-	EF	<3.5 ps	J π : 780.2 γ and 1548.5 γ E2 to 19/2-.
3382.9 [#] 3	23/2+	EFG	12.1 ps 9	J π : 441.0 γ E2 to 19/2+, 323.8 γ M1+E2 to (21/2+),.
3411.1 ^b 4	(23/2-)	EF		J π : 436.7 γ (M1) to (21/2-), 710.5 γ (E2) to (19/2-).
3524.3 ^{&} 5	(21/2+)	EF		J π : based on band structure in ⁹⁶ Zr(¹⁸ O,5n γ).
3524.41 [§] 21	(25/2+)	DEFG	12.1 ps 12	J π : 465.2 γ E2 to (21/2+).
3549.0 ^f 4	(23/2-)	EF	<2.1 ps	J π : 195.0 γ (M1+E2) to (21/2-), band assignment.
3570.1 ^d 4	(23/2+)	EFG		J π : 287.5 γ (M1) to (21/2+), 703.4 γ (M1) to (21/2+).
3615.6 5	(23/2-)	EF		J π : 1793.8 γ (E2) to 19/2-.
3620.6 [@] 4	(23/2+)	EF		J π : 561.6 γ (M1) to (21/2+), 758.6 γ (E1) to 23/2-.
3837.1 9	(25/2+)	E		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
3897.6 ^c 4	(25/2-)	EF		J π : 923.4 γ (E2) to (21/2-).
3910.3 ^{&} 4	(25/2+)	EF	<13 ps	J π : 527.3 γ (M1) to 23/2+, 851.4 γ (E2) to (21/2+).
3939.8 [#] 3	27/2+	EFG	3.8 ps 4	J π : 415.0 γ M1+E2 to (25/2+), 556.8 γ E2 to 23/2+.
4021.3 [‡] 4	(27/2-)	DEFG		J π : 1159.0 γ (E2) to 23/2-.
4030.6 ^f 4	(25/2-)	EF	<2.8 ps	J π : 414.8 γ (M1) to (23/2-), 481.7 γ (M1+E2) to (23/2-).
4088.6 ^a 5	(25/2-)	E		J π : 1046.0 γ (E2) to (21/2-).
4154.2 6		E		
4232.3 [@] 4	(27/2+)	EF		J π : 611.8 γ (E2) to (23/2+), 708.0 γ (M1) to (25/2+).
4246.2 [§] 4	(29/2+)	DEFG	<3.8 ps	J π : 721.8 γ E2 to (25/2+).
4293.2 ^d 5	(25/2+)	EF		J π : 1426.6 γ (E2) to (21/2+).
4296.0 5	(27/2-)	EF		J π : 926.4 γ (E2) to 23/2-.
4414.1 10	(27/2+)	E		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
4431.9 6	(27/2+)	E		J π : 811.3 γ (E2) to (23/2+).
4458.7 ^b 5	(27/2-)	E		J π : 1048.1 γ (E2) to (23/2-).
4591.2 6	(27/2-)	E		J π : 1729.0 γ (E2) to 23/2-.
4630.6 ^f 4	(27/2-)	EF	<4.2 ps	J π : 600.0 γ (M1) to (25/2-).
4697.7 ^{&} 6	(29/2+)	EF		J π : 787.4 γ (E2) to (25/2+).
4724.5 [#] 5	31/2+	EF	<3.1 ps	J π : 785.1 γ E2 to 27/2+, 478.0 γ (M1+E2) to (29/2+).
4875.2 5	(27/2-)	E		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
4950.9 ^d 8	(27/2+)	E		J π : band assignment.
5050.7 [‡] 5	(31/2-)	EF	1.05 ps +4-5	J π : 1029.6 γ (E2) to (27/2-), 754.7 γ E2 to (27/2-). T _{1/2} : from 2000Ch04 in ⁹⁶ Zr(¹⁸ O,5n γ) using DSAM, weighted average of 1.26 ps +12-8, 1.25 ps 5 and 0.85 ps +7-6.
5063.7 5	(27/2-)	E		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
5082.6 [@] 4	(31/2+)	EF		J π : 850.8 γ (E2) to (27/2+).
5122.7 ^c 7	(29/2-)	E		J π : 1225.1 γ (E2) to (25/2-).
5227.6 7		E		
5254.6 11	(29/2-)	E		J π : proposed in ⁹⁶ Zr(¹⁸ O,5n γ).
5261.1 [§] 7	(33/2+)	E		J π : 1014.8 γ (E2) to (29/2+).
5279.7 ^f 4	(29/2-)	EF	<7.6 ps	J π : 649.0 γ (M1) to (27/2-), 1249.0 γ (E2) to (25/2-).
5287.6 ^a 11	(29/2-)	E		J π : band assignment.
5399.3 7	(31/2-)	E		J π : 1378.0 γ (E2) to (27/2-).
5441.3 ^f 7	(31/2-)	EF		J π : 161.6 γ M1+E2 to (29/2-).
5623.0 7		E		
5650.5 ^d 9	(29/2+)	E		J π : band assignment.
5671.7 ^{&} 8	(33/2+)	E		J π : 974.0 γ (E2) to (29/2+).

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Adopted Levels, Gammas (continued) ^{109}Cd Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} ^h	Comments
5731.2 ^f 8	(33/2-)	EF	0.97 ps +2-3	J π : 289.9 γ (M1) to (31/2-). T _{1/2} : from 2000Ch04 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$ using DSAM, weighted average of 0.96 ps 3, 0.81 ps +1-8, and 1.12 ps 5.
5775.1 [#] 7	(35/2+)	EF		J π : 1050.6 γ (E2) to 31/2+.
5788.0 10	(31/2-)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5813.2 ^e 12	(29/2+)	E		J π : band assignment.
5862.0 8	(31/2-)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5954.8 10		E		
5971.4 [‡] 7	(35/2-)	EF	0.233 ps +15-8	J π : 920.7 γ E2 to (31/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.214 ps +14-21, 0.277 ps +21-14, and 0.236 ps +42-7.
5995.8 7	(31/2+)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
6004.2 ^e 7	(31/2+)	E		J π : band assignment.
6154.6 [@] 7	(35/2+)	E		J π : 1072.0 γ (E2) to (31/2+).
6164.5 ^f 10	(35/2-)	E	0.189 ps +3-4	J π : 433.3 γ (M1) to (33/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.173 ps 7, 0.183 ps +5-6, and 0.202 +4-6.
6240.8 9	(35/2-)	E		J π : 379.0 γ (E2) to (31/2-).
6305.2 ^e 8	(33/2+)	E		J π : 301.1 γ (M1) to (31/2+). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, 0.248 ps +10-8, weighted average of 0.284 ps +27-21, 0.263 ps 14, and 0.222 ps 14.
6518.4 [§] 8	(37/2+)	E		J π : 1257.3 γ (E2) to (33/2+).
6572.7 7		E		
6670.8 13	(37/2-)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
6684.2 ^e 13	(35/2+)	E	0.175 ps +3-4	J π : band assignment. T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.187 ps 7, 0.173 ps +6-5 and 0.166 ps +5-9.
6796.0 ^f 11	(37/2-)	E	0.150 ps +3-4	J π : 631.5 γ (M1) to (35/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.215 ps +14-21, 0.194 ps +7-14, and 0.142 ps +2-5.
6861.8 ^{&} 10	(37/2+)	E		J π : band assignment.
7010.4 [‡] 9	(39/2-)	EF	0.274 ps +10-9	J π : 1039.0 γ (E2) to (35/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.28 ps 3, 0.284 ps +14-7, and 0.24 ps 2.
7077.2 [#] 9	(39/2+)	E		J π : 1302.0 γ (E2) to (35/2+).
7147.2 ^e 14	(37/2+)	E	0.146 ps +1-3	J π : 463.0 γ (M1) to (35/2+). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.148 ps +5-6, 0.146 ps 3, and 0.141 ps +3-15.
7384.6 [@] 8	(39/2+)	E		J π : 1230.0 γ (E2) to (35/2+); band assignment.
7555.0 ^f 12	(39/2-)	E	0.226 ps +8-11	J π : 759.0 γ (M1) to (37/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.187 ps +14-21, 0.235 ps 14, and 0.249 ps +14-21.
7562.0 15	(39/2-)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
7687.8 ^e 15	(39/2+)	E	0.077 ps +2-3	J π : 540.6 γ (M1) to (37/2+). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.067 ps 4, 0.078 ps +3-7, and 0.091 ps +4-6.
7908.8 [§] 10	(41/2+)	E		J π : 1390.4 γ (E2) to (37/2+).
7951.0 16	(41/2-)	E		J π : proposed in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
8202.0 [‡] 10	(43/2-)	E	0.129 ps +3-5	J π : 1191.6 γ (E2) to (39/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, weighted average of 0.110 ps +7-14, 0.130 ps +3-13, and 0.133 ps +6-4.

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Adopted Levels, Gammas (continued) ^{109}Cd Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} ^h	Comments
8264.8 ^e 18	(41/2+)	E	0.056 ps +2-4	J π : band assignment. T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, weighted average of 0.059 ps +4-6, 0.049 ps +4-5, and 0.067 ps +3-9.
8598.6 [#] 10	(43/2+)	E		J π : 1521.4 γ (E2) to (39/2+).
8870.8 ^e 20	(43/2+)	E		J π : band assignment.
9377.7 [§] 11	(45/2+)	E		J π : band assignment.
9502.8 ^e 23	(45/2+)	E		J π : band assignment.
9569.0 [‡] 11	(47/2-)	E	0.124 ps 3	J π : 1367.0 γ (E2) to (43/2-). T _{1/2} : from 2000Ch04 using DSAM in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, weighted average of 0.126 ps 5, 0.119 ps +6-5, and 0.126 ps +5-6.
10165.8 ^e 25	(47/2+)	E		J π : band assignment.
10898 ^e 3	(49/2+)	E		J π : band assignment.
11132.1 [‡] 12	(51/2-)	E		J π : band assignment.
x ^g	(37/2)	E		J π : band assignment. E(level): x >5730, since transitions from this level feed members of bands #10 and #11 as labeled by 2000Ch04.
295.0+x ^g 10	(39/2)	E		J π : band assignment.
634.0+x ^g 15	(41/2)	E		J π : band assignment.
1054.0+x ^g 18	(43/2)	E		J π : band assignment.
1542.0+x ^g 20	(45/2)	E		J π : band assignment.
2100.0+x ^g 23	(47/2)	E		J π : band assignment.
2727.0+x ^g 25	(49/2)	E		J π : band assignment.

[†] From a least-squares fit to γ -ray energies.[‡] (A): $\Delta J=2$, vh11/2-.[§] (B): $\Delta J=2$, based on 17/2+.[#] (C): $\Delta J=2$, based on 19/2+.[@] (D): $\Delta J=2$, based on (23/2+).[&] (E): $\Delta J=2$, based on (21/2+).^a (F): $\Delta J=2$, based on (13/2-).^b (G): $\Delta J=2$, based on (19/2-).^c (H): $\Delta J=2$, based on (21/2-).^d (I): $\Delta J=1$, based on (21/2+).^e (J): $\Delta J=1$, magnetic-rotational band, based on (29/2+). Configuration= $\pi g_{9/2}^{-2} 8_+ v[(g_{7/2}/d_{5/2})h_{11/2}^2]$.^f (K): $\Delta J=1$, magnetic-rotational band, based on (21/2-).^g (L): $\Delta J=1$, (37/2) band.^h From (p, γ) by DSAM up to E=1133 keV level, and from 2001Ha09 in $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$ using Recoil Distance Method above E=1133 keV level, unless otherwise noted.

Adopted Levels, Gammas (continued)

$\gamma(^{109}\text{Cd})$						
E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
59.60	59.6 2	100	E2		9.45 18	$E\gamma$: weighted average of 59.6 2 from $^{109}\text{In } \epsilon$ decay, 59.9 5 from ^{109}Cd IT decay (12 μs), and 59.5 5 from $^{109}\text{Ag}(p,n\gamma)$ (1983Ch34). Mult.: $\alpha(\text{exp})=13.3$ (1956Pe56), $K/L=0.85.8$ (1956Pe56), 1.3 5 (1962No06) in $^{109}\text{In } \epsilon$ decay. B(E2)(W.u.)=0.20 3.
203.40	203.3 1	100	M1		0.0659	Mult.: $\alpha(\text{exp})=0.07.1$ and $K/L=7.6.4$ (1956Pe56), $K/(L+M)=7.1$ (1962No06) from $^{109}\text{In } \epsilon$ decay; $\alpha(K)\text{exp}(259.5\gamma)/\alpha(K)\text{exp}(203.2\gamma)=2.06.23$ (1969Be37) and $I\gamma(259.g\gamma)/I\gamma(203.2\gamma)=0.9$ (1966Mc06 and 1964Br27) from ^{109}Cd IT decay (10.9 μs) are consistent with $\text{mul}(203\gamma)=\text{M1}$ and $\text{mul}(259\gamma)=\text{M2}$. B(M1)(W.u.)=0.0683 +19-98.
347.51	288.1 1	75 3	E2		0.0371	$I\gamma$: weighted average of 77 3 from $^{109}\text{In } \epsilon$ decay and 71 5 from $^{109}\text{Ag}(p,n\gamma)$. Mult.: $\alpha(\text{exp})=0.04.1$, $K/L=5.0$ (1956Pe56), $K/(L+M)=6.6.15$ (1962No06) from $^{109}\text{In } \epsilon$ decay; $a_2/a_0=+0.03.3$, $a_4/a_0=-0.06.4$ (1994Ju05) in (p,n γ). Mult.: $\alpha(\text{exp})=0.020.8$ from $K/L=5.1.5$ (1956Pe56), $K/(L+M)=7.5$ (1962No06) from $^{109}\text{In } \epsilon$ decay; $a_2/a_0=+0.01.2$, $a_4/a_0=-0.06.4$ (1994Ju05) in (p,n γ).
	347.5 $\frac{1}{2}$ 1	100 $\frac{1}{2}$ 5	M1+E2		0.01638	Mult.: $\alpha(\text{exp})=0.020.8$ from $K/L=5.1.5$ (1956Pe56), $K/(L+M)=7.5$ (1962No06) from $^{109}\text{In } \epsilon$ decay; $a_2/a_0=+0.01.2$, $a_4/a_0=-0.06.4$ (1994Ju05) in (p,n γ).
426.42	223.0 1	4.7 8				$I\gamma$: weighted average of 2.9 9 from $^{109}\text{In } \epsilon$ decay and 5.0 4 from (p,n γ).
	426.3 1	100 3	M1+E2		0.00984	$I\gamma$: from $^{109}\text{In } \epsilon$ decay. Other: 100 6 from (p,n γ). Mult.: $\alpha(\text{exp})=0.014.5$ from $K/L=8.1$ (1956Pe56), $K/(L+M)=8.2$ (1962No06) from $^{109}\text{In } \epsilon$ decay; $a_2/a_0=+0.10.4$, $a_4/a_0=+0.01.5$ (1994Ju05) in (p,n γ).
463.10	259.7 1	100	M2		0.1676	Mult.: $\alpha(K)\text{exp}(259.5\gamma)/\alpha(K)\text{exp}(203.2\gamma)=2.06.23$ (1969Be37) and $I\gamma(259.5\gamma)/I\gamma(203.2\gamma)=0.9$ (1966Mc06 and 1964Br27) from ^{109}Cd IT decay (10.9 μs) are consistent with $\text{mul}(203\gamma)=\text{M1}$ and $\text{mul}(259\gamma)=\text{M2}$; $K/(L+M)=2.4.8$ (1962No06) from $^{109}\text{In } \epsilon$ decay. $A_2/a_0=+0.045.6$, $a_4/a_0=-0.005.6$, $\text{pol}=-0.13.5$ from $^{96}\text{Zr}(^{16}\text{O},3n\gamma)$. B(M2)(W.u.)=0.093 4.
623.88	420.6 1	16.0 13	(M1)		0.01017	$I\gamma$: weighted average of 14.7 13 from $^{109}\text{In } \epsilon$ decay and 17.2 13 from $^{109}\text{Ag}(p,n\gamma)$. Mult.: $a_2/a_0=+0.22.1$, $a_4/a_0=+0.06.2$ (1994Ju05) in (p,n γ). B(M1)(W.u.)=1.0 +6-4.
	623.8 1	100 4	M1		0.00392	$I\gamma$: from $^{109}\text{In } \epsilon$ decay. Other: 100 7 from (p,n γ). Mult.: $\alpha(\text{exp})=0.0032.15$ (1956Pe56) from $^{109}\text{In } \epsilon$ decay; $a_2/a_0=-0.41.3$, $a_4/a_0=-0.08.4$ (1994Ju05) in (p,n γ). B(M1)(W.u.)=1.9 +11-7.
673.41	326.3 2	24.6 8	[M1]		0.0192	$I\gamma$: weighted average of 24.3 10 from $^{109}\text{In } \epsilon$ decay and 25.1 13 from $^{109}\text{Ag}(p,n\gamma)$.
	470.4 2	2.8 3	[E2]		0.00795	
	613.6 1	100 6	M1		0.00408	Mult.: $a_2/a_0=+0.09.2$, $a_4/a_0=-0.06.6$ (1994Ju05) in (p,n γ), $\text{mul}=\text{Q}$ is ruled out by $T_{1/2}$, polarity from level-parity change based $L(d,t)=2$.
721.67	374.3 4	2.5 5	[M1]		0.01359	
	518.2 5	1.0 5	[M1]		0.00611	
	721.8 1	100 5	[M1]		0.00279	

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Cd})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
822.04	618.5 1	100 6	M1		0.00400	$E\gamma$: from ^{109}In ϵ decay. Mult.: R(angular)=0.64 7 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, $a_2/a_0=-0.67$ 3, $a_4/a_0=-0.10$ 5 (1994Ju05) in (p,n γ).
	822.0 1	68 2	E2		0.00180	$E\gamma$: from ^{109}In ϵ decay. $I\gamma$: weighted average of 67 2 in ^{109}In ϵ decay and 72 6 in (p,n γ) Others: 44 8 from (α ,3n γ), 29 5 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$. Mult.: Q from $a_2/a_0=+0.24$ 4, $a_4/a_0=+0.03$ 6 (p,n γ), M2 is ruled out by $T_{1/2}$.
891.25	169.3 3	2.3 8				
	464.8 2	7.6 8				
	831.7 1	100 1				
	891.2 1	77 5				
929.38	207.6 1	48 3				
	305.6 3	13.1 16				
	503.4 3	18.0 16				
	582.1 3	31.1 16				
	929.4 1	100 8				
985.51	522.4 1	100	E2		0.00587	$E\gamma$: weighted average of 522.0 5 from $^{96}\text{Zr}(^{16}\text{O},3n\gamma)$, 522.4 1 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, 522.4 1 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$, 522.2 2 from $^{108}\text{Pd}(\alpha,3n\gamma)$, and 522.2 4 from $^{109}\text{Ag}(\text{p},n\gamma)$. Mult.: $a_2/a_0=+0.304$ 10, $a_4/a_0=-0.094$ 11 (1978St01) in $^{96}\text{Zr}(^{16}\text{O},3n\gamma)$; $a_2/a_0=+0.292$ 3, $a_4/a_0=-0.108$ 4 (1975Me22) in (α ,3n γ); $T_{1/2}$ rules out M2; R(angular)=1.33 2, DCO(Q)=1.01 1 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$. B(E2)(W.u.)=46.8 19.
997.50	324.4 2	12.9 5				$E\gamma$: from ^{109}In ϵ decay. $I\gamma$: weighted average of 12.8 5 from ^{109}In ϵ decay and 13.3 10 from $^{109}\text{Ag}(\text{p},n\gamma)$.
	571.0 4	9.2 10	[M1]		0.00484	$E\gamma$: weighted average of 570.4 5 from ^{109}In ϵ decay (1970Ri06) and 571.2 3 from $^{109}\text{Ag}(\text{p},n\gamma)$ (1988Vi03). $I\gamma$: from (p,n γ). Other: 2.2 10 from ^{109}In ϵ decay.
	650.0 1	100 5	(M1)		0.00356	Mult.: $a_2/a_0=+0.18$ 4, $a_4/a_0=-0.06$ 6 (1994Ju05) in (p,n γ).
	793.9 1	19.7 15	[M1]		0.00224	$I\gamma$: weighted average of 20 2 from ^{109}In ϵ decay and 19.4 21 from $^{109}\text{Ag}(\text{p},n\gamma)$.
1066.09	998.5 $\frac{3}{2}^{\pm}$ 3	21.8 $\frac{3}{2}^{\pm}$ 13	[M1]		1.33×10^{-3}	$I\gamma$: weighted average of 8.3 17 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$ and 7.8 9 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$.
	243.8 5	7.9 8	(M1)		0.0408	Mult.: R(angular)=1.00 10 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$. $I\gamma$: from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$. Mult.: $a_2/a_0=+0.32$ 6, $a_4/a_0=-0.02$ 8 (1975Me22) in (α ,3n γ); $a_2/a_0=+0.27$ 6, $a_4/a_0=-0.018$ (1994Ju05) in (p,n γ); R(angular)=1.33 8, DCO(Q)=0.93 14 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
	862.7 1	100 4	E2		1.60×10^{-3}	Mult.: from $a_2/a_0=-0.31$ 5, $a_4/a_0=+0.11$ 6 (1994Ju05) in (p,n γ).
1105.83	482.3 2	29 2	(M1+E2)		0.00727	Mult.: $a_2/a_0=+0.33$ 12, $a_4/a_0=+0.1$ 2 (1994Ju05) in (p,n γ).
	679.5 5	15.5 14	[E2]		0.00288	Mult.: $a_2/a_0=+0.33$ 12, $a_4/a_0=+0.1$ 2 (1994Ju05) in (p,n γ).
	901.8 2	43 5	(M1+E2)		1.68×10^{-3}	Mult.: $a_2/a_0=+0.22$ 4, $a_4/a_0=-0.03$ 5 (1994Ju05) in (p,n γ).
	1105.9 1	100 10	(E2)		9.15×10^{-4}	Mult.: $a_2/a_0=+0.22$ 4, $a_4/a_0=-0.03$ 5 (1994Ju05) in (p,n γ).
1121.21	694.8 1	100 6				
	773.7 1	39 4				
	1061.5 2	73 8				
1132.91	929.5 [#] 2	100				$E\gamma$: from ^{109}In ϵ decay. Other: 931.5 5 from (p,n γ).
1173.48	549.4 2	79 4				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Cd})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
1173.48	746.9 4	33 4				
	826.2 2	100 8				
1219.01	497.2 2	100 9				
	871.8 3	64 9				
1318.10	596.4 1	100 6				
	971.2 5	4.5 15				
1352.15	461.4 $\frac{1}{2}$ 4	2.2 $\frac{1}{2}$ 3				
	529.9 $\frac{1}{2}$ 2	11.9 $\frac{1}{2}$ 8				$I\gamma$: Other: 41 4 from (p,n γ).
	630.3 $\frac{1}{2}$ 3	1.6 $\frac{1}{2}$ 2				
	678.6 $\frac{1}{2}$ 2	17.8 $\frac{1}{2}$ 11				$I\gamma$: Other: 26 4 from (p,n γ).
	728.1 $\frac{1}{2}$ 3	5.7 $\frac{1}{2}$ 3				$I\gamma$: Other: 26 4 from (p,n γ).
	925.6 $\frac{1}{2}$ 3	15.2 $\frac{1}{2}$ 11				$I\gamma$: Other: 15 4 from (p,n γ).
	1004.8 $\frac{1}{2}$ 3	4.8 $\frac{1}{2}$ 3				$I\gamma$: Other: 5.6 19 from (p,n γ).
	1148.5 $\frac{1}{2}$ 2	100 $\frac{1}{2}$ 3				$I\gamma$: Other: 100 8 from (p,n γ).
	1352.3 $\frac{1}{2}$ 1	15.2 $\frac{1}{2}$ 6				$I\gamma$: Other: 63 8 from (p,n γ).
1388.56	764.5 4	40 5				
	962.2 2	55 5				
	1185.0 3	40 5				
	1388.6 2	100 5				
1417.96	526.6 5	4.1 22				
	991.4 4	19 4				
	1214.6 2	100 8	[M3]		0.00385	
1425.2	962.2 3	100	M1 (+E2)	-0.08 21	1.45×10^{-3} 3	Mult., δ : from $\gamma\gamma(\text{DCO})$ in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, DCO(Q)=0.52 19.
1430.1	1430.1 4	100				$E\gamma$: from ^{109}In ϵ decay.
1458.75	834.9 2	100 3				
	1255.3 2	15.9 15				
1475.69	584.3 $\frac{1}{2}$ 2	13.6 $\frac{1}{2}$ 23				
	653.4 $\frac{1}{2}$ 2	100 $\frac{1}{2}$ 9				
	753.8 $\frac{1}{2}$ 4	23.2 $\frac{1}{2}$ 14				
	851.8 $\frac{1}{2}$ 3	8.6 $\frac{1}{2}$ 5				
	1049.4 $\frac{1}{2}$ 2	71.8 $\frac{1}{2}$ 23				
	1128.4 $\frac{1}{2}$ 3	7 $\frac{1}{2}$ 3				
	1272.6 $\frac{1}{2}$ 2	35.0 $\frac{1}{2}$ 14				
	1475.6 $\frac{1}{2}$ 2	30 $\frac{1}{2}$ 2				
1479.77	758.6 6	37 7				
	1276.3 2	100 9				
1539.37	542 $\frac{1}{2}$ 2	63 $\frac{1}{2}$ 6				
	1113.0 3	60 30				
	1336.1 4	54 8				
	1539.3 2	100 8				
1563.1	457.5 5	27 13				
	740.3 5	67 7	D+Q			Mult.: $a_2/a_0=-0.74$ 8, $a_4/a_0=+0.06$ 12 from (p,n γ).
	939.6 5	100 13	Q			Mult.: $a_2/a_0=+0.23$ 8, $a_4/a_0=-0.15$ 11 from (p,n γ).
1580.71	907.2 2	100 11				
	1233.4 3	42 5				
1593.3	1245.8 3	100				
1622.46	731.0 $\frac{1}{2}$ 4	16.4 $\frac{1}{2}$ 14				
	800.3 $\frac{1}{2}$ 3	14.3 $\frac{1}{2}$ 11				
	901.7 $\frac{1}{2}$ & 2	17.9 $\frac{1}{2}$ & 11				
	948.9 $\frac{1}{2}$ 2	70 $\frac{1}{2}$ 3				
	998.5 $\frac{1}{2}$ & 3	31 $\frac{1}{2}$ & 2				
	1195.7 $\frac{1}{2}$ 2	79 $\frac{1}{2}$ 3				
	1419.0 $\frac{1}{2}$ 1	60 $\frac{1}{2}$ 2				
	1622.3 $\frac{1}{2}$ 3	100 $\frac{1}{2}$ 4				
1633.55	960.1 6	50 13				
	1207.1 3	100 13				
	1430.2 4	88 13				
1729.99	1382.4 4	58 8				
	1526.6 2	100 8				
1772.79	1346.4 $\frac{1}{2}$ 1	100 $\frac{1}{2}$ 6				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Cd})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
1772.79	1569.9 [‡] 4	19 [‡] 3				
	1772.5 [‡] 2	72 [‡] 4				
1787.36	1066.2 2	57 5				
	1360.8 1	100 5				
1813.42	1465.9 1	100				
1821.50	836.0 1	100	E2		1.72×10^{-3}	E γ : from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$ (1994Ju05). Mult.: $a_2/a_0=+0.284$ 8, $a_4/a_0=-0.079$ 8 in $^{96}\text{Zr}(^{16}\text{O},3n\gamma)$; $a_2/a_0=+0.284$ 8, $a_4/a_0=-0.079$ 8 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$; $a_2/a_0=+0.274$ 5, $a_4/a_0=-0.093$ 8 in ($\alpha,3n\gamma$). $T_{1/2}$ rules out M2. B(E2)(W.u.)=76 18.
1854.0	788.0 5	49 5	(M1)		0.00228	Mult.: R(angular)=0.38 11 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
	1031.8 5	100 9	(E2)		1.06×10^{-3}	Mult.: R(angular)=1.15 13 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
1861.42	1861.4 1	100				E γ : from ^{109}In ϵ decay (1988Vi03).
1869.23	1442.8 4	30 4				
	1521.7 2	100 4				
1937.5	1511.0 3	100 11				
	1734.2 5	57 6				
1944.03	1270.6 2	100 10				
	1740.7 5	52 6				
1956.0	1752.6 6	100				
1989.0	1785.6 3	100				
2033.78	1410.2 6	15 5				
	1607.3 2	100 6				
	2033.8 3	76 6				
2046.4	1698.9 3	100				
2064.67	959.0 ^a 5	75 10				
	999.0 ^a 5	40 15				
	1717.0 1	100 5				
	1861.4 1	100 5				
2111.65	1685.3 4	30 5				
	1764.1 2	100 5				
2141.41	1075.3 2	100	E2		9.71×10^{-4}	E γ : weighted average of 1075.7 5 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$ (1994Ju05), 1075.3 3 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$ (1994Re06) and 1075.1 4 from ($\alpha,3n\gamma$). Mult.: R(angular)=1.40 7, DCO(Q)=1.06 22 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, $a_2/a_0=+0.20$ 8, $a_4/a_0=-0.04$ 12 in (p,n γ), $a_2/a_0=+0.23$ 9, $a_4/a_0=+0.30$ 16 in ($\alpha,3n\gamma$).
2165.94	740.8 3	10 1	(E2)		0.00232	E γ : weighted average of 740.7 3 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$ and 740.9 4 from ($\alpha,3n\gamma$). A 740.3 γ deexcites the 1563 level in (p,n γ). I γ : from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$. Others: 23 2 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$, 25 8 from ($\alpha,3n\gamma$). Mult.: DCO(Q)=0.86 19 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$. B(E2)(W.u.)=15 9.
	1180.2 3	100 2	M1 (+E2)		9.28×10^{-4}	E γ : weighted average of 1180.4 2 from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, 1180.9 5 from $^{100}\text{Mo}(^{13}\text{C},4n\gamma)$ and 1179.6 3 from ($\alpha,3n\gamma$). Not seen in (p,n γ). I γ : from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$. Mult.: R(angular)=2.0 2, DCO(Q)=0.71 26 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
2166.48	1493.2 3	69 8				
	2166.4 2	100 8				
2198.92	1995.5 3	31 3				
	2198.9 2	100 7				
2234.22	2031.0 3	100 6				
	2234.0 3	56 6				
2271.3	1923.8 5	100				
2282.46	1855.7 4	86 14				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Cd})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
2282.46	2079.3 5	47 13				
	2282.6 4	100 14				
2325.8	2122.4 5	87 15				
	2325.7 4	100 33				
2372.3	1698.9 3	100				
2391.85	2044.0 4	100 13				
	2392.0 3	88 25				
2589.8	1604.5 5	100	E2		5.50×10^{-4}	Mult.: R(angular)=1.41 11, DCO(Q)=1.12 18 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)=2.1 11.
2687.1	1701.8 5	100	(E1)		5.79×10^{-4}	Mult.: R(angular)=0.79 10, for 1701.8 γ +1702.8 γ in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
2700.5	878.9 5	100 20	(E2)		1.53×10^{-3}	Mult.: R(angular)=1.32 13 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1715.0 5	44 5	(E2)		5.45×10^{-4}	Mult.: R(angular)=1.4 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
2862.20	1040.7 1	100	E2		1.04×10^{-3}	Mult.: $a_2/a_0=+0.295$ 15, $a_4/a_0=-0.096$ 18, $\text{pol}=+0.44$ 12 in $^{96}\text{Zr}(^{16}\text{O},3\text{n}\gamma)$, $a_2/a_0=+0.26$ 4, $a_4/a_0=-0.09$ 5 in ($\alpha,3\text{n}\gamma$), R(angular)=1.36 3, DCO(Q)=0.96 5 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)>12.
2866.70	1045.2 1	100	(E1)		4.47×10^{-4}	E γ : from $^{100}\text{Mo}(^{13}\text{C},4\text{n}\gamma)$. Mult.: R(angular)=0.80 14 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$ and $a_2/a_0=-0.06$ 2, $a_4/a_0=-0.06$ in ($\alpha,3\text{n}\gamma$). B(E1)(W.u.)= 2.1×10^{-7} 4.
2942.0	776.0 5	28 4	(E1)		8.04×10^{-4}	Mult.: R(angular)=0.83 8, DCO(Q)=0.47 11 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E1)(W.u.)> 3.4×10^{-5} .
	800.5 5	21 4	E2		0.00191	Mult.: R(angular)=1.5 2, DCO(Q)=0.90 18 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)>2.2.
	1120.8 5	100 2	(E1)		4.00×10^{-4}	R(angular)=1.37 9, DCO(Q)=0.78 12 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E1)(W.u.)> 4.0×10^{-5} .
2974.0	273.4 5	10.7 14	(M1)		0.0303	Mult.: R(angular)=0.63 13 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	807.8 5	32.1 18	(E2)		0.00187	Mult.: R(angular)=1.30 7 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E2)(W.u.)>1.6.
	1152.4 5	100 4				Mult.: R(angular)=1.8 3 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
3042.6	876.7 5	67 7	(E2)		1.54×10^{-3}	Mult.: R(angular)=1.29 14 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E2)(W.u.)>4.0.
	1221.2 5	100 7	(M1)		8.66×10^{-4}	Mult.: R(angular)=1.33 11 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
3058.78	371.8 5	1.3 3	(E2)		0.01626	Mult.: R(angular)=1.13 10 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E2)(W.u.)=40 30.
	1237.2 1	100 1	(E1)		3.84×10^{-4}	Mult.: $a_2/a_0=-0.257$ 15, $a_4/a_0=-0.005$ 17, $\text{pol}=+0.4$ 3 in $^{96}\text{Zr}(^{16}\text{O},3\text{n}\gamma)$, $a_2/a_0=-0.29$ 2, $a_4/a_0=+0.05$ 3 in ($\alpha,3\text{n}\gamma$), R(angular)=0.81 3, DCO(Q)=0.53 3 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. B(E1)(W.u.)=0.00019 12.
3256.5	1435 1	100				
3282.4	415.6 5	100			0.01152	Mult.: R(angular)=1.51 14 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
3343.2	481.0 5	100	(M1+E2)		0.00732	E γ : from $^{96}\text{Zr}(^{16}\text{O},3\text{n}\gamma)$. Mult.: $a_2/a_0=-0.25$ 4, $a_4/a_0=+0.12$ 5, $\text{pol}=-0.5$ 4 in $^{96}\text{Zr}(^{16}\text{O},3\text{n}\gamma)$.
3354.0	491.8 5	100 25	(M1)		0.00693	Mult.: R(angular)=0.76 5 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1188.0 5	75 25				
	1532.5 5	75 25				
3369.9	780.2 5	74 3	E2		0.00204	Mult.: R(angular)=1.47 7, DCO(Q)=0.98 15 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)>7.7.
	1548.5 5	100 7	E2		5.58×10^{-4}	Mult.: R(angular)=1.50 10, DCO(Q)=1.05 3 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)>0.34.

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Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{Cd})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
3382.9	323.8 5	92.4 15	M1+E2	0.31 5	0.0201 4	Mult., δ : R(angular)=1.19 3, DCO(Q)=0.89 5 in ⁹⁶ Zr(¹⁸ O,5n γ), $a_2/a_0=+0.13$ 3, $a_4/a_0=-0.08$ 4 from (α ,3n γ). B(M1)(W.u.)=0.0221 19; B(E2)(W.u.)=17 6. B(E1)(W.u.)=2.7 $\times 10^{-5}$ 10. Mult.: R(angular)=1.32 6, DCO(Q)=1.05 9 in ⁹⁶ Zr(¹⁸ O,5n γ), $T_{1/2}$ rules out M2. B(E2)(W.u.)=44 4.
	340.3 5	9 3	[E1]		0.00555	
	441.0 5	100 2	E2		0.00963	
3411.1	436.7 5	100 10	(M1)		0.00927	Mult.: R(angular)=0.42 5 in ⁹⁶ Zr(¹⁸ O,5n γ).
	710.5 5	80 10	(E2)		0.00257	Mult.: R(angular)=1.20 15 in ⁹⁶ Zr(¹⁸ O,5n γ).
	1591.0 5	60 10				
3524.3	1702.8 5	100				Mult.: R(angular)=0.79 10, for 1701.8 γ +1702.8 γ in ⁹⁶ Zr(¹⁸ O,5n γ).
3524.41	141.4 5	1.08 21	(M1)		0.176 3	Mult.: R(angular)=0.99 14 in ⁹⁶ Zr(¹⁸ O,5n γ). B(M1)(W.u.)=0.0046 11.
	465.6 1	100 2	E2		0.00819	Mult.: $a_2/a_0=+0.303$ 16, $a_4/a_0=-0.109$ 19, $\text{pol}=+0.25$ 9 in ⁹⁶ Zr(¹⁶ O,3n γ), $a_2/a_0=+0.29$ 2, $a_4/a_0=-0.13$ 2 in (α ,3n γ), R(angular)=1.33 5, DCO(Q)=1.04 3 in ⁹⁶ Zr(¹⁸ O,5n γ), $T_{1/2}$ rules out M2. B(E2)(W.u.)=46 5.
	662.8 5	47.7 15	(E1+M2)	0.01 6	0.00112 5	
3549.0	195.0 5	26 3	M1(+E2)	-0.05 5	0.0738 13	Mult., δ : R(angular)=0.84 7, DCO(Q)=0.50 9 in ⁹⁶ Zr(¹⁸ O,5n γ).
	686.9 5	100 6	E2		0.00280	Mult.: R(angular)=1.54 8, DCO(Q)=1.28 14 in ⁹⁶ Zr(¹⁸ O,5n γ).
						B(E2)(W.u.)>44.
3570.1	287.5 5	14 3	(M1)		0.0266	Mult.: R(angular)=0.76 14 in ⁹⁶ Zr(¹⁸ O,5n γ).
	703.4 5	100 6	(M1)		0.00296	Mult.: R(angular)=1.0 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
3615.6	1793.8 5	100	(E2)		5.50 $\times 10^{-4}$	Mult.: R(angular)=1.8 4 in ⁹⁶ Zr(¹⁸ O,5n γ).
3620.6	561.6 5	100 14	(M1)		0.00503	Mult.: R(angular)=0.98 8 in ⁹⁶ Zr(¹⁸ O,5n γ).
	678.7 5	36 7				
	758.6 5	36 14	(E1)		8.42 $\times 10^{-4}$	Mult.: R(angular)=1.3 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
3837.1	267 1					
3897.6	487.0 5	<45				
	923.4 5	100 18	(E2)		1.37 $\times 10^{-3}$	Mult.: R(angular)=1.6 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
	1035.0 5	36 18				
3910.3	386.0 5	33 7	(E2)		0.01446	Mult.: R(angular)=1.1 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
						B(E2)(W.u.)>21.
	527.3 5	100 13	(M1)		0.00586	Mult.: R(angular)=0.59 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
	851.4 5	100 20	(E2)		1.65 $\times 10^{-3}$	Mult.: R(angular)=1.41 10 in ⁹⁶ Zr(¹⁸ O,5n γ).
						B(E2)(W.u.)>1.2.
	1048.4 5	27 7				
3939.8	415.0 5	56 2	M1+E2	0.29 5	0.01059 16	Mult.: $a_2/a_0=+0.04$ 3, $a_4/a_0=-0.02$ 5 from (α ,3n γ), R(angular)=1.30 6, DCO(Q)=0.87 5 in ⁹⁶ Zr(¹⁸ O,5n γ).
						B(M1)(W.u.)=0.027 4; B(E2)(W.u.)=11 4.
	556.8 1	100 3	E2		0.00491	Mult.: $a_2/a_0=+0.35$ 3, $a_4/a_0=-0.19$ 4 from (α ,3n γ), R(angular)=1.50 7, DCO(Q)=1.01 6 in ⁹⁶ Zr(¹⁸ O,5n γ), $T_{1/2}$ rules out M2. B(E2)(W.u.)=57 7.
4021.3	1159.0 5	100	(E2)		8.30 $\times 10^{-4}$	Mult.: $a_2/a_0=+0.26$ 5, $a_4/a_0=-0.10$ 6, $\text{pol}=+1.3$ 9 from ⁹⁶ Zr(¹⁶ O,3n γ), $a_2/a_0=+0.18$ 5, $a_4/a_0=-0.04$ 7 from (α ,3n γ), R(angular)=1.44 5, DCO(Q)=0.96 10 from ⁹⁶ Zr(¹⁸ O,5n γ).
4030.6	414.8 5	10 3	(M1)		0.01052	Mult.: R(angular)=0.90 12 ⁹⁶ Zr(¹⁸ O,5n γ).
	481.7 5	100 5	M1(+E2)	0.04 6	0.00729	Mult., δ : M; R(angular)=0.80 3, DCO(Q)=0.63 5 from ⁹⁶ Zr(¹⁸ O,5n γ).
	1168.5 5	13 3				
4088.6	1046.0 5	100	(E2)		1.03 $\times 10^{-3}$	Mult.: R(angular)=1.39 9 in ⁹⁶ Zr(¹⁸ O,5n γ).
4154.2	1292.0 5	100				
4232.3	611.8 5	32 7	(E2)		0.00380	Mult.: R(angular)=1.4 2 in ⁹⁶ Zr(¹⁸ O,5n γ).
	708.0 5	100 11	(M1)		0.00292	Mult.: R(angular)=0.53 6 in ⁹⁶ Zr(¹⁸ O,5n γ).

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Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{Cd})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult. [§]	$\delta^{\oplus}$	α	Comments
4232.3	849.5 5	18 7				
4246.2	721.8 5	100	E2		0.00247	Mult.: $a_2/a_0=+0.255$ 20, $a_4/a_0=-0.111$ 26, $\rho_1=+29$ 15 from $^{96}\text{Zr}(^{18}\text{O},3\text{n}\gamma)$, $a_2/a_0=+0.37$ 3, $a_4/a_0=-0.16$ 5 from $(\alpha,3\text{n}\gamma)$, $R(\text{angular})=1.37$ 5, $\text{DCO}(\text{Q})=1.06$ 7 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ limit rules out M2. $B(\text{E}2)(\text{W.u.})>24$.
4293.2	723.0 5	40 13				
	1426.6 5	100 9	(E2)		5.96×10^{-4}	Mult.: $R(\text{angular})=1.39$ 14 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
4296.0	926.4 5	100	(E2)		1.36×10^{-3}	Mult.: $R(\text{angular})=1.7$ 2, $\text{DCO}(\text{Q})=1.15$ 16 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
4414.1	577 1	100				
4431.9	811.3 5	100	(E2)		0.00185	Mult.: $R(\text{angular})=1.7$ 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
4458.7	1048.1 5	100 50	(E2)		1.03×10^{-3}	Mult.: $R(\text{angular})=1.7$ 3 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1596.0 5	50 25				
4591.2	1729.0 5	100	(E2)		5.46×10^{-4}	Mult.: $R(\text{angular})=1.5$ 4 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
4630.6	542.1 5	11 3	(M1)		0.00548	Mult.: $R(\text{angular})=0.76$ 9 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. $B(\text{M}1)(\text{W.u.})>0.0030$.
	600.0 5	100 5	(M1)		0.00430	$B(\text{M}1)(\text{W.u.})>0.020$.
	609.0 5	7.1 8	(E2)		0.00385	Mult.: $R(\text{angular})=1.30$ 12 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$. $B(\text{E}2)(\text{W.u.})>3.1$.
4697.7	787.4 5	100	(E2)		0.00199	Mult.: $R(\text{angular})=1.6$ 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
4724.5	478.0 5	9.8 18	M1 (+E2)	0.19 22	0.00743	Mult.: $R(\text{angular})=1.7$ 3, $\text{DCO}(\text{Q})=0.77$ 20 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	785.1 5	100 2	E2		0.00201	Mult.: $R(\text{angular})=1.48$ 6, $\text{DCO}(\text{Q})=1.07$ 6 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ limit rules out M2. $B(\text{E}2)(\text{W.u.})>18$.
4875.2	844.5 5	100				
4950.9	658 1					
	1381 1					
5050.7	754.7 5	23.2 12	E2		0.00221	Mult.: $R(\text{angular})=1.40$ 7, $\text{DCO}(\text{Q})=1.16$ 17 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2.
	804.3 5					
	1029.6 5	100 3	E2		1.07×10^{-3}	Mult.: $R(\text{angular})=1.54$ 6, $\text{DCO}(\text{Q})=1.04$ 16 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$, $T_{1/2}$ rules out M2.
5063.7	768.0 5	100				
5082.6	836.8 5	34 14				
	850.8 5	100 14	(E2)		1.65×10^{-3}	Mult.: $R(\text{angular})=1.26$ 12 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1142.0 5	<10				
5122.7	1225.1 5	100	(E2)		7.46×10^{-4}	Mult.: $R(\text{angular})=1.37$ 14 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5227.6	1612.0 5	100				
5254.6	624 1					
5261.1	1014.8 5	100	(E2)		1.10×10^{-3}	Mult.: $R(\text{angular})=1.40$ 13, $\text{DCO}(\text{Q})=0.94$ 8 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5279.7	216.4 5	11 3	(M1)		0.0558	Mult.: $R(\text{angular})=0.84$ 4 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	404.4 5	11 2	(M1)		0.01121	Mult.: $R(\text{angular})=0.85$ 11 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	649.0 5	100 8	(M1)		0.00357	Mult.: $R(\text{angular})=0.87$ 5, $\text{DCO}(\text{D})=1.09$ 21 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1191.2 5	5.6 14	(E2)		7.86×10^{-4}	Mult.: $R(\text{angular})=1.4$ 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
	1249.0 5	17 3	(E2)		7.21×10^{-4}	Mult.: $R(\text{angular})=1.6$ 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5287.6	1199 1					
5399.3	1378.0 5	100	(E2)		6.20×10^{-4}	Mult.: $R(\text{angular})=0.77$ 3, $\text{DCO}(\text{Q})=0.80$ 6 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5441.3	153 1					
	161.6 5	100	M1+E2	0.22 6	0.129 5	Mult.: $R(\text{angular})=0.77$ 3, $\text{DCO}(\text{Q})=0.80$ 6 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5623.0	1327.0 5	100				Mult.: $R(\text{angular})=1.0$ 2 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5650.5	700 1	100				
5671.7	974.0 5	100	(E2)		1.21×10^{-3}	Mult.: $R(\text{angular})=1.39$ 9 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5731.2	289.9 5	100	(M1)		0.0260	Mult.: $R(\text{angular})=0.81$ 3, $\text{DCO}(\text{D})=0.97$ 17 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.
5775.1	1050.6 5	100	(E2)		1.02×10^{-3}	Mult.: $R(\text{angular})=1.27$ 10, $\text{DCO}(\text{Q})=1.08$ 13 in $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Cd})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult. [§]	α	Comments
5788.0	1196 1				
5862.0	1271.0 5	100			
5954.8	223.6 5	100			
5971.4	920.7 5	100	E2	1.38×10^{-3}	Mult.: R(angular)=1.43 8, DCO(Q)=0.98 16 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, $T_{1/2}$ rules out M2.
5995.8	1271 1				
	2056 1				
6004.2	191 1				
	354 1				
	1280 1				
	1590 1				
	2064 1				
6154.6	1072.0 5	100	(E2)	9.78×10^{-4}	Mult.: R(angular)=1.5 2 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
6164.5	433.3 5	100	(M1)	0.00945	Mult.: R(angular)=0.81 5, DCO(Q)=0.59 8 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
6240.8	379.0 5		(E2)	0.01531	Mult.: R(angular)=0.84 5 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
	452 1				
6305.2	301.1 5	100	(M1)	0.0236	Mult.: R(angular)=0.78 5 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
	309 1				
6518.4	1257.3 5	100	(E2)	7.12×10^{-4}	Mult.: R(angular)=1.41 12, DCO(Q)=0.99 10 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
6572.7	1522.0 5	100			
6670.8	430 1	100			
6684.2	379 1	100			
6796.0	631.5 5	100	(M1)	0.00381	Mult.: R(angular)=0.88 6, DCO(D)=1.09 21 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
6861.8	1190.0 5	100			
7010.4	1039.0 5	100	(E2)	1.05×10^{-3}	Mult.: R(angular)=1.36 3 for 1039 γ +1040.7 γ , DCO(Q)=0.87 20 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7077.2	1302.0 5	100	(E2)	6.72×10^{-4}	Mult.: R(angular)=1.40 13, DCO(Q)=1.05 17 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7147.2	463.0 5	100	(M1)	0.00803	Mult.: R(angular)=1.1 2 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7384.6	1230.0 5	100	(E2)		
7555.0	759.0 5	100	(M1)	0.00248	Mult.: R(angular)=0.9 2 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7562.0	766 1				
7687.8	540.6 5	100	(M1)	0.00552	Mult.: R(angular)=0.97 11 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7908.8	1390.4 5	100	(E2)	6.13×10^{-4}	Mult.: R(angular)=1.29 11, DCO(Q)=0.85 20 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
7951.0	396 1	100			
8202.0	1191.6 5	100	(E2)	7.86×10^{-4}	Mult.: R(angular)=1.5 2, DCO(Q)=1.11 24 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
8264.8	577 1	100			
8598.6	1521.4 5	100	(E2)	5.64×10^{-4}	Mult.: R(angular)=1.5 2, DCO(Q)=0.91 18 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$.
8870.8	606 1	100			
9377.7	1468.9 5	100			
9502.8	632 1	100			
9569.0	1367.0 5	100	E2	6.27×10^{-4}	Mult.: R(angular)=1.40 14, DCO(Q)=0.86 17 in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, $T_{1/2}$ rules out M2. B(E2)(W.u.)=30.9 8.
10165.8	663 1	100			
10898	732 1	100			
11132.1	1563.0 5	100			
295.0+x	295 1	100			
634.0+x	339 1	100			
1054.0+x	420 1	100			
1542.0+x	488 1	100			
2100.0+x	558 1	100			
2727.0+x	627 1	100			

[†] From (p,n γ) up to E=2392 level and from $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$ after that, unless otherwise noted.[‡] From ^{109}In ϵ decay.[§] Based on R(angular) and DCO ratios in $^{96}\text{Zr}(^{18}\text{O},5n\gamma)$, ce data in ^{109}In ϵ decay, and $\gamma(\theta)$ in (p,n γ), (α ,3n γ) and $^{96}\text{Zr}(^{16}\text{O},3n\gamma)$.For $\Delta I=0$ dipole and $\Delta I=2$ quadrupole transitions R(angular)=1.3–1.5, for stretched dipole transitions R(angular)=0.80. Expected DCO values are: 0.56 for $\Delta J=1$, dipole and 1.0 for $\Delta J=2$, with gate on $\Delta J=2$ quadrupole; 1.0 for $\Delta J=1$, dipole, with gate on $\Delta J=1$ dipole.

1988Vi03 placed this transition from the 930 level, but confirmed by 1992Si05.

@ If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multiplicities.

& Multiply placed; undivided intensity given.

a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)(A) $\Delta J=2$, $\nu h11/2-$ (B) $\Delta J=2$, based on $17/2+$ (C) $\Delta J=2$, based on $19/2+$ (D) $\Delta J=2$, based on $(23/2+)$

Adopted Levels, Gammas (continued)(E) $\Delta J=2$, based on (21/2+)(F) $\Delta J=2$, based on
(13/2-)(G) $\Delta J=2$, based on (19/2-)(H) $\Delta J=2$, based on (21/2-)

Adopted Levels, Gammas (continued)

¹⁰⁹Cd IT Decay (11.8 μs)

Parent ¹⁰⁹Cd: E=59.9 5; Jπ=1/2+; T_{1/2}=11.8 μs 16; %IT decay=100.
 1968Iv02: (p,nγ) E=9-11 MeV. Measured E_γ, γ(t). Deduced T_{1/2}.
 1956Pe56: isomeric state was populated in ¹⁰⁹In ec decay. Measured E_γ, γ(t). Deduced T_{1/2}.

¹⁰⁹Cd Levels

E(level)	Jπ [†]	T _{1/2} [†]	Comments
0.0	5/2+	461.9 d 4	
59.9 5	1/2+	11.8 μs 16	T _{1/2} : weighted average of 11.7 μs 18 (1968Iv02) and 12 μs 3 (1956Pe56).

[†] From Adopted Levels.

γ(¹⁰⁹Cd)

E _γ	E(level)	I _γ [†]	Mult.	α	I(γ+ce) [†]	Comments
59.9 5	59.9	9.7 4	E2	9.3 4	100	E _γ , Mult.: from Adopted Gammas. I _γ : from I(γ+ce)=100 and conversion coefficient calculated by the BrICC program based on adopted multipolarity. Uncertainty is from Δα(th)=0.4 by BrICC.

[†] Absolute intensity per 100 decays.

Decay Scheme

Intensity: I(γ+ce)
 per 100 decays by
 this branch
 %IT=100

¹⁰⁹Cd IT Decay (10.6 μs)

Parent ¹⁰⁹Cd: E=462.7 4; Jπ=11/2-; T_{1/2}=10.6 μs 4; %IT decay=100.

1969Be37: (p,nγ) E=8.8 MeV. Measured Eγ, Iγ, I(ce), γ(t) with Ge(Li) and Si(Li) detectors. Deduced cc-ratio, T_{1/2} using a microwave pulsing method.

1966Mc06: (p,nγ) E=17.5 MeV. Measured Eγ, Iγ, γ(t) with Li-Ge detectors. Deduced T_{1/2}.

1964Br27: (γ,nγ). Measured Eγ, Iγ, γ(t) with NaI(Tl) detectors. Deduced T_{1/2}.

1968Iv02: (p,nγ) E=9-11 MeV. Measured Eγ, γ(t). Deduced T_{1/2}.

¹⁰⁹Cd Levels

E(level) [†]	Jπ [‡]	T _{1/2}	Comments
0.0	5/2+	461.9 d 4	T _{1/2} : from Adopted Levels.
203.20 20	7/2+		
462.7 4	11/2-	10.6 μs 4	T _{1/2} : weighted average of 10.4 μs 6 (1964Br27), 10.4 μs 10 (1966Mc06), 10.8 μs 16 (1968Iv02), 10.8 μs 7 in 1975Me22.

[†] From a least-squares fit to γ-ray energies.

[‡] From Adopted Levels.

γ(¹⁰⁹Cd)

Eγ [†]	E(level)	Iγ [‡] #	Mult.§	α
203.2 2	203.20	93.81 9	M1	0.0660 10
259.5 3	462.7	85.61 18	M2	0.1681 25

[†] From 1969Be37.

[‡] From I(γ+ce)(203γ)=I(γ+ce)(259 γ)=100 and calculated conversion coefficients by the BrICC program based on adopted multiplicities. Uncertainties are from Δα(th) by BrICC.

§ From Adopted Gammas. Arguments from this data are: α(K)exp(259.5γ)/α(K)exp(203.2γ)=2.06 23 (1969Be37), and Iγ(259.5γ)/Iγ(203.2γ)=0.9 (1966Mc06 and 1964Br27).

Absolute intensity per 100 decays.

Decay Scheme

Intensities: I(γ+ce) per
100 decays by this branch
%IT=100

^{109}In ϵ Decay 1970Ri06,1988Vi03

Parent ^{109}In : $E=0.0$; $J\pi=9/2+$; $T_{1/2}=4.159$ h 10; $Q(\text{g.s.})=2016$ 4; $\% \epsilon + \% \beta^+$ decay=100.

$^{109}\text{In}-J, T_{1/2}$: From Adopted Levels of ^{109}In .

$^{109}\text{In}-Q(\epsilon)$: From 2012Wa38.

1970Ri06: ^{109}In was made by irradiating natural Cadmium target with 28 MeV deuteron and 40 MeV proton. γ rays were detected with Ge(Li) and NaI(Tl) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced level scheme, γ -ray branching ratios.

1988Vi03: ^{109}In was made with $^{111}\text{Cd}(p,3n)$ by irradiating 10 mg/cm² cadmium foil (95% enriched) with 30 MeV protons. γ rays were detected with Ge(Li) and NaI(Tl) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced level scheme, γ -ray branching ratios. 1988Vi03 also report data for ^{109}In ϵ decay. The two measurements share the same data of γ -ray energies.

1972Ch56: ^{109}In activities were produced by bombarding 68.6% enriched ^{108}Cd with proton beams from the Calcutta cyclotron. γ rays were detected with Ge(Li) and NaI(Tl) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced level scheme, γ -ray branching ratios.

1971Ba08: ^{109}In sources were prepared by bombarding 88.4% enriched ^{106}Cd metal with 19-MeV α particles from the Yale Heavy-Ion Accelerator. γ rays were detected with two Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced level scheme, γ -ray branching ratios.

1969Di16: ^{109}In sources were produced using the $(\alpha,2n)$ reaction of 25 MeV α particles on natural silver or enriched ^{107}Ag targets. γ rays were detected with two Ge(Li) detectors (FWHM=5–10 keV at 511 keV). Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced levels, γ -ray branching ratios.

Other measurements: 1977Be19, 1977Sh05, 1966He11, 1962No06, 1956Pe56, 1951Mc11, 1949Ma20.

The decay scheme is from 1970Ri06 with corrections derived from $\gamma\gamma$ -coin in 1988Vi03.

The total average radiation energy released by ^{109}In ϵ decay is 2009 keV 17 (calculated by evaluators using the computer program radlst). This value agrees well with $Q(\beta^+)=2016$ keV 4 (2012Wa38) and shows the completeness of decay scheme.

 ^{109}Cd Levels

$E(\text{level})^\dagger$	$J\pi^\dagger$	$T_{1/2}^\dagger$	Comments
0.0	5/2+	461.9 d 4	
59.60 7	1/2+	11.8 μs 16	
203.40 5	7/2+	36 ps +6-1	
347.51 6	5/2+		$J\pi$: 3/2+ in 1970Ri06.
426.42 6	3/2+, 5/2+		
463.10 11	11/2-	10.6 μs 4	
623.88 7	7/2+	41 fs +25-15	
673.41 8	3/2+	55 fs +15-12	$J\pi$: (1/2+, 3/2+) in 1970Ri06.
721.67 7	5/2+	76 fs +21-13	
822.04 7	9/2+	90 fs +49-28	
891.25 7	3/2+, 5/2+	36 fs +8-6	
997.50 8	7/2+	64 fs +20-12	
1066.09 11	11/2+		$E(\text{level})$: this level is derived from (203 γ)(862 γ)-coin in (p, η) in 1988Vi03.
1105.83 9	(9/2+)	73 fs +38-24	
1132.91 21	7/2+	61 fs +32-18	
1173.48? 14	3/2+, 5/2+		$E(\text{level})$: reported only in 1988Vi03.
1219.01? 18			$E(\text{level})$: this level is reported only by 1988Vi03.
1352.15 7	(7/2)+		
1388.56 13	(7/2+, 9/2+)		$E(\text{level})$: this level is derived from 203 γ -1185 γ -coin in (p, η) (1988Vi03), not reported by 1970Ri06.
1430.1? 4	(7/2, 9/2+)		$E(\text{level})$: not reported by 1988Vi03.
1475.69 9	(7/2, 9/2)+		
1539.37 16	(7/2+, 9/2+)		
1622.46 8	(7/2)+		
1772.79 10	(7/2, 9/2)+		
1846.6? 10			$E(\text{level})$: only reported by 1970Ri06.
1861.42 10	(7/2+, 9/2+)		

† From Adopted Levels.

¹⁰⁹In ε Decay 1970Ri06,1988Vi03 (continued)

β⁺,ε Data

Eε	E(level)	Iβ ⁺	Iε [†]	Log <i>ft</i>	I(ε+β ⁺)
(155 4)	1861.42		0.033 6	6.27 9	0.033 6
(243 4)	1772.79		1.12 5	5.19 3	1.12 5
(394 4)	1622.46		8.07 15	4.785 13	8.07 15
(477 4)	1539.37		0.27 5	6.44 8	0.27 5
(540 4)	1475.69		4.72 18	5.308 18	4.72 18
(586 4)	1430.1?		0.06 3	7.28 22	0.06 3
(627 4)	1388.56		0.23 8	6.76 16	0.23 8
(664 4)	1352.15		8.05 19	5.263 12	8.05 19
(797 4)	1219.01?		0.134 15	7.20 5	0.134 15
(883 4)	1132.91		0.22 3	7.08 6	0.22 3
(910 4)	1105.83		0.75 4	6.576 24	0.75 4
(950 4)	1066.09		0.193 15	7.20 4	0.193 15
(1019 4)	997.50		4.6 2	5.888 20	4.6 2
(1194 4)	822.04		0.75 22	6.82 13	0.75 22
(1392 4)	623.88	0.0223 14	5.33 25	6.102 21	5.35 25
(1553 4)	463.10	0.0010 3	0.060 18	8.15 13	0.061 18
(1813 4)	203.40	4.62 10	63.4 6	5.259 5	68.0 6

[†] Deduced from I(γ+ce) intensity balances by assuming no β⁻ feeding g.s.

γ(¹⁰⁹Cd)

Iγ normalization: from ΣIγ (to g.s.)=100%, by assuming no direct β⁺ feeding to the g.s. (Jπ=5/2+).

Eγ [†]	E(level)	Iγ ^a	Mult.&	α	Comments
59.6 2	59.60	0.25 6	E2	9.45 18	%Iγ=0.19 5, using the calculated normalization. Eγ: 59.6 2 from weighted average of 59.9 5 (1970Ri06), 59.5 3 (1971Ba08), 59.6 5 (1972Ch56) and 60 1 (1969Di16). Iγ: from 1969Di16. Mult.: α(exp)=13 3 (1956Pe56), K/L=0.85 8 (1956Pe56), 1.3 5 (1962No06).
x74.8§b x84.1§b 169.3@ 3 x174.7§	891.25	=3§ =4§ 0.008@ 3 =0.2§			
203.3 1	203.40	100	M1	0.0658	%Iγ=74.2 5, using the calculated normalization. Eγ: 203.4 1 from weighted average of 204.6 4 (1969Di16), 203.5 2 (1970Ri06), 203.3 3 (1971Ba08), 203.6 5 (1972Ch56) and 203.3 1 (1988Vi03). Mult.: α(exp)=0.07 1 and K/L=7.6 4 (1956Pe56), K/(L+M)=7 1 (1962No06). δ=-0.13 4 (1977Be19, Hyperfine field). Eγ: 223.0 1 from weighted average of 223.1 2 (1970Ri06), 223.0 3 (1971Ba08), and 223.0 1 (1988Vi03). Iγ: 0.16 5 from weighted average of 0.10 2 (1970Ri06), 0.20 3 (1971Ba08), and 0.21 2 (1988Vi03).
223.0 1	426.42	0.26± 5			
243.8@ 5 259.7 1	1066.09 463.10	0.021@ 3 0.07 2	(M1) M2	0.1679	Eγ: 259.6 1 from weighted average of 259 2 (1970Ri06), 259.1 3 (1971Ba08), and 259.7 1 (1988Vi03). Iγ: weighted average of 0.08 1 (1971Ba08) and 0.04 2 (1988Vi03). Mult.: α(K)exp=0.12 2 from ratio α(K)exp(259.5γ)/α(K)exp(203.5γ)=2.06 23 (1969Be37). K/(L+M)=2.4 8 (1962No06).
288.1 1	347.51	2.04± 15	E2	0.0371	Eγ: 288.1 1 from weighted average of 289.1 4 (1969Di16), 288.4 8 (1970Ri06), 287.7 3 (1971Ba08), 287.8 5 (1972Ch56), and 288.1 1 (1988Vi03). Iγ: 2.10 7 from weighted average of 2.29 18 (1969Di16), 2.4 2 (1970Ri06), 2.10 11 (1971Ba08), 1.98 23 (1972Ch56), and 2.0 1 (1988Vi03). Mult.: α(exp)=0.04 1, K/L=5.0 (1956Pe56), K/(L+M)=6.6 15 (1962No06).

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^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^a$	Mult.&	α	Comments
$\times 305.6^{\#} 3$		$0.06^{\#} 3$			$E\gamma$: unplaced by evaluators. 1988Vi03 placed this γ from the 930 level in (p,n γ).
324.4 2	997.50	$0.52^{\ddagger} 4$			$E\gamma$: 324.4 2 from weighted average of 324.3 5 (1970Ri06), 324.4 3 (1971Ba08), 324.7 5 (1972Ch56), and 324.4 3 (1988Vi03). Other: 325.3 5 from 1969Di16. $I\gamma$: 0.51 2 from weighted average of 0.50 3 (1971Ba08) and 0.51 3 (1988Vi03). Others: 1.2 1 for the 324.3+326.6 doublet (1970Ri06), 1.39 28 (1972Ch56) for the doublet, 1.24 14 (1969Di16) for the doublet.
326.3 2	673.41	$0.74^{\ddagger} 7$			$E\gamma$: 326.3 2 from weighted average of 326.6 5 (1970Ri06), 326.3 3 (1971Ba08), and 326.3 2 (1988Vi03). $I\gamma$: 0.73 3 from weighted average of 0.73 4 (1971Ba08) and 0.72 5 (1988Vi03). Others: 1.2 1 for the 324.3+326.6 doublet (1970Ri06), 1.39 28 (1972Ch56) for the doublet, 1.24 14 (1969Di16) for the doublet.
347.5 1	347.51	2.72 10	M1, E2	0.0183 19	% $I\gamma$ =2.02 8, using the calculated normalization. $E\gamma$: 347.5 1 from weighted average of 348.3 5 (1969Di16), 347.5 3 (1970Ri06), 347.4 3 (1971Ba08), 347.5 5 (1972Ch56), and 347.5 1 (1988Vi03). $I\gamma$: weighted average of 2.54 16 (1969Di16), 3.0 2 (1970Ri06), 2.7 15 (1971Ba08), 2.5 3 (1972Ch56), and 2.8 2 (1988Vi03). Mult.: $\alpha(\text{exp})=0.020 8$, $\alpha(\text{exp})=0.020 8$ from K/L=5.1 5 (1956Pe56), K/(L+M)=7 5 (1962No06).
374.3@ 4	721.67	$0.025^{\textcircled{a}} 5$			
420.6 1	623.88	$1.22^{\ddagger} 12$	(M1)		$E\gamma$: 420.6 1 from weighted average of 420.5 4 (1970Ri06), 420.5 3 (1971Ba08), 420.9 5 (1972Ch56), and 420.6 1 (1988Vi03). $I\gamma$: 1.12 10 from weighted average of 1.35 10 (1970Ri06), 1.00 6 (1971Ba08), 1.63 19 (1972Ch56), and 1.10 8 (1988Vi03).
426.3 1	426.42	5.46 16	M1, E2	0.0102 5	% $I\gamma$ =4.05 12, using the calculated normalization. $E\gamma$: 426.3 1 from weighted average of 427.0 5 (1969Di16), 426.2 3 (1970Ri06), 426.2 3 (1971Ba08), 426.4 5 (1972Ch56), and 426.3 1 (1988Vi03). $I\gamma$: weighted average of 4.9 3 (1969Di16), 5.75 20 (1970Ri06), 5.3 3 (1971Ba08), 5.7 4 (1972Ch56), and 5.4 3 (1988Vi03). Mult.: $\alpha(\text{exp})=0.014 5$ from K/L=8 1 (1956Pe56), K/(L+M)=8 2 (1962No06).
461.4 4	1352.15	$0.14^{\ddagger} 2$			$E\gamma$: 461.4 4 from 1970Ri06 only. $I\gamma$: 0.14 2 from 1970Ri06 only.
464.8@ 2	891.25	$0.026^{\textcircled{a}} 4$			
470.4@ 2	673.41	$0.084^{\textcircled{a}} 12$			
482.3 2	1105.83	$0.113^{\ddagger} 15$	(M1+E2)		$E\gamma$: 482.3 2 from weighted average of 482.2 4 (1970Ri06), 482.6 3 (1971Ba08), and 482.2 2 (1988Vi03). $I\gamma$: 0.12 2 from weighted average of 0.17 3 (1970Ri06), 0.11 2 (1971Ba08), and 0.11 2 (1988Vi03).
497.2@ 2	1219.01?	$0.28^{\textcircled{a}} 6$			
518.2 5	721.67	$0.010^{\textcircled{a}} 5$			$E\gamma$: seen in coincidence with 203 γ in 1971Ba08, also in (p,n γ) in 1988Vi03.
529.9 2	1352.15	$0.75^{\ddagger} 5$			$E\gamma$: 529.9 2 from weighted average of 530.8 5 (1969Di16), 529.3 4 (1970Ri06), 529.7 5 (1971Ba08), 529.7 7 (1972Ch56), and 530.1 3 (1988Vi03). $I\gamma$: 0.75 5 from weighted average of 0.93 8 (1969Di16), 0.80 4 (1970Ri06), 0.69 5 (1971Ba08), 1.02 19 (1972Ch56), and 0.65 5 (1988Vi03).
542 2	1539.37	$0.10^{\ddagger} 1$			$E\gamma$: 542 2 from 1970Ri06 only. $I\gamma$: 0.10 1 from 1970Ri06 only.
$\times 546.1 4$		0.05 3			$E\gamma$: weighted average of 546.0 6 (1988Vi03) and 546.1 5 (1971Ba08). $I\gamma$: from 1988Vi03. Other: 0.7 (1971Ba08).
549.4 ^b 2	1173.48?	0.02 1			$E\gamma$: 549.4 2 from 1988Vi03 only.

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^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^a$	Mult.&	α	Comments
571.0 4	997.50	0.37 $\frac{+}{-}$ 5			$E\gamma$: 570.4 5 from this dataset. $I\gamma$: 0.09 4 from this dataset.
*580.9 5		0.11 3			$E\gamma, I\gamma$: from 1970Ri06. 1969Di16 placed a 578 1 transition of $I\gamma=0.20$ 3 from the 1773 level.
584.3 2	1475.69	0.30 $\frac{+}{-}$ 5			$E\gamma$: 584.3 2 from weighted average of 583.8 5 (1970Ri06), 584.2 5 (1971Ba08), and 584.6 3 (1988Vi03). $I\gamma$: 0.30 5 from unweighted average of 0.40 3 (1970Ri06), 0.24 2 (1971Ba08), and 0.25 2 (1988Vi03).
*599.6 5		<0.3			$E\gamma$: weighted average of 599.3 5 (1970Ri06) and 600.3 7 (1972Ch56). $I\gamma$: from 1972Ch56. $I\gamma<0.3$ from 1970Ri06.
613.6 1	673.41	3.0 2	M1	0.00377	$E\gamma$: 613.6 1 from weighted average of 614 1 (1969Di16), 613.6 4 (1970Ri06), 614.0 5 (1971Ba08), and 613.6 1 (1988Vi03). $I\gamma$: weighted average of 2.8 4 (1969Di16), 3.4 3 (1970Ri06), 2.8 4 (1971Ba08), and 2.8 3 (1988Vi03).
618.5 1	822.04	2.6 2	M1	0.00400	$E\gamma$: 618.5 1 from weighted average of 619.0 5 (1970Ri06), 619.3 5 (1971Ba08), 618.8 10 (1972Ch56), and 618.4 1 (1988Vi03). $I\gamma$: weighted average of 2.4 3 (1970Ri06), 2.6 4 (1971Ba08), 3.0 3 (1972Ch56), and 2.3 3 (1988Vi03).
623.8 1	623.88	7.6 3	M1	0.00392	% $I\gamma=5.64$ 22, using the calculated normalization. $E\gamma$: 623.8 1 from weighted average of 623.0 5 (1969Di16), 623.5 4 (1970Ri06), 623.8 5 (1971Ba08), 623.7 10 (1972Ch56), and 623.8 1 (1988Vi03). $I\gamma$: weighted average of 7.9 8 (1969Di16), 8.2 4 (1970Ri06), 7.1 6 (1971Ba08), 7.3 6 (1972Ch56), and 6.9 6 (1988Vi03).
630.3 3	1352.15	0.10 $\frac{+}{-}$ 1			Mult.: $\alpha(\text{exp})=0.0032$ 15 (1956Pe56). $E\gamma$: 630.3 3 from weighted average of 629.9 6 (1970Ri06), 630.8 5 (1971Ba08), and 630.2 4 (1988Vi03). $I\gamma$: 0.10 1 from weighted average of 0.10 3 (1970Ri06), 0.10 1 (1971Ba08), and 0.10 2 (1988Vi03).
650.0 1	997.50	4.0 2	(M1)	0.00324	$E\gamma$: 650.0 1 from weighted average of 651.0 5 (1969Di16), 649.8 4 (1970Ri06), 650.1 5 (1971Ba08), 650.1 10 (1972Ch56), and 650.0 1 (1988Vi03). $I\gamma$: weighted average of 4.1 3 (1970Ri06), 3.8 4 (1971Ba08), 4.4 4 (1972Ch56), and 3.7 3 (1988Vi03). Other: 5.9 4 (1969Di16).
653.4 2	1475.69	2.2 2			$E\gamma$: 653.4 2 from weighted average of 652.9 4 (1970Ri06), 653.4 5 (1971Ba08), 653.5 10 (1972Ch56), and 653.6 3 (1988Vi03). $I\gamma$: unweighted average of 2.6 2 (1970Ri06), 1.9 4 (1971Ba08), 2.3 3 (1972Ch56), and 1.8 1 (1988Vi03).
678.6 2	1352.15	1.12 $\frac{+}{-}$ 8			$E\gamma$: 678.6 2 from weighted average of 677.5 5 (1969Di16), 678.8 4 (1970Ri06), 678.9 5 (1971Ba08), 679.0 7 (1972Ch56), and 678.8 3 (1988Vi03). $I\gamma$: 1.12 7 from weighted average of 0.93 8 (1969Di16), 1.35 10 (1970Ri06), 1.12 7 (1971Ba08), 1.19 24 (1972Ch56), and 1.2 1 (1988Vi03).
679.5@ 5	1105.83	0.060@ 9			
*692.3 3		0.25 2			$E\gamma$: weighted average of 691.8 4 (1970Ri06), 692.3 5 (1971Ba08), 692.6 7 (1972Ch56) and 692.9 5 (1988Vi03). $I\gamma$: weighted average of 0.26 3 (1970Ri06), 0.24 2 (1971Ba08), 0.35 23 (1972Ch56) and 0.23 4 (1988Vi03).
*704.4 4		0.10 2			$E\gamma$: weighted average of 704.0 6 (1970Ri06) and 704.6 5 (1971Ba08). $I\gamma$: from 1971Ba08. $I\gamma<0.1$ in 1970Ri06.

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^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^a$	Mult.&	α	Comments
721.8 1	721.67	0.99 6			%I γ =0.73 5, using the calculated normalization. E γ : 721.8 1 from weighted average of 721.0 5 (1969Di16), 721.5 4 (1970Ri06), 721.5 5 (1971Ba08), 721.9 10 (1972Ch56), and 721.8 1 (1988Vi03). I γ : weighted average of 0.93 8 (1969Di16), 1.22 10 (1970Ri06), 0.91 5 (1971Ba08), 1.4 3 (1972Ch56), and 1.05 8 (1988Vi03).
728.1 3	1352.15	0.36 $\frac{1}{2}$ 2			E γ : 728.1 3 from weighted average of 727.4 5 (1970Ri06), 728.2 5 (1971Ba08), 728.8 10 (1972Ch56), and 728.3 4 (1988Vi03). I γ : 0.36 2 from weighted average of 0.35 5 (1970Ri06), 0.34 3 (1971Ba08), 0.56 18 (1972Ch56), and 0.38 3 (1988Vi03).
731.0 4	1622.46	0.46 $\frac{1}{2}$ 4			E γ : 731.0 4 from weighted average of 729.7 5 (1969Di16), 730.9 5 (1970Ri06), 731.6 5 (1971Ba08), 732.2 10 (1972Ch56), and 731.6 6 (1988Vi03). I γ : 0.46 4 from weighted average of 0.68 7 (1969Di16), 0.53 5 (1970Ri06), 0.40 3 (1971Ba08), 0.64 23 (1972Ch56), and 0.45 4 (1988Vi03).
746.9@ 4	1173.48?	0.008@ 4			I γ : normalized to I(549.2 γ)=0.02 1 based on I(746.9 γ)/I(549.4 γ)=(33 4)/(79 4) in Adopted Gammas.
753.8 4	1475.69	0.51 $\frac{1}{2}$ 3			E γ : 753.8 4 from weighted average of 752.5 5 (1969Di16), 753.9 6 (1970Ri06), 754.4 5 (1971Ba08), 754.6 7 (1972Ch56), and 754.0 6 (1988Vi03). I γ : 0.51 3 from weighted average of 0.41 6 (1969Di16), 0.6 1 (1970Ri06), 0.55 4 (1971Ba08), 0.6 3 (1972Ch56), and 0.49 4 (1988Vi03).
764.5@ 4	1388.56	0.032@ 9			
^x 765.6 6		0.06 1			E γ ,I γ : seen only by 1971Ba08.
793.9 1	997.50	0.79 $\frac{1}{2}$ 8			E γ : 794.0 3 from weighted average of 793.9 4 (1970Ri06), 794.0 5 (1971Ba08), and 794.7 10 (1972Ch56). Other: 792.5 5 (1969Di16). I γ : 0.80 8 from weighted average of 0.8 2 (1970Ri06), 0.74 6 (1971Ba08), 0.99 13 (1969Di16), and 1.4 3 (1972Ch56).
800.3 3	1622.46	0.40 $\frac{1}{2}$ 3			E γ : 800.3 3 from weighted average of 800.0 6 (1970Ri06), 800.3 5 (1971Ba08), 800.4 10 (1972Ch56), 800.4 6 (1988Vi03) and 800 2 (1969Di16). I γ : 0.40 3 from weighted average of 0.48 5 (1970Ri06), 0.42 4 (1971Ba08), 0.5 3 (1972Ch56) and 0.35 4 (1988Vi03). Other: 0.12 3 (1969Di16).
822.0 1	822.04	1.77 $\frac{1}{2}$ 18	E2		%I γ =1.31 14, using the calculated normalization. E γ : 822.0 1 from weighted average of 822 1 (1969Di16), 822.5 5 (1970Ri06), 822.5 5 (1971Ba08), 823.1 7 (1972Ch56), and 821.9 1 (1988Vi03). I γ : 1.75 6 from weighted average of 1.68 15 (1969Di16), 1.9 1 (1970Ri06), 1.74 8 (1971Ba08), 2.1 3 (1972Ch56), and 1.6 1 (1988Vi03).
826.2@ 2	1173.48?	0.025@ 13			I γ : normalized to I(549.2 γ)=0.02 1 based on I(826.2 γ)/I(549.4 γ)=(100 8)/(79 4) in Adopted Gammas.
831.7 1	891.25	0.34 3			E γ : 831.7 1 from weighted average of 832 1 (1969Di16), 832.2 10 (1970Ri06), 831.5 5 (1971Ba08), 831.8 10 (1972Ch56), and 831.7 1 (1988Vi03). I γ : weighted average of 0.34 5 (1970Ri06) and 0.34 3 (1971Ba08). Others: 0.18 2 (1969Di16), 0.24 2 (1988Vi03), 0.8 3 (1972Ch56).
^x 843.0 6		0.10 2			E γ : weighted average of 842.5 5 (1971Ba08) and 843.7 6 (1988Vi03). I γ : weighted average of 0.10 2 (1971Ba08) and 0.12 4 (1988Vi03).

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^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E_{\gamma}^{\dagger}$	E(level)	I_{γ}^a	Mult.&	α	Comments
851.8 3	1475.69	0.19 $\frac{+}{-}$ 1			E γ : 851.8 3 from weighted average of 851 1 (1969Di16), 852.3 5 (1970Ri06), 851.6 5 (1971Ba08), 851.5 10 (1972Ch56), and 851.9 5 (1988Vi03). I γ : 0.19 1 from weighted average of 0.18 2 (1969Di16), 0.35 10 (1970Ri06), 0.23 4 (1971Ba08), 0.4 3 (1972Ch56), and 0.19 2 (1988Vi03).
862.7 1	1066.09	0.26 2	E2	1.60 $\times 10^{-3}$	E γ : 862.7 1 from weighted average of 864 1 (1969Di16), 862.2 6 (1970Ri06), 863.2 5 (1971Ba08), 863.2 10 (1972Ch56), and 862.7 1 (1988Vi03). E γ : this placement is proposed by 1988Vi03 based on observed 203 γ -862 γ -coin in (p,n γ); 1970Ri06 placed this transition from the 1861 level. I γ : weighted average of 0.15 12 (1969Di16), 0.23 7 (1970Ri06), 0.24 3 (1971Ba08), 0.4 3 (1972Ch56), and 0.29 3 (1988Vi03). E γ : 871.8 3 from 1988Vi03 only. %I γ =0.193 23, using the calculated normalization. E γ : 891.2 1 from weighted average of 890 1 (1969Di16), 890.5 6 (1970Ri06), 890.8 5 (1971Ba08), and 891.2 1 (1988Vi03). I γ : 0.31 3 from weighted average of 0.29 3 (1969Di16), 0.38 7 (1970Ri06), 0.28 3 (1971Ba08), and 0.35 3 (1988Vi03).
871.8 3	1219.01?	0.18 2			
891.2 1	891.25	0.26 $\frac{+}{-}$ 3			
901.7 ^c 2	1622.46	0.50 $\frac{+}{-}$ ^c 3			E γ : 901.7 2 from weighted average of 901 1 (1969Di16), 900.7 6 (1970Ri06), 901.6 5 (1971Ba08), 901.9 10 (1972Ch56) and 901.8 2 (1988Vi03). Also placed as a transition from E=1622 level. I γ : 0.50 3 from weighted average of 0.44 5 (1969Di16), 0.64 10 (1970Ri06), 0.50 4 (1971Ba08), 0.7 3 (1972Ch56) and 0.6 1 (1988Vi03).
901.8 ^c 2	1105.83	0.17 $\frac{+}{-}$ ^c 3	(M1+E2)		E γ : 901.7 2 from weighted average of 901 1 (1969Di16), 900.7 6 (1970Ri06), 901.6 5 (1971Ba08), 901.9 10 (1972Ch56) and 901.8 2 (1988Vi03). Also placed as a transition from E=1622 level. I γ : 0.50 3 from weighted average of 0.44 5 (1969Di16), 0.64 10 (1970Ri06), 0.50 4 (1971Ba08), 0.7 3 (1972Ch56) and 0.6 1 (1988Vi03).
925.6 3	1352.15	0.96 $\frac{+}{-}$ 7			E γ : 925.6 3 from weighted average of 925.8 5 (1970Ri06), 925.8 5 (1971Ba08), 926.4 10 (1972Ch56), and 925.3 4 (1988Vi03). I γ : 0.96 7 from weighted average of 1.2 2 (1970Ri06), 1.00 7 (1971Ba08), 1.2 3 (1972Ch56), and 0.8 1 (1988Vi03).
929.5 2	1132.91	0.30 4			E γ : 929.5 2 from weighted average of 930.3 5 (1970Ri06), 930.4 5 (1971Ba08), 931.3 10 (1972Ch56), and 929.4 1 (1988Vi03). 1988Vi03 placed this transition from the 930 level in (p,n γ). I γ : weighted average of 0.4 1 (1970Ri06), 0.27 5 (1971Ba08), and 0.3 1 (1988Vi03). Other: 1.0 3 (1972Ch56).
948.9 2	1622.46	1.96 $\frac{+}{-}$ 7			E γ : 948.9 2 from weighted average of 949.1 5 (1970Ri06), 949.2 5 (1971Ba08), and 949.3 10 (1972Ch56). I γ : 1.96 7 from weighted average of 2.1 3 (1970Ri06), 2.00 12 (1971Ba08), and 2.1 3 (1972Ch56). Other: 1.24 9 (1969Di16).
962.2 2	1388.56	0.044 $\frac{+}{-}$ 12			E γ : 962.2 2 from weighted average of 962.2 3 (1988Vi03) and 962.6 7 (1970I γ 6). Placed by 1988Vi03, this γ was unplaced in 1970Ri06. 1988Vi03 also placed this γ from the 1425 level in (p,n γ). I γ : 0.03 2 from 1988Vi03. Other: 0.13 3 (1970Ri06).
^x 969.5 [#] 3		0.12 [#] 7			

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^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^a$	Mult.&	α	Comments
998.5 c 3	997.50	0.87 $\frac{3}{2}$ c 8			%I γ =0.65 6, using the calculated normalization. E γ : 998.5 3 from weighted average of 998 1 (1969Di16), 998.5 6 (1970Ri06), 998.7 5 (1971Ba08), 998.2 10 (1972Ch56), and 998.5 4 (1988Vi03). I γ : 0.87 5 from weighted average of 0.99 13 (1969Di16), 0.97 5 (1970Ri06), 0.77 5 (1971Ba08), 1.1 3 (1972Ch56), and 0.8 1 (1988Vi03).
	1622.46	0.87 $\frac{3}{2}$ c 5			E γ : 998.5 3 from weighted average of 998 1 (1969Di16), 998.5 6 (1970Ri06), 998.7 5 (1971Ba08), 998.2 10 (1972Ch56), and 998.5 4 (1988Vi03). I γ : 0.87 5 from weighted average of 0.99 13 (1969Di16), 0.97 5 (1970Ri06), 0.77 5 (1971Ba08), 1.1 3 (1972Ch56), and 0.8 1 (1988Vi03).
1004.8 3	1352.15	0.30 $\frac{3}{2}$ 2			E γ : 1004.8 3 from weighted average of 1004.1 7 (1970Ri06), 1005.0 5 (1971Ba08), 1004.9 10 (1972Ch56), and 1005.0 6 (1988Vi03). I γ : 0.30 2 from weighted average of 0.30 3 (1970Ri06), 0.30 3 (1971Ba08), 0.35 20 (1972Ch56), and 0.25 6 (1988Vi03).
1049.4 2	1475.69	1.58 $\frac{3}{2}$ 5			E γ : 1049.4 2 from weighted average of 1048.5 5 (1969Di16), 1049.7 6 (1970Ri06), 1049.8 5 (1971Ba08), 1049.6 10 (1972Ch56), and 1049.5 3 (1988Vi03). I γ : 1.58 5 from weighted average of 1.76 18 (1969Di16), 1.58 8 (1970Ri06), 1.5 1 (1971Ba08), 1.5 3 (1972Ch56), and 1.6 1 (1988Vi03).
*1061.5# 2		0.05# 2			E γ : unplaced by evaluators. 1988Vi03 placed this γ from the 1121 level in (p,n γ).
*1066.2 ^b 2		0.09			E γ : unplaced by evaluators. 1988Vi03 placed this γ from the 1789 level in (p,n γ).
1105.9 1	1105.83	0.39 2	(E2)	9.15 $\times 10^{-4}$	%I γ =0.289 15, using the calculated normalization. E γ : 1105.9 1 from weighted average of 1106.0 5 (1969Di16), 1106.2 8 (1970Ri06), 1106.0 5 (1971Ba08), 1105.9 10 (1972Ch56), and 1105.9 1 (1988Vi03). I γ : weighted average of 0.43 4 (1970Ri06), 0.38 4 (1971Ba08), 0.4 3 (1972Ch56), and 0.36 4 (1988Vi03). Other: 0.74 7 (1969Di16).
1113.0 3	1539.37	0.11 $\frac{3}{2}$ 6			E γ : 1113.0 3 from 1988Vi03 only.
1128.4 3	1475.69	0.15 $\frac{3}{2}$ 6			I γ : 0.11 6 from 1988Vi03 only.
1148.5 2	1352.15	6.3 2			E γ : 1128.4 3 from 1988Vi03 only.
					I γ : 0.15 6 from 1988Vi03 only.
1185.0 3	1388.56	0.032 $\frac{3}{2}$ 9			E γ : 1148.5 2 from weighted average of 1148.0 5 (1969Di16), 1149.1 6 (1970Ri06), 1148.8 5 (1971Ba08), 1148.6 10 (1972Ch56), and 1148.5 2 (1988Vi03). 1971Ba08 also placed this γ from the 1773 level. I γ : weighted average of 6.2 4 (1969Di16), 5.9 5 (1970Ri06), 7.0 4 (1971Ba08), 6.4 6 (1972Ch56), and 6.0 4 (1988Vi03).
1195.7 2	1622.46	2.21 $\frac{3}{2}$ 8			E γ : 1186.8 10 from 1970Ri06 only. This γ was not seen by 1988Vi03 in ^{109}In ϵ decay but seen in their (p,n γ) measurements. Placed by evaluators based on (p,n γ). I γ : <0.4 from 1970Ri06 in this dataset.
					E γ : 1195.7 2 from weighted average of 1195 1 (1969Di16), 1196.5 6 (1970Ri06), 1196.2 5 (1971Ba08), 1196.1 10 (1972Ch56), and 1195.6 2 (1988Vi03).
					I γ : 2.21 8 from weighted average of 2.5 2 (1969Di16), 2.4 3 (1970Ri06), 2.20 12 (1971Ba08), 2.6 4 (1972Ch56), and 2.1 1 (1988Vi03).
1272.6 2	1475.69	0.77 $\frac{3}{2}$ 3			E γ : 1272.6 2 from weighted average of 1272.9 7 (1970Ri06), 1272.6 5 (1971Ba08), 1272 1 (1972Ch56), 1271 2 (1969Di16) and 1272.6 3 (1988Vi03). 1972Ch56 also placed this γ from a level at 1272. I γ : 0.77 3 from weighted average of 0.80 5 (1970Ri06), 0.77 5 (1971Ba08), 0.8 3 (1972Ch56), 0.81 8 (1969Di16) and 0.72 6 (1988Vi03).

Continued on next page (footnotes at end of table)

^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^a$	Comments
1336.1@ 4	1539.37	0.09@ 2	
1346.4 1	1772.79	0.79 5	E γ : 1346.4 1 from weighted average of 1346.9 7 (1970Ri06), 1346.6 5 (1971Ba08), 1346.3 15 (1972Ch56), and 1346.4 1 (1988Vi03). I γ : weighted average of 0.80 5 (1970Ri06), 1.0 3 (1972Ch56), and 0.72 10 (1988Vi03). Other: 0.28 3 (1971Ba08).
1352.3 1	1352.15	0.96 $\frac{\ddagger}{2}$ 4	%I γ =0.71 3, using the calculated normalization. E γ : 1352.3 1 from weighted average of 1352.3 7 (1970Ri06), 1352.2 5 (1971Ba08), 1351.9 15 (1972Ch56), and 1352.3 1 (1988Vi03). I γ : 0.96 4 from weighted average of 1.0 1 (1970Ri06), 0.99 6 (1971Ba08), 1.2 3 (1972Ch56), and 0.86 8 (1988Vi03).
1388.6 2	1388.56	0.08 2	%I γ =0.059 15, using the calculated normalization. E γ : 1388.8 3 from weighted average of 1388.2 10 (1970Ri06), 1389.9 5 (1971Ba08), and 1388.6 2 (1988Vi03). Placed by 1988Vi03, but 1970Ri06 placed this γ from a level at 1847. I γ : weighted average of 0.05 2 (1970Ri06), 0.11 2 (1971Ba08), and 0.07 4 (1988Vi03).
1419.0 1	1622.46	1.68 $\frac{\ddagger}{2}$ 6	E γ : 1419.0 1 from weighted average of 1418 1 (1969Di16), 1419.2 7 (1970Ri06), 1419.1 5 (1971Ba08), 1419.3 10 (1972Ch56), and 1419.0 1 (1988Vi03). I γ : 1.68 6 from weighted average of 1.47 15 (1969Di16), 1.8 2 (1970Ri06), 1.74 11 (1971Ba08), 1.9 3 (1972Ch56), and 1.66 10 (1988Vi03).
1430.1 4	1430.1?	0.08 4	%I γ =0.06 3, using the calculated normalization. E γ : 1430.1 4 from weighted average of 1429.8 10 (1970Ri06) and 1430.2 4 (1988Vi03). Seen by 1988Vi03 in both ^{109}In ϵ decay and (p, γ) but 1988Vi03 placed this γ from the 1633 level in (p, γ), which is not populated in ^{109}In ϵ decay.
1475.6 2	1475.69	0.66 $\frac{\ddagger}{2}$ 4	I γ : unweighted average of 0.12 3 (1970Ri06) and 0.04 2 (1988Vi03). %I γ =0.49 3, using the calculated normalization. E γ : 1475.6 2 from weighted average of 1473 1 (1969Di16), 1475.8 7 (1970Ri06), 1475.6 5 (1971Ba08), 1475.6 10 (1972Ch56), and 1475.7 2 (1988Vi03). I γ : 0.66 4 from weighted average of 0.74 15 (1969Di16), 0.6 1 (1970Ri06), 0.69 5 (1971Ba08), 0.74 22 (1972Ch56), and 0.61 7 (1988Vi03).
$^{*}1521.7^{\#}$ 2		0.09 $^{\#}$ 5	E γ : unplaced by evaluators. 1988Vi03 placed this γ from the 1869 level in (p, γ).
$^{*}1535^b$ 2		0.18 2	E γ ,I γ : from 1969Di16 only.
1539.3 2	1539.37	0.16 2	%I γ =0.119 15, using the calculated normalization. E γ : 1539.4 2 from weighted average of 1539.3 10 (1970Ri06), 1539.8 5 (1971Ba08), 1539.0 15 (1972Ch56), and 1539.3 2 (1988Vi03). I γ : weighted average of 0.19 3 (1970Ri06), 0.15 2 (1971Ba08), 0.33 16 (1972Ch56), and 0.13 5 (1988Vi03).
1569.9 4	1772.79	0.15 $\frac{\ddagger}{2}$ 2	E γ : 1569.9 4 from weighted average of 1567 2 (1969Di16), 1569 1 (1970Ri06), 1570.7 5 (1971Ba08), 1570.0 15 (1972Ch56), and 1569.5 5 (1988Vi03). I γ : 0.15 2 from weighted average of 0.12 2 (1969Di16), 0.18 3 (1970Ri06), 0.18 3 (1971Ba08), 0.18 12 (1972Ch56), and 0.15 5 (1988Vi03).
1622.3 3	1622.46	2.8 1	%I γ =2.08 8, using the calculated normalization. E γ : 1622.3 3 from weighted average of 1620 1 (1969Di16), 1622.3 8 (1970Ri06), 1622.5 5 (1971Ba08), 1621.6 10 (1972Ch56), and 1622.5 3 (1988Vi03). I γ : weighted average of 2.9 2 (1969Di16), 2.8 3 (1970Ri06), 3.0 2 (1971Ba08), 3.2 5 (1972Ch56), and 2.6 2 (1988Vi03).
1772.5 2	1772.79	0.57 $\frac{\ddagger}{2}$ 3	%I γ =0.423 23, using the calculated normalization. E γ : 1772.5 2 from weighted average of 1774 2 (1969Di16), 1771.9 8 (1970Ri06), 1772.6 5 (1971Ba08), 1772.1 10 (1972Ch56), and 1772.6 3 (1988Vi03). I γ : 0.57 3 from weighted average of 0.57 4 (1969Di16), 0.6 1 (1970Ri06), 0.60 5 (1971Ba08), 0.65 16 (1972Ch56), and 0.54 5 (1988Vi03).
1846.6 b 10	1846.6?	<0.02	E γ ,I γ : from 1970Ri06 only.
1861.4 1	1861.42	0.045 8	%I γ =0.033 6, using the calculated normalization. E γ : 1861.4 1 from 1988Vi03. Others: 1860.6 10 (1970Ri06), 1863 3 (1969Di16). I γ : weighted average of 0.047 9 (1969Di16), 0.04 2 (1970Ri06), and 0.04 2 (1988Vi03).

† From Adopted Gammas, unless otherwise noted. Values from this dataset are given in comments. Unplaced γ rays are from this dataset.

$\frac{\ddagger}{2}$ Values are obtained by normalizing relative intensities from each level in Adopted Gammas to the intensity of the strongest transition from each level in this dataset. Values originally from this dataset are given under comments where indicated. All values are relative to $I\gamma(203\gamma)=100$.

$^{\#}$ From 1970Ri06 only.

b From 1988Vi03 only.

 ^{109}In ϵ Decay 1970Ri06,1988Vi03 (continued)

 $\gamma(^{109}\text{Cd})$ (continued)

@ Not observed in this dataset and data are taken from Adopted Gammas. Intensities have been normalized to that of the strongest transition from each level in this dataset.

& From Adopted Gammas, unless otherwise noted. ce data in this dataset are from 1956Pe56 and given in comments.

^a For absolute intensity per 100 decays, multiply by 0.742 5.

^b Placement of transition in the level scheme is uncertain.

^c Multiply placed; undivided intensity given.

^x γ ray not placed in level scheme.

¹⁰⁹In ε Decay 1970Ri06,1988Vi03 (continued)

Decay Scheme

Intensities: I(γ+ce) per 100 parent decays
& Multiply placed; undivided intensity given

9/2+ 0.0 4.159 h
¹⁰⁹In₆₀
%ε+%β⁺=100
Q⁺=2016⁴

¹⁰⁹In ε Decay 1970Ri06,1988Vi03 (continued)

Decay Scheme (continued)

Intensities: I(γ+ce) per 100 parent decays
& Multiply placed; undivided intensity given

9/2+ 0.0 4.159 h
¹⁰⁹In₆₀
%ε+%β⁺=100
Q⁺=2016⁴

$^{96}\text{Zr}(^{16}\text{O},3\text{n}\gamma)$ 1978St01

1978St01: E(^{16}O)=56 MeV, FN Tandem Van de Graaff accelerator. Target: = 3.6 mg/cm². Detectors: Two Ge(Li). Measured: E γ , I γ , $\gamma(\theta)$, linear polarization.

 ^{109}Cd Levels

E(level) [†]	J $\pi^{\ddagger}$	E(level) [†]	J $\pi^{\ddagger}$	E(level) [†]	J $\pi^{\ddagger}$
0.0	5/2+	1821.0 10	19/2-	3523.0 12	25/2+
203.0 5	7/2+	2861.0 11	23/2-	4020.0 12	27/2-
463.0 7	11/2-	3058.0 11	21/2+	4245.0 13	29/2+
985.0 9	15/2-	3342.0 12	25/2-		

[†] From a least-squares fit to E γ .

[‡] From deduced γ -ray transition multipolarities.

 $\gamma(^{109}\text{Cd})$

E $\gamma^{\dagger}$	E(level)	I $\gamma^{\dagger}$	Mult. [‡]	Comments
203.0 5	203.0	100		
260.0 5	463.0	96.1 16	M2	Mult.: A ₂ /A ₀ =+0.045 6, A ₄ /A ₀ =-0.005 6, pol=-0.13 5.
465.0 5	3523.0	8.4 4	E2	Mult.: A ₂ /A ₀ =+0.303 16, A ₄ /A ₀ =-0.109 19, pol=+0.25 9.
481.0 5	3342.0	1.9 5	(M1+E2)	Mult.: A ₂ /A ₀ =-0.25 4, A ₄ /A ₀ =+0.12 5 pol=-0.5 4.
522.0 5	985.0	74.9 17	E2	Mult.: A ₂ /A ₀ =+0.304 10, A ₄ /A ₀ =-0.094 11, Pol=+0.49 4.
662.0 5	3523.0			
722.0 5	4245.0	6.6 5	E2	Mult.: A ₂ /A ₀ =+0.255 20, A ₄ /A ₀ =-0.111 26, pol=+29 15.
836.0 5	1821.0	59.4 13	E2	Mult.: A ₂ /A ₀ =+0.284 8, A ₄ /A ₀ =-0.079 8, Pol=+0.51 4.
1040.0 5	2861.0	19.9 7	E2	Mult.: A ₂ /A ₀ =+0.295 15, A ₄ /A ₀ =-0.096 18, pol=+0.44 12.
1159.0 5	4020.0	3.5 4	E2	Mult.: A ₂ /A ₀ =+0.26 5, A ₄ /A ₀ =-0.10 6, pol=+1.3 9.
1237.0 5	3058.0	16.3 7	E1+M2	Mult.: A ₂ /A ₀ =-0.257 15, A ₄ /A ₀ =-0.005 17, pol=+0.4 3. -0.16≤δ≤0.06 from pol (1978St01).

[†] As given in 1978St01, ΔE γ is assumed by evaluators.

[‡] As given in 1978St01, based on angular distributions co-efficients and linear polarization measurements.

⁹⁶Zr(¹⁸O,5nγ) 1994Ju05,2000Ch04,1994Re06

1994Ju05: Reaction: ⁹⁶Zr(¹⁸O,5nγ), E(¹⁸O)=73 MeV. Target: A stacked target consisting of two 0.9 mg/cm², enriched to 85% in ⁹⁶Zr and a 0.74 mg/cm² thick target with a 6 mg/cm² thick gold backing. The beams were provided by the Tandem Accelerator Laboratory of the Niels Bohr Institute. γ-rays were detected using Nordball array consisting of 17-20 Compton-suppressed Ge detectors (at 37°, 79°, 101° and 143°) and a BaF₂-multiplicity filter. Measured: Eγ, γγ, γ(θ). Deduced: ¹⁰⁹Cd levels, Jπ, T_{1/2}, B(M1)/B(E2). 1994Ju05 also report data for ¹⁰⁰Mo(¹³C,4nγ) and (p,nγ).

2000Ch04: Reaction: ⁹⁶Zr(¹⁸O,5nγ), E(¹⁸O)=70 MeV, 88-Inch Cyclotron at LBNL. Target: 500 μg/cm² (86% enriched ⁹⁶Zr) backed with 10 μg/cm² with natural Pb, and 500 μg/cm² thin target. Detectors: 99 Compton-suppressed Ge detectors (GAMMASPHERE array) Measured: Eγ, Iγ, γ(θ), γγγ, DSA. Deduced: Jπ, T_{1/2}, B(M1), B(E2) and comparison with Tilted Axis Cranking (TAC).

1994Re06: ⁹⁶Zr(¹⁸O,5nγ) E=60,70 MeV, "TASCC" facility, Chalk River Laboratories. Target: 600 μg/cm² (85% enriched ⁹⁶Zr). Detectors: 20 Compton-suppressed Ge detectors, 70 BGO in an inner ball, an array of CsI(Tl) detectors. Measured: Eγ, Iγ, γγ(θ)(DCO), γ(θ),γγ, MR.

¹⁰⁹Cd Levels

Level scheme and band structures of high-spin states are based on the assignments in 1994Ju05, unless otherwise noted.

E(level) [†]	Jπ [‡]	T _{1/2} [§]	Comments
0.0	5/2+		
203.3 4	7/2+		
462.9 # 6	11/2-		
822.5 4	9/2+		
985.4 # 6	15/2-		
1066.3 5	11/2+		
1425.4 c 7	13/2-		
1821.3 # 6	19/2-		
1854.3 6	13/2+		
2141.6 6	15/2+		
2165.9 c 6	17/2-		
2589.8 7	19/2-		
2687.3 @ 7	17/2+		
2700.4 d 7	19/2-		
2862.1 # 6	23/2-		
2865.9 f 7	21/2(+)		
2942.1 & 6	19/2+		
2973.9 e 7	21/2-		
3042.5 c 7	21/2-		
3059.1 @ 6	21/2+		
3256.6 10	(21/2-)		
3279.5 7	21/2(+)		
3353.9 h 7	21/2-		
3370.0 7	23/2-		
3383.1 & 6	23/2+		
3411.0 d 7	23/2-		
3524.3 b 7	21/2+		
3524.7 @ 6	25/2+		
3548.8 h 7	23/2-		
3568.7 f 7	23/2(+)		
3615.3 7	23/2-		
3620.7 a 6	23/2+		
3836.2 11	(25/2+)		
3897.5 e 7	25/2-		
3910.4 b 7	25/2+		
3939.9 & 6	27/2+		
4021.7 # 6	27/2-		
4030.3 h 7	25/2-		
4088.2 c 7	25/2-		
4154.1 8			
4232.5 a 7	27/2+		
4246.7 @ 6	29/2+		
4292.6 f 7	25/2(+)		
4296.4 8	27/2-		
4413.7 11	(27/2+)		
4432.0 8	(27/2+)		
4458.6 d 7	27/2-		
4591.1 8	(27/2-)		

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⁹⁶Zr(¹⁸O,5nγ) 1994Ju05,2000Ch04,1994Re06 (continued)

¹⁰⁹Cd Levels (continued)

E(level) [†]	Jπ [‡]	T _{1/2} [§]	Comments
4630.3 ^h 7	27/2-		
4697.8 ^b 8	29/2+		
4725.0 ^{&} 6	31/2+		
4874.7 8	27/2-		
4950.2 ^f 10	(27/2+)		
5051.1 [#] 7	31/2-	1.05 ps +4-5	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.85 ps +7-6 1.26 ps +11-8, and 1.25 ps +10-8.
5061.6 8	27/2-		
5082.9 ^a 7	31/2+		
5122.6 ^e 9	29/2-		
5227.3 9			
5254.3 12	(29/2-)		
5261.5 [@] 8	33/2+		
5279.0 ^h 7	29/2-		
5287.4 ^c 10	(29/2-)		
5399.7 8	31/2-		
5440.6 ^h 8	31/2-		
5623.4 9			
5650.2 ^f 11	(29/2+)		
5671.8 ^b 10	33/2+		
5730.5 ^h 10	33/2-	0.97 ps +2-3	T _{1/2} : using DSAM in 2000Ch04, weighted average of 1.12 ps 5, 0.96 ps 3, and 0.81 ps +1-8.
5775.6 ^{&} 8	35/2+		
5787.9 11	(31/2-)		
5813.2 ^g 13	29/2+		
5861.9 9	(31/2-)		
5954.1 11	(35/2-)		
5971.8 [#] 9	35/2-	0.233 ps +15-8	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.214 ps ¹⁴⁻²¹ , 0.277 ps +21-14, and 0.236 ps +42-7.
5996.1 9	31/2+		
6004.2 ^g 8	31/2+		
6008.3 16	(31/2-)		
6154.9 ^a 9	35/2+		
6163.8 ^h 11	35/2-	0.189 ps +3-4	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.173 ps 7, 0.183 ps +5-6, and 0.202 ps +4-6.
6240.7 10	(35/2-)		
6305.2 ^g 9	33/2+	0.248 ps +10-8	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.284 ps +27-21, 0.263 ps +14-14, and 0.222 ps +14-14.
6518.8 [@] 10	37/2+		
6573.2 9			
6670.7 14	(37/2-)		
6684.2 ^g 14	35/2+	0.175 ps +3-4	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.187 ps 7, 0.173 ps +6-5, and 0.166 ps +5-9.
6795.3 ^h 12	37/2-	0.150 ps +3-4	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.215 ps +14-21, 0.194 ps +7-14, and 0.142 ps +2-5.
6861.9 ^b 11	(37/2+)		
7010.8 [#] 10	39/2-	0.274 ps +10-9	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.28 ps 3, 0.284 ps +14-7, and 0.24 ps 2.
7077.6 ^{&} 10	39/2+		
7147.2 ^g 15	37/2+	0.146 ps +1-3	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.148 ps +5-6, 0.146 ps 3, and 0.141 ps +3-15.
7384.9 ^a 10	(39/2+)		
7554.3 ^h 13	(39/2-)	0.226 ps +8-11	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.187 ps +14-21, 0.235 ps 14, and 0.249 ps +14-21.
7561.3 16	(39/2-)		
7687.8 ^g 15	39/2+	0.077 ps +2-3	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.067 ps 4, 0.078 ps +3-7, and 0.091 ps +4-6.
7909.2 [@] 11	41/2+		
7950.3 17	(41/2-)		
8202.5 [#] 11	43/2-	0.129 ps +3-5	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.110 ps +7-14, 0.130 ps +3-13, and 0.133 ps +6-4.
8264.8 ^g 19	41/2+	0.056 ps +2-4	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.059 ps +4-6, 0.049 ps +4-5, and 0.067 ps +3-9.

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⁹⁶Zr(¹⁸O,5nγ) 1994Ju05,2000Ch04,1994Re06 (continued)

¹⁰⁹Cd Levels (continued)

E(level) [†]	Jπ [‡]	T _{1/2} [§]	Comments
8599.0& 11	43/2+		
8746.3 19	(43/2-)		
8870.8g 21	43/2+		
9378.2@ 12	(45/2+)		
9502.8g 23	(45/2+)		
9569.5# 12	47/2-	0.124 ps +3-3	T _{1/2} : using DSAM in 2000Ch04, weighted average of 0.126 ps +5-5, 0.119 ps +6-5, and 0.126 ps +5-6.
10166g 3	(47/2+)		
10898g 3	(49/2+)		
11132.5# 13	(51/2-)		
x i	(37/2)		E(level): x >5730, since transitions from this level feed members of bands #10 and #11 as labeled by 2000Ch04.
295.0+x i 10	(39/2)		
634.0+x i 15	(41/2)		
1054.0+x i 18	(43/2)		
1542.0+x i 20	(45/2)		
2100.0+x i 23	(47/2)		
2727.0+x i 25	(49/2)		

[†] From a least-squares fit to γ-ray energies.

[‡] From deduced γ-ray transition multiplicities, apparent band structures and decay patterns.

[§] From 2000Ch04 by DSAM, unless otherwise stated; systematic uncertainties of up to 20 % are not included.

(A): ΔJ=2, v_{h11/2} band.

@ (B): ΔJ=2, 17/2+ band.

& (C): ΔJ=2, 19/2+ band.

a (D): ΔJ=2, 23/2+ band.

b (E): ΔJ=2, 21/2+ band.

c (F): ΔJ=2, 13/2- band.

d (G): ΔJ=2, 19/2- band, (band-head at 2701 KeV).

e (H): ΔJ=2, 21/2- band, (band-head at 2974 KeV).

f (I): ΔJ=1, 21/2(+) band Band 14 in 2000Ch04.

g (J): ΔJ=1, magnetic-rotational band, based on 29/2+. Configuration=πg_{9/2}⁻²₈₊v[(g_{7/2}/d_{5/2})h_{11/2}²] Band 11 in 2000Ch04.

h (K): ΔJ=1, magnetic-rotational band, based on 21/2-.

i (L): ΔJ=1, (37/2) band. Band 16 in 2000Ch04.

γ(¹⁰⁹Cd)

Eγ [†]	E(level)	Iγ [†]	Mult. [§]	δ [#]	Comments
141.4 5	3524.7	0.21 4	(M1)		Mult.: R(angular)=0.99 14.
153 [‡] 1	5440.6				
161.6 5	5440.6	4.2 4	(M1+E2)	0.22 6	Eγ: other: 161.6 1 (1994Re06). Mult.: R(angular)=0.77 3, DCO(Q)=0.80 6.
191 [‡] 1	6004.2				
195.0 5	3548.8	0.9 1	(M1+E2)	-0.05 5	Eγ: other: 195.3 2 (1994Re06). Mult.: R(angular)=0.84 7, DCO(Q)=0.50 9.
203.3 5	203.3	3.0 5	M1(+E2)	0.08 11	Eγ: other: 203.6 2 (1994Re06). Mult.: R(angular)=0.73 4, DCO(Q)=0.67 10.
216.4 5	5279.0	0.4 1	(M1)		Mult.: R(angular)=0.84 4.
223.6 5	5954.1	0.30 6			Mult.: R(angular)=1.54 7.
243.8 5	1066.3	0.20 4	(M1)		Mult.: R(angular)=1.00 10.
259.6 5	462.9				
267 [‡] 1	3836.2				
273.4 5	2973.9	0.30 4	(M1)		Mult.: R(angular)=0.63 13.
287.5 5	3568.7	0.13 3	(M1)		Mult.: R(angular)=0.76 14.
289.9 5	5730.5	4.9 4	(M1)		Eγ: other: 290.3 3 (1994Re06). Mult.: R(angular)=0.81 3, DCO(D)=0.97 17.
292 [‡] 1	3548.8				Eγ: other: 290.9 2 (1994Re06).
295 [‡] 1	295.0+x				
301.1 5	6305.2	1.8 2	(M1)		Mult.: R(angular)=0.78 5.
309 [‡] 1	6305.2				

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$^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$ 1994Ju05,2000Ch04,1994Re06 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. §	$\delta^{\#}$	Comments
323.8 5	3383.1	6.1 1	(M1+E2)	0.31 5	E γ : other: 324.3 1 (1994Re06). Mult.: R(angular)=1.19 3, DCO(Q)=0.89 5.
339 $\frac{1}{2}$ 1	634.0+x				
340.3 5	3383.1	0.6 2	(E1)		
354 $\frac{1}{2}$ 1	6004.2				
371.8 5	3059.1	0.4 1	(E2)		Mult.: R(angular)=1.13 10.
379.0 5	6240.7	2.4 2	(E2)		Mult.: R(angular)=0.84 5.
379 $\frac{1}{2}$ 1	6684.2				
386.0 5	3910.4	0.5 1	(E2)		Mult.: R(angular)=1.1 2.
396 $\frac{1}{2}$ 1	7950.3				
404.4 5	5279.0	0.40 8	(M1)		Mult.: R(angular)=0.85 11.
414.8 5	4030.3	0.4 1	(M1)		Mult.: R(angular)=0.90 12.
415.0 5	3939.9	5.6 2	(M1+E2)	0.29 5	E γ : other: 415.2 1 (1994Re06). Mult.: R(angular)=1.30 6, DCO(Q)=0.87 5. Mult.: R(angular)=1.51 14.
415.6 5	3279.5	0.65 5			
420 $\frac{1}{2}$ 1	1054.0+x				
430 $\frac{1}{2}$ 1	6670.7				
433.3 5	6163.8	3.6 2	(M1)		E γ : other: 433.6 2 (1994Re06). Mult.: R(angular)=0.81 5, DCO(Q)=0.59 8. Mult.: R(angular)=0.42 5.
436.7 5	3411.0	1.0 1	(M1)		E γ : other: 441.3 2 (1994Re06). Mult.: R(angular)=1.32 6, DCO(Q)=1.05 9.
441.0 5	3383.1	6.6 1	(E2)		
452 $\frac{1}{2}$ 1	6240.7				
463.0 5	7147.2	2.2 2	(M1)		Mult.: R(angular)=1.1 2.
465.6 1	3524.7	19.5 3	(E2)		E γ : other: 465.8 1 (1994Re06). Mult.: R(angular)=1.33 5, DCO(Q)=1.04 3.
478.0 5	4725.0	1.1 2	(M1+E2)	0.19 22	E γ : other: 478.3 3 (1994Re06). Mult.: R(angular)=1.7 3, DCO(Q)=0.77 20.
481.7 5	4030.3	4.0 2	(M1+E2)	0.04 6	E γ : other: 481.9 2 (1994Re06). Mult.: R(angular)=0.80 3, DCO(Q)=0.63 5. R(angular)<0.7.
487.0 5	3897.5	<0.5			
488 $\frac{1}{2}$ 1	1542.0+x				
491.8 5	3353.9	0.4 1	(M1)		Mult.: R(angular)=0.76 5.
522.4 1	985.4	115 1	E2		E γ : other: 522.7 1 (1994Re06). Mult.: R(angular)=1.33 2, DCO(Q)=1.01 1. Mult.: R(angular)=0.59 2.
527.3 5	3910.4	1.5 2	(M1)		Mult.: R(angular)=0.97 11.
540.6 5	7687.8	1.0 2	(M1)		Mult.: R(angular)=0.76 9.
542.1 5	4630.3	0.4 1	(M1)		E γ : other: 556.9 2 (1994Re06). R(angular)=1.50 7, DCO(Q)=1.01 6.
556.8 1	3939.9	10.1 3	(E2)		
558 $\frac{1}{2}$ 1	2100.0+x				
561.6 5	3620.7	1.4 2	(M1)		Mult.: R(angular)=0.98 8.
577 $\frac{1}{2}$ 1	4413.7				
	8264.8				
600.0 5	4630.3	3.8 2	(M1)		E γ : other: 600.0 2 (1994Re06). Mult.: R(angular)=0.91 3, DCO(D)=0.93 18.
606 $\frac{1}{2}$ 1	8870.8	0.5 1			
609.0 5	4630.3	0.27 3	(E2)		Mult.: R(angular)=1.30 12.
611.8 5	4232.5	0.9 2	(E2)		Mult.: R(angular)=1.4 2.
619.3 5	822.5	0.7 1	(M1)		R(angular)=0.64 7.
624 $\frac{1}{2}$ 1	5254.3				
627 1	2727.0+x				
631.5 5	6795.3	2.8 3	(M1)		E γ : other: 632.0 2 (1994Re06). Mult.: R(angular)=0.88 6, DCO(D)=1.09 21.
632 $\frac{1}{2}$ 1	9502.8				
649.0 5	5279.0	3.6 3	(M1)		E γ : other: 649.0 2 (1994Re06). Mult.: R(angular)=0.87 5, DCO(D)=1.09 21.
658 $\frac{1}{2}$ 1	4950.2				
662.8 5	3524.7	9.3 3	(E1+M2)	0.01 6	E γ : other: 662.8 3 (1994Re06). Mult.: R(angular)=0.80 3, DCO(Q)=0.60 5.
663 $\frac{1}{2}$ 1	10166				
678.7 5	3620.7	0.5 1			

Continued on next page (footnotes at end of table)

⁹⁶Zr(¹⁸O,5n γ) 1994Ju05,2000Ch04,1994Re06 (continued)

 $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\#}$	Comments
686.9 5	3548.8	3.5 2	(E2)		E γ : other: 686.9 2 (1994Re06). Mult.: R(angular)=1.54 8, DCO(Q)=1.28 14.
700 $\frac{1}{2}$ 1	5650.2				
703.4 5	3568.7	0.94 6	(M1)		Mult.: R(angular)=1.0 2.
708.0 5	4232.5	2.8 3	(M1)		Mult.: R(angular)=0.53 6.
710.5 5	3411.0	0.8 1	(E2)		Mult.: R(angular)=1.20 15.
722.0 1	4246.7	16.2 3	(E2)		E γ : other: 722.1 1 (1994Re06). Mult.: R(angular)=1.37 5, DCO(Q)=1.06 7.
723.0 5	4292.6	0.3 1			
732 $\frac{1}{2}$ 1	10898				
740.7 3	2165.9	0.60 5	(E2)		E γ : from 1994Re06. 740.8 5 from 1994Ju05. Mult.: DCO(Q)=0.86 19.
754 $\frac{1}{2}$ 1	6008.3				
754.7 5	5051.1	1.9 1	(E2)		E γ : other: 755.0 3 (1994Re06). Mult.: R(angular)=1.40 7, DCO(Q)=1.16 17.
758.6 5	3620.7	0.5 2	(E1)		Mult.: R(angular)=1.3 2.
759.0 5	7554.3	1.0 1	(M1)		Mult.: R(angular)=0.9 2.
766 $\frac{1}{2}$ 1	7561.3				
768.0 5	5061.6	0.3 1			
776.0 5	2942.1	1.6 2	(E1)		E γ : other: 776.2 4 (1994Re06). Mult.: R(angular)=0.83 8, DCO(Q)=0.47 11.
780.2 5	3370.0	2.3 1	(E2)		E γ : other: 780.1 3 (1994Re06). Mult.: R(angular)=1.47 7, DCO(Q)=0.98 15.
785.1 1	4725.0	11.2 2	(E2)		E γ : other: 785.3 2 (1994Re06). Mult.: R(angular)=1.48 6, DCO(Q)=1.07 6.
787.4 5	4697.8	2.3 3	(E2)		Mult.: R(angular)=1.6 2.
788.0 5	1854.3	0.15 2	(M1)		Mult.: R(angular)=0.38 11.
796 $\frac{1}{2}$ 1	8746.3				
800.5 5	2942.1	1.2 2	(E2)		E γ : other: 799.9 3 (1994Re06). Mult.: R(angular)=1.5 2, DCO(Q)=0.90 18.
804.3 5	5051.1				E γ : Not given in Table (1994Ju05).
807.8 5	2973.9	0.90 5	(E2)		Mult.: R(angular)=1.30 7.
811.3 5	4432.0	1.2 1	(E2)		Mult.: R(angular)=1.7 2.
822.5 5	822.5				
836.0 1	1821.3	100.0	E2		E γ : other: 836.2 1 (1994Re06). Mult.: R(angular)=1.33 2, DCO(Q)=0.99 2.
836.8 5	5082.9	1.0 4			
844.5 5	4874.7	0.3 1			Mult.: R(angular)=0.99 11.
849.5 5	4232.5	0.5 2			
850.8 5	5082.9	2.9 4	(E2)		Mult.: R(angular)=1.26 12.
851.4 5	3910.4	1.5 3	(E2)		Mult.: R(angular)=1.41 10.
863.1 5	1066.3	2.4 2	(E2)		E γ : other: 863.4 3 (1994Re06). Mult.: R(angular)=1.33 8, DCO(Q)=0.93 14.
876.7 5	3042.5	2.0 2	(E2)		Mult.: R(angular)=1.29 14.
878.9 5	2700.4	2.0 4	(E2)		Mult.: R(angular)=1.32 13.
920.7 5	5971.8	6.1 1	(E2)		E γ : other: 920.7 2 (1994Re06). Mult.: R(angular)=1.43 8, DCO(Q)=0.98 16.
923.4 5	3897.5	1.1 2	(E2)		Mult.: R(angular)=1.6 2.
926.4 5	4296.4	4.0 2	(E2)		E γ : other: 926.2 3 (1994Re06). Mult.: R(angular)=1.7 2, DCO(Q)=1.15 16.
963.0 5	1425.4	0.6 1	(M1+E2)	-0.08 21	E γ : other: 962.3 3 (1994Re06). Mult.: DCO(Q)=0.52 19.
974.0 5	5671.8	1.1 2	(E2)		Mult.: R(angular)=1.39 9.
1014.8 5	5261.5	7.3 1	(E2)		E γ : other: 1014.4 2 (1994Re06). Mult.: R(angular)=1.40 13, DCO(Q)=0.94 8.
1029.6 5	5051.1	8.2 2	(E2)		E γ : other: 1029.3 2 (1994Re06). Mult.: R(angular)=1.54 6, DCO(Q)=1.04 16. B(E2) $\downarrow$ =0.043 5.
1031.8 5	1854.3	0.30 5	(E2)		Mult.: R(angular)=1.15 13.
1035.0 5	3897.5	0.4 2			
1039.0 5	7010.8	4.0 1	(E2)		E γ : other: 1037.9 2 (1994Re06). Mult.: R(angular)=1.36 3, DCO(Q)=0.87 20; R(angular) is for 1039 γ +1040.7 γ .

Continued on next page (footnotes at end of table)

$^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$ 1994Ju05,2000Ch04,1994Re06 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. §	$\delta^{\#}$	Comments
1040.7 1	2862.1	42.5 4	E2		E γ : other: 1040.8 3 (1994Re06). Mult.: R(angular)=1.36 3, DCO(Q)=0.96 5, R(angular) is for 1039 γ +1040.7 γ .
1045.2 5	2865.9	6.5 8	(E1)		Mult.: R(angular)=0.80 14.
1046.0 5	4088.2	1.0 1	(E2)		Mult.: R(angular)=1.39 9.
1048.1 5	4458.6	0.4 2	(E2)		Mult.: R(angular)=1.7 3.
1048.4 5	3910.4	0.4 2			
1050.6 5	5775.6	5.2 2	(E2)		E γ : other: 1049.7 3 (1994Re06). Mult.: R(angular)=1.27 10, DCO(Q)=1.08 13.
1072.0 5	6154.9	1.5 3	(E2)		Mult.: R(angular)=1.5 2.
1075.3 3	2141.6	1.5 2	(E2)		E γ : from 1994Re06. 1075.7 5 from 1994Ju05. Mult.: R(angular)=1.40 7, DCO(Q)=1.06 22.
1120.8 5	2942.1	5.7 1	(E1)		E γ : other: 1120.4 2 (1994Re06). R(angular)=1.37 9, DCO(Q)=0.78 12.
1142.0 5	5082.9	<0.3			
1152.4 5	2973.9	2.8 1			Mult.: R(angular)=1.8 3.
1159.6 1	4021.7	12.8 4	(E2)		E γ : other: 1159.2 2 (1994Re06). Mult.: R(angular)=1.44 5, DCO(Q)= 0.96 10.
1168.5 5	4030.3	0.5 1			
1180.4 2	2165.9	6.0 1	(M1+E2)	0.13 27	E γ : from 1994Re06. 1180.9 5 from 1994Ju05. R(angular)=2.0 2, DCO(Q)=0.71 26. E γ : other: 1187.3 8 (1994Re06).
1188.0 5	3353.9	0.3 1			
1190.0 5	6861.9	0.3 1			
1191.2 5	5279.0	0.20 5	(E2)		Mult.: R(angular)=1.4 2.
1191.6 5	8202.5	2.5 2	(E2)		E γ : other: 1191.4 2 (1994Re06). Mult.: R(angular)=1.5 2, DCO(Q)=1.11 24.
1196 $\frac{1}{2}^{\ddagger}$ 1	5787.9				
1199 $\frac{1}{2}^{\ddagger}$ 1	5287.4				
1221.2 5	3042.5	3.0 2	(M1)		Mult.: R(angular)=1.33 11.
1225.1 5	5122.6	0.57 5	(E2)		Mult.: R(angular)=1.37 14.
1230.0 5	7384.9	0.3 1	(E2)		
1237.8 1	3059.1	30.5 3	(E1)		E γ : other: 1237.3 1 (1994Re06). Mult.: R(angular)=0.81 3, DCO(Q)=0.53 3.
1249.0 5	5279.0	0.6 1	(E2)		Mult.: R(angular)=1.6 2.
1257.3 5	6518.8	4.1 3	(E2)		E γ : other: 1256.7 3 (1994Re06). Mult.: R(angular)=1.41 12, DCO(Q)=0.99 10.
1271.0 5	5861.9	0.3 1			
1271 $\frac{1}{2}^{\ddagger}$ 1	5996.1				
1280 $\frac{1}{2}^{\ddagger}$ 1	6004.2				
1292.0 5	4154.1	0.6 2			
1302.0 5	7077.6	2.5 4	(E2)		E γ : other: 1301.6 3 (1994Re06). Mult.: R(angular)=1.40 13, DCO(Q)=1.05 17.
1327.0 5	5623.4	0.4 1			Mult.: R(angular)=1.0 2.
1367.0 5	9569.5	1.1 1	(E2)		E γ : other: 1366.8 3 (1994Re06). Mult.: R(angular)=1.40 14, DCO(Q)=0.86 17.
1378.0 5	5399.7	1.2 1	(E2)		Mult.: R(angular)=1.27 13.
1381 $\frac{1}{2}^{\ddagger}$ 1	4950.2				
1390.4 5	7909.2	1.4 2	(E2)		E γ : other: 1389.6 4 (1994Re06). Mult.: R(angular)=1.29 11, DCO(Q)=0.85 20.
1426.6 5	4292.6	0.75 7	(E2)		Mult.: R(angular)=1.39 14.
1435 $\frac{1}{2}^{\ddagger}$ 1	3256.6				E γ : other: 1435.8 8 (1994Re06).
1468.9 5	9378.2	0.5 2			E γ : other: 1460.0 5 (1994Re06).
1521.4 5	8599.0	1.0 1	(E2)		E γ : other: 1520.9 4 (1994Re06). Mult.: R(angular)=1.5 2, DCO(Q)=0.91 18.
1522.0 5	6573.2	0.4 1			
1532.5 5	3353.9	0.3 1			E γ : other: 1531.7 5 (1994Re06).
1548.5 5	3370.0	3.1 2	(E2)		E γ : other: 1548.1 3 (1994Re06). Mult.: R(angular)=1.50 10, DCO(Q)=1.05 3.
1563.0 5	11132.5	<0.5			E γ : other: 1564.5 5 (1994Re06).
1590 $\frac{1}{2}^{\ddagger}$ 1	6004.2				
1591.0 5	3411.0	0.6 1			
1596.0 5	4458.6	0.2 1			

Continued on next page (footnotes at end of table)

⁹⁶Zr(¹⁸O,5n γ) 1994Ju05,2000Ch04,1994Re06 (continued)

 $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. [§]	Comments
1604.5 5	2589.8	3.9 2	(E2)	E γ : other: 1604.1 4 (1994Re06). Mult.: R(angular)=1.41 11, DCO(Q)=1.12 18.
1612.0 5	5227.3	0.2 1		
1701.8 5	2687.3	1.0 1	(E1)	Mult.: R(angular)=0.79 10, both for 1701.8 γ +1702.8 γ .
1702.8 5	3524.3	0.5 1		Mult.: R(angular)=0.79 10, R(angular) is for 1701.8 γ +1702.8 γ .
1715.0 5	2700.4	0.87 10	(E2)	Mult.: R(angular)=1.4 2.
1729.0 5	4591.1	0.6 2	(E2)	Mult.: R(angular)=1.5 4.
1793.8 5	3615.3	0.8 1	(E2)	Mult.: R(angular)=1.8 4.
2056 $\frac{1}{2}$ 1	5996.1			
2064 $\frac{1}{2}$ 1	6004.2			

[†] From ⁹⁶Zr(¹⁸O,5n γ) in 1994Ju05, unless otherwise noted. Evaluators assigned $\Delta E\gamma$ according to author's statement in Table 1 (1994Ju05) that the $\Delta E\gamma=0.1$ keV for the strong transitions, rising to 0.5 keV for the weak ones: $\Delta E\gamma=0.1$ keV for $I(\gamma) \geq 10$, $\Delta E\gamma=0.5$ keV for others; $\Delta E\gamma=1$ keV for transitions from 2000Ch04.

[‡] From 2000Ch04 only.

[§] Base on R(angular) (1994Ju05) and DCO ratio (1994Re06) measurements. (R(angular)= $I_\gamma(143^\circ \text{ or } 37^\circ)/I_\gamma(79^\circ \text{ or } 101^\circ)$). For $\Delta I=0$ dipole and $\Delta I=2$ quadrupole transitions R(angular)=1.3–1.5, for stretched dipole transitions R(angular)=0.80. DCO (R_{DCO} in 1994Re06)=[$I(\gamma_1)$ observed at 37° gated on γ_2 at 90°]/[$I(\gamma_1)$ observed at 79° gated on γ_2 at 37°]. Expected values are: 0.56 for $\Delta J=1$, dipole and 1.0 for $\Delta J=2$, with gate on $\Delta J=2$ quadrupole; 1.0 for $\Delta J=1$, dipole, with gate on $\Delta J=1$ dipole.

[#] From 1994Re06, based on rigid rotor model.

¹⁰⁰Mo(¹³C,4n γ) 1994Ju05,2001Ha09

1994Ju05: Reaction: ¹⁰⁰Mo(¹³C,4n γ), E(¹³C)=44 MeV. Target: A 0.59 mg/cm² thick (97.4% enriched) with a 8.9 mg/cm² thick gold backing. The beams were provided by the Tandem Accelerator Laboratory of the Niels Bohr Institute. γ -rays were detected using Nordball array consisting of 17–20 Compton-suppressed Ge detectors (at 37° , 79° , 101° and 143°) and a BaF₂-multiplicity filter. Measured: E γ , $\gamma\gamma$, $\gamma(\theta)$. Deduced: ¹⁰⁹Cd levels, J π , T_{1/2}, B(M1)/B(E2).

1994Ju05 also report data for ⁹⁶Zr(¹⁸O,5n γ) and (p,n γ).

2001Ha09: Reaction: ¹⁰⁰Mo(¹³C,4n γ), E(¹³C)=50 MeV, FN Van de Graaff Tandem accelerator at the University of Cologne. Target: A 0.6 mg/cm² thick (98 % enriched) with a 4.3 mg/cm² thick gold backing (Intensity measurements), A 0.6 μ g/cm² thick (98 % enriched) with 2 mg/cm² Ta stopper (lifetime measurements). Detectors: 3 Ge detectors at 0° , 55° , 160° angles, 24 target-to- stopper distances in the range of 2.9 μ m to 8 mm. Measured: E γ , I γ , T_{1/2}, lifetime using the Recoil Distance Doppler Shift technique (RDDS) and an intensity measurement, The data have been analyzed using the Differential Decay Curve Method.

¹⁰⁹Cd Levels

E(level) [†]	J π [‡]	T _{1/2} [§]	Comments
0.0	5/2+		
203.30 10	7/2+		
462.91 14	11/2+		
822.5 3	9/2+		
985.32 17	15/2-	10.0 ps 4	
1066.3 4	11/2+		
1105.9 5	9/2+		
1425.8 5	13/2-		
1563.0 6	11/2+		
1821.34 20	19/2-	0.59 ps 14	
1854.3 5	13/2+		
2065.3? 6	13/2+		E(level): proposed by 1994Ju05 in ¹⁰⁰ Mo(¹³ C,4n γ) based on the 999.0 γ , but not observed in ⁹⁶ Zr(¹⁸ O,5n γ) by the same authors. Evaluators have considered this assignment questionable.
2141.8 5	15/2+		
2166.1 4	17/2-	0.5 ps 3	
2589.8 5	19/2-	0.8 ps 4	
2687.2 4	17/2+		
2700.2 5	19/2-		
2862.03 22	23/2-	<1.2 ps	
2866.54 22	21/2(+)	1.26 ns 19	

Continued on next page (footnotes at end of table)

¹⁰⁰Mo(¹³C,4nγ) 1994Ju05,2001Ha09 (continued)

¹⁰⁹Cd Levels (continued)

E(level) [†]	Jπ [‡]	T _{1/2} [§]	E(level) [†]	Jπ [‡]	T _{1/2} [§]
2942.2 4	19/2+	<3.5 ps	4021.6 6	27/2-	
2973.8 4	21/2-	<7.6 ps	4030.4 5	25/2-	<2.8 ps
3042.7 4	21/2-	<3.5 ps	4232.8 6	27/2+	
3059.15 22	21/2+	0.8 ps 5	4246.8 5	29/2+	<3.8 ps
3282.2 5	21/2(+)		4293.2 6	25/2(+)	
3353.8 5	21/2-		4296.3 7	27/2-	
3369.9 5	23/2-	<3.5 ps	4630.4 7	27/2-	<4.2 ps
3383.0 4	23/2+	12.1 ps 9	4697.6 7	29/2+	
3410.6 5	23/2-		4724.8 6	31/2+	<3.1 ps
3524.2 6	21/2+		5051.2 8	31/2-	
3524.76 24	25/2+	12.1 ps 12	5083.6 8	31/2+	
3548.8 5	23/2-	<2.1 ps	5279.4 8	29/2-	<7.6 ps
3569.8 5	23/2(+)		5441.0 9	31/2-	
3615.4 5	23/2-		5731.0 11	33/2-	
3620.7 4	23/2+		5775.4 8	35/2+	
3897.4 6	25/2-		5971.9 9	35/2-	
3910.2 5	25/2+	<13 ps	7011.0 11	39/2-	
3939.8 4	27/2+	3.8 ps 4			

[†] From a least-squares fit to γ-ray energies.

[‡] From 1994Ju05 (see ⁹⁶Zr(¹⁸O,5nγ) for details).

[§] From 2001Ha09 using the RDDS method.

γ(¹⁰⁹Cd)

Eγ [†]	E(level)	Iγ [†]	Comments
161.6 5	5441.0	1.4 1	
195.0 5	3548.8	1.1 1	
203.3 1	203.30	26 1	
243.8 5	1066.3	0.45 5	
259.6 1	462.91	15.9 3	
273.4 5	2973.8	0.4 2	
287.5 5	3569.8	0.40 5	
289.9 5	5731.0	1.4 1	
323.8 5	3383.0	4.4 1	
340.3 5	3383.0	0.6 3	
371.8 5	3059.15	0.24 8	
414.8 5	4030.4	0.6 2	
415.0 5	3939.8	2.1 1	
415.6 5	3282.2	2.0 3	
436.7 5	3410.6	2.6 1	
441.0 5	3383.0	4.0 2	
465.6 1	3524.76	11.1 2	
478.0 5	4724.8	0.9 [‡] 1	
481.7 5	4030.4	3.2 1	
487.0 5	3897.4	1.0 1	
491.8 5	3353.8	0.55 5	
522.4 1	985.32	119 1	
527.3 5	3910.2	1.6 [‡] 2	
556.8 5	3939.8	3.1 2	
561.6 5	3620.7	2.1 1	
600.0 5	4630.4	5.7 [‡] 4	
619.3 5	822.5	4.2 1	
649.0 5	5279.4	2.2 [‡] 1	
662.8 5	3524.76	6.3 1	
686.9 5	3548.8	2.5 1	
703.4 5	3569.8	2.8 1	
708.0 5	4232.8	2.8 1	
710.5 5	3410.6	1.7 3	
722.0 5	4246.8	6.7 2	
740.5 5	1563.0	0.40 3	

Continued on next page (footnotes at end of table)

¹⁰⁰Mo(¹³C,4nγ) 1994Ju05,2001Ha09 (continued)

γ(¹⁰⁹Cd) (continued)

Eγ [†]	E(level)	Iγ [†]	Comments
741.7 [‡] 1	2166.1	1.1 [‡] 1	
758.7 5	3620.7	0.71 7	
776.0 5	2942.2	1.6 1	
780.2 5	3369.9	2.1 2	
785.1 5	4724.8	6.0 [‡] 2	
787.4 5	4697.6	1.6 3	
788.0 5	1854.3	0.54 5	
800.5 5	2942.2	0.59 4	
807.8 5	2973.8	1.0 1	
822.5 5	822.5	1.2 2	
836.0 1	1821.34	100.0	
850.8 5	5083.6	3.1 3	
851.7 [‡] 1	3910.2	1.8 [‡] 2	
863.1 5	1066.3	5.8 2	
876.7 5	3042.7	2.1 2	
878.9 5	2700.2	3.3 2	
902.6 5	1105.9	0.6 1	
920.7 5	5971.9		Iγ: Not given in ¹⁰⁰ Mo(¹³ C,4nγ) (1994Ju05), However, level is fed by 1039.0γ.
923.4 5	3897.4	1.2 1	
926.4 5	4296.3	1.8 1	
963.0 5	1425.8	2.0 5	
999.0 5	2065.3?	0.5 2	Eγ: placed by 1994Ju05 in ¹⁰⁰ Mo(¹³ C,4nγ), but not observed in ⁹⁶ Zr(¹⁸ O,5nγ) by the same authors.
1029.6 5	5051.2	1.3 1	
1031.8 5	1854.3	1.1 1	
1039.0 5	7011.0	1.36 3	
1040.7 1	2862.03	22.9 3	
1045.2 1	2866.54	16.1 2	
1048.7 [‡] 1	3910.2	1.5 [‡] 5	
1050.6 5	5775.4	2.7 2	
1075.7 5	2141.8	2.8 1	
1120.8 5	2942.2	4.0 1	
1152.4 5	2973.8	2.5 1	
1159.6 5	4021.6	4.1 2	
1169.7 [‡] 1	4030.4	2.2 [‡] 1	
1180.9 5	2166.1	4.8 [‡] 1	
1221.2 5	3042.7	3.1 2	
1237.8 1	3059.15	21.3 4	
1249.7 [‡] 1	5279.4	0.4 [‡] 1	
1426.6 5	4293.2	0.8 2	
1548.5 5	3369.9	1.4 1	
1604.5 5	2589.8	3.1 1	
1701.8 5	2687.2	2.2 2	Iγ: given for 1701.8γ+1702.8γ.
1702.8 5	3524.2	2.2 2	Iγ: given for 1701.8γ+1702.8γ.
1793.8 5	3615.4	0.4 2	

[†] From ¹⁰⁰Mo(¹³C,4nγ) in 1994Ju05.

[‡] From 2001Ha09, Evaluators assigned ΔEγ according to author's statement in Table 1 (1994Ju05) that the ΔEγ=0.1 keV for the strong transitions, rising to 0.5 keV for the weak ones: ΔEγ=0.1 keV for I(γ) ≥ 10, ΔEγ=0.5 keV for others. ΔEγ=1 keV for transitions from 2001Ha09.

¹⁰⁸Pd(α,3nγ) 1975Me22,1979Oh02

1975Me22: ¹⁰⁸Pd(α,3nγ), E(α)=36.7-45.8 MeV, variable energy cyclotron at Grenoble. Target: ≈ 15 mg/cm² ¹⁰⁸Pd (= 94.7 % enriched) deposited on a 14 mg/cm² polyethylene backing. Detectors: two coaxial Ge(Li) Measured: Eγ, Iγ, γγ, γ(θ), T_{1/2}.

1979Oh02: ¹⁰⁸Pd(α,3nγ), E(α)=35-45 MeV, SF cyclotron at INS. Target: a metallic powder of ¹⁰⁸Pd precipitated on VYNS. Detectors: two coaxial Ge(Li) Measured: Eγ, Iγ, γγ (40 MeV data). New levels were proposed at 1425.2, 2165.1, 2864.1, 2940.6, 3344.6, 3571.2 and 4243.9 keV.

Level scheme is taken from 1975Me22 with addition of new levels proposed by 1979Oh02. The level of 2030.3 keV (1975Me22) is ruled out, as proposed by 1979Oh02.

¹⁰⁹Cd Levels

E(level) [†]	Jπ [‡]	T _{1/2}	Comments
0.0	5/2+		
203.47 19	7/2+		
463.3# 3	11/2-	10.8 μs 7	T _{1/2} : using 552.2-259.8γ(t) by the Time correlation method (1975Me22).
822.5 3	9/2+		
985.6# 4	15/2-		
1066.4 4	(11/2+)		
1419.5? 4			
1424.8 5	(13/2-)		
1448.2?‡ 6			
1821.3# 5	19/2-		
2033.4 5			
2141.5 6	(15/2+)		
2165.3‡ 5	(17/2-)		
2461.8? 11			
2861.3# 6	23/2-		
2865.4?‡ 6			
2941.4?‡ 6			
3058.3 5	(21/2)		
3261.8? 7	(19/2+)		
3345.8?‡ 7	(19/2+)		
3382.2 6	(19/2, 23/2)		
3523.5 6	(25/2)		
3571.7‡ 7			
3938.6 6	(23/2, 27/2)		
4020.2# 7	(27/2-)		
4244.9‡ 7			
4501.6? 7			

[†] From a least-squares fit to γ-ray energies.

[‡] Only seen in 1979Oh02.

[§] From 1975Me22 based on deduced γ-ray transition multipolarities and band structure.

(A): ΔJ=2, v_{h11/2}.

γ(¹⁰⁹Cd)

Eγ [†]	E(level)	Iγ [†]	Mult. [§]	Comments
x184.5 3		22 4		
x191.8 3		23 8		
197.6 5	3058.3	30 15		
203.5 2	203.47	1000	M1	
x214.4 2		19 4		Mult.: a ₂ /a ₀ =-0.05 6, a ₄ /a ₀ =+0.08 10, ΔJ=±1.
259.8 2	463.3	800 80	M2	
x273.3 3		14 3		
x287.6 4		9 2		
x290.6 4		12 3		
x311.8 2		13 2		
324.1 3	3382.2	24 5		Mult.: a ₂ /a ₀ =+0.13 3, a ₄ /a ₀ =-0.08 4, ΔJ=0,±1,±2.
381.8‡ 4	1448.2?	2.5‡ 13		
415.2 2	3938.6	30 5		Mult.: a ₂ /a ₀ =+0.04 3, a ₄ /a ₀ =-0.02 5, ΔJ=(±1).
x426.4 4		10 2		Mult.: a ₂ /a ₀ =+0.25 5, a ₄ /a ₀ =-0.16 7, ΔJ=0,±2.
433.9 2	1419.5?	91 10		Mult.: a ₂ /a ₀ =-0.27 1, a ₄ /a ₀ =-0.08 2, ΔJ=±1.
440.4 3	3382.2	28 5		Eγ: 440.2 3 in 1979Oh02. Placement from 1979Oh02, unplaced in 1975Me22.

Continued on next page (footnotes at end of table)

$^{108}\text{Pd}(\alpha,3n\gamma)$ 1975Me22,1979Oh02 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult.§	Comments
465.2 3	3523.5	20 10		Mult.: $a_2/a_0=+0.29$ 2, $a_4/a_0=-0.13$ 2, $\Delta J=0,-2$.
481.4 3	4501.6?	18 3		
497.0	4020.2			$E\gamma$: not given in table of 1975Me22.
522.2 2	985.6	610 6	E2	Mult.: $a_2/a_0=+0.292$ 3, $a_4/a_0=-0.108$ 4.
556.2 5	3938.6	21 5		Mult.: $a_2/a_0=+0.35$ 3, $a_4/a_0=-0.19$ 4, $\Delta J=0,-2$.
^x 571.0 5		12 5		
613.9 3	2033.4	20 4		
619.1 3	822.5	25 5		
^x 623.8 3		21 4		
640.5	2461.8?			$E\gamma$: Not in table of 1975Me22.
662.3 3	3523.5	24 6		Mult.: $a_2/a_0=-0.47$ 9, $a_4/a_0=+0.17$ 14, $\Delta J=\pm 1$.
^x 703.9 5		13 3		
706.3 $\frac{3}{2}$ 3	3571.7	31 $\frac{3}{2}$ 6		
^x 707.7 4		24 4		
^x 717.7 4		22 3		
721.4 $\frac{3}{2}$ 3	4244.9	30 $\frac{3}{2}$ 6		$E\gamma$: 721.8 4 in 1975Me22. $I\gamma$: 31 4 in 1975Me22. Mult.: $a_2/a_0=+0.37$ 3, $a_4/a_0=-0.16$ 5, $\Delta J=0,-2$.
740.9 $\frac{3}{2}$ 4	2165.3	9 $\frac{3}{2}$ 3		
^x 755.4 4		10 2		
^x 778.7 5		10 2		
^x 786.7 5		15 3		
822.3 5	822.5	11 2		
835.7 3	1821.3	431 45	E2	Mult.: $a_2/a_0=+0.274$ 5, $a_4/a_0=-0.093$ 8.
862.9 3	1066.4	32 5		Mult.: $a_2/a_0=+0.32$ 6, $a_4/a_0=-0.02$ 8, $\Delta J=0,\pm 1,\pm 2$.
961.8 $\frac{3}{2}$ 4	1424.8	39 6		
^x 1014.4 4		25 6		
1040.4 4	2861.3	116 15	E2	Mult.: $a_2/a_0=+0.26$ 4, $a_4/a_0=-0.09$ 5.
1044.1 $\frac{3}{2}$ 3	2865.4?	66 $\frac{3}{2}$ 11		$E\gamma$: 1044.8 5 in 1975Me22. $I\gamma$: 46 9 in 1975Me22. Mult.: $a_2/a_0=-0.06$ 2, $a_4/a_0=-0.06$ 3, $\Delta J=0,\pm 1$.
1075.1 4	2141.5	18 3		Mult.: $a_2/a_0=+0.23$ 9, $a_4/a_0=+0.30$ 16, $\Delta J=0,-2$.
1119.8 $\frac{3}{2}$ 3	2941.4?	30 $\frac{3}{2}$ 6		
1120.3 4	3261.8?	22 4		Mult.: $a_2/a_0=0.28$ 5, $a_4/a_0=-0.19$ 7, $\Delta J=0,-2$.
1158.9 4	4020.2	19 4		Mult.: $a_2/a_0=+0.18$ 5, $a_4/a_0=-0.04$ 7.
1179.6 $\frac{3}{2}$ 3	2165.3	36 $\frac{3}{2}$ 7		
1204.3 $\frac{3}{2}$ 4	3345.8?	5.7 $\frac{3}{2}$ 14		
^x 1220.8 5		14 3		
1237.2 3	3058.3	109 10		Mult.: $a_2/a_0=-0.29$ 2, $a_4/a_0=+0.05$ 3, $\Delta J=\pm 1$.

† From 1975Me22, unless otherwise noted.

‡ From 1979Oh02, re-normalised by evaluators w.r.t. 203.5 γ per 1000 γ -rays.

§ Based on angular distribution data (1975Me22) and proposed band structure.

^x γ ray not placed in level scheme.

$^{109}\text{Ag}(\text{p},\text{n}\gamma)$ 1988Vi03,1994Ju05

1988Vi03: E(p)=6.8 MeV. Detectors: two HPGe. Measured: E γ , I γ , $\gamma\gamma$. 1988Vi03 also report data for ^{109}In ϵ decay. Data from the two measurements share the same γ -ray energies.

1994Ju05: E(p)=12–17.4 MeV, Jyvaskyla MC-20 cyclotron. Target: 7.6 mg/cm² thick self support ^{109}Ag (98.9 % enriched). Detectors: Two Compton suppressed Ge. Measured: E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, excitation functions. 1994Ju05 also report data for $^{96}\text{Zr}(^{18}\text{O},5\text{n}\gamma)$ and $^{100}\text{Mo}(^{13}\text{C},4\text{n}\gamma)$.

Others: 1992Si05, 1988Ch35, 1983Ch34, 1982Av07, 1969Be37, 1966Mc06.

Level scheme and placements of γ -ray transitions are from 1988Vi03 and 1994Ju05, unless otherwise noted.

 ^{109}Cd Levels

E(level) [†]	J π [#]	T _{1/2} [@]	Comments
0.0	5/2+		
59.56 8	1/2+		
203.36 5	7/2+	36 ps +6-1	T _{1/2} : from microwave modulation of beam and lens spectrometer (1969Be37).
347.48 6	5/2+		J π : 3/2 from $\gamma(\theta)$ in 1994Ju05, 5/2+ in 1992Si05 and 1983Ch34.
426.41 6	5/2+		J π : 3/2+ in 1983Ch34.
463.06 11	11/2-		
623.86 7	7/2+	41 fs +25-15	J π : 5/2+ in 1983Ch34.
			T _{1/2} : using 623.2 γ in 1988Ch35.
673.34 9	3/2+	55 fs +15-12	J π : 5/2+ in 1994Ju05.
			T _{1/2} : using 613.6 γ (t) in 1982Av07.
721.76 7	5/2+	76 fs +21-13	J π : from 1992Si05 only, J=3/2 is ruled out based on 721.8 $\gamma(\theta)$ using the χ^2 fits method.
			T _{1/2} : Weighted average of 104 fs +49-28 (using 721 γ) and 69 fs +21-17 (using 518 γ) in 1982Av07.
821.89 7	9/2+	90 fs +49-28	T _{1/2} : using 822 γ in 1982Av07.
891.22 8	3/2+, 5/2+	36 fs +8-6	J π : 5/2+ from 1992Si05.
			T _{1/2} : weighted average of 47 fs +15-11 (using 891 γ) and 31 fs +10-7 (using 831 γ) in 1982Av07.
929.42 8	5/2+		
985.3 5	15/2-		
997.40 8	7/2+	64 fs +20-12	J π : 9/2+ in 1992Si05.
			T _{1/2} : weighted average of 76 fs 35-21 (using 794 γ (t)) and 59 fs +24-14 in 1982Av07.
1066.03 11	11/2+		
1105.80 8	(9/2+)	73 fs +38-24	T _{1/2} : using 1106 γ in 1982Av07.
1121.18 8	(1/2+, 3/2, 5/2+)		
1134.97 $\frac{1}{2}$ 5	7/2+	61 fs +32-18	E(level): not confirmed in 1988Vi03.
			J π : from 1992Si05 based on measured 929.5 $\gamma(\theta)$.
			T _{1/2} : weighted average of 83 fs +55-28 (using 932 γ in 1982Av07) and 49 fs +38-26 (using 932 γ in 1988Ch35).
1173.45 14	3/2+, 5/2+		
1219.06 18			
1318.19 12	3/2+, 5/2+		
1352.18 8	(7/2)+		
1388.55 13	(7/2+, 9/2+)		
1417.92 18	1/2+		
1425.3 4	(13/2-)		
1458.71 15			
1475.81 11	(7/2, 9/2)+		
1479.74 20			
1539.36 16	(7/2+, 9/2+)		
1563.0 $\frac{5}{2}$ 3	11/2(+)		
1580.65 18			
1593.3 3			
1622.29 10	(7/2)+		
1633.52 23			
1729.95 19			
1772.80 11	(7/2, 9/2)+		
1787.37 10			
1813.39 12			
1853.9 $\frac{5}{2}$ 4	(13/2+)		
1869.20 19			
1937.5 3			
1943.97 20			
1956.0 6			

Continued on next page (footnotes at end of table)

¹⁰⁹Ag(p,n γ) 1988Vi03,1994Ju05 (continued)

¹⁰⁹Cd Levels (continued)

E(level) [†]	J π [#]	E(level) [†]	J π [#]	E(level) [†]
1989.0 3		2141.7 § 6	15/2+	2282.45 25
2033.77 17		2166.19 17		2325.7 4
2046.4 3		2198.91 17		2372.3 4
2064.65 9		2234.20 22		2391.84 24
2111.62 19		2271.3 5		

[†] From a least-squares fit to γ -ray energies.

[‡] Seen in 1988Ch35,1992Si05,1982Av07.

[§] Only seen in 1994Ju05.

[#] From Adopted Levels, unless otherwise noted.

[@] From 1982Av07 and 1988Ch35 (Doppler shift attenuation technique), unless otherwise stated.

 $\gamma(^{109}\text{Cd})$

E γ [†]	E(level)	I γ [†]	Mult. [@]	Comments
59.6 # 5	59.56			
169.3 3	891.22	0.3 1		
203.3 1	203.36	100	M1	E γ : other: 203.3 1 (1994Ju05), 203.4 2 (1988Ch35), 203.4 3 (1983Ch34), 203.2 3 (1969Be37). Mult.: from Adopted Gammas. A ₂ /A ₀ =-0.10 4, A ₄ /A ₀ =-0.02 5 (1994Ju05).
207.6 1	929.42	2.9 2		
223.0 1	426.41	2.5 2		E γ : other: 222.9 5 (1994Ju05). I γ : other: 0.25 4 (1994Ju05).
243.8 § 5	1066.03		(M1)	
259.7 1	463.06	23.8 9	M2	E γ : others: 259.6 1 (1994Ju05), 259.9 2 (1988Ch35), 259.7 3 (1983Ch34), 259.5 3 (1969Be37). I γ : others: 36.0 10 (1994Ju05), 15.7 17 (1988Ch35), 20.7 (1983Ch34). Mult.: from measured $\alpha_K(260\gamma)/\alpha_K(203\gamma)=2.06$ 23 in 1969Be37.
288.1 1	347.48	31.8 20	E2	E γ : others: 287.5 1 (1994Ju05), 287.9 2 (1988Ch35), 287.9 3 (1983Ch34). I γ : others: 7.2 2 (1994Ju05), 32.5 33 (1988Ch35), 42.9 (1983Ch34). A ₂ /A ₀ =+0.03 3, A ₄ /A ₀ =-0.06 4 (1994Ju05).
305.6 3	929.42	0.8 1		
324.4 3	997.40	1.3 1		E γ : other: 324.1 5 (1994Ju05). I γ : other: 0.9 1 (1994Ju05).
326.3 2	673.34	8.0 4		E γ : others: 325.5 1 (1994Ju05), 325.7 2 (1988Ch35). I γ : others: 2.3 5 (1994Ju05), 9.5 11 (1988Ch35).
347.5 1	347.48	44.7 20	M1,E2	E γ : others: 347.4 1 (1994Ju05), 347.6 2 (1988Ch35), 347.5 3 (1983Ch34). I γ : others: 9.2 1 (1994Ju05), 49 5 (1988Ch35), 58.3 (1983Ch34). A ₂ /A ₀ =+0.01 2, A ₄ /A ₀ =-0.06 4 (1994Ju05).
374.3 4	721.76	0.5 1		
420.6 1	623.86	5.3 4	(M1)	E γ : other: 420.5 1 (1994Ju05). I γ : other: 2.3 1 (1994Ju05). A ₂ /A ₀ =+0.22 1, A ₄ /A ₀ =+0.06 2 (1994Ju05).
426.3 1	426.41	50 3	M1,E2	E γ : others: 426.2 1 (1994Ju05), 426.4 2 (1988Ch35), 426.4 3 (1983Ch34). I γ : others: 12.2 3 (1994Ju05), 55 6 (1988Ch35), 51 (1983Ch34). A ₂ /A ₀ =+0.10 4, A ₄ /A ₀ =+0.01 5 (1994Ju05).
457.5 § 5	1563.0	0.4 § 2		
464.8 2	891.22	1.0 1		
470.4 2	673.34	0.9 1		
482.2 2	1105.80	1.2 1	(M1+E2)	E γ : other: 482.0 5 (1994Ju05). I γ : other: 1.1 2 (1994Ju05). A ₂ /A ₀ =-0.31 5, A ₄ /A ₀ =+0.11 6 (1994Ju05).
497.2 2	1219.06	1.1 1		
503.4 3	929.42	1.1 1		
518.2 5	721.76	0.2 1		E γ : other: 518.0 2 (1982Av07).
522.2 4	985.3	1.4 1	E2	
526.6 5	1417.92	0.11 6		
530.1 3	1352.18	1.1 1		
549.4 2	1173.45	1.9 1		
571.2 3	997.40	0.9 1		E γ : other: 571.4 2 (1982Av07).

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$^{109}\text{Ag}(\text{p},\text{n}\gamma)$ 1988Vi03,1994Ju05 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. @	Comments
582.1 3	929.42	1.9 1		
584.6 3	1475.81	2.1 2		
596.4 1	1318.19	6.6 4		E γ : other: 596.2 5 (1988Ch35).
				I γ : other: 17.7 20 (1988Ch25).
613.6 1	673.34	31.9 20	M1	E γ : others: 614.2 1 (1994Ju05), 614.0 5 (1988Ch35), 613.6 2 (1982Av07), 614.0 3 (1983Ch34).
				I γ : others: 6.3 4 (1994Ju05), 40 4 (1988Ch35), 41.5 (1983Ch34).
				$A_2/A_0=+0.09$ 2, $A_4/A_0=-0.06$ 6 (1994Ju05).
618.4 1	821.89	9.4 6	M1	E γ : others: 619.3 1 (1994Ju05), 619.2 5 (1988Ch35), 619.4 5 (1983Ch34).
				I γ : others: 6.8 3 (1994Ju05), 8.1 13 (1988Ch35), 10.5 (1983Ch34).
				$A_2/A_0=-0.67$ 3, $A_4/A_0=-0.10$ 5 (1994Ju05).
623.8 1	623.86	30.8 20	M1	E γ : others: 623.8 1 (1994Ju05), 623.2 5 (1988Ch35), 623.9 5 (1983Ch34).
				I γ : others: 12.1 3 (1994Ju05), 33 4 (1988Ch35), 34.1 (1983Ch34).
				$A_2/A_0=-0.41$ 3, $A_4/A_0=-0.08$ 4 (1994Ju05).
650.0 1	997.40	9.8 7	(M1)	E γ : others: 649.9 1 (1994Ju05), 649.8 5 (1988Ch35), 650.2 5 (1983Ch34).
				I γ : others: 4.9 2 (1994Ju05), 10.1 14 (1988Ch35), 7.2 (1983Ch34).
				Mult.: Q from $A_2/A_0=+0.18$ 4, $A_4/A_0=-0.06$ 6 (1994Ju05), $T_{1/2}$ rules out M2.
653.6 3	1475.81	1.6 1		
678.8 3	1352.18	0.7 1		E γ : 1994Ju05 place a 679.5 γ from 1106 level.
679.5 $\frac{5}{2}$ 5	1105.80	0.65 $\frac{5}{2}$ 6		E γ : 1988Vi03 place a 678.8 γ from 1352 level.
694.8 1	1121.18	5.1 3		
$\times 705.7\frac{3}{2}\& 5$		41 $\frac{3}{2}$ 4		
721.8 1	721.76	20.2 10		E γ : others: 721.7 5 (1988Ch35), 721.2 2 (1982Av07), 721.8 5 (1983Ch34).
				I γ : other: 29 3 (1988Ch35), 27.9 (1983Ch34).
728.3 4	1352.18	0.7 1		
740.5 $\frac{5}{2}$ 5	1563.0	1.0 $\frac{5}{2}$ 1	D+Q	Mult.: from $A_2/A_0=-0.74$ 8, $A_4/A_0=+0.06$ 12 (1994Ju05).
746.9 4	1173.45	0.8 1		
754.0 6	1475.81	0.22 8		
758.6 6	1479.74	0.41 8		
764.5 4	1388.55	0.8 1		
773.7 1	1121.18	2.0 2		
788.0 $\frac{5}{2}$ 5	1853.9	1.6 $\frac{5}{2}$ 4	(M1)	
793.9 1	997.40	1.9 2		E γ : others: 794.0 5 (1994Ju05), 794.2 2 (1982Av07), 794.3 5 (1983Ch34).
				I γ : other: 0.8 2 (1994Ju05), 2.3 (1983Ch34).
800.4 6	1622.29	0.30 6		
821.9 1	821.89	6.8 6	E2	E γ : others: 822.5 1 (1994Ju05), 821.0 3 (1982Av07), 821.9 5 (1983Ch34).
				I γ : other: 2.0 2 (1994Ju05), 13.5 (1983Ch34).
				Mult.: Q from $A_2/A_0=+0.24$ 4, $A_4/A_0=+0.03$ 6 (1994Ju05), M2 is ruled out by $T_{1/2}$.
826.2 2	1173.45	2.4 2		
831.7 1	891.22	13.1 1		E γ : other: 831.0 3 (1982Av07). 1988Ch35 report a γ ray at $E\gamma=833.1$ 2 with $I\gamma=28$ 3 and 1983Ch34 report $E\gamma=833.1$ 5 with $I\gamma=31.7$.
834.9 2	1458.71	6.9 2		
$\times 843.7$ 6		0.4 1		
851.9 5	1475.81			
862.7 1	1066.03	3.0 2	E2	E γ : other: 863.1 1 in 1994Ju05.
				I γ : other: 6.9 3 (1994Ju05).
				Mult.: Q from $A_2/A_0=+0.27$ 6, $A_4/A_0=-0.01$ 8 (1994Ju05).
871.8 3	1219.06	0.7 1		
891.2 1	891.22	10.1 6		E γ : others: 891.7 5 (1988Ch35), 890.6 3 (1982Av07), 891.6 5 (1983Ch34).
				I γ : other: 13.5 17 (1988Ch35), 15.5 (1983Ch34).
901.8 2	1105.80	1.8 2	(M1+E2)	E γ : other: 902.6 0.5 (1994Ju05).
				I γ : other: 1.4 2 (1994Ju05).
				$A_2/A_0=+0.33$ 12, $A_4/A_0=+0.1$ 2 (1994Ju05).
907.2 2	1580.65	1.9 2		
$\times 910.7\frac{3}{2}\& 5$		7.5 $\frac{3}{2}$ 13		
925.3 4	1352.18	0.4 1		
929.4 1	929.42	6.1 5		
931.5 $\frac{3}{2}$ 5	1134.9?	13.1 $\frac{3}{2}$ 16		E γ : others: 931.7 3 (1982Av07), 930.5 5 (1983Ch34).
				I γ : other: 10.2 (1983Ch34).
939.6 $\frac{5}{2}$ 5	1563.0	1.5 $\frac{5}{2}$ 2	Q	Mult.: from $A_2/A_0=+0.23$ 8, $A_4/A_0=-0.15$ 11 (1994Ju05).
948.9 2	1622.29	0.4 1		
959.0 $\frac{5}{2}\& 5$	2064.65	1.5 $\frac{5}{2}$ 2		E γ : placed by 1994Ju05. 1988Vi03 place a 960.1 γ from 1633.5 level.

Continued on next page (footnotes at end of table)

$^{109}\text{Ag}(\text{p},\text{n}\gamma)$ 1988Vi03,1994Ju05 (continued) $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. @	Comments
960.1 6	1633.52	0.4 1		
962.2 3	1388.55	1.1 1		
	1425.3	1.1 1		
$\times$ 969.5 3		2.0 1		
971.5 5	1318.19	0.3 1		
991.4 4	1417.92	0.5 1		
998.4& 5	997.40	17.2		$E\gamma, I\gamma$: from 1983Ch34 only, also assigned to ^{107}Cd .
998.5 4	1622.29	0.7 1		$E\gamma$: Placed by evaluators. 1988Vi03 has seen this γ -ray in coincidence with 623.8 γ but not placed it. 1983Ch34 report a γ ray at $E\gamma=998.4$ 5 with $I\gamma=17.2$ and place it from 998 level and they also assign it to ^{107}Cd .
999.0§& 5	2064.65	0.8§ 3		$E\gamma$: placed by 1994Ju05. A 998.5 γ is seen by 1988Vi03 in coincidence with 623.8 γ but not placed.
				$A_2=-0.15$ 19 (1994Ju05).
1005.0 6	1352.18	0.15 5		
1031.8§ 5	1853.9	1.0§ 3	(E2)	
1049.5 3	1475.81	0.9 1		
1061.5 2	1121.18	3.7 4		
1066.2 2	1787.37	1.2 1		
1075.7§ 5	2141.7	0.9§ 1	E2	$A_2/A_0=+0.20$ 8, $A_4/A_0=-0.04$ 12 (1994Ju05).
1105.9 1	1105.80	4.2 4	(E2)	$E\gamma$: others: 1106.1 1 (1994Ju05), 1105.6 5 (1988Ch35), 1106.2 3 (1982Av07).
				$I\gamma$: others: 2.5 2 (1994Ju05), 5.0 10 (1988Ch35).
				Q from $A_2/A_0=+0.22$ 4, $A_4/A_0=-0.03$ 5 (1994Ju05).
1113.0 3	1539.36	0.8 4		
1128.4 3	1475.81	0.9 1		
1148.5 2	1352.18	2.7 2		$E\gamma$: other: 1148.2 5 (1983Ch34).
				$I\gamma$: other: 2.1 (1983Ch34).
1185.0 3	1388.55	0.8 1		
1195.6 2	1622.29	1.2 1		
1207.1 3	1633.52	0.8 1		
1214.6 2	1417.92	2.7 2		
1233.4 3	1580.65	0.8 1		
1245.8 3	1593.3	0.9 1		
1255.3 2	1458.71	1.1 1		
1270.6 2	1943.97	1.0 1		
1272.6 2	1475.81	0.7 1		
1276.3 2	1479.74	1.1 1		
1336.1 4	1539.36	0.7 1		
1346.4 1	1772.80	1.7 1		
1352.3 1	1352.18	1.7 2		
1360.8 1	1787.37	2.1 1		
1382.4 4	1729.95	0.7 1		
1388.6 2	1388.55	2.0 1		
1410.2 6	2033.77	0.25 8		
1419.0 1	1622.29	1.8 1		
1430.2 4	1633.52	0.7 1		
1442.8 4	1869.20	0.7 1		
$\times$ 1446.2 7		0.4 1		
1465.9 1	1813.39	2.6 2		
1475.7 2	1475.81	1.5 1		
1493.2 3	2166.19	0.9 1		
1511.0 3	1937.5	0.9 1		
1521.7 2	1869.20	2.3 1		
1526.6 2	1729.95	1.2 1		
1539.3 2	1539.36	1.3 1		
1569.5 5	1772.80	0.5 1		
1607.3 2	2033.77	1.7 1		
$\times$ 1622.5 3		0.8 1		
1685.3 4	2111.62	0.6 1		
1698.9 3	2046.4	0.9 1		
	2372.3	0.9 1		
1717.0 1	2064.65	2.0 1		
1734.2 5	1937.5	0.51 5		
1740.7 5	1943.97	0.52 6		

Continued on next page (footnotes at end of table)

¹⁰⁹Ag(p,n γ) 1988Vi03,1994Ju05 (continued)

 $\gamma(^{109}\text{Cd})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$
1752.6 6	1956.0	0.40 6	^x 1940.0 8		0.08 4	2166.0 2	2166.19	1.3 1
1764.1 2	2111.62	2.0 1	1995.5 3	2198.91	0.9 1	2198.9 2	2198.91	2.9 2
1772.6 3	1772.80	0.8 1	2031.0 3	2234.20	1.6 1	2234.0 3	2234.20	0.9 1
1785.6 3	1989.0	0.7 1	2033.8 3	2033.77	1.3 1	2282.6 4	2282.45	0.7 1
1855.7 4	2282.45	0.6 1	2044.0 4	2391.84	0.8 1	2325.7 4	2325.7	0.6 2
1861.4 1	2064.65	2.0 1	2079.3 5	2282.45	0.33 9	^x 2371.2 4		0.6 2
1923.8 5	2271.3	0.42 7	2122.4 5	2325.7	0.52 9	2392.0 3	2391.84	0.7 2

[†] From 1988Vi03, unless otherwise noted. γ -ray intensities are normalized to $I\gamma(203\gamma)=100$. Data from other work are also available and given under comments but they are not as complete and/or precise as those in 1988Vi03.

[‡] From 1988Ch35.

[§] From 1994Ju05.

[#] From 1983Ch34.

[@] From Adopted Gammas, unless otherwise noted.

[&] Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

¹¹⁰Cd(d,t) 1975Ch07

Target ¹¹⁰Cd $J\pi(g.s.)=0+$.

1975Ch07: E(d)=16 MeV beam was produced from the University of Pittsburgh three stage Van de Graaff accelerator.

Target was a 95% isotopically pure self-supporting foil of 553 $\mu\text{g}/\text{cm}^2$ thick. Tritons were momentum analyzed by an Enge split-pole spectrograph (FWHM=23 keV) and recorded in photographic emulsion plates. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

Other: 1964Ro17.

All data are from 1975Ch07.

¹⁰⁹Cd Levels

E(level)	$J\pi^\dagger$	L	$C^2S^\ddagger$	Comments
0.0	5/2+	2	2.08	
59 5	1/2+	0	0.39	
202 5	7/2+	4	3.50	
345 5	3/2+	2	0.66	$J\pi$: 5/2+ in Adopted Levels.
425 5	5/2+	2	0.24	
462 5	11/2-	5	1.14	
620 5	7/2+	4	1.11	
672 5	3/2+	2	0.06	
717 5	5/2+, 3/2+	2	0.22, 0.29	
818 5	5/2+, 3/2+	2	0.04, 0.06	
890 5	5/2+, 3/2+	(2)	0.81, 1.08	L: 1975Ch07 state in text that L=0+2 (70% L=2, 30% L=0) provides best fit to the angular distribution of the 890-keV peak. However, in authors' table of results only L=2 is given.
927 5	5/2+	2	1.30	
1105 5	5/2+, 3/2+	2	0.07, 0.09	
1170 5	5/2+, 3/2+	2	0.44, 0.58	
1315 5	5/2+, 3/2+	2	0.11, 0.14	
1414 5	1/2+	0	0.04	

[†] Values shown here are for the purpose of extracting corresponding spectroscopic factors.

[‡] Spectroscopic factor is deduced based on: $(d\sigma/d\Omega)(\text{exp})/(d\sigma/d\Omega)(\text{DWBA})=3.33\times C^2S$. 1975Ch07 assign 15% maximum uncertainty in the absolute cross sections.

Adopted Levels, Gammas

Q(β⁻)=-3857 9; S(n)=10439 9; S(p)=4524 5; Q(α)=-1842 6 2012Wa38.

¹⁰⁹In Levels

Cross Reference (XREF) Flags

A ¹⁰⁹In IT Decay (1.34 min)
B ¹⁰⁹In IT Decay (210.0 ms)
C ¹⁰⁹Sn ε Decay
D ¹⁰⁸Cd(d,nγ)

E ¹⁰⁸Cd(³He,d)
F ¹¹²Sn(p,α)
G ¹⁰⁸Cd(p,p),(p,p') IAR
H ¹⁰⁷Ag(α,2nγ)

I ⁷⁶Ge(³⁷Cl,4nγ)
J ⁹²Mo(¹⁹F,2pγ)
K ⁹⁶Zr(¹⁹F,6nγ)
L ⁹⁷Mo(¹⁶O,3npγ)

E(level) [†]	Jπ	XREF	T _{1/2} [‡]	Comments
0.0 ^b	9/2+	ABCDEF HIJKL	4.159 h 10	%ε+%β ⁺ =100. Jπ: from atomic-beam magnetic-resonance flop-in technique (1958Ma43,1959Ma19); π=+ from μ, L(³ He,d)=4. T _{1/2} : weighted average of 4.167 h 18 (203γ(t) in 2005Gy02, uncertainty is statistical only), and 4.155 h 12 (203γ(t) in 2009Ra17, weighted average of 4.143 h 4 (Au catcher), 4.184 h 6 (Pb catcher) and 4.151 h 7 (Al catcher); uncertainty is statistical only). Others: 4.30 h 15 (β(t) in 1949Ma20), 4.2 h 2 (ce(t) in 1951Mc11), 4.3 h 3 (momentum plot of positron in 1962No06), and 4.2 h 1 (203γ(t) in 1968Sm08). μ=+5.538 4. Q=+0.841 13. μ: from collinear fast-beam LASER spectroscopy (1985U103,1987Eb02) Other: +5.538 11 from nuclear magnetic resonance on oriented nuclei (1981Ha26), 5.53 6 (from atomic beam in 1959Ma19),. Q: from collinear fast-beam LASER spectroscopy (1985U103,1987Eb02). configuration: π(g _{9/2}) ⁻¹ . δ<r ² >(115,109)=-0.410 7 (1985U103). %IT=100.
649.79 10	1/2-	A CDEF H	1.34 min 6	Jπ: 649.87γ M4 to 9/2+; L(³ He,d)=1. T _{1/2} : weighted average of 1.34 min 7 (651γ(t) in 1968Sm08), 1.35 min 20 (658γ(t) in 1966Ma39) and 1.3 min 2 (1956Ku51). configuration: π(p _{1/2}) ⁻¹ .
980.92 11	3/2-	CDEF H	0.62 ps +30-15	Jπ: 331.2γ M1 ΔJ=1 to 1/2-; L(³ He,d)=1.
1026.39 ^b 8	11/2+	BCD HIJKL	0.17 ps 7	Jπ: 1026.36γ M1+E2 ΔJ=1 to 9/2+; band assignment. configuration: π(g _{9/2}) ⁻¹ ⊗v2 ⁺ .
1099.31 [§] 8	5/2+	CDE HI L	0.45 ps 21	Jπ: 1099.3γ E2 to 9/2+; L(³ He,d)=2. configuration: π(d _{5/2}) ⁻¹ .
1171.71 16	1/2+	CDE		Jπ: 521.9γ E1 to 1/2+; L(³ He,d)=0. configuration: π(s _{1/2}) ⁻¹ .
1321.25 11	5/2+	CDE		Jπ: 1321.2γ E2 to 9/2+, 340.2γ to 3/2-; direct feeding in ¹⁰⁹ Sn ε decay (Jπ=5/2+).
1334.73? 22	(3/2, 5/2, 7/2-)	C		Jπ: 353.9γ to 3/2-; direct feeding in ¹⁰⁹ Sn ε decay (Jπ=5/2+).
1428.36 ^b 8	13/2+	BCD HIJKL	0.28 ps 14	Jπ: 1428.32γ E2 to 9/2+, 401.97γ M1+E2 to 11/2+. configuration: π(g _{9/2}) ⁻¹ ⊗v4 ⁺ .
1440.70 21	5/2-	CD F		Jπ: 791.0γ E2 to 1/2-, 459.8 (M1) to 3/2-.
1463.59 18	9/2+	CD H L	0.21 ps 7	Jπ: 437.2γ M1 to 11/2+.
1482.22? 22	(5/2+, 7/2-)	C		Jπ: 383γ to 5/2+, 501.2γ to 3/2-, 1482.3γ to 9/2+; direct feeding in ¹⁰⁹ Sn ε decay (Jπ=5/2+).
1483.75 18	5/2+	CDE		Jπ: L(³ He,d)=2; 229.2γ from 9/2+; 384.5γ M1 to 5/2+, 312.0γ to 1/2+.
1574.30 13	(5/2+, 7/2)	CD		Jπ: 1574.3γ to 9/2+; direct feeding in ¹⁰⁹ Sn ε decay (Jπ=5/2+).
1713.27 [§] 12	9/2+	CD HI		Jπ: 614.1γ E2 to 5/2+, 285.0γ to 13/2+.
1722.38 [#] 16	7/2+	CDE I		Jπ: L(³ He,d)=4, 623.5γ M1 to 5/2+; direct feeding in ¹⁰⁹ Sn ε decay (Jπ=5/2+).

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Adopted Levels, Gammas (continued)

¹⁰⁹In Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} [‡]	Comments
1759.32 12	3/2-, 5/2-, 7/2	C		J π : 660.1 γ to 5/2+; probable direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
1816.65 13	(3/2-, 5/2-)-	CD		J π : 835.7 γ M1,E2 to 3/2-, 1166.6 γ to 1/2-, 495.8 γ to 5/2+.
1843.7 6	(5/2+, 7/2)	C		J π : 1843.7 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
1900.28 12	13/2+	HI KL	0.14 ps 7	J π : 873.95 γ M1+E2 to 11/2+, 421.9 γ D(+Q) from 15/2+.
1923 19		F		
1957.10 11	5/2+	C E		J π : L(³ He,d)=(2); 785.3 γ to 1/2+ and 1956.9 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2030 6	(1/2+, 3/2+, 5/2+)	E		J π : L(³ He,d)=(0,2).
2055.14 25	(5/2+, 7/2)	C F		J π : 2055.2 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2064.2 5	(3/2-, 5/2-, 7/2-)	CD		J π : 1083.4 γ (M1,E2) to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay(J π =5/2+).
2076 5	(1/2+, 3/2+, 5/2+)	E		J π : L(³ He,d)=(0,2).
2101.86 11	19/2+	B HI KL	210.0 ms 9	%IT=100. J π : 673.52 γ M3 to 13/2+. T _{1/2} : weighted average: 214 ms 12 (γ (t) in 1994ByZZ), 210 ms 4 (using 402-,673-,1026-,1428 γ (t) in 1979Va13), 210 ms 1 (using 405-,680-,1035-,1435 γ (t) in 1966We01), 204 ms 10 (γ (t) in 1965Al15), and 210 ms 2 (1963Po10). configuration: v(g _{9/2}) ⁻¹ ⊗v6*, where v6* is a mixture of v(d _{5/2} ,g _{7/2}) and v(g _{7/2}) ⁺² . Shell model would suggest configuration= π g _{9/2} ⁻³ ; However, no such isomer was observed in other odd-A In isotopes.
2102.21 14	17/2+	JK		J π : 673.85 γ E2 to 13/2+.
2125.78 11	(5/2+, 7/2)	C F		XREF: F(2128). J π : 1026.4 γ to 5/2+, 2125.9 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2138.43 12	(3/2+)	C E		XREF: E(2140). J π : L(³ He,d)=(2); 1039.0 γ to 5/2+, 1488.7 γ to 1/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2151.4 3	(3/2-, 5/2-)	C		J π : 710.7 γ to 5/2-, 1501.7 γ to 1/2-, 1170.2 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2195.26 ^b 22	15/2+	HI L	0.35 ps 14	J π : 766.9 γ M1+E2 to 13/2+; band assignment.
2210 5	(1/2-, 3/2-, 5/2+)	E		J π : L(³ He,d)=(1,2).
2218.56 15	(5/2+, 7/2)	C		J π : 1119.2 γ to 5/2+, 2218.5 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2235.8 3	(5/2+, 7/2)	C		J π : 522 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2271.4 5	(3/2+)	C E		XREF: E(2266). J π : L(³ He,d)=(2), 1621.7 γ to 1/2-, 1290.0 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2272.2 ^d 3	13/2-	HI KL		J π : 1245.8 γ E1 (Δ J=1) to 11/2+, 842 γ to 13/2+.
2276.5 7	(7/2+)	C		J π : 1250.1 γ to 11/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2305.2 4	(3/2-, 5/2-)	C E		J π : L(³ He,d)=(0,2,3); 1655.7 γ to 1/2-, 1205.6 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2317.3 [#] 7	(11/2+)	I		J π : 595 γ to 7/2+, 604 γ to 9/2+; band assignment.
2321.92 15	15/2+	HI		J π : 893.5 γ M1 to 13/2+, 1295.0 γ to 11/2+.
2332 5	(1/2+, 3/2+, 5/2+)	E		J π : L(³ He,d)=(0,2).
2356.14 22	(3/2-, 5/2-, 7/2-)	CDE		XREF: E(2360). J π : 1375.2 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2410.9 4	(3/2-, 5/2+)	C		J π : 1239.9 γ to 1/2+, 1429.7 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2469.04 24	(3/2-, 5/2-, 7/2+)	CDE		XREF: E(2474). J π : 985.3 γ M1,E2 to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).

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Adopted Levels, Gammas (continued)
¹⁰⁹In Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} [‡]	Comments
2508.33 13	(3/2, 5/2-)	C f		XREF: f(2528). J π : 1858.7 γ to 1/2-, 1408.9 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2532.44 ^d 11	15/2-	HIJKL	0.24 ps 10	J π : 1104.04 γ E1 to 13/2+ 259.6 γ (M1) to 13/2-; band assignment.
2542.02 11	(5/2+, 7/2)	C f		XREF: f(2528). J π : 2541.8 γ to 9/2+, 1442.7 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2561.02 19	3/2+	C ef		XREF: e(2564)f(2559). J π : L(³ He,d)=(0,2); 1911.1 γ to 1/2-, 1462.0 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2564.2 7	(5/2+)	C ef		XREF: e(2564)f(2559). J π : L(³ He,d)=(0,2); 2564.2 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2574.8 3	(5/2+, 7/2)	C		J π : 2574.8 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2591.85 17	7/2+	C E		XREF: E(2585). J π : L(³ He,d)=(4), 1565.6 γ to 11/2+, 452.8 γ to 3/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2602.3 4	(5/2+, 7/2)	C		J π : 2602.7 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2617.16 20	(5/2, 7/2)+	C		J π : 2617.0 γ to 9/2+, 478.5 γ to 3/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2674 6	(1/2+, 3/2+, 5/2+)	E		J π : L(³ He,d)=(0,2).
2709 6		E		
2785.59 14	(5/2+, 7/2)	C F		XREF: F(2775). J π : 1072.7 γ to 9/2+, 1464.2 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2808.8 3	3/2	C		J π : 2158.9 γ to 1/2-, 1709.3 γ to 5/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2812 7	(1/2+)	E		J π : L(³ He,d)=(0).
2813.47 20	(5/2+, 7/2)	C		J π : 2813.2 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2845.77 12	3/2	C E		XREF: E(2839). J π : 2195.6 γ to 1/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2851.70 23	7/2+	C		J π : 1825.1 γ to 11/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2858.58 18	(5/2+, 7/2)	C F		XREF: F(2857). J π : 2858.6 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2868.77 ^d 12	17/2-	HIJKL	0.40 ps 12	J π : 336.36 γ M1+E2 to 15/2-, band assignment. T _{1/2} [‡] : weighted average of 0.38 ps 17 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ) and 0.42 ps 17 (also 1987KuZV) in ⁹⁷ Mo(¹⁶ O,3pn γ).
2871.19 14	5/2+	C		J π : 1889.8 γ to 3/2-, 1157.8 γ to 9/2+, 1700.7 γ to 1/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2888 7	(1/2+, 3/2+, 5/2)	E		J π : L(³ He,d)=(0,2,3).
2919.8 7	(5/2+, 7/2)	C		J π : 2919.8 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2924.42 13	(3/2, 5/2)	C		J π : 1943.5 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2943.0 4	(5/2+, 7/2-)	C		J π : 2942.8 γ to 9/2+, 1962.2 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2958.04 ^d 13	19/2-	HIJKL		J π : 89.24 γ M1(+E2) to 17/2-, 856.2 γ E1 Δ I=0 to 19/2+, band assignment.
2986.8 3	(3/2+, 5/2+)	C E		XREF: E(2993). J π : L(³ He,d)=(2); 848.6 γ to 3/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
2995.9 9	(17/2+)	I		J π : 674 γ to 15/2+; adopted from ⁷⁶ Ge(³⁷ Cl,4n γ).
3013.4 3	(5/2+, 7/2)	C		J π : 3013.4 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).

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Adopted Levels, Gammas (continued)
¹⁰⁹In Levels (continued)

E(level) [†]	J π	XREF	T _{1/2} [‡]	Comments
3029.69 21	(5/2+)	C		J π : 3029.7 γ to 9/2+, 2049.0 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3034.8 4	(5/2+, 7/2)	C		J π : 3034.8 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3050.73 19	(5/2+, 7/2)	C		J π : 3050.7 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3065.65 20	(5/2+, 7/2)	C		J π : 3065.6 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3067.35 ^h 23	17/2-	HI L	0.21 ps 9	J π : 534.9 γ M1+E2 to 15/2-. T _{1/2} : weighted average of 0.17 ps 10 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ) and 0.31 ps 17 (also 1987KuZV) in ⁹⁷ Mo(¹⁶ O,3pn γ).
3092.10 ^g 13	19/2-	HIJKL	0.44 ps 12	J π : 990.25 γ E1 Δ J=0 to 19/2+, 223.4 γ M1 to 17/2-; band assignment. T _{1/2} : weighted average of 0.49 ps 21 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ) and 0.42 ps 14 (also 1987KuZV) in ⁹⁷ Mo(¹⁶ O,3pn γ).
3122.54 ^d 14	21/2-	HIJKL		J π : 164.47 γ M1(+E2) to 19/2-; band assignment.
3140.3 5	(5/2+, 7/2)	C		J π : 3139.8 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3155.2 [#] 6	(15/2+)	I		J π : 838 γ to (11/2+), 1053 γ to 19/2+; band assignment.
3202.49 ^g 14	21/2-	HIJKL		J π : 110.42 γ and 224.5 γ M1(+E2) to 19/2-; band assignment.
3273.44? 24		J		
3285.8 ^h 3	19/2-	HI L	>1.0 ps	J π : 218.48 γ M1 to 17/2-.
3316.8 3	(5/2+, 7/2)	C		J π : 3316.7 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3361.0 6	(5/2+, 7/2)	C		J π : 3316.7 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3374.74 24	(19/2-)	H L	0.21 ps 10	J π : 416.7 γ (M1) to 19/2-, probably Δ J=0.
3395.68 20	(5/2+, 7/2)	C		J π : 3395.6 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3410.37 ^g 15	23/2-	HIJKL	0.69 ps 21	J π : 207.90 γ M1(+E2) to 21/2-; band assignment. T _{1/2} : from ⁹⁷ Mo(¹⁶ O,3pn γ) (1987KuZV); Other: 0.42 ps 14 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ).
3418.5 4	5/2+, 7/2-	C		J π : 3418.5 γ to 9/2+, 2437.5 γ to 3/2-; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3426.54 22	(5/2+, 7/2)	C		J π : 3427.3 γ to 9/2+; direct feeding in ¹⁰⁹ Sn ϵ decay (J π =5/2+).
3462.04 ^d 16	23/2-	HIJKL	0.8 ps 3	J π : 339.47 γ M1+E2 to 21/2-; band assignment.
3484.4? 4	(23/2)	JK		J π : 361.9 d+Q to 21/2-.
3517.1 ^h 4	21/2-	HI L	0.43 ps 10	J π : 231.3 γ (M1) to 19/2-. T _{1/2} : weighted average of 0.45 ps 14 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ) and 0.42 ps 14 (also 1987KuZV) in ⁹⁷ Mo(¹⁶ O,3pn γ).
3528.7 8	(21/2+)	I		J π : 1427 γ to 19/2+.
3653.8 9	(17/2+)	I		J π : 1552 γ to 19/2+.
3798.3 8	(23/2+)	I		J π : 1697 γ to 19/2+.
3800.14 ^g 16	25/2-	HIJKL	1.7 ps 6	J π : 389.80 γ M1+E2 to 23/2-, band assignment. T _{1/2} : weighted average of 1.4 ps 7 (1987KuZV) in ¹⁰⁷ Ag(α ,2n γ) and 2.7 ps 14 (also 1987KuZV) in ⁹⁷ Mo(¹⁶ O,3pn γ).
3844.1 ^h 11	(23/2-)	I		J π : 327 γ to 21/2-; band assignment.
4037.54 ^d 23	25/2-	HIJKL	0.6 ps 3	J π : 575.3 γ M1 to 23/2-, band assignment.
4097.4 [#] 10	(19/2+)	I		J π : 942 γ to (15/2+); band assignment.
4300.8 ^{&} 9	(21/2+)	I		J π : 647 γ to (17/2+); band assignment.
4354.6 ^c 7	(23/2+)	I		J π : 826 γ to (21/2+); band assignment.
4436.0 ^g 5	27/2(-)	I K		J π : 630.0 γ (M1) to 25/2-, band assignment.
4508.37 ^f 25	27/2-	IJK		J π : 470.9 γ (M1) to 25/2-, band assignment.
4508.37+x ^e	(25/2-)	I		J π : feeding to J π =19/2- (band 8) and J π =23/2- and 25/2- (band 11) levels in ⁷⁶ Ge(³⁷ Cl,4n γ) (1997VaZS).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

¹⁰⁹In Levels (continued)

E(level) [†]	J π	XREF	Comments
4565.4 ^c 7	(25/2+)	I	J π : 211 γ (M1) to (23/2+); band assignment.
4572.6 ⁹	(25/2+)	I	J π : 774 γ to (23/2+); proposed by 1997VaZS based on band structure.
4743.7 ^{&} 10	(25/2+)	I	J π : 443 γ to (21/2+); band assignment.
4756.6 [#] 11	(23/2+)	I	J π : 659 γ to (19/2+); band assignment.
4832.4 ^f 4	29/2(-)	IJK	J π : 324.0 γ (M1) to 27/2(-), band assignment.
4927.8 ^c 7	(27/2+)	I	J π : 355 γ (M1) to (25/2+); band assignment.
5024.7 ^g 7	29/2(-)	I K	J π : 588.7 γ (M1) to 27/2(-), band assignment.
5219.8 [#] 10	(27/2+)	I	J π : 463 γ to (23/2+); band assignment.
5241.4 ^f 11	31/2(-)	IJK	J π : 409.0 γ (M1) to 29/2(-), band assignment.
5275.2+x ^e 10	(29/2-)	I	J π : 767 γ to (25/2-); band assignment.
5397.5 ^{&} 9	(29/2+)	I	J π : 470 γ to (27/2+, 654 γ to (25/2+); band assignment.
5424.8 ^c 10	(29/2+)	IJ	XREF: J(?). J π : 497 γ (M1) to (27/2+); band assignment.
5580.1 ^g 9	31/2(-)	K	J π : 555.4 γ (M1) to 29/2(-), band assignment.
5761.9 ^a 16	(29/2+)	I	J π : band assignment.
5796.6 ^f 12	33/2(-)	IJK	J π : 554.7 γ (M1) to 31/2(-), band assignment.
5851.1 [#] 10	(31/2+)	I	J π : 631 γ to (27/2+); band assignment.
5918.0 ^c 10	(31/2+)	I	J π : 493 γ (M1) to (29/2+), 990 γ to (27/2+); band assignment.
6005.9 ^a 12	(31/2+)	I	J π : 581 γ (M1) to (29/2+); band assignment.
6263.3 ^{&} 13	(33/2+)	I	J π : band assignment.
6272.0 ^a 13	(33/2+)	I	J π : band assignment.
6293.2+x ^e 15	(33/2-)	I	J π : band assignment.
6428.6 ^f 16	(35/2-)	I	J π : band assignment.
6433.4 ^c 12	(33/2+)	I	J π : band assignment.
6506.8 [@] 13	(31/2+)	I	J π : band assignment.
6639.0 ^a 16	(35/2+)	I	J π : band assignment.
6668.1 [#] 14	(35/2+)	I	J π : band assignment.
6927.4 ^c 15	(35/2+)	I	J π : band assignment.
7120.0 ^a 19	(37/2+)	I	J π : band assignment.
7151.1 [@] 14	(35/2+)	I	J π : band assignment.
7288.2 ^{&} 15	(37/2+)	I	J π : band assignment.
7384.2+x ^e 18	(37/2-)	I	J π : band assignment.
7423.4 ^c 19	(37/2+)	I	J π : band assignment.
7642.1 [#] 17	(39/2+)	I	J π : band assignment.
7712.0 ^a 22	(39/2+)	I	J π : band assignment.
7981.1 [@] 15	(39/2+)	I	J π : band assignment.
8005.4 ^c 21	(39/2+)	I	J π : band assignment.
8310.2+x ^e 20	(41/2-)	I	J π : band assignment.
8329.0 ^a 24	(41/2+)	I	J π : band assignment.
8463 ^{&} 6	(41/2+)	I	J π : band assignment.
8632.4 ^c 23	(41/2+)	I	J π : band assignment.
8786.1 [#] 20	(43/2+)	I	J π : band assignment.
8977 ^a 3	(43/2+)	I	J π : band assignment.
8981.1 [@] 18	(43/2+)	I	J π : band assignment.
9292.2+x ^e 23	(45/2-)	I	J π : band assignment.
9317 ^c 3	(43/2+)	I	J π : band assignment.
9783 ^{&} 6	(45/2+)	I	J π : band assignment.
10105.1 [#] 23	(47/2+)	I	J π : band assignment.
10218.1 [@] 21	(47/2+)	I	J π : band assignment.
10428.2+x ^e 25	(49/2-)	I	J π : band assignment.
10746 ⁵	1/2+	G	J π : from IAR.
11055 ⁵	3/2+	G	J π : from IAR.
11189 [?] & 6	(49/2+)	I	J π : band assignment.
11598 ⁵	1/2+	G	J π : from IAR.
11634.1 [#] 25	(51/2+)	I	J π : band assignment.
11642.1 [@] 12	(51/2+)	I	J π : band assignment.
11730+x ^e 3	(53/2-)	I	J π : band assignment.
13244+x ^e 3	(57/2-)	I	J π : band assignment.
13338.0 [#] 14	(55/2+)	I	J π : band assignment.
14821.1+x ^e 15	(61/2-)	I	J π : band assignment.

[†] From a least-squares fit to E γ .

[‡] From 1987KuZV (and 1988Vi07) in ¹⁰⁷Ag(α ,2n γ) by DSAM, unless otherwise noted.

Adopted Levels, Gammas (continued)

¹⁰⁹In Levels (continued)

- § (A): Band 1: $\Delta J=2$ band based on $5/2+$ at 1099 keV.
(B): Band 2: $\Delta J=2$ band based on $7/2+$ at 1722 keV.
@ (C): Band 3: $\Delta J=2$ band based on $(31/2+)$ at 6507 keV.
& (D): Band 4: $\Delta J=2$ band based on $(21/2+)$ at 4300 keV.
a (E): Band 5: $\Delta J=1$ band based on $(29/2+)$ at 5762 keV.
b (F): Band 6: ground state band.
c (G): Band 7: $\Delta J=1$ band based on $23/2+$ at 4354 keV.
d (H): Band 8: $\Delta J=1$ band based on $13/2-$ at 2272 keV.
e (I): Band 9: $\Delta J=2$ band based on $(25/2-)$ at 4508.37+x keV.
f (J): Band 10: $\Delta J=1$ band based on $27/2-$ at 4508.37 keV.
g (K): Band 11: $\Delta J=1$ band based on $19/2-$ at 3092 keV. Configuration= $\pi g_{9/2}^{-1} \otimes v[h_{11/2}, (d_{5/2}/g_{7/2})]$ before alignment and $\pi g_{9/2}^{-1} \otimes v[h_{11/2}, (d_{5/2}/g_{7/2})^3]$ after alignment around $\hbar\omega=0.7$ MeV.
h (L): Band 12: $\Delta J=1$ band based on $17/2-$ at 3067 keV.

$\gamma(^{109}\text{In})$

E(level)	E $\gamma^\dagger$	I $\gamma^\dagger$	Mult.@	$\delta@ \&$	α	I($\gamma+ce$)	Comments
649.79	649.8 2	100	M4		0.0695		E γ : Other: 650.1 3 from ¹⁰⁸ Cd(d,n γ), and 649.8 3 from ¹⁰⁷ Ag(α ,2n γ). Mult.: $\alpha(\text{exp})=0.07$ 2(1956Pe56), $\alpha(\text{exp})=0.08$ 3, K/L=6.2 9 (1965Kh04) from ¹⁰⁹ Sn ϵ decay. B(M4)(W.u.)=10.0 5.
980.92	331.2 2	100	M1		0.0203		E γ : Other: 331.2 3 from ¹⁰⁸ Cd(d,n γ) and 331.0 4 from ¹⁰⁷ Ag(α ,2n γ). Mult.: $a_2/a_0=-0.14$ 4, $a_4/a_0=+0.08$ 5(1979Va13) in ¹⁰⁷ Ag(α ,2n γ); $\alpha(K)\text{exp}=12 \times 10^{-3}$ (1965Kh04), $\alpha(K)\text{exp}=28 \times 10^{-3}$ (1970Sh05) in ¹⁰⁹ Sn ϵ decay; $a_2/a_0=-0.08$ 4 (1975Di12) in ¹⁰⁸ Cd(d,n γ). B(M1)(W.u.)=0.96 +30-31.
1026.39	1026.4 1	100	M1+E2	+0.41 13	0.00133 3		E γ : Other: 1026.0 5 from ¹⁰⁸ Cd(d,n γ), 1026.35 8 from ¹⁰⁷ Ag(α ,2n γ), 1026.2 5 from ⁹⁶ Zr(¹⁹ F,6n γ), 1025.3 6 (1994ByZZ) in ¹⁰⁹ In IT decay (0.210 s), 1027.6 1 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ). Mult.: $\alpha(K)\text{exp}=1.1 \times 10^{-3}$ 3, $\text{pol}=-0.47$ 5, $\delta=+0.40$ +9-4, $a_2/a_0=+0.25$ 1, $a_4/a_0=-0.04$ 2 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); $R=0.65$ 3 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); $\alpha(K)\text{exp}=1.08 \times 10^{-3}$ 10, $a_2/a_0=+0.15$ 3 (1975Di12) in ¹⁰⁸ Cd(d,n γ); $\alpha(K)\text{exp}=0.0046$ (1970Sh05) in ¹⁰⁹ Sn ϵ decay. δ : deduced by evaluators using experimental conversion coefficients and mixing ratio from $\gamma(\theta)$ using the BrIccMixing program. B(M1)(W.u.)=0.10 5; B(E2)(W.u.)=14 10.
1099.31	119.0 6	0.2 1	[E1]		0.1062 22		B(E1)(W.u.)=0.0008 6.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I($\gamma+\text{ce}$)	Comments
1099.31	1099.2 2	100 $\frac{3}{4}$ 5	E2		9.85 $\times 10^{-4}$		E γ : Other: 1099.2 5 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, and 1099.5 3 from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=0.79\times 10^{-3}$ 14, $a_2/a_0=+0.01$ 3 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$; $\alpha(\text{K})_{\text{exp}}=0.89\times 10^{-3}$ 20, $\text{pol}=0.11$ 13, $a_2/a_0=+0.01$ 2, $a_4/a_0=-0.033$ (1979Va13) in $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$; $\alpha(\text{K})_{\text{exp}}=0.0013$ (1970Sh05) in ^{109}Sn ϵ decay. B(E2)(W.u.)=25 12.
1171.71	521.9 2	100	E1		0.00204		E γ : Other: 522.2 3 in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=1.5\times 10^{-3}$ 3, $a_2/a_0=+0.004$ 30 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$; $\alpha(\text{K})_{\text{exp}}=0.012$ (1970Sh05) in ^{109}Sn ϵ decay.
1321.25	222.2 7 340.2 3 1321.3 2	0.51 25 2.0 5 100 6	[M1] [E1] E2		0.0571 10 0.00586 6.98 $\times 10^{-4}$		E γ : Other: 1320.8 5 in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=0.59\times 10^{-3}$ 20, $a_2/a_0=+0.04$ 3 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
1334.73? 1428.36	353.9 2 401.97 6	100 22.5 11	M1+E2	+0.07 +5-4	0.01244		E γ : from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$. Others: 402.2 5 from ^{109}In IT decay (0.210 s), 401.6 4 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, 402.1 from $^{76}\text{Ge}(\text{}^{37}\text{Cl},4\text{n}\gamma)$, 402.0 2 from $^{92}\text{Mo}(\text{}^{19}\text{F},2\text{p}\gamma)$, and 402.2 5 from $^{96}\text{Zr}(\text{}^{19}\text{F},6\text{n}\gamma)$. I γ : weighted average of 26 7 from ^{109}In IT decay (0.210 s), 23.1 23 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, 23.8 10 from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$, and 19.5 14 from $^{96}\text{Zr}(\text{}^{19}\text{F},6\text{n}\gamma)$. Other: 19.0 5 from $^{92}\text{Mo}(\text{}^{19}\text{F},2\text{p}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=10\times 10^{-3}$ 4, $\text{pol}=-0.25$ 3, $\delta=+0.07$ 03, $a_2/a_0=-0.11$ 2, $a_4/a_0=-0.03$ 3(1979Va13) in $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$; $\alpha(\text{K})_{\text{exp}}=15\times 10^{-3}$ 5 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, $R=1.10$ 3 (1997Ko51) in $^{92}\text{Mo}(\text{}^{19}\text{F},2\text{p}\gamma)$. δ : deduced by evaluators using experimental conversion coefficient and mixing ratio from $\gamma(\theta)$ using the BrIccMixing program. B(M1)(W.u.)=0.22 12; B(E2)(W.u.)=6 +9-6.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I(γ +ce)	Comments
1428.36	1428.32 10	100 3	E2		6.30×10^{-4}		E γ : from $^{107}\text{Ag}(\alpha, 2n\gamma)$. Others: 1427.5 5 from ^{109}In IT decay (0.210 s), 1428.4 6 from $^{108}\text{Cd}(\text{d}, n\gamma)$, 1428 1 from $^{76}\text{Ge}(^{37}\text{Cl}, 4n\gamma)$, 1429.4 1 from $^{92}\text{Mo}(^{19}\text{F}, 2p\gamma)$, and 1428.4 5 from $^{96}\text{Zr}(^{19}\text{F}, 6n\gamma)$. I γ : weighted average of 100 20 from ^{109}In IT decay (0.210 s), 100 19 from $^{108}\text{Cd}(\text{d}, n\gamma)$, 100.0 3 from $^{92}\text{Mo}(^{19}\text{F}, 2p\gamma)$, and 100 6 from $^{96}\text{Zr}(^{19}\text{F}, 6n\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=0.53 \times 10^{-3}$ 8, pol=+0.33 6, $a_2/a_0=+0.32$ 1, $a_4/a_0=-0.16$ 2 (1979Val13) in $^{107}\text{Ag}(\alpha, 2n\gamma)$; R=1.56 2 (1997Ko51) in $^{92}\text{Mo}(^{19}\text{F}, 2p\gamma)$; $a_2/a_0=+0.32$ 12 (1975Di12) in $^{108}\text{Cd}(\text{d}, n\gamma)$. B(E2)(W.u.)=9 5.
1440.70	459.8 4	8.7 23	(M1)		0.00892		E γ : Other: 460.1 5 in $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : weighted average of 13 6 from ^{109}Sn ϵ decay and 7.9 26 from $^{108}\text{Cd}(\text{d}, n\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=8 \times 10^{-3}$ 4 (1975Di12) in $^{108}\text{Cd}(\text{d}, n\gamma)$. E γ : weighted average of 790.9 3 from ^{109}Sn ϵ decay and 791.2 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : weighted average of 100 4 from ^{109}Sn ϵ decay and 100 13 from $^{108}\text{Cd}(\text{d}, n\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=1.4 \times 10^{-3}$ 4, $a_2/a_0=+0.09$ 8 (1975Di12) in $^{108}\text{Cd}(\text{d}, n\gamma)$.
	791.0 3	100 4	E2		0.00209		E γ : weighted average of 790.9 3 from ^{109}Sn ϵ decay and 791.2 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : weighted average of 100 4 from ^{109}Sn ϵ decay and 100 13 from $^{108}\text{Cd}(\text{d}, n\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=1.4 \times 10^{-3}$ 4, $a_2/a_0=+0.09$ 8 (1975Di12) in $^{108}\text{Cd}(\text{d}, n\gamma)$.
1463.59	437.2 3	55 6	M1		0.01010		E γ : Others: 437.6 5 in $^{108}\text{Cd}(\text{d}, n\gamma)$ and 437.0 2 in $^{107}\text{Ag}(\alpha, 2n\gamma)$. I γ : weighted average of 50 13 from ^{109}Sn ϵ decay, 55 7 from $^{108}\text{Cd}(\text{d}, n\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=10 \times 10^{-3}$ 4, $a_2/a_0=-0.25$ 7 (1975Di12) in $^{108}\text{Cd}(\text{d}, n\gamma)$. B(M1)(W.u.)=0.44 17. E γ : Other: 1463.4 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : weighted average of 100 30 from ^{109}Sn ϵ decay and 100 17 from $^{108}\text{Cd}(\text{d}, n\gamma)$. B(E2)(W.u.)=8 4.
	1463.6 4	100 15	[E2]		6.14×10^{-4}		E γ : Other: 1463.4 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : weighted average of 100 30 from ^{109}Sn ϵ decay and 100 17 from $^{108}\text{Cd}(\text{d}, n\gamma)$. B(E2)(W.u.)=8 4.
1482.22?	383 501.2 3	100 30 10					E γ : could correspond to the 501.0 γ from the 1483.9 level observed in $^{108}\text{Cd}(\text{d}, n\gamma)$.
	1482.3 3	47 10					E γ : Other: 311.6 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : Other: 9 3 in $^{108}\text{Cd}(\text{d}, n\gamma)$. Other: 25 3 from ^{109}Sn ϵ decay.
1483.75	312.0 3	25.0 25					E γ : Other: 311.6 5 from $^{108}\text{Cd}(\text{d}, n\gamma)$. I γ : Other: 9 3 in $^{108}\text{Cd}(\text{d}, n\gamma)$. Other: 25 3 from ^{109}Sn ϵ decay.

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I(γ +ce)	Comments
1483.75	384.5 4	100 9	M1		0.01390		E γ : Other: 384.2 3 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. I γ : from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=12.4\times 10^{-3}$ 13, $a_2/a_0=-0.07$ 4 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. E γ ,I γ : from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$ only. This γ could correspond to the 501.2 γ from the 1482.2 level observed in ^{109}Sn ε decay. Mult.: $\alpha(\text{K})_{\text{exp}}=3.6\times 10^{-3}$, 1975Di12 in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$ suggest (M1,E2), but not compatible with parity. E γ : Other: 1573.9 5 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
	501.0 6	16.0 23					
1574.30	1574.4 2	100					
1713.27	229.2 3	7 3	[E2]		0.0837		E γ ,I γ : from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$ only.
	285.0 5	20 5	[E2]		0.0402		E γ : Others: 614.2 4 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, and 614.2 3 from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$.
	614.1 3	100 6	E2		0.00397		Mult.: M1 or E2 from $\alpha(\text{K})_{\text{exp}}=2.5\times 10^{-3}$ 9 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$, $\Delta J=2$ based on $J_{\pi}(1713)=9/2+$ deduced from γ transitions to $5/2+$ and $13/2+$ rules out M1. $A_2/a_0=-0.12$ 6, $a_4/a_0=+0.024$ (1979Va13) in $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$ is for an unresolved doublet with transition in ^{109}Cd produced in ^{109}In decay and in the (α , p $\text{n}\gamma$) reaction.
	687# 1						
	1713.5 2	55 7					E γ : Other: 1712.5 8 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. I γ : Other: 50 10 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
1722.38	623.4 4	100 28	M1		0.00428		E γ : Other: 623.6 4 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=3.5\times 10^{-3}$ 13 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. E γ : Other: 1721.5 8 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. I γ : Other: 40 8 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
	1722.2 2	49 4					
1759.32	437.4 3	75 27					
	660.1 1	100 13					
1816.65	376.1 5	10					
	482.7 6	14 7					
	495.8 4	45 10					
	835.7 1	100 14	M1, E2		0.00216		E γ : Other: 833.0 5 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=1.7\times 10^{-3}$ 7 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
	1166.6 3	52 10					
1843.7	1843.7 6	100					

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I(γ +ce)	Comments
1900.28	873.95 $\pm$ 10	100 $\pm$	M1+E2	+0.34 +18-17	0.00192 5		E γ : Other: 874.0 5 from $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$. Mult.: $\alpha(K)_{\text{exp}}=1.3\times 10^{-3}$ 3, pol=-0.48 6, $a_2/a_0=0.19$ 2, $a_4/a_0=0.003$, $\delta=+0.32 +17-7$ (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$. δ : deduced by evaluators using experimental conversion coefficient and mixing ratio from $\gamma(0)$ using the BrIccMixing program.
1957.10	473.2 5 785.3 2 976.3 1 1956.9 2	17 6 25 6 100 8 36 6	[M1]		0.00831		
2055.14	2055.2 3	100					
2064.2	1083.3 4	100	(M1, E2)		1.21×10^{-3}		E γ : Other: 1083.9 5 from $^{108}\text{Cd}(d,n\gamma)$. Mult.: $\alpha(K)_{\text{exp}}=1\times 10^{-3}$ (1975Di12) in $^{108}\text{Cd}(d,n\gamma)$.
2101.86	673.52 8	100	M3		0.0251		E γ : from 1979Va13 in $^{107}\text{Ag}(\alpha,2n\gamma)$. Others: 673.5 1 from ^{109}In IT decay (0.210 s), 673.2 from $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ (2012Ne03), 674 1 from $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$ (1997VaZS). 1979Va13 also report a unplaced prompt γ ray at $E_{\gamma}=673.85$ with mult=E2. This prompt γ ray is also reported by 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ and by 1997Ko51 in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$, and is placed from a $J\pi=17/2+$ level, slightly above the E=2101.8 level. Mult.: $\alpha(K)_{\text{exp}}=19.9\times 10^{-3}$ 20, K/L=7.5 7 (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$. B(M3)(W.u.)=0.00945 5.
2102.21	673.85 12	100	E2		0.00312		E γ : placement as suggested in by 1997Ko51 and 2012Ne03. Unplaced in 1979Va13. Others: 673.9 3 (1997Ko51) in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$, 673.8 5 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$. 1997VaZS in $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$ has placed an unresolved doublet of $E_{\gamma}=674$ 1 from the isomer at E=2101.8 ($J\pi=19/2+$) and from a level at E=2995.4 ($J\pi=17/2+$). The evaluators have adopted the placement here for the latter. Mult.: $\alpha(K)_{\text{exp}}=2.4\times 10^{-3}$ 5, $a_2/a_0=+0.26$ 2, $a_4/a_0=-0.18$ 3 (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$, DCO(Q)=1.13 14 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$.
2125.78	1026.4 1	87 15					E γ : not resolved with 1026.4 γ from the E=1026 level.
	2125.9 2	100 7					
2138.43	181.8 6	1.3 7					

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.@	$\delta@$	α	I($\gamma+ce$)	Comments
2138.43	816.2 ^a 4 1039.0 2 1488.7 1	12 ^a 3 100 4 90 7					
2151.4	710.7 3 1170.2 1501.7 4	100 22 21 36 14					
2195.26	766.9 [‡] 2	100 [‡]	M1+E2	+0.190 10	0.00262		Mult.: $\alpha(K)\text{exp}=2.1\times 10^{-3}$ 4, pol=-0.85 9, $\delta=+0.19$ +1-3, $a_2/a_0=+0.05$ 2, $a_4/a_0=-0.043$ (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$. δ : deduced by evaluators from the experimental conversion coefficient and mixing ratio from $\gamma(\theta)$ using the BrIccMixing program. B(M1)(W.u.)=0.13 6; B(E2)(W.u.)=7 3.
2218.56	261.1 12 401.8 4 897.5 2 1119.2 3 2218.5 5	11 4 2.9 10 31 4 100 5 7.0 7					
2235.8	522 2235.8 3	100 18.0 25					
2271.4	1290.0 1621.7 5	33 100 20					
2272.2	842 [#] 1 1245.8 3		E1		4.04×10^{-4}		E γ : from $^{107}\text{Ag}(\alpha,2n\gamma)$. Other: 1245.7 5 from $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$, 1246 1 from $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$. Mult.: $\alpha(K)\text{exp}<0.34\times 10^{-3}$, pol=+0.14 5, $a_2/a_0=-0.26$ 3, $a_4/a_0=-0.09$ 6 (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$.
2276.5	1250.1 10 2276.5 8	100 38 100 38					
2305.2	1205.6 5 1655.7 6	81 13 100 19					
2317.3	595 [#] 1 604 [#] 1						
2321.92	421.9 [‡] 2 893.5 [‡] 2	80 [‡] 5 100 [‡] 6	M1 (+E2) M1		0.01103 0.00186		Mult.: $a_2/a_0=-0.19$ 2, $a_4/a_0=-0.054$ (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$. E γ : others: 893 1 from 1997VaZS in $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$. 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ have tentatively placed a γ -ray of E γ =893.7 5 from a level at E=2996. The evaluators has adopted the placement here. Mult.: $\alpha(K)\text{exp}=1.7\times 10^{-3}$ 4, pol=-0.51 8, $a_2/a_0=+0.10$ 2, $a_4/a_0=-0.063$ (1979Va13) in $^{107}\text{Ag}(\alpha,2n\gamma)$.
2356.14	1295.0 [#] 5 597.2 12 1375.2 2						E γ ,I γ : other: E γ =1375 1, I γ =100 33 from $^{108}\text{Cd}(d,n\gamma)$.
2410.9	454.4 ^b 20 594.6 ^b 3 1239.9 7 1429.7 4	46 15 23 15 100 23 77 15					
2469.04	250.1 6	31 15					

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I($\gamma+\text{ce}$)	Comments
2469.04	985.3 2	100 15	M1,E2		1.49×10^{-3}		$E\gamma, I\gamma$: other: $E\gamma=984.3$ 10, $I\gamma=100$ 43 from $^{108}\text{Cd}(\text{d},\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=1.08 \times 10^{-3}$ 10 (1975Di12) in $^{108}\text{Cd}(\text{d},\text{n}\gamma)$.
2508.33	1187.8 5 1408.9 2 1858.7 2	35 13 100 9 57 9					
2532.44	259.6 5	6.6 7	(M1)		0.0380		$E\gamma$: weighted average of 259.0 4 from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$, 260 1 from $^{76}\text{Ge}(^{37}\text{Cl},4\text{n}\gamma)$, and 260.4 5 from $^{96}\text{Zr}(^{19}\text{F},6\text{n}\gamma)$. $I\gamma$: from $^{96}\text{Zr}(^{19}\text{F},6\text{n}\gamma)$. Other: 7 4 from $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$. Mult.: $a_2/a_0=-0.14$ 7, $a_4/a_0=-0.16$ 14 (1979Va13) in $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$. B(M1)(W.u.)=0.32 14. $E\gamma$: others: 1104.0 10 from $^{92}\text{Mo}(^{19}\text{F},2\text{p}\gamma)$, and 1103.8 5 from $^{96}\text{Zr}(^{19}\text{F},6\text{n}\gamma)$, 1104 1 from $^{76}\text{Ge}(^{37}\text{Cl},4\text{n}\gamma)$. Mult.: $\alpha(\text{K})_{\text{exp}}=0.38 \times 10^{-3}$ 9, $\text{pol}=+0.35$ 5, $a_2/a_0=-0.266$ 10, $a_4/a_0=-0.022$ 17 (1979Va13) in $^{107}\text{Ag}(\alpha,2\text{n}\gamma)$; $R=0.77$ 2 (1997Ko51) in $^{92}\text{Mo}(^{19}\text{F},2\text{p}\gamma)$; DCO(Q)=0.50 5 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6\text{n}\gamma)$. B(E1)(W.u.)=0.0009 4.
	1104.04 $\frac{1}{2}$ 10	100 $\frac{1}{2}$ 4	E1		4.33×10^{-4}		
2542.02	828.8 2 1078.5 1220.9 5 1442.7 1 2541.8 3	33 4 3.5 5.8 23 27.6 23 100 6					
2561.02	1462.0 6 1580.7 5 1911.1 2	36 10 20 2 100 4					
2564.2	2564.2 7	100					
2574.8	2574.8 3	100					
2591.85	373.7 3 452.8 ^b 5 465.8 8 869.3 4 1107.2 8	17 4 11 4 11 4 49 6 34 6					
	1128.2 3 1492.4 8 1565.6 5 2591.6 4	100 4 96 13 17 4 43 4					$E\gamma, I\gamma$: unresolved with 1107.7 γ from E=2924 level.
2602.3	879.2 5 2602.7 4	100 25 13 2					
2617.16	478.5 4 857.9 2 2617.0 10	22 11 100 22 11 6					
2785.59	1072.7 3 1211.4 3 1464.2 2 1686.2 3 2785.4 3	6.7 17 28 3 100 33 20.8 25 48 3					
2808.8	1709.3 6 2158.9 4	13 4 100 13					
2813.47	1054.2 2 2813.2 4	100 10 62 10					

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Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{In})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult. @	$\delta @ \&$	α	I($\gamma + \text{ce}$)	Comments
2845.77	539.4 ^b 2	15 4					
	888.7 1	45 11					
	1271.5 3	34 6					
	1524.9 3	36 4					
	2195.6 2	100 6					
2851.70	1092.2 5	86 24					
	1130.5 8	14 10					
	1388.2 5	38 10					
	1825.1 ^a 3	100 ^a 10					
	2852.2 10	10 5					
2858.58	732.5 5	57 8					
	1759.2 5	100 6					
	2858.6 2	92 8					
2868.77	336.30 [‡] 6	100 [‡] 4	M1 (+E2)	+0.03 3	0.0195		E γ : others: 336 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 335.9 1 from ⁹² Mo(¹⁹ F,2p γ), and 336.6 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult., δ : $\alpha(K)_{\text{exp}}=18 \times 10^{-3}$ 8, pol=-0.14 4, $\delta=0.03$ 3 from $\gamma(\theta)$, $a_2/a_0=-0.113$ 8, $a_4/a_0=-0.033$ 14 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=0.98 3 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.69 4 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $a_2/a_0=-0.30$ 5, $a_4/a_0=-0.02$ 8 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(E1)(W.u.)=0.00053 17.
	547.1 [‡] 3	13.5 [‡] 12	(E1)		0.00183		
2871.19	310.3 5	9 8					
	362.9 1	16 4					
	459.8 ^b 4	14 6					E γ ,I γ : unresolved with E γ =459.9 γ from E=1441 level.
	745.3 9	22 6					
	816.2 ^a 4	35 ^a 8					
	1157.8 3	33 6					
	1700.7 13	7 8 20					
	1889.8 3	100 10					
	2871.2 9	5 1					
2919.8	2919.8 7	100					
2924.42	967.2 4	44 8					
	1107.7 8	44 8					E γ ,I γ : unresolved with 1107.7 γ from E=2592 level.
	1350.1 1	83 8					
	1603.3 3	36 6					
	1825.1 ^a 3	58 ^a 6					
	1943.5 3	100 11					
2943.0	1962.2 5	100 20					
	2942.8 4	74 10					
2958.04	89.24 [‡] 8	100 [‡] 5	M1 (+E2)	$\leq +0.05$	0.707 11		E γ : other: 88.9 5 from ⁹⁶ Zr(¹⁹ F,6n γ), 89 1 from ⁷⁶ Ge(³⁷ Cl,4n γ). Mult., δ : $a_2/a_0=-0.206$ 9, $a_4/a_0=+0.01$ 2, $\delta=0.01$ 4 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=1.02 1 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ).

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Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{In})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult.@	$\delta^{\text{@@}}$	α	I(γ +ce)	Comments
2958.04	856.2 $\frac{3}{2}$ 2	42 $\frac{3}{2}$ 2	E1		6.98 $\times 10^{-4}$		E γ : others: 856.2 5 from ⁹⁶ Zr(¹⁹ F,6n γ), 856 1 from ⁷⁶ Ge(³⁷ Cl,4n γ). I γ : other: 19.8 13 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(\text{K})\text{exp} \leq 1.0 \times 10^{-3}$, pol=-0.48 6, $a_2/a_0=+0.38$ 3, $a_4/a_0=-0.04$ 5 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ).
2986.8	848.6 8	45 18					
	1227.4 3	100 27					
	1546.6 8	36 9					
2995.9	674 [#] 1						
3013.4	3013.4 3	100					
3029.69	158.6 ^b 6	14 5					
	216.9 ^b 7	9 5					
	220.5 6	18 9					
	560.3 7	14 5					
	1455.3 5	100 14					
	1930.5 3	77 9					
	2049.0 5	45 9					
	3029.5 6	7 3					
3034.8	3034.8 4	100					
3050.73	1951.3 5	25					
	3050.7 2	100 17					
3065.65	3065.6 2	100					
3067.35	534.9 $\frac{3}{2}$ 2	100	M1+E2	+0.14 7	0.00616		Mult., δ : pol=-0.64 15, $\delta=0.14$ 7, $a_2/a_0=-0.04$ 3, $a_4/a_0=-0.06$ 5 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). E γ : weighted average of 223.4 3 from ¹⁰⁷ Ag(α ,2n γ), 223 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 223.5 2 from ⁹² Mo(¹⁹ F,2p γ), and 223.1 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(\text{K})\text{exp}=24 \times 10^{-3}$ 12, $a_2/a_0=-0.18$ 3, $a_4/a_0=+0.09$ 5 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(M1)(W.u.)=0.57 17. E γ ,I γ : from ⁹⁶ Zr(¹⁹ F,6n γ) only. E γ : others: 990 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 989.4 10 from ⁹² Mo(¹⁹ F,2p γ), and 990.4 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(\text{K})\text{exp}=0.45 \times 10^{-3}$ 15, pol=-0.62 14, $a_2/a_0=+0.32$ 3, $a_4/a_0=-0.01$ 5 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=0.85 7 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ). B(E1)(W.u.)=0.00044 13.
3092.10	223.4 2	20 $\frac{3}{2}$ 2	M1		0.0563		
	989.8 ^b 5	37 4					
	990.25 $\frac{3}{2}$ 12	100 $\frac{3}{2}$ 6	E1		5.25 $\times 10^{-4}$		
3122.54	164.47 $\frac{3}{2}$ 6	100	M1 (+E2)	$\leq +0.05$	0.1284 19 9		E γ : others: 164 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 164.7 2 from ⁹² Mo(¹⁹ F,2p γ), and 164.6 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(\text{K})\text{exp}=159 \times 10^{-3}$ 50, $\delta=0.01$ 5, $a_2/a_0=-0.197$ 9, $a_4/a_0=-0.017$ 15 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=0.82 2 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.78 8 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
	1021 [#] 1						
3140.3	1819.0 4	100 33					
	3139.8 ^b 6	23 7					

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Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{In})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult.@	$\delta@$	α	Comments
3155.2	838 [#] 1 1053 [#] 1 1727 [#] 1					
3202.49	110.42 [‡] 10	56 [‡] 3	M1 (+E2)	≤ -0.12	0.391 8	E γ : others: 110 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 110.1 3 from ⁹² Mo(¹⁹ F,2p γ), and 110.4 5 from ⁹⁶ Zr(¹⁹ F,6n γ). I γ : others: 23.5 6 from ⁹² Mo(¹⁹ F,2p γ), 89 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult., δ : $a_2/a_0 = -0.24$ 2, $a_4/a_0 = +0.04$ 2, $\delta = -0.05$ 7 (1979Va13) in; R=0.73 1 (1997Ko51); DCO(D)=0.99 21 (2012Ne03).
	244.6 2	100 [‡] 5	M1 (+E2)	≤ 0.04	0.0444	E γ : weighted average of 244.5 3 from ¹⁰⁷ Ag(α ,2n γ), 244 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 244.7 2 from ⁹² Mo(¹⁹ F,2p γ), and 244.6 5 from ⁹⁶ Zr(¹⁹ F,6n γ). I γ : others: 100 1 from ⁹² Mo(¹⁹ F,2p γ), and 100 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(K)\text{exp} = 34 \times 10^{-3}$ 12, $\text{pol} = -0.27$ 13, $\delta = 0.00$ 4, $a_2/a_0 = -0.21$ 2, $a_4/a_0 = 0.01$ 2 (1979Va13) ¹⁰⁷ Ag(α ,2n γ); R=0.76 1 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.70 10 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
3273.44?	1100.8 [§] 5 150.9 ^b 2	47 [§] 2 100				E γ : seen only in ⁹² Mo(¹⁹ F,2p γ) (1997Ko51).
3285.8	218.48 [‡] 11	100	M1		0.0598	Mult.: $\alpha(K)\text{exp} = 36 \times 10^{-3}$ 18, $a_2/a_0 = -0.18$ 3, $a_4/a_0 = +0.13$ 4 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(M1)(W.u.) < 2.0.
3316.8	3316.7 3	100				
3361.0	3360.9 6	100				
3374.74	416.7 [‡] 2	100	(M1)		0.01137	Mult.: $a_2/a_0 = -0.27$ 2, $a_4/a_0 = -0.09$ 4 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(M1)(W.u.) = 1.4 7.
3395.68	2074.8 9 3395.6 2	81 27 100 14				
3410.37	207.90 [‡] 6	100 [‡] 5	M1		0.0682	E γ : others: 208 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 207.9 1 from ⁹² Mo(¹⁹ F,2p γ), and 208.0 5 from ⁹⁶ Zr(¹⁹ F,6n γ). I γ : others: 100.0 2 from ⁹² Mo(¹⁹ F,2p γ), and 100 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult., δ : $\alpha(K)\text{exp} = 59 \times 10^{-3}$ 20, $\text{pol} = -0.42$ 15, $\delta = -0.02$ 7, $a_2/a_0 = -0.217$ 10, $a_4/a_0 = -0.032$ 17(1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=0.82 2 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.75 14 (2012Ne03) ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.) = 3.0 10.
	287.79 [‡] 12	10.0 [‡] 4	(M1)		0.0290	E γ : others: 288 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 287.9 3 from ⁹² Mo(¹⁹ F,2p γ), and 288.0 5 from ⁹⁶ Zr(¹⁹ F,6n γ). I γ : from ⁹² Mo(¹⁹ F,2p γ). Other: 17 3 in ¹⁰⁷ Ag(α ,2n γ) and 10.8 13 in ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $a_2/a_0 = -0.13$ 5, $a_4/a_0 = -0.02$ 8 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); DCO(D)=1.0 3 (2012Ne03) ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.) = 0.11 4.
3418.5	2437.5 4 3418.5 5	100 11 8.5				
3426.54	1300.7 2 3427.3 8	100 24 3.5 12				

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{In})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult.@	$\delta@&$	α	Comments
3462.04	339.47 $\frac{7}{8}$	100	M1+E2	+0.05 3	0.0190	E γ : others: 339 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 339.4 2 from ⁹² Mo(¹⁹ F,2p γ), and 339.7 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult., δ : $\alpha(K)\text{exp}=19\times 10^{-3}$ 8, $\text{pol}=-0.26$ 10, $\delta=+0.05$ 3 $a_2/a_0=-0.097$ 11, $a_4/a_0=-0.018$ 9 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=1.05 4 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.56 5 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.)=0.7 3; B(E2)(W.u.)=12 +16-12.
3484.4?	211.0 2	57.3 7	D			E γ ,I γ : from ⁹² Mo(¹⁹ F,2p γ) (1997Ko51). 2012Ne03 in ⁹⁶ Zr(¹⁹ F,6n γ) tentatively place a γ ray of 211.4 keV 5 from a level at E=4686 while 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ) place a γ ray of 211 keV 1 from the level at E=4565 keV. Mult.: DCO(Q)=0.56 17, DCO(D)=1.15 20 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). E γ ,I γ : from ⁹² Mo(¹⁹ F,2p γ) (1997Ko51). Other: E γ =363.5 5 from ⁹⁶ Zr(¹⁹ F,6n γ) (2012Ne03). 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ) have placed a γ ray of 362 from the level at E=4928. Mult.: DCO(Q)=0.63 10 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
	361.9 ^b 2	100.0 4	D+Q			Mult.: $a_2/a_0=-0.25$ 5, $a_4/a_0=+0.12$ 3(1979Va13) (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(M1)(W.u.)=3.9 10.
3517.1	231.3 $\frac{3}{2}$	100	(M1)		0.0514	Mult.: $a_2/a_0=-0.25$ 5, $a_4/a_0=+0.12$ 3(1979Va13) (1979Va13) in ¹⁰⁷ Ag(α ,2n γ). B(M1)(W.u.)=3.9 10.
3528.7	1427 [#] 1					
3653.8	1552 [#] 1					
3798.3	1697 [#] 1					
3800.14	338.4 5	12.5 6	(M1)		0.0192	E γ ,I γ : from ⁹² Mo(¹⁹ F,2p γ). Other: E γ =338.4 5, I γ =13.1 18 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: DCO(Q)=0.56 5 for 339.7+338.4 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.)=0.037 13.
	389.80 $\frac{3}{8}$	100 1	M1+E2	+0.04 3	0.01343	E γ : others: 390 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 389.8 2 from ⁹² Mo(¹⁹ F,2p γ), and 390.1 5 from ⁹⁶ Zr(¹⁹ F,6n γ). I γ : weighted average of 100 4 from ¹⁰⁷ Ag(α ,2n γ), 100 1 from ⁹² Mo(¹⁹ F,2p γ), and 100 6 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult., δ : $\alpha(K)\text{exp}=13\times 10^{-3}$ 4, $\text{pol}=-0.35$ 6, $\delta=+0.04$ 3, $a_2/a_0=-0.151$ 12, $a_4/a_0=-0.027$ 20 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); R=1.02 6 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.61 8 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.)=0.19 7; B(E2)(W.u.)=1.7 +26-17.
3844.1	327 [#] 1					
4037.54	575.3 $\frac{3}{2}$	100	M1		0.00518	E γ : others: 576 1 from ⁷⁶ Ge(³⁷ Cl,4n γ), 575.4 4 from ⁹² Mo(¹⁹ F,2p γ), and 575.6 5 from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: $\alpha(K)\text{exp}=3.0\times 10^{-3}$ 15, $a_2/a_0=-0.29$ 4, $a_4/a_0=-0.09$ 6 (1979Va13) in ¹⁰⁷ Ag(α ,2n γ); DCO(D)=1.04 17 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). B(M1)(W.u.)=0.19 10.
4097.4	942 [#] 1					
4300.8	647 [#] 1					
	1305 [#] 1					
4354.6	826 [#] 1					
	1232 [#] 1					

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{In})$ (continued)

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult. @	α	Comments
4436.0	636.0 § 5	100	(M1)	0.00408	Mult.: DCO(D)=0.97 21 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
4508.37	470.6 2	16.0 8	(M1)	0.00843	E γ , I γ : from ⁹² Mo(¹⁹ F,2p γ). Other: E γ =470.9 5, I γ =41 4 from ⁹⁶ Zr(¹⁹ F,6n γ).
	708.7 3	100 1	(M1+E2)	0.00316	Mult.: DCO(D)=0.93 14 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). E γ , I γ : from ⁹² Mo(¹⁹ F,2p γ). Other: E γ =708.1 5, I γ =100 4 from ⁹⁶ Zr(¹⁹ F,6n γ).
4565.4	211 # 1		(M1)	0.0656 13	Mult.: R=0.95 6 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ), DCO(D)=1.28 19 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ). E γ : 2012Ne03 in ⁹⁶ Zr(¹⁹ F,6n γ) tentatively place a γ ray of 211.4 keV 5 from a level at E=4686; 1997Ko51 in ⁹² Mo(¹⁹ F,2p γ) tentatively place a γ ray of 211.0 keV 2 from a level at E=3485 keV. The evaluators have adopted the placement here by 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ). Mult.: DCO(Q)=0.56 17, DCO(D)=1.15 20 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
	768 # 1				
	1102 # 1				
4572.6	774 # 1				
4743.7	443 # 1				
4756.6	659 # 1				
4832.4	324.0 3	100 5	(M1)	0.0214	E γ : from ⁹² Mo(¹⁹ F,2p γ). Others: 324.4 5 from ⁹⁶ Zr(¹⁹ F,6n γ), 324 1 from ⁷⁶ Ge(³⁷ Cl,4n γ). I γ : from ⁹⁶ Zr(¹⁹ F,6n γ). Mult.: R=0.90 4 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(Q)=0.73 18 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
4927.8	396.5 § 5	17 § 2	(M1)	0.0170 3	E γ : other: 396 1 from ⁷⁶ Ge(³⁷ Cl,4n γ). E γ : 2012Ne03 in ⁹⁶ Zr(¹⁹ F,6n γ) tentatively place a γ ray of 354.8 keV 5 from a level at E=5408; 1997Ko51 in ⁹² Mo(¹⁹ F,2p γ) tentatively place a γ ray of 353.9 keV 2 from a level at E=(6259) keV. The evaluators have adopted the placement here by 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ). 1997VaZS also place a γ ray of E γ =354 1 from the level at E=6272. Mult.: DCO(D)=1.2 4 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
	362 # 1		(M1)	0.0162 3	E γ : 2012Ne03 in ⁹⁶ Zr(¹⁹ F,6n γ) tentatively place a γ ray of 362.5 keV 5 from a level at E=3485; 1997Ko51 in ⁹² Mo(¹⁹ F,2p γ) tentatively place a γ ray of 361.9 keV 2 from a level at E=3485 keV. The evaluators have adopted the placement here by 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ). Mult.: DCO(Q)=0.63 10 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
	891 # 1				
5024.7	588.7 5	100	(M1)	0.00490	E γ : from ⁹⁶ Zr(¹⁹ F,6n γ). Other: 589 1 from ⁷⁶ Ge(³⁷ Cl,4n γ). Mult.: DCO(D)=1.0 5 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
5219.8	463 # 1				
	476 # 1				
5241.4	409 # 1	100	(M1)	0.01191	Mult.: R=0.96 4 (1997Ko51) in ⁹² Mo(¹⁹ F,2p γ); DCO(D)=1.19 23 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
5275.2+x	767 # 1				
5397.5	470 # 1				
	654 # 1				
5424.8	497 # 1	100	(M1)	0.00737	E γ : 2012Ne03 in ⁹⁶ Zr(¹⁹ F,6n γ) have tentatively placed a γ -ray of E γ =497.2 5 from a level at E=3982 and 1997Ko51 in ⁹² Mo(¹⁹ F,2p γ) have tentatively placed a γ -ray of E γ =497.0 3 from a level at E=4474. The evaluators have adopted the placement here by 1997VaZS in ⁷⁶ Ge(³⁷ Cl,4n γ). Mult.: DCO(D)=1.03 16 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
5580.1?	555.4 § 5	100	(M1)	0.00564	Mult.: DCO(D)=0.9 3 for 555.4+554.7 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).
5796.6	555.2 4	100	(M1)	0.00564	E γ : from ⁹² Mo(¹⁹ F,2p γ) (1997Ko51). Other: 555 1 from ⁷⁶ Ge(³⁷ Cl,4n γ) (1997VaZS) and 554.7 5 in ⁹⁶ Zr(¹⁹ F,6n γ) (2012Ne03). 2012Ne03 also report a γ ray of E γ =555.4 5 from a level at E=5581. Mult.: DCO(D)=0.9 3 for 555.4+554.7 (2012Ne03) in ⁹⁶ Zr(¹⁹ F,6n γ).

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.@	α	Comments
5851.1	426# <i>I</i> 454# <i>I</i> 631# <i>I</i>				
5918.0	493\$ <i>I</i>	100	(M1)	0.00752	E_{γ} : 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=492.9$ 5 from a level at $E=4475$ and 1997Ko51 in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=492.0$ 2 from a level at $E=3977$. The evaluators have adopted the placement here by 1997VaZS in $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$. Mult.: DCO(D)=1.20 22 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$.
6005.9	990 <i>I</i> 244# <i>I</i> 581# <i>I</i>		(M1)	0.00506	E_{γ} : 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=581.3$ 5 from a level at $E=5990$ and 1997Ko51 in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=581.8$ 3 from a level at $E=5905$. The evaluators have adopted the placement here by 1997VaZS in $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$. 1997VaZS also place a γ ray of $E_{\gamma}=582$ <i>I</i> from the level at $E=8005$. Mult.: DCO(D)=1.1 4 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$.
6263.3	866# <i>I</i>	100			
6272.0	266# <i>I</i> 354# <i>I</i>				
6293.2+x	1018# <i>I</i>				
6428.6	632# <i>I</i>				
6433.4	515# <i>I</i> 1009# <i>I</i>				
6506.8	1109# <i>I</i>				
6639.0	367# <i>I</i>	100	D		E_{γ} : 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=367.1$ 5 from a level at $E=5054$ and 1997Ko51 in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$ have tentatively placed a γ -ray of $E_{\gamma}=367.6$ 2 from a level at $E=5423$. The evaluators have adopted the placement here by 1997VaZS in $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$. Mult.: DCO(D)=1.0 3 (2012Ne03) in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$.
6668.1	817# <i>I</i>				
6927.4	494# <i>I</i>				
7120.0	481# <i>I</i>				E_{γ} : 1997Ko51 ($^{92}\text{Mo}(^{19}\text{F},2p\gamma)$) tentatively placed $E_{\gamma}=481.8$ keV 3 from a level at $E=5905$ keV.
7151.1	644# <i>I</i> 888# <i>I</i>				
7288.2	1025# <i>I</i>				
7384.2+x	1091# <i>I</i>				
7423.4	496# <i>I</i>				
7642.1	974# <i>I</i>				
7712.0	592# <i>I</i>				
7981.1	693# <i>I</i> 830# <i>I</i>				
8005.4	582# <i>I</i>				
8310.2+x	926# <i>I</i>				
8329.0	617# <i>I</i>				
8463	1175# 5				
8632.4	627# <i>I</i>				
8786.1	1144# <i>I</i>				
8977	648# <i>I</i>				
8981.1	1000# <i>I</i>				
9292.2+x	982# <i>I</i>				
9317	685# <i>I</i>				
9783	1320# <i>I</i>				
10105.1	1319# <i>I</i>				
10218.1	1237# <i>I</i>				
10428.2+x	1136# <i>I</i>				
11189?	1406# ^b <i>I</i>				
11634.1	1529# <i>I</i>				
11642.1	1424# ^b <i>I</i>				
11730+x	1302# <i>I</i>				

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{In})$ (continued)

E(level)	$E\gamma^\dagger$
13244+x	1514# I
13338.0	1704#b I
14821.1+x	1577#b I

[†] From ^{109}Sn ϵ decay up to E(level)=3427 keV and from $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$ after that, unless otherwise noted.

[‡] From 1979Val3 in $^{107}\text{Ag}(\alpha,2n\gamma)$.

[§] From 2012Ne03 in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$.

[#] From $^{76}\text{Ge}(^{37}\text{Cl},4n\gamma)$ only.

[@] Based on $\alpha(\text{K})\text{exp}$, $\gamma(\theta)$ and pol from $^{107}\text{Ag}(\alpha,2n\gamma)$, ^{109}Sn ϵ decay, $^{108}\text{Cd}(\text{d},n\gamma)$; and angular correlation intensity ratios (R) in $^{92}\text{Mo}(^{19}\text{F},2p\gamma)$, and DCO ratios in $^{96}\text{Zr}(^{19}\text{F},6n\gamma)$ for transitions from high-spin states. Intensity ratios R=0.8 for stretched dipole with $\Delta J=1$ and R=1.5 for stretched quadrupole with $\Delta J=2$; DCO(Q) for gate on $\Delta J=2$, quadrupole transition; DCO(D) for gate on $\Delta J=1$, dipole transition.

[&] If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

^a Multiply placed; undivided intensity given.

^b Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)(A) Band 1: $\Delta J=2$ band based on 5/2+ at 1099 keV(B) Band 2: $\Delta J=2$ band based on 7/2+ at 1722 keV(C) Band 3: $\Delta J=2$ band based on (31/2+) at 6507 keV(D) Band 4: $\Delta J=2$ band based on (21/2+) at 4300 keV

Adopted Levels, Gammas (continued)

(E) Band 5: $\Delta J=1$ band
based on (29/2+) at 5762
keV

(F) Band 6:
ground state band

(G) Band 7: $\Delta J=1$ band
based on 23/2+ at 4354 keV

(H) Band 8: $\Delta J=1$ band based
on 13/2- at 2272 keV

$^{109}_{49}\text{In}_{60}$

Adopted Levels, Gammas (continued)

¹⁰⁹In IT Decay (1.34 min) 1968Sm08,1966Ma39

Parent ¹⁰⁹In: E=649.79 10; Jπ=1/2-; T_{1/2}=1.34 min 6; %IT decay=100.
All data are taken from Adopted Levels, Gammas, unless otherwise noted.

¹⁰⁹In Levels

E(level)	Jπ	T _{1/2}	Comments
0.0	9/2+	4.159 h 10	%IT=100. T _{1/2} : weighted average of 1.34 min 7 (651γ(t) in 1968Sm08), 1.35 min 20 (658γ(t) in 1966Ma39) and 1.3 min 2 (1956Ku51).
649.79 10	1/2-	1.34 min 6	

γ(¹⁰⁹In)

Eγ	E(level)	Iγ [†]	Mult.	α	I(γ+ce) [†]	Comments
649.8 2	649.79	93.51 9	M4	0.0694	100	Iγ: from I(γ+ce)=100 and α(total)=0.0694.

[†] Absolute intensity per 100 decays.

Decay Scheme

¹⁰⁹In IT Decay (210 ms) 1994ByZZ,1965Al15

Parent ¹⁰⁹In: E=2101.86 11; Jπ=19/2+; T_{1/2}=210.0 ms 9; %IT decay=100.

1994ByZZ: Mo(¹⁴N,X), E=119 MeV, Measured: Eγ, Iγ, T1/2.

1965Al15:¹⁰³Rh(¹²C,α2n),E=40-80 MeV; ¹⁰⁷Ag(α,2n), E=28 MeV Measured: Eγ, Iγ; decay scheme similar to 1994ByZZ.

Others: 1966We01, 1963Po10, 1965De15.

The decay scheme is from 1994ByZZ.

¹⁰⁹In Levels

E(level) [†]	Jπ [‡]	T _{1/2} [‡]
0.0	9/2+	4.159 h 10
1026.39 8	11/2+	
1428.35 8	13/2+	
2101.87 11	19/2+	210.0 ms 9

[†] From a least-squares fit to Eγ.

[‡] From Adopted Levels.

γ(¹⁰⁹In)

Eγ [†]	E(level)	Iγ [§]	Mult. [†]	δ [†]	α	I(γ+ce) [#]	Comments
x170 [‡]		12					
x210 [‡]		12					
401.97 6	1428.35	18.3 9	M1+E2	0.07 +5-4	0.01244	18.5 9	Iγ: others: 20 5 (1965Al15) and 21 (1994ByZZ).
673.52 8	2101.87	97.6 3	M3		0.0251	100	Eγ: Other: 673.5 1 from 1994ByZZ.
1026.4 1	1026.39	18.5 9	M1+E2	0.41 13	0.00133 3	18.5 9	Iγ: other: 20 5 (1965Al15) and 25 (1994ByZZ).
1428.32 10	1428.35	81.5 9	E2		6.30×10 ⁻⁴	81.5 9	Iγ: other: 77 15 (1965Al15) and 75 (1994ByZZ).

[†] From Adopted gammas.

[‡] From 1965Al15.

[§] From I(γ+ce) and α.

[#] Absolute intensity per 100 decays.

x γ ray not placed in level scheme.

Decay Scheme

Intensities: I(γ+ce) per 100 decays by this branch
%IT=100

¹⁰⁹Sn ϵ Decay 1981Bu17

Parent ¹⁰⁹Sn: E=0; J π =5/2⁺; T_{1/2}=18.1 min 2; Q(g.s.)=3857 9; % ϵ +% β^+ decay=100.

1981Bu17: ¹⁰⁹Sn source was produced via the ¹⁰⁶Cd(α ,n) reaction with E=25 MeV alpha beam from the isochronous cyclotron of the Institute of Nuclear Physics, Academy of Sciences of the Kazakh SSR and with targets of self-supporting Cadmium foils about 10 mg/cm² thick (64% enriched). γ rays were detected by Ge(Li) detectors. Measured E γ , I γ , $\gamma\gamma$ -coin, spectra of integral anticoincidence. Deduced levels, γ -ray branching ratios, beta decay branching ratios, log ft.

1970Sh05: ¹⁰⁹Sn sources were produced by bombarding enriched metal ¹⁰⁶Cd with 19-MeV alpha particles from the Yale Heavy Ion Accelerator. γ rays were detected using NaI(Tl) counters and Ge(Li) detectors; electrons were detected using an anthracene crystal. Measured E γ , I γ , E(X-ray), I(X-ray), E β , E(ce), I(ce), $\gamma\gamma$ -coin, $\beta\gamma$ -coin, γ (t). Deduced levels, J π , branching ratios, conversion coefficients, γ -ray multipolarities, half-life of decay parent.

Systematics of low-lying levels of odd-mass In isotopes.

Others: 1965Kh04, 1956Pe56.

The decay schemes is from 1981Bu17.

¹⁰⁹In Levels

E(level) [†]	J π [§]	T _{1/2} [§]	E(level) [†]	J π [§]
0.0	9/2 ⁺	4.159 h 10	2469.05 24	(3/2, 5/2, 7/2) ⁺
649.80 10	1/2 ⁻	1.34 min 6	2508.33 $\frac{1}{2}$ 13	(3/2, 5/2 ⁻)
980.93 11	3/2 ⁻		2542.01 11	(5/2 ⁺ , 7/2)
1026.42 10	11/2 ⁺		2561.02 19	3/2 ⁺
1099.29 9	5/2 ⁺		2564.2 $\frac{1}{2}$ 7	(5/2 ⁺)
1171.72 16	1/2 ⁺		2574.8 $\frac{1}{2}$ 3	(5/2 ⁺ , 7/2)
1321.26 11	5/2 ⁺		2591.87 17	7/2 ⁺
1334.74 $\frac{1}{2}$ 22	(3/2, 5/2, 7/2 ⁻)		2602.3 $\frac{1}{2}$ 4	(5/2 ⁺ , 7/2)
1428.3 6	13/2 ⁺		2617.16 $\frac{1}{2}$ 21	(5/2, 7/2) ⁺
1440.67 21	5/2 ⁻		2785.62 14	(5/2 ⁺ , 7/2)
1463.62 19	9/2 ⁺		2808.8 $\frac{1}{2}$ 3	3/2
1482.22 $\frac{1}{2}$ 22	(5/2 ⁺ , 7/2 ⁻)		2813.46 $\frac{1}{2}$ 20	(5/2 ⁺ , 7/2)
1483.76 18	5/2 ⁺		2845.78 $\frac{1}{2}$ 12	3/2
1574.36 13	(5/2 ⁺ , 7/2)		2851.72 $\frac{1}{2}$ 23	7/2 ⁺
1713.27 12	9/2 ⁺		2858.58 18	(5/2 ⁺ , 7/2)
1722.38 16	7/2 ⁺		2871.19 14	5/2 ⁺
1759.31 $\frac{1}{2}$ 12	3/2, 5/2, 7/2		2919.8 $\frac{1}{2}$ 7	(5/2 ⁺ , 7/2)
1816.66 13	(3/2, 5/2 ⁻)		2924.48 13	(3/2, 5/2)
1843.7 $\frac{1}{2}$ 6	(5/2 ⁺ , 7/2)		2943.0 4	(5/2 ⁺ , 7/2 ⁻)
1957.11 $\frac{1}{2}$ 11	5/2 ⁺		2986.8 $\frac{1}{2}$ 3	(3/2 ⁺ , 5/2 ⁺)
2055.14 $\frac{1}{2}$ 25	(5/2 ⁺ , 7/2)		3013.4 3	(5/2 ⁺ , 7/2)
2064.3 4	(3/2 ⁻ , 5/2 ⁻ , 7/2 ⁻)		3029.70 21	(5/2 ⁺)
2125.77 11	(5/2 ⁺ , 7/2)		3034.8 4	(5/2 ⁺ , 7/2)
2138.44 12	(3/2 ⁺)		3050.74 20	(5/2 ⁺ , 7/2)
2151.4 $\frac{1}{2}$ 3	(3/2, 5/2 ⁻)		3065.65 20	(5/2 ⁺ , 7/2)
2218.56 $\frac{1}{2}$ 15	(5/2 ⁺ , 7/2)		3140.3 $\frac{1}{2}$ 5	(5/2 ⁺ , 7/2)
2235.8 $\frac{1}{2}$ 3	(5/2 ⁺ , 7/2)		3316.8 3	(5/2 ⁺ , 7/2)
2271.4 $\frac{1}{2}$ 5	(3/2 ⁺)		3361.0 6	(5/2 ⁺ , 7/2)
2276.5 7	(7/2 ⁺)		3395.68 20	(5/2 ⁺ , 7/2)
2305.2 $\frac{1}{2}$ 4	(3/2, 5/2 ⁻)		3418.5 $\frac{1}{2}$ 4	5/2 ⁺ , 7/2 ⁻
2356.15 $\frac{1}{2}$ 23	(3/2, 5/2, 7/2 ⁻)		3426.53 $\frac{1}{2}$ 22	(5/2 ⁺ , 7/2)
2410.9 $\frac{1}{2}$ 4	(3/2, 5/2 ⁺)			

[†] From a least-squares fit to E γ .

$\frac{1}{2}$ Seen only in 1981Bu17.

$\frac{1}{2}$ From Adopted Levels.

β^+ , ϵ Data

E ϵ	E(level)	I β^+	I ϵ	Log ft	I(ϵ + β^+) [†]
(430 9)	3426.53		0.52 12	4.95 11	0.52 12
(439 9)	3418.5		0.149 15	5.51 5	0.149 15
(461 9)	3395.68		0.20 4	5.43 9	0.20 4
(496 9)	3361.0		0.021 6	6.48 13	0.021 6
(540 9)	3316.8		0.088 15	5.93 8	0.088 15
(717 9)	3140.3		0.18 6	5.88 15	0.18 6
(791 9)	3065.65		0.076 15	6.34 9	0.076 15

Continued on next page (footnotes at end of table)

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

β⁺,ε Data (continued)

Eε	E(level)	Iβ ⁺	Iε	Log <i>ft</i>	I(ε+β ⁺) [†]
(806 9)	3050.74		0.44 6	5.60 6	0.44 6
(822 9)	3034.8		0.120 18	6.18 7	0.120 18
(827 9)	3029.70		1.69 15	5.03 4	1.69 15
(844 9)	3013.4		0.123 15	6.19 6	0.123 15
(870 9)	2986.8		0.59 11	5.54 9	0.59 11
(914 9)	2943.0		0.25 4	5.95 7	0.25 4
(933 9)	2924.48		3.87 22	4.78 3	3.87 22
(937 9)	2919.8		0.015 6	7.20 18	0.015 6
(986 9)	2871.19		3.42 25	4.89 4	3.42 25
(998 9)	2858.58		2.70 15	5.00 3	2.70 15
(1005 9)	2851.72		1.52 19	5.25 6	1.52 19
(1011 9)	2845.78		2.96 21	4.97 4	2.96 21
(1044 9)	2813.46		1.00 9	5.47 4	1.00 9
(1048 9)	2808.8		0.67 11	5.65 8	0.67 11
(1071 9)	2785.62		7.1 12	4.64 8	7.1 12
(1240 9)	2617.16		0.70 9	5.78 6	0.70 9
(1255 9)	2602.3		0.66 15	5.81 10	0.66 15
(1265 9)	2591.87	0.0033 6	5.0 3	4.94 3	5.0 3
(1282 9)	2574.8		0.108 18	6.62 8	0.108 18
(1293 9)	2564.2	0.00010 3	0.100 21	6.66 10	0.100 21
(1296 9)	2561.02	0.0095 16	8.7 7	4.72 4	8.7 7
(1315 9)	2542.01	0.0063 9	4.33 21	5.038 23	4.34 21
(1349 9)	2508.33	0.0024 4	1.05 14	5.68 6	1.05 14
(1388 9)	2469.05	0.0015 4	0.41 9	6.11 10	0.41 9
(1446 9)	2410.9	0.0043 8	0.67 11	5.94 8	0.67 11
(1501 9)	2356.15	0.0054 10	0.52 9	6.07 8	0.53 9
(1552 9)	2305.2	0.013 2	0.84 11	5.90 6	0.85 11
(1581 9)	2276.5	0.0086 24	0.46 13	6.17 12	0.47 13
(1586 9)	2271.4	0.011 2	0.58 9	6.08 7	0.59 9
(1621 9)	2235.8	0.0163 10	0.675 19	6.031 14	0.691 19
(1638 9)	2218.56	0.11 1	4.2 3	5.25 4	4.3 3
(1706 9)	2151.4	0.024 4	0.62 11	6.12 8	0.64 11
(1719 9)	2138.44	0.35 3	8.3 5	4.99 3	8.7 5
(1731 9)	2125.77	0.04 1	0.9 3	5.98 15	0.9 3
(1793 9)	2064.3	0.034 5	0.56 8	6.20 7	0.59 9
(1802 9)	2055.14	0.071 9	1.13 14	5.90 6	1.20 15
(1900 9)	1957.11	0.036 22	0.37 23	6.4 3	0.41 25
(2013 9)	1843.7	0.089 8	0.61 5	6.26 4	0.70 6
(2040 9)	1816.66	0.18 3	1.14 18	6.01 7	1.32 21
(2098 9)	1759.31	<0.1	<0.7	>6.3	<0.8
(2135 9)	1722.38	0.32 12	1.5 6	5.93 17	1.8 7
(2144 9)	1713.27	0.19 5	0.87 20	6.17 11	1.06 25
(2283 9)	1574.36	0.59 7	1.8 2	5.90 6	2.4 3
(2373 9)	1483.76	0.64 5	1.56 12	6.00 4	2.20 17
(2375 9)	1482.22	0.46 4	1.11 9	6.15 4	1.57 13
(2416 9)	1440.67	0.32 4	0.72 8	6.36 5	1.04 12
(2522 9)	1334.74?	0.32 4	0.56 7	6.50 6	0.88 11
(2536 9)	1321.26	1.4 6	2.5 9	5.86 17	3.9 15
(2685 9)	1171.72	0.64 10	0.81 12	6.40 7	1.45 22
(2758 9)	1099.29	1.9 5	2.0 5	6.02 12	3.9 10
(2831 9)	1026.42	0.61 15	0.59 15	6.58 11	1.2 3
(2876 9)	980.93	<0.3	<0.2	>7.0	<0.5
(3207 9)	649.80	1.6 6	2.5 9	7.65 ^{1u} 15	4.1 14

[†] Deduced by evaluators from intensity balances.

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

 $\gamma(^{109}\text{In})$

I γ normalization: from $\Sigma I(\gamma+\text{ce})$ (to g.s.)=100, by assuming no direct feeding to g.s.

E $\gamma^{\dagger}$	E(level)	I $\gamma^{\ddagger\#}$	Mult. †	$\delta^{\ddagger\S}$	α	Comments
119.0 6	1099.29	0.2 1	[E1]		0.1062 22	%I γ =0.06 3, using the calculated normalization.
^x 142.8 5		0.3 1				%I γ =0.09 3, using the calculated normalization.
158.6@ 6	3029.70	0.3 1	[M1]		0.1416 25	%I γ =0.09 3, using the calculated normalization.
181.8 6	2138.44	0.2 1	[M1]		0.0977 17	%I γ =0.06 3, using the calculated normalization.
216.9@ 7	3029.70	0.2 1				%I γ =0.06 3, using the calculated normalization.
220.5 6	3029.70	0.4 2				%I γ =0.12 6, using the calculated normalization.
222.2 7	1321.26	0.2 1	[M1]		0.0571 10	%I γ =0.06 3, using the calculated normalization.
229.2 3	1713.27	0.4 2	[E2]		0.0837	%I γ =0.12 6, using the calculated normalization.
250.1 6	2469.05	0.4 2				%I γ =0.12 6, using the calculated normalization.
261.1 12	2218.56	1.1 4				%I γ =0.32 12, using the calculated normalization.
285.0 5	1713.27	1.2 3	[E2]		0.0402	%I γ =0.35 9, using the calculated normalization.
310.3 5	2871.19	0.5	[M1]		0.0239	E γ ,I γ : From adopted gammas and I γ (614.1)=6.0. %I γ =0.146 3, using the calculated normalization.
312.0 3	1483.76	2.0 2	[E2]		0.0299	E γ : not given in the table 3 (1981Bu17). %I γ =0.59 6, using the calculated normalization.
331.2 2	980.93	32.2 13	M1		0.0203	%I γ =9.4 4, using the calculated normalization. Mult.: $\alpha(\text{K})_{\text{exp}}=0.012$ (1965Kh04), $\alpha(\text{K})_{\text{exp}}=0.028$ (1970Sh05).
340.2 3	1321.26	0.8 2	[E1]		0.00586	%I γ =0.23 6, using the calculated normalization.
353.9 2	1334.74?	3.4 3				%I γ =1.00 9, using the calculated normalization.
362.9 1	2871.19	0.8 2				%I γ =0.23 6, using the calculated normalization.
373.7 3	2591.87	0.8 2	[M1]		0.01493	%I γ =0.23 6, using the calculated normalization.
376.1 5	1816.66	0.3	[M1]		0.01469	%I γ =0.0879 16, using the calculated normalization.
383	1482.22	≈ 3			0.01404	E γ : not listed in Table 3 (1981Bu17). %I γ =0.9 5, using the calculated normalization.
384.5 4	1483.76	≈ 8	M1		0.01390	I γ : 11.0 9 for 383 γ +384.5 γ in 1981Bu17. %I γ =2.3 12, using the calculated normalization.
401.8 4	2218.56	0.3 1				I γ : 11.0 9 for 383 γ +384.5 γ in 1981Bu17. %I γ =0.09 3, using the calculated normalization.
401.97 6	1428.3	0.22 7	M1+E2	+0.07 +5-4	0.01244	%I γ =0.064 21, using the calculated normalization.
^x 407.3 4		0.5 2				E γ ,Mult., δ : From Adopted gammas.
^x 414.7 4		0.4 3				I γ : From I(γ +ce)=1.2 4 (from intensity balances) and branching from adopted gammas.
^x 422.6 2		3.2 4				%I γ =0.15 6, using the calculated normalization.
437.2 3	1463.62	5.5 6	M1		0.01010	%I γ =0.12 9, using the calculated normalization. %I γ =0.94 12, using the calculated normalization.
437.4 3	1759.31	3.6 13				%I γ =1.61 18, using the calculated normalization.
^x 448.7 5		0.3 1				I γ : From adopted gammas. Other: 8.6 13 for 437.2 γ +437.4 γ , I(437.2 γ)=5 and I(437.4 γ)=3.6 in 1981Bu17.
452.8@ 5	2591.87	0.5 2	[E2]		0.00936	%I γ =1.1 4, using the calculated normalization.
454.4@ 20	2410.9	0.6 2				I γ : from 8.6 13 for 437.2 γ +437.4 γ , I(437.2 γ)=5 and I(437.4 γ)=3.6 in 1981Bu17.
459.8 ^a 4	1440.67	0.45 ^a 12	(M1)		0.00892	%I γ =0.09 3, using the calculated normalization.
	2871.19	0.7 ^a 3				%I γ =0.15 6, using the calculated normalization.
465.8 8	2591.87	0.5 2	[M1]		0.00864	%I γ =0.18 6, using the calculated normalization.
473.2 5	1957.11	0.6 2	[M1]		0.00831	%I γ =0.13 4, using the calculated normalization.
478.5 4	2617.16	0.4 2				I γ : From adopted gammas and I γ (790.9 γ)=5.2.
482.7 6	1816.66	0.4 2	[E1]		0.00245	I γ =0.7 3 in 1991Bu17.
495.8 4	1816.66	1.3 3	[E1]		0.00230	%I γ =0.21 9, using the calculated normalization.
						%I γ =0.15 6, using the calculated normalization.
						%I γ =0.18 6, using the calculated normalization.
						%I γ =0.12 6, using the calculated normalization.
						%I γ =0.12 6, using the calculated normalization.
						%I γ =0.38 9, using the calculated normalization.

Continued on next page (footnotes at end of table)

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

^γ(¹⁰⁹In) (continued)

E _γ [†]	E(level)	I _γ [‡] #	Mult. [†]	δ [†] §	α	Comments
501.0 6	1483.76	1.28 18	[E1]		0.00225	%I _γ =0.38 6, using the calculated normalization. E _γ ,I _γ : From adopted gammas and I _γ (384.5)=8.
501.2 3	1482.22	0.9 3			0.00224	%I _γ =0.26 9, using the calculated normalization.
521.9 2	1171.72	9.6 6	E1		0.00204	%I _γ =2.81 18, using the calculated normalization.
522	2235.8	≈2				Mult.: α(K)exp=0.012 (1970Sh05).
539.4@ 2	2845.78	0.7 2				%I _γ =0.6 3, using the calculated normalization.
x548.9 7		0.5 2				E _γ : not given in the table 3 (1981Bu17).
560.3 7	3029.70	0.3 1				%I _γ =0.21 6, using the calculated normalization.
594.6@ 3	2410.9	0.3 2				%I _γ =0.15 6, using the calculated normalization.
597.2 12	2356.15	0.5 2				%I _γ =0.09 3, using the calculated normalization.
614.1 3	1713.27	6.0 4	E2		0.00397	%I _γ =0.09 6, using the calculated normalization.
623.4 4	1722.38	7.2 20	M1		0.00428	%I _γ =0.15 6, using the calculated normalization.
649.8 2	649.80	101 4	M4		0.0695	%I _γ =1.76 12, using the calculated normalization.
						%I _γ =2.1 6, using the calculated normalization.
						%I _γ =29.6 9, using the calculated normalization.
						I _γ : from Table 3 in 1981Bu17, while I _γ =93 from Table 4.
						Mult.: α(exp)=0.07 2(1956Pe56), α(exp)=0.08 3, K/L=6.2 9 (1965Kh04), 0.07 (1970Sh05).
660.1 1	1759.31	4.8 6				%I _γ =1.41 18, using the calculated normalization.
x686.8 3		2.5 4				%I _γ =0.73 12, using the calculated normalization.
710.7 3	2151.4	1.4 3				%I _γ =0.41 9, using the calculated normalization.
x722.1 5		1.9 3				%I _γ =0.56 9, using the calculated normalization.
732.5 5	2858.58	2.1 3				%I _γ =0.62 9, using the calculated normalization.
745.3 9	2871.19	1.1 3				%I _γ =0.32 9, using the calculated normalization.
x780.1 4		0.8 3				%I _γ =0.23 9, using the calculated normalization.
785.3 2	1957.11	0.9 2	[E2]		0.00213	%I _γ =0.26 6, using the calculated normalization.
790.9 3	1440.67	5.2 2	E2		0.00209	%I _γ =1.52 7, using the calculated normalization.
x804.9 4		0.7 2				%I _γ =0.21 6, using the calculated normalization.
816.2 ^a 4	2138.44	1.8 ^a 4	[M1]		0.00228	%I _γ =0.53 12, using the calculated normalization.
	2871.19	1.8 ^a 4				%I _γ =0.53 12, using the calculated normalization.
828.8 2	2542.01	2.9 3				%I _γ =0.85 9, using the calculated normalization.
835.7 1	1816.66	2.9 4	M1,E2		0.00216	%I _γ =0.85 12, using the calculated normalization.
848.6 8	2986.8	0.5 2				%I _γ =0.15 6, using the calculated normalization.
857.9 2	2617.16	1.8 2				%I _γ =0.53 6, using the calculated normalization.
869.3 4	2591.87	2.3 3	[M1]		0.00198	%I _γ =0.67 9, using the calculated normalization.
879.2 5	2602.3	2.0 5				%I _γ =0.59 15, using the calculated normalization.
888.7 1	2845.78	2.1 5				%I _γ =0.62 15, using the calculated normalization.
897.5 2	2218.56	3.2 4				%I _γ =0.94 12, using the calculated normalization.
x903.4 4		0.6 2				%I _γ =0.18 6, using the calculated normalization.
967.2 4	2924.48	1.6 3				%I _γ =0.47 9, using the calculated normalization.
976.3 1	1957.11	3.6 3	[E1]		5.40×10 ⁻⁴	%I _γ =1.05 9, using the calculated normalization.
985.3 2	2469.05	1.3 2	M1,E2		1.49×10 ⁻³	%I _γ =0.38 6, using the calculated normalization.
1026.4& 1	1026.42	13.6& 7	M1+E2	+0.41 13	0.00133 3	%I _γ =3.98 21, using the calculated normalization.
						I _γ : from 17.6 7 for the doublet placed from levels at E=1026 and 2126, and individual intensity of I _γ =13 and I _γ =4, respectively, in 1981Bu17.
						Mult.: α(K)exp=0.0046 (1970Sh05).

Continued on next page (footnotes at end of table)

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

 $\gamma(^{109}\text{In})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$	Mult. [†]	$\delta^{\dagger\S}$	α	Comments
1026.4& 1	2125.77	4.0& 7				%I γ =1.17 21, using the calculated normalization. I γ : from 17.6 7 for the doublet placed from levels at E=1026 and 2126, and individual intensity of I γ =13 and I γ =4, respectively, in 1981Bu17.
1039.0 2	2138.44	15.0 6	[M1]		1.32×10 ⁻³	%I γ =4.39 19, using the calculated normalization.
1054.2 2	2813.46	2.1 2				%I γ =0.62 6, using the calculated normalization.
1072.7 3	2785.62	0.8 2				%I γ =0.23 6, using the calculated normalization.
1078.5	2542.01	0.3				%I γ =0.0879 16, using the calculated normalization.
1083.4 3	2064.3	2.0 3	(M1, E2)		1.21×10 ⁻³	E γ : not given in the table 3 (1981Bu17). %I γ =0.59 9, using the calculated normalization.
1092.2 5	2851.72	1.8 5				%I γ =0.53 15, using the calculated normalization.
1099.2 2	1099.29	100	E2		9.85×10 ⁻⁴	%I γ =29.3 5, using the calculated normalization. Mult.: $\alpha(K)\text{exp}=0.0013$ (1970Sh05).
1107.2 ^a 8	2591.87	1.6 ^a 3	[M1]		1.15×10 ⁻³	%I γ =0.47 9, using the calculated normalization. E γ , I γ : unresolved with 1107.7 γ from E=2924 level.
1107.7 ^a 8	2924.48	1.6 ^a 3				%I γ =0.47 9, using the calculated normalization. E γ , I γ : unresolved with 1107.2 γ from E=2592 level.
1119.2 3	2218.56	10.5 5				%I γ =3.08 16, using the calculated normalization.
1128.2 3	2591.87	4.7 2	[M1]		1.10×10 ⁻³	%I γ =1.38 7, using the calculated normalization.
1130.5 8	2851.72	0.3 2	[M1]		1.10×10 ⁻³	%I γ =0.09 6, using the calculated normalization.
1157.8 3	2871.19	1.7 3	[E2]		8.84×10 ⁻⁴	%I γ =0.50 9, using the calculated normalization.
1166.6 3	1816.66	1.5 3	[M1, E2]		1.03×10 ⁻³	%I γ =0.44 9, using the calculated normalization.
1170.2	2151.4	0.3				I γ : 1.8 is listed in Table 4 (1981Bu17). %I γ =0.0879 16, using the calculated normalization.
^x 1174.6 1		0.6 2				E γ : not given in the table 3 (1981Bu17).
1187.8 5	2508.33	0.8 3				%I γ =0.18 6, using the calculated normalization.
1205.6 5	2305.2	1.3 2				%I γ =0.23 9, using the calculated normalization.
1211.4 3	2785.62	3.3 4				%I γ =0.38 6, using the calculated normalization.
1220.9 5	2542.01	0.5 2				%I γ =0.97 12, using the calculated normalization.
1227.4 3	2986.8	1.1 3				%I γ =0.15 6, using the calculated normalization.
^x 1231.0 1		1.9 4				%I γ =0.32 9, using the calculated normalization.
1239.9 7	2410.9	1.3 3				%I γ =0.56 12, using the calculated normalization.
1250.1 10	2276.5	0.8 3	[E2]		7.65×10 ⁻⁴	%I γ =0.38 9, using the calculated normalization.
1271.5 3	2845.78	1.6 3				%I γ =0.23 9, using the calculated normalization.
1290.0	2271.4	0.5	[E1]		4.08×10 ⁻⁴	%I γ =0.47 9, using the calculated normalization.
1300.7 2	3426.53	1.7 4				%I γ =0.146 3, using the calculated normalization.
^x 1307.1 3		1.1 2				E γ : not given in the table 3 (1981Bu17). %I γ =0.50 12, using the calculated normalization.
1321.3 2	1321.26	39.4 23	E2		6.98×10 ⁻⁴	%I γ =0.32 6, using the calculated normalization.
1350.1 1	2924.48	3.0 3				%I γ =11.5 7, using the calculated normalization.
1375.2 2	2356.15	1.3 2				%I γ =0.88 9, using the calculated normalization.
1388.2 5	2851.72	0.8 2	[M1]		7.44×10 ⁻⁴	%I γ =0.38 6, using the calculated normalization.
1408.9 2	2508.33	2.3 2				%I γ =0.23 6, using the calculated normalization.
1428.32 10	1428.3	0.98 3	E2		6.30×10 ⁻⁴	%I γ =0.67 6, using the calculated normalization.
1429.7 4	2410.9	1.0 2				%I γ =0.287 10, using the calculated normalization.
						E γ , Mult.: From Adopted gammas. I γ : From I(γ +ce)=1.2 4 (from intensity balances) and branching from adopted gammas.
						%I γ =0.29 6, using the calculated normalization.

Continued on next page (footnotes at end of table)

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

^γ(¹⁰⁹In) (continued)

E _γ [†]	E(level)	I _γ [‡] #	Mult. [†]	α	Comments
1442.7 1	2542.01	2.4 2			%I _γ =0.70 6, using the calculated normalization.
1455.3 5	3029.70	2.2 3			%I _γ =0.64 9, using the calculated normalization.
1462.0 6	2561.02	7 2	[M1]	6.92×10 ⁻⁴	%I _γ =2.1 6, using the calculated normalization.
1463.6 4	1463.62	10 3	[E2]	6.14×10 ⁻⁴	%I _γ =2.9 9, using the calculated normalization.
1464.2 2	2785.62	12 4			%I _γ =3.5 12, using the calculated normalization.
1482.3 3	1482.22	1.4 3			%I _γ =0.41 9, using the calculated normalization.
					E _γ : it is indicated in Table 3 of 1981Bu17 that this γ is assigned in the decay scheme but no specific placement is made. Evaluators have made this placement based on γ-ray energy.
1488.7 1	2138.44	13.5 11	[E1]	4.76×10 ⁻⁴	%I _γ =4.0 4, using the calculated normalization.
1492.6 8	2591.87	4.5 6	[M1]	6.75×10 ⁻⁴	%I _γ =1.32 18, using the calculated normalization.
1501.7 4	2151.4	0.5 2			%I _γ =0.15 6, using the calculated normalization.
^x 1507.6 4		0.4 1			%I _γ =0.12 3, using the calculated normalization.
1524.9 3	2845.78	1.7 2			%I _γ =0.50 6, using the calculated normalization.
1546.6 8	2986.8	0.4 1	[E1]	5.04×10 ⁻⁴	%I _γ =0.12 3, using the calculated normalization.
^x 1557.9 2		0.8 2			%I _γ =0.23 6, using the calculated normalization.
1565.6 5	2591.87	0.8 2	[E2]	5.84×10 ⁻⁴	%I _γ =0.23 6, using the calculated normalization.
1574.4 2	1574.36	18.2 8			%I _γ =5.33 24, using the calculated normalization.
1580.7 5	2561.02	3.8 4	[E1]	5.22×10 ⁻⁴	%I _γ =1.11 12, using the calculated normalization.
1603.3 3	2924.48	1.3 2			%I _γ =0.38 6, using the calculated normalization.
1621.7 5	2271.4	1.5 3	[E1]	5.44×10 ⁻⁴	%I _γ =0.44 9, using the calculated normalization.
1655.7 6	2305.2	1.6 3			%I _γ =0.47 9, using the calculated normalization.
^x 1674.1 12		0.7 2			%I _γ =0.21 6, using the calculated normalization.
1686.3 3	2785.62	2.5 3			%I _γ =0.73 9, using the calculated normalization.
1700.7 13	2871.19	0.4 1	[E2]	5.70×10 ⁻⁴	%I _γ =0.12 3, using the calculated normalization.
1709.3 6	2808.8	0.3 1			%I _γ =0.09 3, using the calculated normalization.
1713.5 2	1713.27	3.3 4	[M1]	6.08×10 ⁻⁴	%I _γ =0.97 12, using the calculated normalization.
1722.2 2	1722.38	3.5 3	[M1]	6.07×10 ⁻⁴	%I _γ =1.03 9, using the calculated normalization.
^x 1734.3 5		1.0 2			%I _γ =0.29 6, using the calculated normalization.
1759.2 5	2858.58	3.7 2			%I _γ =1.08 6, using the calculated normalization.
^x 1770.8 2		1.2 2			%I _γ =0.35 6, using the calculated normalization.
^x 1792.0 3		0.8 2			%I _γ =0.23 6, using the calculated normalization.
1819.0 4	3140.3	0.6 2			%I _γ =0.18 6, using the calculated normalization.
1825.1 ^a 3	2851.72	2.1 ^a 2	[E2]	5.75×10 ⁻⁴	%I _γ =0.62 6, using the calculated normalization.
1825.3 ^a 3	2924.48	2.1 ^a 2			%I _γ =0.62 6, using the calculated normalization.
1843.7 6	1843.7	2.4 2			%I _γ =0.70 6, using the calculated normalization.
^x 1850.1 5		1.7 3			%I _γ =0.50 9, using the calculated normalization.
1858.7 2	2508.33	1.3 2			%I _γ =0.38 6, using the calculated normalization.
1889.8 3	2871.19	5.1 5	[E1]	6.98×10 ⁻⁴	%I _γ =1.49 15, using the calculated normalization.
1911.1 2	2561.02	19.3 8	[E1]	7.11×10 ⁻⁴	%I _γ =5.7 25, using the calculated normalization.
1930.5 3	3029.70	1.7 2	[M1]	6.08×10 ⁻⁴	%I _γ =0.50 6, using the calculated normalization.
1943.5 3	2924.48	3.6 4			%I _γ =1.05 12, using the calculated normalization.
1951.3	3050.74	0.3			%I _γ =0.0879 16, using the calculated normalization.
					E _γ : not given in the table 3 (1981Bu17).
1956.9 2	1957.11	1.3 2	[E2]	5.93×10 ⁻⁴	%I _γ =0.38 6, using the calculated normalization.
1962.2 5	2943.0	0.5 1			%I _γ =0.15 3, using the calculated normalization.
^x 2007.1 3		0.3 1			%I _γ =0.09 3, using the calculated normalization.
^x 2030.0 [@] 2		1.2 3			%I _γ =0.35 9, using the calculated normalization.
2049.0 5	3029.70	1.0 2	[E1]	7.92×10 ⁻⁴	%I _γ =0.29 6, using the calculated normalization.
2055.2 3	2055.14	5.9 3			%I _γ =1.73 10, using the calculated normalization.
2074.8 9	3395.68	0.3 1			%I _γ =0.09 3, using the calculated normalization.
^x 2078.8 5		0.2 1			%I _γ =0.06 3, using the calculated normalization.
^x 2099.2 7		0.3 1			%I _γ =0.09 3, using the calculated normalization.
^x 2106.2 5		0.1 1			%I _γ =0.03 3, using the calculated normalization.
2125.9 2	2125.77	4.6 3			%I _γ =1.35 9, using the calculated normalization.
2158.9 4	2808.8	2.4 3			%I _γ =0.70 9, using the calculated normalization.
2195.6 2	2845.78	4.7 3			%I _γ =1.38 9, using the calculated normalization.
2218.5 5	2218.56	0.73 7			%I _γ =0.214 21, using the calculated normalization.
2235.8 3	2235.8	0.36 5			%I _γ =0.105 15, using the calculated normalization.
2276.5 8	2276.5	0.8 3	[M1]	6.76×10 ⁻⁴	%I _γ =0.23 9, using the calculated normalization.
^x 2302.5 [@] 6		0.4 2			%I _γ =0.12 6, using the calculated normalization.
2437.5 4	3418.5	0.47 5			%I _γ =0.138 15, using the calculated normalization.

Continued on next page (footnotes at end of table)

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

 $\gamma(^{109}\text{In})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^{\ddagger\#}$	Mult. [†]	α	Comments
2541.8 3	2542.01	8.7 5			%I γ =2.55 15, using the calculated normalization.
2564.2 7	2564.2	0.34 7	[E2]	7.64 $\times 10^{-4}$	%I γ =0.100 21, using the calculated normalization.
2574.8 3	2574.8	0.37 6			%I γ =0.108 18, using the calculated normalization.
2591.6 4	2591.87	2.0 2	[M1]	7.70 $\times 10^{-4}$	%I γ =0.59 6, using the calculated normalization.
2602.7 4	2602.3	0.26 4			%I γ =0.076 12, using the calculated normalization.
2617.0 10	2617.16	0.2 1			%I γ =0.06 3, using the calculated normalization.
2785.4 3	2785.62	5.8 4			%I γ =1.70 12, using the calculated normalization.
2813.2 4	2813.46	1.3 2			%I γ =0.38 6, using the calculated normalization.
2852.2 10	2851.72	0.2 1	[M1]	8.59 $\times 10^{-4}$	%I γ =0.06 3, using the calculated normalization.
2858.6 2	2858.58	3.4 3			%I γ =1.00 9, using the calculated normalization.
2871.2 9	2871.19	0.27 5	[E2]	8.69 $\times 10^{-4}$	%I γ =0.079 15, using the calculated normalization.
2919.8 7	2919.8	0.05 2			%I γ =0.015 6, using the calculated normalization.
2942.8 4	2943.0	0.37 5			%I γ =0.108 15, using the calculated normalization.
3013.4 3	3013.4	0.42 5			%I γ =0.123 15, using the calculated normalization.
3029.5 6	3029.70	0.15 6	[E2]	9.25 $\times 10^{-4}$	%I γ =0.044 18, using the calculated normalization.
3034.8 4	3034.8	0.41 6			%I γ =0.120 18, using the calculated normalization.
3050.7 2	3050.74	1.2 2			%I γ =0.35 6, using the calculated normalization.
3065.6 2	3065.65	0.26 5			%I γ =0.076 15, using the calculated normalization.
3139.8@ 6	3140.3	0.14 4			%I γ =0.041 12, using the calculated normalization.
3316.7 3	3316.8	0.30 5			%I γ =0.088 15, using the calculated normalization.
3360.9 6	3361.0	0.07 2			%I γ =0.021 6, using the calculated normalization.
3395.6 2	3395.68	0.37 5			%I γ =0.108 15, using the calculated normalization.
3418.5	3418.5	0.04			%I γ =0.01172 21, using the calculated normalization.
3427.3 8	3426.53	0.06 2			E γ : not given in the table 3 (1981Bu17).
					%I γ =0.018 6, using the calculated normalization.

[†] From adopted gammas. ce data from ¹⁰⁹Sn ε decay are given in the comments.

[‡] From 1981Bu17, unless otherwise stated.

[§] If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

[#] For absolute intensity per 100 decays, multiply by 0.293 5.

[@] Placement of transition in the level scheme is uncertain.

[&] Multiply placed; intensity suitably divided.

^a Multiply placed; undivided intensity given.

^x γ ray not placed in level scheme.

^{109}Sn ϵ Decay 1981Bu17 (continued)

Decay Scheme

Intensities: relative I_γ
 @ Multiply placed; intensity suitably divided
 & Multiply placed; undivided intensity given

$^{109}_{50}\text{Sn}_{59}$ 5/2+ 0.0 18.1 min
 $Q^+(g.s.)=3857^9$
 $\% \epsilon + \% \beta^+ = 100$

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

Decay Scheme (continued)

Intensities: relative I_γ
 @ Multiply placed; intensity suitably divided
 & Multiply placed; undivided intensity given

¹⁰⁹Sn₅₉
 5/2+ 0.0 18.1 min
 %ε+%β⁺=100
 Q⁺(g.s.)=3857⁹

¹⁰⁹Sn ε Decay 1981Bu17 (continued)

Decay Scheme (continued)

Intensities: relative I_γ
 @ Multiply placed; intensity suitably divided
 & Multiply placed; undivided intensity given

¹⁰⁹Sn₅₉ 5/2+ 0.0 18.1 min
 %ε+%β⁺=100
 Q⁺(g.s.)=3857⁹

^{109}Sn ϵ Decay 1981Bu17 (continued)

Decay Scheme (continued)

Intensities: relative I_γ
 @ Multiply placed; intensity suitably divided
 & Multiply placed; undivided intensity given

$^{109}_{50}\text{Sn}_{59}$ 18.1 min
 $5/2+ \quad 0.0$
 $\% \epsilon + \% \beta^+ = 100$
 $Q^+(g.s.) = 3857^9$

Decay Scheme (continued)

$^{109}_{50}\text{Sn}_{59}$ 18.1 min
 $5/2^+$ 0.0
 β^+
 $^{109}_{51}\text{Sb}_{58}$
 $\% \epsilon + \% \beta^+ = 100$
 $Q^+(\text{g.s.}) = 38579$

$^{76}\text{Ge}(^{37}\text{Cl}, 4n\gamma)$ 1997VaZS

1997VaZS: $E(^{37}\text{Cl})=138$ MeV; Chalk River TASC Facility. Target: two stacked foils of ^{76}Ge each of $300\text{ }\mu\text{g}/\text{cm}^2$.
 Detectors: 8π array, 20 Ge detectors, 72 BGO, ALF ball (24 CsI detectors). Measured: $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma\gamma$.

 ^{109}In Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	Comments
0.0 ^b	9/2+	
1025.9 ^b 7	11/2+	
1099.0 ^s 8	5/2+	
1428.2 ^b 7	13/2+	
1713.0 ^s 8	9/2+	
1722.0 [#] 8	7/2+	
1899.6 10	13/2+	
2101.6 9	19/2+	
2195.2 ^b 13	15/2+	
2271.4 ^d 9	13/2-	
2317.0 [#] 9	11/2+	
2321.3 9	15/2+	
2532.0 ^d 10	15/2-	
2868.5 ^d 10	17/2-	
2957.9 ^d 10	19/2-	
2995.4 12	17/2+	
3068.0 ^h 14	17/2-	
3091.8 ^f 11	19/2-	
3122.5 ^d 11	21/2-	
3155.0 [#] 9	15/2+	
3202.2 ^f 11	21/2-	
3287.0 ^h 17	19/2-	
3410.3 ^f 12	23/2-	
3462.0 ^d 12	23/2-	
3518.0 ^h 20	21/2-	
3528.5 12	21/2+	
3653.5 12	17/2+	
3798.1 12	23/2+	
3800.3 ^f 14	25/2-	
3845.0 ^h 22	23/2-	
4037.3 ^d 13	25/2-	
4097.2 [#] 12	19/2+	
4300.4 ^{&} 12	21/2+	
4354.4 ^c 12	23/2+	
4436.3 ^f 16	27/2-	
4508.3 ^g 14	27/2-	
4508.3+x ^e	(25/2-)	$J\pi$: feeding to 19/2- level of band 8; also feeding 23/2- and 25/2- levels of band 11.
4565.3 ^c 12	25/2+	
4572.3 13	25/2+	
4743.4 ^{&} 12	25/2+	
4756.3 [#] 13	23/2+	
4832.3 ^g 16	29/2-	
4927.6 ^c 12	27/2+	
5025.3 ^f 19	29/2-	
5219.5 [#] 13	27/2+	
5241.3 ^g 19	31/2-	
5275.3+x ^e 10	(29/2-)	
5397.3 ^{&} 13	29/2+	
5424.6 ^c 13	29/2+	
5761.7 ^a 18	(29/2+)	
5796.3 ^g 21	33/2-	
5850.8 [#] 13	31/2+	
5917.8 ^c 14	31/2+	
6005.7 ^a 15	(31/2+)	
6263.0 ^{&} 15	33/2+	
6271.7 ^a 16	(33/2+)	
6293.3+x ^e 15	(33/2-)	
6428.3 ^g 24	(35/2-)	
6433.2 ^c 15	33/2+	
6506.5 [@] 15	(31/2+)	

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76Ge(37Cl,4nγ) 1997VaZS (continued)**109In Levels (continued)**

E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]
6638.7 ^a 19	(35/2+)	8005.2 ^c 23	39/2+	10104.8 [#] 24	47/2+
6667.8 [#] 17	35/2+	8310.3+x ^e 20	(41/2-)	10217.9 [@] 23	(47/2+)
6927.2 ^c 18	35/2+	8329 ^a 3	(41/2+)	10428.3+x ^e 25	(49/2-)
7119.7 ^a 21	(37/2+)	8463.0 ^{&} 20	41/2+	11189.0 ^{&} 25	(49/2+)
7150.8 [@] 16	(35/2+)	8632.2 ^c 25	41/2+	11634 [#] 3	51/2+
7287.9 ^{&} 17	37/2+	8785.8 [#] 22	43/2+	11641.9 [@] 25	(51/2+)
7384.3+x ^e 18	(37/2-)	8977 ^a 3	(43/2+)	11730+x ^e 3	(53/2-)
7423.2 ^c 21	37/2+	8980.9 [@] 20	(43/2+)	13244+x ^e 3	(57/2-)
7641.8 [#] 19	39/2+	9292.3+x ^e 23	(45/2-)	13338 [#] 3	(55/2+)
7711.7 ^a 23	(39/2+)	9317 ^c 3	43/2+	14821+x ^e 3	(61/2-)
7980.9 [@] 17	(39/2+)	9783.0 ^{&} 22	45/2+		

[†] From a least-squares fit to E_γ.[‡] From 1997VaZS, based on deduced transition multipolarities and band structures.[§] (A): Band 1: ΔJ=2 band based on 5/2+ at 1099 keV.[#] (B): Band 2: ΔJ=2 band based on 7/2+ at 1722 keV.[@] (C): Band 3: ΔJ=2 band based on 31/2+ at 6507 keV.[&] (D): Band 4: ΔJ=2 band based on 21/2+ at 4300 keV.^a (E): Band 5: ΔJ=1 band based on (29/2+) at 5762 keV.^b (F): Band 6: ground state band.^c (G): Band 7: ΔJ=1 band based on 23/2+ at 4354 keV.^d (H): Band 8: ΔJ=1 band based on 13/2- at 2271 keV.^e (I): Band 9: ΔJ=2 band based on (25/2-) at 4508.3+x keV.^f (J): Band 11: ΔJ=1 band based on 19/2- at 3091 keV.^g (K): Band 10: ΔJ=1 band based on 27/2- at 4508 keV.^h (L): Band 12: ΔJ=1 band based on 17/2- at 3068 keV.**γ(109In)**

E _γ [†]	E(level)	E _γ [†]	E(level)	E _γ [†]	E(level)
89 1	2957.9	471 1	4508.3	674 1	2995.4
110 1	3202.2	476 1	5219.5	685 1	9317
164 1	3122.5	481 1	7119.7	687 1	1713.0
208 1	3410.3	493 1	5917.8	693 1	7980.9
211 1	4565.3	494 1	6927.2	708 1	4508.3
219 1	3287.0	496 1	7423.2	767 1	2195.2
223 1	3091.8	497 1	5424.6		5275.3+x
231 1	3518.0	515 1	6433.2	768 1	4565.3
244 1	3202.2	536 [‡] 1	3068.0	774 1	4572.3
	6005.7	547 1	2868.5	817 1	6667.8
260 1	2532.0	555 1	5796.3	826 1	4354.4
266 1	6271.7	576 1	4037.3	830 1	7980.9
288 1	3410.3	581 1	6005.7	838 1	3155.0
324 1	4832.3	582 1	8005.2	842 1	2271.4
327 1	3845.0	589 1	5025.3	856 1	2957.9
336 1	2868.5	592 1	7711.7	866 1	6263.0
339 1	3462.0	595 1	2317.0	874 1	1899.6
354 1	6271.7	604 1	2317.0	888 1	7150.8
355 1	4927.6	614 1	1713.0	891 1	4927.6
362 1	4927.6	617 1	8329	893 1	2321.3
367 1	6638.7	623 1	1722.0	926 1	8310.3+x
390 1	3800.3	627 1	8632.2	942 1	4097.2
396 1	4832.3	631 1	5850.8	974 1	7641.8
402 1	1428.2	632 1	6428.3	982 1	9292.3+x
409 1	5241.3	636 1	4436.3	990 1	3091.8
422 1	2321.3	644 1	7150.8		5917.8
426 1	5850.8	647 1	4300.4	1000 1	8980.9
443 1	4743.4	648 1	8977	1009 1	6433.2
454 1	5850.8	654 1	5397.3	1018 1	6293.3+x
463 1	5219.5	659 1	4756.3	1021 1	3122.5
470 1	5397.3	674 1	2101.6	1025 1	7287.9

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⁷⁶Ge(³⁷Cl,4n γ) **1997VaZS (continued)**
 $\gamma(^{109}\text{In})$ (continued)

$E\gamma^\dagger$	E(level)	$E\gamma^\dagger$	E(level)	$E\gamma^\dagger$	E(level)
1026 1	1025.9	1232 1	4354.4	1428 1	1428.2
1053 1	3155.0	1237 1	10217.9	1514 1	13244+x
1091 1	7384.3+x	1246 1	2271.4	1529 1	11634
1099 1	1099.0	1295 1	2321.3	1552 1	3653.5
1101 1	3202.2	1302 1	11730+x	1577 $\ddagger$ 1	14821+x
1102 1	4565.3	1305 1	4300.4	1697 1	3798.1
1104 1	2532.0	1319 1	10104.8	1704 $\ddagger$ 1	13338
1109 1	6506.5	1320 1	9783.0	1712 $\ddagger$ 1	1713.0
1136 1	10428.3+x	1406 $\ddagger$ 1	11189.0	1722 1	1722.0
1144 1	8785.8	1424 $\ddagger$ 1	11641.9	1727 1	3155.0
1175 1	8463.0	1427 1	3528.5		

$\dagger$ $\Delta E\gamma=1$ keV was assumed by evaluators.

$\ddagger$ Placement of transition in the level scheme is uncertain.

⁹²Mo(¹⁹F,2p γ) **1997Ko51**

1997Ko51: E(¹⁹F)=95 MeV; Tandem Accelerator at Niels Bohr Institute, Denmark. Detectors: Nordball array with 20 Compton-suppressed Ge detectors and a plastic-photoswitch detector array to select a charge particle reaction channel. Measured: γ , $\gamma\gamma(t)$, $\gamma(\theta)$, angular correlation intensity ratios R. Deduced levels, J π , band structures.

¹⁰⁹In Levels

E(level) †	J $\pi^\ddagger$	Comments
0.0	9/2+	configuration: $\pi(g_{9/2})^{-1}$.
1027.57 10	11/2+	configuration: $\pi(g_{9/2})^{-1}\otimes v2^+$.
1429.44 10	13/2+	configuration: $\pi(g_{9/2})^{-1}\otimes v4^+$.
2103.3 3	17/2+	configuration: $\pi(g_{9/2})^{-1}\otimes v6^+$.
2533.4 $\S$ 8	15/2-	
2869.3 $\S$ 8	17/2-	
2958.2 $\S$ 8	19/2-	
3092.8 $\#$ 8	19/2-	
3122.9 $\S$ 8	21/2-	
3202.9 $\#$ 8	21/2-	
3273.8? $@$ 8		
3410.8 $\#$ 8	23/2-	
3462.3 $\S$ 8	23/2-	
3484.8 $@$ 8		
3800.6 $\#$ 8	25/2-	
3976.8? $@$ 9		
4037.7 $\S$ 9	(25/2-)	
4473.8? $@$ 9		
4508.3 $\#$ 9	(27/2-)	
4832.3 $\#$ 9	(29/2-)	
5055.6? $@$ 10		
5241.5 $\#$ 9	(31/2-)	
5423.2? $@$ 10		
5796.7 $\#$ 10		
5905.0? $@$ 10		
6258.9? $@$ 10		
6385.7 $\#$ 11		

$\dagger$ From a least-squares fit to $E\gamma$.

$\ddagger$ From 1997Ko51 based on deduced γ -ray transition multipolarities and band structure.

$\S$ (A): Band 1: $\Delta J=1$ band based on the J $\pi=15/2-$ level at 2533 keV.

$\#$ (B): Band 2: $\Delta J=1$ band based on the J $\pi=19/2-$ level at 3093 keV.

$@$ (C): Band 3, based on the level at 3274 keV.

$^{92}\text{Mo}(^{19}\text{F}, 2\text{p}\gamma)$ 1997Ko51 (continued) $\gamma(^{109}\text{In})$

$E\gamma$	E(level)	$I\gamma$	Mult. [†]	Comments
88.9 5	2958.2	28.2 2	(M1)	Mult.: R=1.02 1 (1997Ko51).
110.1 3	3202.9	8.4 2	(M1)	Mult.: R=0.73 1 (1997Ko51).
150.9 [‡] 2	3273.8?	18.0 3		
164.7 2	3122.9	27.1 5	(M1)	Mult.: R=0.82 2 (1997Ko51).
207.9 1	3410.8	48.9 1	(M1)	Mult.: R=0.82 2 (1997Ko51).
211.0 2	3484.8	16.0 2		
223.5 2	3092.8	9.5 1		
244.7 2	3202.9	35.8 3	(M1)	Mult.: R=0.76 1 (1997Ko51).
287.9 3	3410.8	4.9 2		
324.0 3	4832.3	15.0 2	(M1)	Mult.: R=0.90 4 (1997Ko51).
335.9 1	2869.3	79.6 2	(M1)	Mult.: R=0.98 3 (1997Ko51).
338.3 3	3800.6	4.1 2		
339.4 2	3462.3	20.6 1	(M1)	Mult.: R=1.05 4 (1997Ko51).
353.9 2	6258.9?	9.0 1		
361.9 2	3484.8	27.9 1		
367.6 2	5423.2?	12.6 1		
389.8 2	3800.6	32.8 4	(M1)	Mult.: R=1.02 6 (1997Ko51).
402.0 2	1429.44	12.8 3	(M1)	Mult.: R=1.10 3 (1997Ko51).
409.2 2	5241.5	12.6 3	(M1)	Mult.: R=0.96 4 (1997Ko51).
470.6 2	4508.3	4.3 2		
481.8 3	5905.0?	9.4 3		
492.0 2	3976.8?	36.9 3		
497.0 3	4473.8?	38.8 3		
514.5 3	3976.8?	7.2 2		
555.2 4	5796.7	10.8 2		
575.4 4	4037.7	8.9 3		
581.8 3	5055.6?	13.4 2		
589.0 3	6385.7	3.5 2		
673.9 3	2103.3	8.4 3		
707.7 3	4508.3	26.9 2	(M1)	Mult.: R=0.95 6 (1997Ko51).
989.4 10	3092.8	5.8 2	(E1)	Mult.: R=0.85 7 (1997Ko51).
1027.6 1	1027.57	23.0 3	(M1)	Mult.: R=0.65 3 (1997Ko51).
1104.0 10	2533.4	100.0 2	(E1)	Mult.: R=0.77 2 (1997Ko51).
1429.4 1	1429.44	67.3 2	(E2)	Mult.: R=1.56 2 (1997Ko51).

[†] Based on measured angular correlation intensity ratio R, defined as $R = I\gamma(37^\circ + 143^\circ) / I\gamma(79^\circ + 101^\circ)$, where R=0.8 for $\Delta J=1$ stretched dipole and R=1.5 for $\Delta J=2$ stretched quadrupole transitions.

[‡] Placement of transition in the level scheme is uncertain.

⁹⁶Zr(¹⁹F,6n γ) ²⁰¹²Ne03

2012Ne03: E(¹⁹F) beam at 105 MeV, 15UD Pelletron Accelerator at the Inter University Accelerator Centre (IUAC).
 Target=1.0 mg/cm² of ⁹⁶Zr, 10.0 mg/cm² backing of Pb; Indian National Gamma Array (INGA) consist of 14
 Compton-suppressed Ge clover detectors; Measured: E γ , I γ , $\gamma\gamma$ -coin, $\gamma\gamma(\theta)$, DCO ratio. Deduced: J, π , bands
 configurations, and multipolarity. Comparison with Tilted Axis Cranking (TAC) calculations. Systematics of angular
 momentum as a function of rotational frequency for In isotopes.
 Other: 2007ZhZX, using ⁹⁶Zr(²⁰Ne,1p6n γ) at RIKEN and GRAPE array comprising of 17 detectors.
 All data are from 2012Ne03, unless otherwise noted.

¹⁰⁹In Levels

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0	9/2+		
1026.2 4	11/2+		
1428.4 4	13/2+		
1900.2 7			
2101.6 7	19/2+	210.0 ms 9	%IT=100. T _{1/2} : From Adopted levels.
2102.2 ^a 6	17/2+		
2271.9 6	13/2-		
2532.3 [@] 6	15/2-		
2868.9 [@] 6	17/2-		
2957.8 [@] 7	19/2-		
2995.9 [?] ^a 8			
3092.0 [§] 6	19/2-		
3122.4 [@] 8	21/2-		
3202.4 [§] 7	21/2-		
3410.4 [§] 8	23/2-		
3462.1 [@] 9	23/2-		E(level): 3800.5 in table I of 2012Ne03.
3484.9 ^{&} 9	23/2		
3800.5 [§] 9	25/2-		
3861.3 [?] ^a 10			
3982.1 ^{&} 11	25/2		J π : from figure 1 of 2012Ne03, listed as 27/2 in table I.
4037.7 [@] 9	25/2-		
4436.5 [#] 10	27/2(-)		
4475.0 ^{&} 12	27/2		J π : from figure 1 of 2012Ne03, listed as 25/2 in table I.
4508.6 [§] 9	27/2(-)		
4686.4 ^{&} 13	29/2		
4833.0 [§] 10	29/2(-)		
5025.2 [#] 11	29/2(-)		
5053.5 ^{&} 14	31/2		
5166.1 [?] ^a 11			
5242.0 [§] 11	31/2(-)		
5408.3 ^{&} 15	33/2		
5580.6 [#] 12	31/2(-)		
5796.7 [§] 12	33/2(-)		
5989.6 ^{&} 16	(35/2)		

[†] From a least-squares fit to γ -ray energies.

[‡] As given in 2012Ne03 based on deduced γ -ray transition multiplicities and band structure.

[§] (A): Band 1: $\Delta J=1$ band based on 19/2-. Configuration= $\pi g_{9/2}^{-1} \otimes v[h_{11/2}, (d_{5/2}/g_{7/2})]$ before alignment and $\pi g_{9/2}^{-1} \otimes v[h_{11/2}, (d_{5/2}/g_{7/2})^3]$ after alignment around $\hbar\omega=0.7$ MeV.

[#] (B): Band 2: $\Delta J=1$ band based on 27/2(-).

[@] (C): Band 3: $\Delta J=1$ band based on 15/2-.

[&] (D): Band 4: $\Delta J=1$ band based on 23/2.

^a (E): Band 5: band based on 17/2+.

⁹⁶Zr(¹⁹F,6n γ) **2012Ne03 (continued)**
 $\gamma(^{109}\text{In})$

$E\gamma^\dagger$	E(level)	I_γ	Mult. [‡]	Comments
88.9 5	2957.8	64 4		
110.4 5	3202.4	31.2 19	D	Mult.: DCO(D)=0.99 21 (2012Ne03).
164.6 5	3122.4	54.2 25	D+Q	Mult.: DCO(Q)=0.78 8 (2012Ne03).
208.0 5	3410.4	78 4	D+Q	Mult.: DCO(Q)=0.75 14 (2012Ne03).
211.4 5	4686.4	19.9 12	D	Mult.: DCO(Q)=0.56 17, DCO(D)=1.15 20 (2012Ne03).
223.1 5	3092.0	6.0 15		
244.6 5	3202.4	35.2 17	D+Q	Mult.: DCO(Q)=0.70 10 (2012Ne03).
260.4 5	2532.3	6.6 7		
288.0 5	3410.4	8.4 10	D	Mult.: DCO(D)=1.0 3 (2012Ne03).
324.4 5	4833.0	23.6 12	D+Q	Mult.: DCO(Q)=0.73 18 (2012Ne03).
336.6 5	2868.9	100 4	D+Q	Mult.: DCO(Q)=0.69 4 (2012Ne03).
338.4 5	3800.5	9.7 13	D	Mult.: DCO(Q)=0.56 5 for 339.7+338.4 (2012Ne03).
339.7 5	3462.1	34 4	D	Mult.: DCO(Q)=0.56 5 for 339.7+338.4 (2012Ne03).
354.8 5	5408.3	8.8 9	D+Q	Mult.: DCO(D)=1.2 4 (2012Ne03).
362.5 5	3484.9	32.6 13	D+Q	Mult.: DCO(Q)=0.63 10 (2012Ne03).
367.1 5	5053.5	13.8 9	D	Mult.: DCO(D)=1.0 3 (2012Ne03).
390.1 5	3800.5	74 4	D+Q	Mult.: DCO(Q)=0.61 8 (2012Ne03).
396.5 5	4833.0	4.0 5		
402.2 5	1428.4	26.0 18		
409.0 5	5242.0	16.4 10	D	Mult.: DCO(D)=1.19 23 (2012Ne03).
470.9 5	4508.6	9.9 10	D	Mult.: DCO(D)=0.93 14 (2012Ne03).
492.9 5	4475.0	22.6 13	D+Q	E γ : Transition shown from 25/2 to 23/2 in table I of 2012Ne03.
				Mult.: DCO(D)=1.20 22 (2012Ne03).
497.2 5	3982.1	28.7 15	D	E γ : 497.1 listed in figure 1 of 2012Ne03. Transition shown from 27/2 to 25/2 in table I of 2012Ne03.
				Mult.: DCO(D)=1.03 16 (2012Ne03).
554.7 5	5796.7	3.1 15	D	Mult.: DCO(D)=0.9 3 for 555.4+554.7 (2012Ne03).
555.4 5	5580.6	7.4 12	D	Mult.: DCO(D)=0.9 3 for 555.4+554.7 (2012Ne03).
575.6 5	4037.7	14.8 8	D	Mult.: DCO(D)=1.04 17 (2012Ne03).
581.3 5	5989.6	8.8 9	D	Mult.: DCO(D)=1.1 4 (2012Ne03).
588.7 5	5025.2	11.0 10	D	Mult.: DCO(D)=1.0 5 (2012Ne03).
636.0 5	4436.5	26.0 13		Mult.: DCO(D)=0.97 21 (2012Ne03).
673.2	2101.6			E γ : delayed transition not seen in 2012Ne03.
673.8 5	2102.2	59 3	Q	Mult.: DCO(Q)=1.13 14 (2012Ne03).
708.1 5	4508.6	24.4 9	D+Q	Mult.: DCO(D)=1.28 19 (2012Ne03).
856.2 5	2957.8	12.7 8		Initial level=2868.9 listed in table I of 2012Ne03 seems in error.
865.4 [§] 5	3861.3?	17.1 12		
874.0 5	1900.2	9.9 8		
893.7 5	2995.9?	18.8 15		
989.8 5	3092.0	9.6 11		
990.4 5	3092.0	26 5		
1026.2 5	1026.2	70 3		
1100.8 5	3202.4	16.5 8		
1103.8 5	2532.3	100.0	D	Mult.: DCO(Q)=0.50 5 (2012Ne03).
1245.7 5	2271.9	8.3 8		
1304.8 5	5166.1?	10.6 11		
1428.4 5	1428.4	133 8		

[†] $\Delta E\gamma=0.5$ keV was assumed by evaluators.

[‡] Based on measured DCO ratios. DCO(Q) for gate on $\Delta J=2$, quadrupole transition; DCO(D) for gate on $\Delta J=1$, dipole transition.

[§] Placement of transition in the level scheme is uncertain.

$^{97}\text{Mo}(^{16}\text{O},3\text{npy})$ 1988Vi07,1987KuZV

1988Vi07,1987KuZV: E=69.5 MeV ^{16}O beam. Measured $E\gamma$ with a HPGe detector and $T_{1/2}$ using the Doppler-shift attenuation method (DSAM).

 ^{109}In Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}^{\#}$	Comments
0.0	9/2+ $\S$		
1026.38 6	11/2+ $\S$		
1099.31 20	5/2+ $\S$		
1428.30 10	13/2+ $\S$		
1463.48 21	9/2+ $\S$		
1900.33 12	13/2+ $\S$		
2101.82 13	19/2+ $\S$	210.0 ms 9	$T_{1/2}$: From adopted levels.
2195.20 23	15/2+ $\S$		
2272.5 3	13/2- $\S$		
2532.31 14	15/2-		
2868.7 4	17/2-	0.42 ps 17	
2957.9 6	19/2-		
3067.2 6	(17/2-)	0.31 ps 17	
3092.07 18	19/2-	0.42 ps 14	
3122.5 6	21/2-		
3202.4 5	21/2-		
3285.7 8	(19/2-)	>1.4 ps	
3374.6 6	19/2-		
3410.3 6		0.69 ps 21	
3462.0 8	23/2-	0.8 ps 3	
3517.0 9	(21/2-)	0.42 ps 14	
3800.1 8	25/2-	2.7 ps 14	
4037.3 9	(25/2-)		

[†] From a least-squares fit to $E\gamma$.

[‡] From 1987KuZV and 1988Vi07, unless otherwise stated.

$\S$ From adopted levels.

$\#$ From 1987KuZV (also 1988Vi07) by DSAM.

 $\gamma(^{109}\text{In})$

$E\gamma^{\dagger}$	E(level)	$E\gamma^{\dagger}$	E(level)	$E\gamma^{\dagger}$	E(level)
89.2 5	2957.9	336.3 5	2868.7	873.95 $\ddagger$ 10	1900.33
110.4 5	3202.4	339.5 5	3462.0	990.25 $\ddagger$ 12	3092.07
164.5 5	3122.5	389.8 5	3800.1	1026.36 $\ddagger$ 6	1026.38
207.9 5	3410.3	416.7 $\ddagger$ 2	3374.6	1099.3 $\ddagger$ 2	1099.31
218.5 5	3285.7	437.1 $\ddagger$ 2	1463.48	1104.04 $\ddagger$ 10	2532.31
223.4 5	3092.07	534.9 5	3067.2	1245.8 $\ddagger$ 3	2272.5
231.3 5	3517.0	575.3 5	4037.3	1428.32 $\ddagger$ 10	1428.30
259.0 5	2532.31	673.52 $\ddagger$ 8	2101.82		
287.79 $\ddagger$ 12	3410.3	766.9 $\ddagger$ 2	2195.20		

[†] From 1987KuZV and 1988Vi07, by assuming $\Delta E=0.5$ keV, unless otherwise stated.

$\ddagger$ From adopted gammas.

107Ag($\alpha, 2n\gamma$) 1979Va13

1979Va13: $E\alpha=20-30$ MeV, AVF Cyclotron, Free University, Amsterdam. Target: $^{107}\text{Ag}=5$ mg/cm² for γ measurement, ≈ 0.5 mg/cm² for $\alpha(\text{K})\text{exp}$. Detectors: two 65 cm³ Ge(Li), Si(Li), mini-orange electron spectrometer. Measured: γ , $\gamma\gamma(\text{t})$, $\gamma(\theta)$, linear polarization (three-crystal Compton polarimeter), $T_{1/2}$.
 1988Vi07, 1987KuZV, 1986KuZV: $E\alpha=21.5, 26.1$ MeV, measured $T_{1/2}$.
 Others: 1976EiZY, 1976PoZU, 1968Sm08.

109In Levels

E(level) [†]	J $\pi^{\ddagger}$	$T_{1/2}^{\S}$	Comments
0.0	9/2+		configuration: $\nu(g_{9/2})^{-1}$.
649.8 3	1/2-	1.34 min 7	$T_{1/2}$: from 649.8 $\gamma(\text{t})$ in 1968Sm08. configuration: $\nu(p_{1/2})^{-1}$.
980.8 5	3/2-	0.62 ps +30-15	$T_{1/2}$: from 1986KuZV by DSAM.
1026.36 7	11/2+	0.17 ps 7	
1099.5 3	5/2+	0.45 ps 21	
1428.33 7	13/2+	0.28 ps 14	
1463.36 21	(5/2, 7/2, 9/2)	0.21 ps 7	
1713.7 5	(5/2, 7/2, 9/2)		
1900.25 12	13/2+	0.14 ps 7	
2101.83 11	19/2+	210 ms 4	$T_{1/2}$: using 673 $\gamma(\text{t})$ (216 ms 2), 402 $\gamma(\text{t})$ (202 ms 5), 1026 $\gamma(\text{t})$ (204 ms 6) and 1428 $\gamma(\text{t})$ (218 ms 3) in 1979Va13. configuration: $\nu(g_{9/2})^{-1} \otimes \nu 6^+$, where $\nu 6^+$ is a mixture of $\nu(d_{5/2}, g_{7/2})$ and $\nu(g_{7/2})^{+2}$.
2195.23 22	15/2+	0.35 ps 14	
2272.61 25	13/2-		
2321.93 15	15/2		
2532.40 11	15/2-	0.24 ps 10	
2868.72 12	17/2-	0.38 ps 17	
2957.99 13	19/2-		
3067.30 23	17/2-	0.17 ps 10	
3092.05 14	19/2-	0.49 ps 21	
3122.47 14	21/2-		
3202.43 15	21/2-		
3285.8 3	(19/2-)	>1.0 ps	
3374.69 24	(19/2-)	0.21 ps 10	
3410.32 15	23/2-	0.69 ps 21	
3461.94 16	23/2-		
3517.1 4	(21/2-)	0.45 ps 14	
3800.12 17	25/2-	1.4 ps 7	
4037.2 3	(25/2-)	0.6 ps 3	

[†] From a least-squares fit to $E\gamma$.

[‡] From 1979Va13, based on deduced γ -ray transition multipolarities. Configurations of the $\pi=-$ states are most likely $\nu(g_{9/2})^{-1} \otimes J\pi=3^-, 5^-, 7^-$ and 9^- core states.

[§] From 1987KuZV (and 1988Vi07) by DSAM, unless otherwise noted.

 $\gamma(^{109}\text{In})$

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. [‡]	$\delta^{\S}$	Comments
89.24 8	2957.99	12.4 6	M1+E2	+0.01 4	Mult.: $a_2/a_0=-0.206$ 9, $a_4/a_0=+0.01$ 2 (1979Va13).
110.42 10	3202.43	4.2 2	M1+E2	-0.05 7	Mult.: $a_2/a_0=-0.24$ 2, $a_4/a_0=+0.04$ 2 (1979Va13).
164.47 6	3122.47	12.0 6	M1+E2	+0.01 5	Mult.: $\alpha(\text{K})\text{exp}=0.16$ 5, $a_2/a_0=-0.197$ 9, $a_4/a_0=-0.017$ 15 (1979Va13).
207.90 6	3410.32	9.8 5	M1+E2	-0.02 7	Mult.: $\alpha(\text{K})\text{exp}=59 \times 10^{-3}$ 20, $\text{pol}=-0.42$ 15, $a_2/a_0=-0.217$ 10, $a_4/a_0=-0.032$ 17 (1979Va13).
218.48 11	3285.8	2.1 2	(M1)		Mult.: $\alpha(\text{K})\text{exp}=36 \times 10^{-3}$ 18, $a_2/a_0=-0.18$ 3, $a_4/a_0=+0.13$ 4 (1979Va13).
223.4 3	3092.05	1.7 2			Mult.: $\alpha(\text{K})\text{exp}=24 \times 10^{-3}$ 12, $a_2/a_0=-0.18$ 3, $a_4/a_0=+0.09$ 5 (1979Va13).
231.3 2	3517.1	1.1 2			Mult.: $a_2/a_0=-0.25$ 5, $a_4/a_0=+0.12$ 3 (1979Va13).
244.5 3	3202.43	7.5 4	M1+E2	0.00 4	Mult.: $\alpha(\text{K})\text{exp}=34 \times 10^{-3}$ 12, $\text{pol}=-0.27$ 13, $a_2/a_0=-0.21$ 2, $a_4/a_0=+0.01$ 2 (1979Va13).
259.0 4	2532.40	2.0 10			Mult.: $a_2/a_0=-0.14$ 7, $a_4/a_0=-0.16$ 14 (1979Va13).
287.79 12	3410.32	1.7 3			Mult.: $a_2/a_0=-0.13$ 5, $a_4/a_0=-0.02$ 8 (1979Va13).

Continued on next page (footnotes at end of table)

$^{107}\text{Ag}(\alpha, 2n\gamma)$ 1979Va13 (continued) $\gamma(^{109}\text{In})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. ‡	$\delta^\S$	Comments
331.0 4	980.8	3.5 6			Mult.: $a_2/a_0=-0.14$ 4, $a_4/a_0=+0.08$ 5 (1979Va13).
336.30 6	2868.72	24.5 10	M1+E2	+0.03 3	Mult.: $\alpha(K)\text{exp}=18\times 10^{-3}$ 8, $\text{pol}=-0.14$ 4, $a_2/a_0=-0.113$ 8, $a_4/a_0=-0.033$ 14 (1979Va13).
339.47 8	3461.94	9.0 4	M1+E2	+0.05 3	Mult.: $\alpha(K)\text{exp}=19\times 10^{-3}$ 8, $\text{pol}=-0.26$ 10, $a_2/a_0=-0.097$ 11, $a_4/a_0=-0.018$ 9 (1979Va13).
389.80 8	3800.12	7.1 3	M1+E2	+0.04 3	Mult.: $\alpha(K)\text{exp}=13\times 10^{-3}$ 4, $\text{pol}=-0.35$ 6, $a_2/a_0=-0.151$ 12, $a_4/a_0=-0.027$ 20 (1979Va13).
401.97 6	1428.33	23.8 10	M1+E2	+0.07 3	I γ : for prompt+delayed components of this transition, 14 4 for the prompt component only. Mult.: $\alpha(K)\text{exp}=10\times 10^{-3}$ 4, $\text{pol}=-0.25$ 3, $a_2/a_0=-0.080$ 8, $a_4/a_0=-0.017$ 14 for prompt+delayed components, $a_2/a_0=-0.11$ 2, $a_4/a_0=-0.03$ 3 for prompt component only (1979Va13).
416.7 2	3374.69	3.3 4			Mult.: $a_2/a_0=-0.27$ 2, $a_4/a_0=-0.09$ 4 (1979Va13).
421.9 2	2321.93	6.7 4			Mult.: $a_2/a_0=-0.19$ 2, $a_4/a_0=-0.05$ 4 (1979Va13).
437.0 2	1463.36	1.5 5			
534.9 2	3067.30	3.0 2	M1+E2	+0.14 7	Mult.: $\text{pol}=-0.64$ 15, $a_2/a_0=-0.04$ 3, $a_4/a_0=-0.06$ 5 (1979Va13).
547.1 3	2868.72	3.3 3			Mult.: $a_2/a_0=-0.30$ 5, $a_4/a_0=-0.02$ 8 (1979Va13).
575.3 2	4037.2	2.5 3			Mult.: $\alpha(K)\text{exp}=3\times 10^{-3}$ 2, $a_2/a_0=-0.29$ 4, $a_4/a_0=-0.09$ 6 (1979Va13).
614.2 3	1713.7	3.0 4			$A_2/a_0=-0.12$ 6, $a_4/a_0=+0.02$ 4 (1979Va13).
649.8 3	649.8	4.8 5	M4		Mult.: From Adopted Gammas.
673.52 8	2101.83	46.7 10	M3		Mult.: $\alpha(K)\text{exp}=19.9\times 10^{-3}$ 20, $K/L=7.5$ 7 (1979Va13).
$^*673.85$ 12		21.0 15	E2		E γ : This prompt γ ray fits well between the 2869 keV and 2195 keV levels on the basis of coincidence and energy relations, but the intensity and angular distribution coefficients are not in agreement with such a placement (1979Va13). Mult.: $\alpha(K)\text{exp}=2.4\times 10^{-3}$ 5, $a_2/a_0=+0.26$ 2, $a_4/a_0=-0.18$ 3 (1979Va13).
766.9 2	2195.23	9.3 5	M1+E2	+0.19 +1-3	Mult.: $\alpha(K)\text{exp}=2.1\times 10^{-3}$ 4, $\text{pol}=-0.85$ 9, $a_2/a_0=+0.05$ 2, $a_4/a_0=-0.04$ 3 (1979Va13).
856.2 2	2957.99	5.2 3	E1		Mult.: $\alpha(K)\text{exp}\leq 1.0\times 10^{-3}$, $\text{pol}=-0.48$ 6, $a_2/a_0=+0.38$ 3, $a_4/a_0=-0.04$ 5 (1979Va13).
873.95 10	1900.25	12.5 6	M1+E2	+0.32 +17-7	Mult.: $\alpha(K)\text{exp}=1.3\times 10^{-3}$ 3, $\text{pol}=-0.48$ 6, $a_2/a_0=+0.19$ 2, $a_4/a_0=0.00$ 3 (1979Va13).
893.5 2	2321.93	8.4 5			Mult.: $\alpha(K)\text{exp}=1.7\times 10^{-3}$ 4, $\text{pol}=-0.51$ 8, $a_2/a_0=+0.10$ 2, $a_4/a_0=-0.06$ 3 (1979Va13).
990.25 12	3092.05	8.7 5	E1		Mult.: $\alpha(K)\text{exp}=0.45\times 10^{-3}$ 15, $\text{pol}=-0.62$ 14, $a_2/a_0=+0.32$ 3, $a_4/a_0=-0.01$ 5 (1979Va13).
1026.35 8	1026.36	64 3	M1+E2	+0.40 +9-4	I γ : for prompt+delayed components of this transition, 50 3 for the prompt component only. Mult.: $\alpha(K)\text{exp}=1.1\times 10^{-3}$ 3, $\text{pol}=-0.47$ 5, $a_2/a_0=+0.215$ 9, $a_4/a_0=-0.03013$ for prompt+delayed components, $a_2/a_0=+0.25$ 1, $a_4/a_0=-0.04$ 2 for prompt component only (1979Va13).
1099.5 3	1099.5	10.3 5			Mult.: $\alpha(K)\text{exp}=0.89\times 10^{-3}$ 20, $\text{pol}=+0.11$ 13, $a_2/a_0=+0.01$ 2, $a_4/a_0=-0.033$ (1979Va13).
1104.04 10	2532.40	29.1 12	E1		Mult.: $\alpha(K)\text{exp}=0.38\times 10^{-3}$ 9, $\text{pol}=+0.35$ 5, $a_2/a_0=-0.266$ 10, $a_4/a_0=-0.022$ 17 (1979Va13).
1245.8 3	2272.61	5.7 4	E1		Mult.: $\alpha(K)\text{exp}<0.34\times 10^{-3}$, $\text{pol}=+0.14$ 5, $a_2/a_0=-0.26$ 3, $a_4/a_0=-0.09$ 6 (1979Va13).
1428.32 10	1428.33	100	E2		I γ : for prompt+delayed components of this transition, 61 3 for the prompt component only. Mult.: $\alpha(K)\text{exp}=0.53\times 10^{-3}$ 8, $\text{pol}=+0.33$ 6, $a_2/a_0=+0.191$ 11, $a_4/a_0=-0.09711$ for prompt+delayed components, $a_2/a_0=+0.32$ 1, $a_4/a_0=-0.16$ 2 for prompt component only (1979Va13).

 † From 1979Va13. ‡ From 1979Va13, based on $\gamma(\theta)$, pol , $\alpha(K)\text{exp}$, unless otherwise noted. The theoretical M4 value of 649.8 γ was used for normalization of ce data in 1979Va13 (renormalized by evaluators using $\alpha(K)=0.0582$, calculated using the BrIcc program). § From $\gamma(\theta)$ in 1979Va13. * γ ray not placed in level scheme.

 $^{108}\text{Cd}(\text{p,p}),(\text{p,p}') \text{ IAR } 1969\text{Ab09}$

1969Ab09: $E_p=5-8$ MeV, EN Tandem Van de Graaff accelerator, Weizmann Institute. Target: $250 \mu\text{g}/\text{cm}^2$ on $100 \mu\text{g}/\text{cm}^2$ Ni backing. Detectors: four ssd detectors (FWHM=20–25 keV), 3 NaI detectors angles $90^\circ, 125^\circ, 140^\circ, 170^\circ$ for (p,p); angle 125° for (p,p').
 Others: 1969Ab04, 1970Ab02.

 ^{109}In Levels

E(level) [†]	$J\pi^\ddagger$	Comments
10746 5	1/2+	E(level): E(p)=6222, IAS of ^{109}Cd (g.s.).
11055 5	3/2+	E(level): E(p)=6531 2, possible IAS of ^{109}Cd (347.5 level).
11598 5	1/2+	E(level): E(p)=7074.

[†] Sum of S(p)=4524 5 (2012Wa38) and resonance E(p)(c.m.).

[‡] Deduced by 1969Ab09 from analysis of resonance structure.

¹⁰⁸Cd(d,n) γ 1975Di12

1975Di12: E(d)=5-11 MeV, EN Tandem Van de Graaff Accelerator, University of Uppsala, Sweden. Target: 1.3-2.0 mg/cm² in thickness with 82.35 % enriched; Measured: γ -singles, $\gamma\gamma$, n γ , $\gamma(\theta)$, and Ie. Detectors: Two Ge(Li), Liquid scintillator, Si detector with magnetic lens, angular Si detector.

¹⁰⁹In Levels

E(level) [†]	J π [‡]	E(level) [†]	J π [‡]	E(level) [†]	J π [‡]
0.0	9/2+	1320.8 5	5/2+	1712.9 4	5/2+, 7/2+, 9/2+
650.1 3	1/2-	1428.0 4	9/2+, 11/2+, 13/2+	1722.3 5	5/2+, 7/2+, 9/2+
981.4 4	3/2-	1441.4 5	3/2-, 5/2-	1814.4 7	1/2-, 3/2-, 5/2-
1026.1 4	7/2+, 9/2+, 11/2+	1463.6 4	5/2+, 7/2+, 9/2+	2065.3 7	7/2(-)
1098.8 4	5/2+	1483.1 4	3/2+, (1/2+)	2356.4 11	
1172.1 4	1/2+, (3/2+)	1573.9 5	7/2, 9/2, 11/2	2467.4 11	1/2+ to 7/2+

[†] From a least-squares fit to E γ .

[‡] From 1975Di12, based on excitation functions data and deduced γ -ray transition multipolarities.

 $\gamma(^{109}\text{In})$

E γ	E(level)	I γ [†]	Mult. [§]	Comments
285.0 5	1712.9	4 1		
311.6 5	1483.1	4 2		
331.2 3	981.4	100	M1	Mult.: from Adopted Gammas. $a_2/a_0=-0.08$ 4 (1975Di12).
384.2 3	1483.1	44 4	M1 (+E2)	Mult.: $\alpha(K)\text{exp}=12.4\times 10^{-3}$ 13, $a_2/a_0=-0.07$ 4 (1975Di12).
401.6 4	1428.0	6.0 6	M1, E2	Mult.: $\alpha(K)\text{exp}=15\times 10^{-3}$ 5.
437.6 5	1463.6	16 2	M1 (+E2)	Mult.: $\alpha(K)\text{exp}=10\times 10^{-3}$ 4, $a_2/a_0=-0.25$ 7 (1975Di12).
460.1 5	1441.4	3 1	M1, E2	Mult.: $\alpha(K)\text{exp}=8\times 10^{-3}$ 4.
501.0 6	1483.1	7 1		Mult.: $\alpha(K)\text{exp}=3.6\times 10^{-3}$. 1975Di12 suggest (M1,E2), not compatible with parity change of the level.
522.2 3	1172.1	52 4	E1	Mult.: $\alpha(K)\text{exp}=1.5\times 10^{-3}$ 3, $a_2/a_0=+0.004$ 30 (1975Di12).
614.2 4	1712.9	20 $\frac{3}{2}$ 5	M1, E2	Mult.: $\alpha(K)\text{exp}=2.5\times 10^{-3}$ 9 (1975Di12).
623.6 4	1722.3	25 $\frac{3}{2}$ 5	M1, E2	Mult.: $\alpha(K)\text{exp}=3.5\times 10^{-3}$ 13 (1975Di12).
650.1 3	650.1			
791.2 5	1441.4	38 5	M1, E2	Mult.: $\alpha(K)\text{exp}=1.4\times 10^{-3}$ 4, $a_2/a_0=+0.09$ 8 (1975Di12).
833.0 5	1814.4	15 5	M1, E2	Mult.: $\alpha(K)\text{exp}=1.7\times 10^{-3}$ 7 (1975Di12).
984.3 10	2467.4	7 3	M1, E2	Mult.: $\alpha(K)\text{exp}=1.08\times 10^{-3}$ 10 (1975Di12).
1026.0 5	1026.1	106 10	E2 (+M1)	Mult.: $\alpha(K)\text{exp}=1.08\times 10^{-3}$ 10, $a_2/a_0=+0.15$ 3 (1975Di12).
1083.9 5	2065.3	13 2		Mult.: $\alpha(K)\text{exp}=1\times 10^{-3}$, 1975Di12 suggest (M1,E2).
1099.2 5	1098.8	205 15	E2	Mult.: $\alpha(K)\text{exp}=0.79\times 10^{-3}$ 14, $a_2/a_0=+0.01$ 3 (1975Di12).
1320.8 5	1320.8	57 6	E2	Mult.: $\alpha(K)\text{exp}=0.59\times 10^{-3}$ 20, $a_2/a_0=+0.04$ 3 (1975Di12).
1375 1	2356.4	9 $\frac{3}{2}$ 3		
1428.4 6	1428.0	26 5		Mult.: $a_2/a_0=+0.32$ 12 (1975Di12).
1463.4 5	1463.6	29 5		
1573.9 5	1573.9	32 6		
1712.5 8	1712.9	10 2		
1721.5 8	1722.3	10 2		

[†] From data at 55° and E(beam)=8 MeV.

[‡] From n- γ and $\gamma\gamma$ -coincidence data.

[§] From 1975Di12, based on measured CE data and $\gamma(\theta)$, unless otherwise noted. The $\alpha(K)\text{exp}$ values were normalized to $\alpha(K)(331.2\gamma)=0.0176$ from the BrIcc program by assuming Mult.=M1.

¹⁰⁸Cd(³He,d) ¹⁹⁸³Ta06

Target ¹⁰⁸Cd J π =0+.

¹⁹⁸³Ta06: E(³He)=19.5 and 21 MeV, Tandem Accelerator, University of Sao Paulo. Target: 40–50 μ g/cm² thick with carbon backing, 82.4 % enriched. Detectors: Engel split-pole magnetic spectrometer (FWHM=16 keV), Nuclear emulsion plates with Al absorbers, Measured: σ (³He,d) (12 angles ranging from 6° to 56° at 19.5 MeV, and 4 angles ranging from 10° to 40° at 21 MeV), angular distributions, DWBA analysis. Deduced: L, J, π , spectroscopic factor. Absolute cross-sections were obtained by normalising the results with elastic ³He cross-section measured at 38.6° ϕ , which lead to 12% systematic uncertainty.

¹⁰⁹In Levels

E(level) [†]	J π [†]	L $\ddagger$	C ² S $\ddagger$	Comments
0.0	9/2+	4	0.17	C ² S: 0.17 at E(³ He)=21 MeV.
647 4	1/2-	1	0.071	C ² S: 0.067 at E(³ He)=21 MeV.
981 4	3/2-	1	0.040	C ² S: 0.043 at E(³ He)=21 MeV.
1098 4	5/2+	2	0.50	C ² S: 0.48 at E(³ He)=21 MeV.
1171 4	1/2+	0	0.34	C ² S: 0.33 at E(³ He)=21 MeV.
1321 7				
1484 5	3/2+, 5/2+	2	0.27, 0.14	C ² S: 0.26, 0.14 at E(³ He)=21 MeV.
1723 5	7/2+, 9/2+	4	0.47, 0.21	C ² S: 0.37, 0.16 at E(³ He)=21 MeV.
1957 7	(3/2+, 5/2+)	(2)	0.049, 0.026	C ² S: 0.040, 0.021 at E(³ He)=21 MeV.
2030 6	(1/2+, 3/2+, 5/2+)	(0, 2)		C ² S: 0.066, 0.098, 0.051 at E(³ He)=19.5 MeV, 0.056, 0.088, 0.046 at 21 MeV.
2076 5	(1/2+, 3/2+, 5/2+)	(0, 2)		C ² S: 0.063, 0.088, 0.046 at E(³ He)=19.5 MeV, 0.043, 0.061, 0.032 at 21 MeV.
2140 5	(3/2+, 5/2+)	(2)	0.070, 0.036	C ² S: 0.046, 0.024 at E(³ He)=21 MeV.
2210 5	(1/2-, 3/2, 5/2+)	(1, 2)		C ² S: 0.048, 0.021, 0.028, 0.015 at E(³ He)=19.5 MeV, 0.042, 0.018, 0.026, 0.014 at 21 MeV.
2266 5	(3/2+, 5/2+)	(2)	0.059, 0.031	C ² S: 0.057, 0.030 at 21 MeV.
2307 5	(1/2+, 3/2+, 5/2)	(0, 2, 3)		C ² S: 0.022, 0.031, 0.016, 0.10 at E(³ He)=19.5 MeV, 0.023, 0.030, 0.015, 0.12 at 21 MeV.
2332 5	(1/2+, 3/2+, 5/2+)	(0, 2)		C ² S: 0.020, 0.030, 0.016 at E(³ He)=19.5 MeV, 0.017, 0.028, 0.014 at 21 MeV.
2360 6				
2474 7				
2564 6	(1/2+, 3/2+, 5/2+)	(0, 2)		C ² S: 0.053, 0.078, 0.041 at E(³ He)=19.5 MeV, 0.050, 0.079, 0.041 at 21 MeV.
2585 6	(7/2+, 9/2+)	(4)	0.54, 0.24	C ² S: 0.41, 0.18 at E(³ He)=21 MeV.
2674 6	(1/2+, 3/2+, 5/2+)	(0, 2)		C ² S: 0.060, 0.090, 0.048 at E(³ He)=19.5 MeV, 0.046, 0.064, 0.033 at 21 MeV.
2709 6				
2812 7	(1/2+)	(0)	0.046	C ² S: 0.045 at 21 MeV.
2839 6				
2888 7	(1/2+, 3/2+, 5/2)	(0, 2, 3)		C ² S: 0.047, 0.067, 0.035, 0.21 at E(³ He)=19.5 MeV, 0.052, 0.076, 0.038, 0.25 at 21 MeV.
2993 6	(3/2+, 5/2+)	(2)	0.12, 0.066	C ² S: 0.14, 0.071 at E(³ He)=21 MeV.

[†] From ¹⁹⁸³Ta06.

[‡] From ¹⁹⁸³Ta06, by comparing the experimental differential cross-sections with results from DWBA calculations. The latter used finite range and non-locality corrections (DWUCK II code), proton parameters radius=1.25 fm, diffuseness=0.65 fm, and spin-orbit-coupling strength=25 for 19.5 MeV. Spectroscopic factors are normalized by $\Sigma(2J+1)C^2S=2$ and the first three levels (¹⁹⁸³Ta06). Values quoted are for E(³He)=19.5 MeV and values for E(³He)=21 MeV are given in comments.

 $^{112}\text{Sn}(\text{p},\alpha)$ 1976Sm04

E(p)=22 MeV, AVF cyclotron, KVI; Four silicon surface barrier detectors (700 to 1000 μm); Measured: $\sigma(\theta)$, $\sigma(\alpha)$,
 $\theta=10^\circ-60^\circ$, FWHM ≥ 35 KeV.

 ^{109}In Levels

E(level) [†]	J π [†]	Comments
0 . 0	9 / 2+	
650 7	1 / 2-	
984 10	3 / 2-	
1438 14	(5 / 2-, 9 / 2+, 13 / 2+)	E(level): unresolved multiplet.
1923 19		
2056 21		
2128 21		
2528 25		
2559 26		
2775 28		
2857 29		

[†] From 1976Sm04. Authors estimated $\Delta E=1\%$.

Adopted Levels, Gammas

Q(β⁻)=-6380 9; S(n)=8632 10; S(p)=5800 12; Q(α)=-722 8 2012Wa38.

¹⁰⁹Sn Levels

Cross Reference (XREF) Flags

A ¹⁰⁹Sb ε Decay
B ¹⁰⁶Cd(α,nγ)
C ¹⁰⁸Cd(α,3nγ)
D ⁹⁴Mo(¹⁹F,p3nγ)

E ¹¹²Sn(³He,⁶He)
F (HI,xnγ)
G Coulomb Excitation

E(level)#	Jπ	XREF	T _{1/2} @	Comments
0.0	5/2+	ABCDEFG	18.1 min 2	%ε+%β ⁺ =100. Jπ: From hyperfine structure splitting measurement in 1987Eb01. The value is in conflict with J=7/2+, measured using the atomic-beam magnetic resonance method in 1974Ho17, where no isotope selection between ¹⁰⁹ Sn and ¹¹¹ Sn was made. π from μ and shell model. T _{1/2} : Weighted average of 19 min 2 (using 625γ,648γ ce(t) in 1965Kh04), 18.1 min 3 (using 650γ(t) in 1956Pe56), 18.3 min 3 (1972Bu41, using weighted average of 330.5γ(t),649.8γ(t), 1098.1γ(t), 1321.5γ(t) and 1463.9γ(t)), 18.0 min 2 (1969Bu04). μ=-1.079 6. μ: From collinear fast-beam laser spectroscopy technique (1987Eb01) μ=1.086 5 for J=7/2+ (1987Ku09,1987Eb01). Q=+0.31 10. Q: From collinear fast-beam laser spectroscopy (1987Eb01). configuration: vd _{5/2} . δ<r ² >(116,109)=-0.506 4 (1987Eb01). configuration: vg _{7/2} . E(level): the existence of this level is confirmed by 1999Da05 in (α,nγ) and 2002Re14 in ¹⁰⁹ Sb ε decay, based on γγ-coincidence measurements. Jπ: 13.9γ to 5/2+; systematics in neighboring nuclei; shell-model predictions.
13.97 6	(7/2+)	ABCD FG		Jπ: not populated directly in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)), non-observation of a γ ray to the 7/2+ state at 14 keV and shell-model predictions; 544.8γ(θ) in (α,nγ) (1981JoZX,1999Da05) suggest D transition, and hence, Jπ=3/2,5/2; α(K)exp in (α,nγ) (1976Ma09,1999Da05) is consistent with both M1 and E2. T _{1/2} : 6.9 ns 6 could be expected using B(E2)(W.u.)=0.054 5 in ¹¹¹ Sn. configuration: vs _{1/2} (2002Re14).
544.88 10	(1/2+)	AB		Jπ: 664.0γ to 5/2+, 650.1γ to (7/2+), direct feeding in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)); systematics in neighboring Sn nuclei and shell-model predictions (2002Re14). B(E2)=0.013 +8-11 in Coulomb excitation (2012Di13).
664.44 12	(3/2+)	A G		Jπ: 664.5γ M1 to (7/2+), 678.6γ M1(+E2) to 5/2+; excitation functions in (α,nγ) (1999Da05) suggests J<7/2; direct population in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)) and shell-model predictions (2002Re14). B(E2)<0.012 (2012Di13, Coulomb Excitation).
678.51 7	(5/2)+	AB G		Jπ: 925.3γ M1(+E2) to 5/2+, 910.9γ to (7/2+), 381.3γ to (1/2+); strong direct feeding in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)); shell-model predictions (2002Re14). B(E2)=0.029 +14-15 in Coulomb excitation (2012Di13). configuration: vd _{3/2} state.
925.56 11	(3/2)+	AB G		Jπ: 991γ M1(+E2) to 5/2+, 446.3γ to (1/2+); direct feeding in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)). B(E2)<0.028 in Coulomb excitation (2012Di13).
991.38 17	(3/2)+	AB G		Jπ: 1061.8γ M1(+E2) to 5/2+, 516.5γ to (1/2+) and 1047.7γ to (7/2+); direct feeding in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)); shell-model predictions (2002Re14).
1061.82 15	(3/2)+	AB		Jπ: 1078.0γ M1(+E2) to 5/2+, 1064.0γ M1(+E2) to (7/2+); direct feeding in ¹⁰⁹ Sb ε decay (Jπ=(5/2+)); shell-model predictions (2002Re14); excitation functions in (α,nγ) suggests J=7/2 (1999Da05). B(E2)=0.060 +20-22 (2012Di13, Coulomb Excitation).
1078.14 9	(7/2)+	AB G		

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Adopted Levels, Gammas (continued) ^{109}Sn Levels (continued)

E(level) [#]	J π	XREF	T _{1/2} [@]	Comments
1228.81 18	(3/2+, 5/2+)	A		J π : 1229.3 γ to 5/2+, 1214.4 γ to (7/2+); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
1239.77 [†] 12	9/2+	B FG	≤ 0.2 ns	J π : 1239.67 γ E2 to 5/2+, 1225.8 γ to (7/2+).
1257.79 [†] 10	(11/2+)	BCD F		J π : 1243.8 γ E2 γ to (7/2+); not populated in ^{109}Sb ϵ decay (J π =(5/2+)).
1269.79 [§] 10	(11/2-)	BCDEF	2.0 ns 2	XREF: E(1277). J π : 1255.85 γ M2 to (7/2+); not populated in ^{109}Sb ϵ decay (J π =(5/2+)). T _{1/2} : from 1995Ka09 in (HI,xn γ) Other: 2.0 ns 3 (Centroid shift method in 1982An17). configuration: $\text{vh}_{11/2}$ state.
1343.75 12	(7/2)+	AB		J π : 1343.64 γ M1 to 5/2+; excitation functions in (α ,n γ) suggests J=7/2 (1999Da05); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)).
1495.91 13	(3/2+)	AB		J π : 951.1 γ to (1/2+), 1482.2 γ to (7/2+); strong direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
1614.33 16	(3/2+, 5/2+)	AB		J π : 1601.4 γ to (7/2+), 687.3 γ to (3/2)+; J $\leq$ 5/2 from excitation function in (α ,n γ) (1999Da05); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
1649.87 14	(3/2+, 5/2+)	AB		J π : 1636.3 γ to (7/2+), 1104.4 γ to (1/2+); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
1677.1 5	(11/2, 13/2+)	B		J π : 437.3 γ to 9/2+; shell-model calculations in (α ,n γ) (1999Da05).
1715.0 3	(7/2, 9/2+)	B		J π : 1036.5 γ to (5/2+); shell-model calculations in (α ,n γ) (1999Da05).
1883.66 22	(11/2)+	B		J π : 805.52 γ M1,E2 to (7/2+); J=11/2 from excitation function data in (α ,n γ) (1999Da05).
1914.04 16	(3/2+, 5/2+)	A		J π : 835.0 γ to (7/2)+, 1369.6 γ to (1/2+); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
1930.18 [†] 11	13/2+	B F		J π : 690.3 γ E2 to 9/2+, 672.43 γ M1 to 11/2+. J=13/2 is also suggested from side-feeding excitation function of this state in (α ,n γ) (1999Da05).
1992.1 4	(9/2)	B		J π : based on side-feeding excitation function of this state in (α ,n γ) (1999Da05).
2015.98 17	(3/2+, 5/2+)	A		J π : 1024.4 γ to (3/2)+, 2016.2 γ to 5/2+; direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
2050.0 4	(11/2+)	B		J π : 971.9 γ to (7/2+); excitation function in (α ,n γ) (1999Da05).
2071.29 16	(13/2)+	B		J π : 813.44 γ M1,E2 to 11/2+; J=13/2 based on side-feeding excitation function of this state in (α ,n γ) (1999Da05).
2090.59 [†] 15	15/2+	BCD F		J π : 832.71 γ E2 to 11/2+, 160.45 γ to 13/2+.
2116.10 [†] 20	17/2+	BC F	7 ns 1	J π : 185.8 γ (E2) to 13/2+, 25.5 γ (M1) to 15/2+.
2126.66 15	(3/2+, 5/2+)	A		J π : 2127.1 γ to 5/2+, 1581.8 γ to (1/2+); direct feeding in ^{109}Sb ϵ decay (J π =(5/2+)); shell-model predictions (2002Re14).
2218.33 14	(15/2)+	B		J π : 288.17 γ M1,E2 to 13/2+, 960.5 γ M1,E2 to 11/2+; J=15/2 based on excitation function data in (α ,n γ) (1999Da05).
2244.39 23	(7/2+)	B		J π : 986.8 γ to (11/2+); excitation function data in (α ,n γ) (1999Da05).
2350.98 [§] 14	15/2-	BCD F	≤ 0.2 ns	J π : 1081.2 γ E2 to 11/2-; band assignment in (HI,xn γ) (1996Ka43). T _{1/2} : from 1995Ka09 in (HI,xn γ).
2380.1 4	(13/2)	B		J π : 1122.3 γ to (11/2+); excitation function data in (α ,n γ) (1999Da05).
2397.5 3	(13/2+)	B		J π : 1157.72 γ to 9/2+; excitation function data in (α ,n γ) (1999Da05).
2442.85 17	(13/2)	B		J π : 1173.08 γ to (11/2-), 1185.03 γ to (11/2+); excitation function data in (α ,n γ) (1999Da05).
2512.0 3	(9/2, 11/2)	B		J π : 1272.19 γ to 9/2+.
2532.09 23		B		
2571.1 3	(7/2+, 9/2)	B		J π : 1313.32 γ to (11/2+); population in (α ,n γ) (1999Da05).
2645.3 3		B		
2821.5 5	(9/2+)	B		J π : 1563.7 γ to (11/2+); population in (α ,n γ) (1999Da05).
2921.7 6		B		
3266.1 [‡] 3	(19/2+)	B F		J π : 1150.0 γ to 17/2+; population in (α ,n γ) (1999Da05).
3301.10 [§] 17	19/2-	BCD F	≤ 0.2 ns	J π : 950.17 γ E2 to 15/2-, 1184.8 γ to 17/2+. T _{1/2} : from 1995Ka09 in (HI,xn γ).
3316.06 20	19/2-	BCD F	≤ 0.2 ns	J π : 965.0 γ E2 to 15/2-, 1199.8 γ to 17/2+. T _{1/2} : from 1995Ka09 in (HI,xn γ).
3346.3 [‡] 3	21/2+	BC F	≤ 0.2 ns	J π : γ E2 to 17/2+. T _{1/2} : from 1995Ka09 in (HI,xn γ).

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Adopted Levels, Gammas (continued)

¹⁰⁹Sn Levels (continued)

E(level)#	J π	XREF	T _{1/2} [@]	Comments
3474.41 21	21/2+	BCD F	≤ 0.2 ns	J π : 1352.8 γ E2 to 17/2+, 208.4 γ D to 19/2+. T _{1/2} : from 1995Ka09 in (HI,xn γ).
3527.4 4	(19/2-)	B F		J π : 1176.4 γ to 15/2-.
3864.2 $\frac{1}{2}$ 4	(23/2+)	CD F		J π : 389.8 γ (M1,E2) to 21/2+.
3926.5 3	(23/2+)	F		J π : 452.0 γ (M1) to 21/2+.
4262.0 $\frac{1}{2}$ 4	23/2-	D F		J π : 961 γ (E2) to 19/2-; band assignment.
4451.2 7	23/2-	F		E(level): Placement as given in 1998KaZZ. J π : 1135 γ E2 to 19/2-; band assignment.
4609.5 ^d 4	25/2+	D F		J π : 1135.1 γ E2 to 21/2+; band assignment.
4984.7 5	(27/2+)	D F		J π : 1120.5 γ E2 to (23/2+).
5130.4 5	(27/2+)	F		J π : 1203.9 γ (E2) to (23/2+).
5172.0 ^b 8	(25/2+)	F		J π : 721 γ (E1) to 23/2-; band assignment.
5285.7 $\frac{1}{2}$ 5	27/2-	D F		J π : 1023.7 γ (E2) to 23/2-; band assignment.
5450.5 ^d 5	(27/2+)	D F		J π : 841.0 γ (M1) to 25/2+.
5849.8 6	(31/2+)	F		J π : 865.1 γ (E2) to (27/2+).
5992.8 ^b 9	(29/2+)	F		J π : 821 γ (E2) to (25/2+); band assignment.
6224.2 $\frac{1}{2}$ 6	31/2-	D F		J π : 938.5 γ (E2) to 27/2-; band assignment.
6337.1 ^d 6	(31/2+)	D F		J π : 886.6 γ (E2) to (27/2+); band assignment.
6824.8 ^b 14	(33/2+)	F		J π : 832 γ (E2) to (29/2+); band assignment.
7194.4 ^d 7	(35/2+)	D F		J π : 857.3 γ (E2) to (31/2+); band assignment.
7233.2 $\frac{1}{2}$ 12	35/2-	F		J π : 1009 γ (E2) to 31/2-; band assignment.
7724.8 ^b 17	(37/2+)	F		J π : 900 γ (E2) to (33/2+); band assignment.
8123.6 ^d 7	(39/2+)	D F		J π : 929.2 γ (E2) to (35/2+); band assignment.
8263.2 $\frac{1}{2}$ 16	39/2-	F		J π : 1030 γ (E2) to 35/2-; band assignment.
8540.6 ^e 15	(37/2-, 39/2+)	F		E(level),J π : proposed in (HI,xn γ) (1996Ka43).
8726.8 ^b 20	(41/2+)	F		J π : 1002 γ (E2) to (37/2+); band assignment.
9144.6 ^d 12	(43/2+)	D F		J π : 1021 γ (E2) to (39/2+); band assignment.
9330.6 ^e 12	(41/2-, 43/2+)	F		J π : 1207 γ to (39/2+); 790 γ to (37/2-, 39/2+).
9347.2 $\frac{1}{2}$ 19	43/2-	F		J π : 1084 γ (E2) to 39/2-; band assignment.
9865.9 ^b 22	(45/2+)	F		J π : 1139 γ (E2) to (41/2+); band assignment.
10133.6 ^e 13	(45/2-, 47/2+)	F		J π : 803 γ (E2) to (41/2-, 43/2+); band assignment.
10286.6 ^d 15	(47/2+)	F		J π : 1142 γ (E2) to (43/2+); band assignment.
10509.2 $\frac{1}{2}$ 21	47/2-	F		J π : 1162 γ (E2) to 43/2-; band assignment.
11069.6 ^e 16	(49/2-, 51/2+)	F		J π : 936 γ (E2) to (45/2-, 47/2+); band assignment.
11149.9 ^b 24	(49/2+)	F		J π : 1284 γ (E2) to (45/2+); band assignment.
11583.7 ^d 18	(51/2+)	F		J π : 1297 γ (E2) to (47/2+); band assignment.
11704.2 ^a 23	(51/2-)	F		J π : 1195 γ (E2) to 47/2-; band assignment.
11799.2 $\frac{1}{2}$ 23	(51/2-)	F		J π : 1290 γ (E2) to 47/2-; band assignment.
12188.7 ^e 19	(53/2-, 55/2+)	F		J π : 1119 γ (E2) to (49/2-, 51/2+); band assignment.
12344 ^b 3	(53/2+)	F		J π : 1194 γ (E2) to (49/2+); band assignment.
12596 ^c 3	(53/2+)	F		J π : 1446 γ (E2) to (49/2+); band assignment.
12978.2 ^a 23	(55/2-)	F		J π : 1274 γ (E2) to (51/2-); band assignment.
13092.7 ^d 21	(55/2+)	F		J π : 1509 γ (E2) to (51/2+); band assignment.
13155.2 $\frac{1}{2}$ 25	(55/2-)	F		J π : 1356 γ (E2) to (51/2-); band assignment.
13488.7 ^e 22	(57/2-, 59/2+)	F		J π : 1300 γ (E2) to (53/2-, 55/2+); band assignment.
13771 ^c 3	(57/2+)	F		J π : 1175 γ (E2) to (53/2+); band assignment.
14427 ^a 3	(59/2-)	F		J π : 1449 γ (E2) to (55/2-); band assignment.
14640 $\frac{1}{2}$ 3	(59/2-)	F		J π : 1485 γ (E2) to (55/2-); band assignment.
14833.7 ^d 23	(59/2+)	F		J π : 1741 γ (E2) to (55/2+); band assignment.
14907 ^c 3	(61/2+)	F		J π : 1136 γ (E2) to (57/2+); band assignment.
15012.7 ^e 24	(61/2-, 63/2+)	F		J π : 1524 γ (E2) to (57/2-, 59/2+); band assignment.
16070 ^a 3	(63/2-)	F		J π : 1643 γ (E2) to (59/2-); band assignment.
16226 ^c 3	(65/2+)	F		J π : 1319 γ (E2) to (61/2+); band assignment.
16272 $\frac{1}{2}$ 3	(63/2-)	F		J π : 1632 γ (E2) to (59/2-); band assignment.
16757.7 ^d 25	(63/2+)	F		J π : 1924 γ (E2) to (59/2+); band assignment.
16779 ^e 3	(65/2-, 67/2+)	F		J π : 1766 γ (E2) to (61/2-, 63/2+); band assignment.
17720 ^c 4	(69/2+)	F		J π : 1494 γ (E2) to (65/2+); band assignment.
17907 ^a 3	(67/2-)	F		J π : 1837 γ (E2) to (63/2-); band assignment.
18731 ^e 3	(69/2-, 71/2+)	F		J π : 1952 γ (E2) to (65/2-, 67/2+); band assignment.
18880 ^d 3	(67/2+)	F		J π : 2122 γ (E2) to (63/2+); band assignment.
19397 ^c 4	(73/2+)	F		J π : 1677 γ (E2) to (69/2+); band assignment.
19948 ^a 3	(71/2-)	F		J π : 2041 γ (E2) to (67/2-); band assignment.
20910 ^e 3	(73/2-, 75/2+)	F		J π : 2179 γ (E2) to (69/2-, 71/2+); band assignment.

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Adopted Levels, Gammas (continued)

¹⁰⁹Sn Levels (continued)

E(level) [#]	Jπ	XREF	Comments
21275 ^c 4	(77/2+)	F	Jπ: 1878γ (E2) to (73/2+); band assignment.
22217 ^a 4	(75/2-)	F	Jπ: 2041γ (E2) to (71/2-); band assignment.
23383 ^c 4	(81/2+)	F	Jπ: 2108γ (E2) to (77/2+); band assignment.
24743 ^a 4	(79/2-)	F	Jπ: 2041γ (E2) to (75/2-); band assignment.

[†] v(d_{5/2})⊗v(d_{5/2}g_{7/2})⁺².

[‡] v(d_{5/2})⊗v(d_{5/2}g_{7/2})⁺⁴ and/or v(g_{7/2})⊗v(d_{5/2}g_{7/2})⁺⁴.

[§] v(h_{11/2})⊗v(d_{5/2}g_{7/2})⁺².

[#] From a least-squares fit to Eγ.

[@] From 1995Ka09, unless otherwise stated.

[&] (A): Band 1.

^a (B): Band 2.

^b (C): Band 3a.

^c (D): Band 3b.

^d (E): Band 4.

^e (F): Band 5.

γ(¹⁰⁹Sn)

E(level)	Eγ	Iγ	Mult. [#]	α	Comments
13.97	13.97 7	100			Eγ: From level-energy differences by evaluators. Eγ=12.8 keV in ¹⁰⁶ Cd(α,nγ) (seen only in γγ coinc).
544.88	544.86 15	100 [‡]	[E2]	0.00580	Eγ: From (α,nγ) (1999Da05). Mult.: a ₂ /a ₀ =-0.17 2, a ₄ /a ₀ =0.032 (1981JoZX), a ₂ /a ₀ =-0.37 16 (1999Da05) supports D transition, while α(K)exp=0.0043 14 (1999Da05) and α(K)exp=0.0048 9 (1976Ma09) in (α,nγ) are consistent with M1,E2.
664.44	650.1 [‡] 3	3.3 [‡] 3			
	664.0 [‡] 3	100 [‡]			
678.51	664.5 1	100 [‡]	M1	0.00400	Eγ: weighted average of 664.5 3(1982Jo03), 664.6 5 (1976Ox01), 664.2 2 (2002Re14) in ¹⁰⁹ Sb ε decay, 664.58 10 (1999Da05), 664.5 4 (1976Ma09) in (α,nγ). Mult.: a ₂ /a ₀ =-0.33 2, a ₄ /a ₀ =0.05 2 (1981JoZX), a ₂ /a ₀ =-0.50 12; α(K)exp=0.0025 8 (1999Da05), α(K)exp=0.0030 6 (1976Ma09) in (α,nγ).
	678.6 1	84.2 [‡] 8	M1 (+E2)	0.00381	Eγ: weighted average of 678.6 3 (1982Jo03), 678.3 3 (2002Re14) in ¹⁰⁹ Sb ε decay, 678.7 2 (1976Ma09), 678.73 25 (1999Da05) in (α,nγ). Iγ: other: 27 3 (¹⁰⁶ Cd(α,nγ) in (1999Da05)) and 13 7 in Coulomb excitation (2012Di13). Mult.: a ₂ /a ₀ =0.05 3, a ₄ /a ₀ =0.013 (1981JoZX) in (α,nγ).
925.56	246.6 [‡] 3	2.8 [‡] 1			
	260.8 [‡] 3	6.4 [‡] 2			
	381.3 [‡] 3	0.6 [‡] 2			
	910.9 [‡] 3	2.9 [‡] 2			
	925.3 2	100 [‡]	M1 (+E2)	0.00186	Eγ: weighted average of 925.4 3 (1982Jo03), 925.4 3 (1976Ox01), 925.0 3 (2002Re14) in ¹⁰⁹ Sb ε decay, 925.6 5 (1999Da05) in (α,nγ). Mult.: a ₂ /a ₀ =-0.03 1, a ₄ /a ₀ =0.01 1 (1981JoZX), α(K)exp=0.0016 6 (1999Da05) in (α,nγ).
991.38	446.3 [‡] 3	22 [‡] 6			
	991.2 [‡] 3	100 [‡]	M1 (+E2)	1.59×10 ⁻³	Mult.: a ₂ /a ₀ =-0.20 2, a ₄ /a ₀ =0.02 1 (1981JoZX), α(K)exp=0.0010 4 (1999Da05) in (α,nγ).
1061.82	397.5 [‡] 3	4.4 [‡] 10			
	516.5 [‡] 3	5.9 [‡] 15			
	1047.7 [‡] 3	7.07 [‡] 15			
	1061.8 [‡] 3	100 [‡]	M1 (+E2)	1.37×10 ⁻³	Eγ: other: 1067.7 3 (1999Da05) in (α,nγ). Mult.: a ₂ /a ₀ =-0.36 3, a ₄ /a ₀ =0.10 3 (1981JoZX), a ₂ /a ₀ =-0.22 20, α(K)exp=0.0011 4 (1999Da05) in (α,nγ).
1078.14	1064.0 [§] 3	22.5 [§] 15	M1 (+E2)	1.36×10 ⁻³	Mult.: α(K)exp=0.0009 3 (1999Da05) in (α,nγ).

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sn})$ (continued)

E(level)	E γ	I γ	Mult.#	α	Comments
1078.14	1078.0 1	100 $\S$	M1 (+E2)	1.32 $\times 10^{-3}$	E γ : weighted average of 1078.7 10 (1976Ma09), 1078.05 10 (1999Da05) in (α ,n γ), 1078.0 3 (1982Jo03) in ^{109}Sb ϵ decay,. Mult.: $a_2/a_0=-0.82$ 5, $a_4/a_0=0.22$ 5 (1981JoZX), $\alpha(\text{K})\text{exp}=0.0010$ 3 (1999Da05) in (α ,n γ).
1228.81	550.2 $\frac{3}{2}$ 3 1214.4 $\frac{3}{2}$ 3 1229.3 $\frac{3}{2}$ 3	7.8 $\frac{3}{2}$ 13 14.3 $\frac{3}{2}$ 13 100.0 $\frac{3}{2}$ 13			
1239.77	1225.8 $\S$ 3 1239.67 $\S$ 15	9.5 $\S$ 10 100 $\S$ 4	[M1] E2	8.25 $\times 10^{-4}$	Mult.: $a_2/a_0=0.24$ 3, $a_4/a_0=-0.19$ 3 (1981JoZX), $\alpha(\text{K})\text{exp}=0.0009$ 3 (1999Da05) in (α ,n γ).
1257.79	1243.8 1	100	E2	8.20 $\times 10^{-4}$	E γ : weighted average of 1243.80 15(1976Ma09), 1243.83 10 (1999Da05), 1243.4 3 (1995Ka09) in (HI,xn γ), 1243.8 5 (1979Ha12) in (α ,3n γ). Mult.: $a_2/a_0=0.25$ 3, $a_4/a_0=-0.18$ 3 (1981JoZX) $\alpha(\text{K})\text{exp}=0.0007$ 2 (1999Da05), $\alpha(\text{K})\text{exp}=0.0006$ 2 (1976Ma09) in (α ,n γ).
1269.79	1255.85 9	100	M2	0.00215	E γ : weighted average of 1255.8 2 (1976Ma09), 1255.93 13 (1999Da05) in (α ,n γ), 1255.8 3 (1979Ha12) in (α ,3n γ), 1256.0 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$, 1255.5 3 (1995Ka09) in (HI,xn γ). Mult.: $a_2/a_0=0.15$ 3, $a_4/a_0=-0.20$ 3 (1981JoZX) in (α ,n γ) $a_2/a_0=0.158$ 11, $a_4/a_0=0.006$ 27 (1979Ha12) in (α ,3n γ), $\alpha(\text{K})\text{exp}=0.0019$ 6 (1999Da05), $\alpha(\text{K})\text{exp}=0.0016$ 3 (1976Ma09) in (α ,n γ). B(M2)(W.u.)=0.217 22.
1343.75	665.8 $\frac{3}{2}$ 3 1343.64 13	22 $\frac{3}{2}$ 4 100 $\frac{3}{2}$ 4	M1	8.44 $\times 10^{-4}$	E γ : weighted average of 1343.5 3 (1982Jo03), 1343.7 2 (1976Ma09), 1343.55 25 (1999Da05) in (α ,n γ), 1343.7 3 (2002Re14) in ^{109}Sb ϵ decay. Mult.: $a_2/a_0=-0.23$ 3, $a_4/a_0=-0.02$ 3 (1981JoZX) $\alpha(\text{K})\text{exp}=0.0007$ 2 (1999Da05), $\alpha(\text{K})\text{exp}=0.00060$ 13(1976Ma09) in (α ,n γ).
1495.91	433.6 $\frac{3}{2}$ 3 831.4 $\frac{3}{2}$ 3 951.1 $\frac{3}{2}$ 3 1482.2 $\frac{3}{2}$ 3 1496.0 2	1.8 $\frac{3}{2}$ 4 7.4 $\frac{3}{2}$ 21 8.5 $\frac{3}{2}$ 7 6.0 $\frac{3}{2}$ 3 100.0 $\frac{3}{2}$ 7			E γ : weighted average of 1495.8 3 (1982Jo03), 1496.2 3 (2002Re14) 1495.8 5 (1999Da05).
1614.33	687.3 $\frac{3}{2}$ 3 936.0 2	11 $\frac{3}{2}$ 3 84 $\frac{3}{2}$ 5			E γ : poor fit, level-energy difference=688.78. E γ : weighted average of 936.2 3 (2002Re14) in ^{109}Sb ϵ decay, 935.8 3 (1999Da05) in (α ,n γ). E γ : poor fit, level-energy difference=1600.35.
1649.87	1601.4 $\frac{3}{2}$ 3 571.3 $\frac{3}{2}$ 3 985.5 $\frac{3}{2}$ 3 1104.4 $\frac{3}{2}$ 3 1636.3 $\frac{3}{2}$ 3 1650.4 $\frac{3}{2}$ 3	100 $\frac{3}{2}$ 5 26 $\frac{3}{2}$ 3 36 $\frac{3}{2}$ 7 87 $\frac{3}{2}$ 7 52 $\frac{3}{2}$ 7 100 $\frac{3}{2}$ 7			
1677.1	437.3 $\S$ 4	100 $\S$			
1715.0	1036.5 $\S$ 3	100 $\S$			
1883.66	805.52 $\S$ 20	100 $\S$	(E2)	0.00212	Mult.: $\alpha(\text{K})\text{exp}=0.0018$ 6 (1999Da05), $\alpha(\text{K})\text{exp}=0.0022$ 4 (1976Ma09).
1914.04	685 $\frac{3}{2}$ 835.0 $\frac{3}{2}$ 3 1249.4 $\frac{3}{2}$ 3 1369.6 $\frac{3}{2}$ 3 1914.7 $\frac{3}{2}$ 3	$\leq 53\frac{3}{2}$ 32 $\frac{3}{2}$ 11 95 $\frac{3}{2}$ 26 42 $\frac{3}{2}$ 5 100 $\frac{3}{2}$ 5			
1930.18	660.43 $\S$ 10 672.43 13	46 $\S$ 6 79 $\S$ 6	M1	0.00389	E γ : weighted average of 673.0 4 (1976Ma09), 672.45 10 (1999Da05) in (α ,n γ), 672.0 3 (1995Ka09) in (HI,xn γ). Mult.: $\alpha(\text{K})\text{exp}=0.0040$ 16 (1999Da05), mul=D based on DCO ratios in (HI,xn γ) (1996Ka43).

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sn})$ (continued)

E(level)	E γ	I γ	Mult.#	α	Comments
1930.18	690.3 2	100\$ 6	E2	0.00310	E γ : weighted average of 690.42 20 (1999Da05) in (α ,n γ), 690.1 3 (1995Ka09) in (HI,xn γ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0040$ 14 (1999Da05), mul=Q based on DCO ratios in (HI,xn γ) (1996Ka43).
1992.1	734.2\$ 4	100\$ 10			
	752.6\$ 5	21\$ 7			
2015.98	1024.4\$ 3	10.9\$ 22			
	1090.8\$ 3	10.9\$ 22			
	1351.1\$ 3	15.3\$ 22			
	2016.2\$ 3	100\$ 4			
2050.0	971.9\$ 3	100\$			
2071.29	813.44\$ 15	100\$	M1,E2	0.00250	Mult.: $\alpha(\text{K})_{\text{exp}}=0.0026$ 8 (1999Da05) in (α ,n γ).
2090.59	160.45\$ 15	10.1\$ 10			
	832.71\$ 20	100\$ 7	E2	0.00196	Mult.: $a_2/a_0=0.296$ 14, $a_4/a_0=-0.14$ 3 (1979Ha12) in (α ,3n γ), $\alpha(\text{K})_{\text{exp}}=0.0018$ 6 (1999Da05), $\alpha(\text{K})_{\text{exp}}=0.0017$ 3 (1976Ma09) in (α ,n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43). B(M1)(W.u.)=0.028 14.
2116.10	25.5\$ 5	78\$ 28	(M1)	4.2 3	Mult.: mul=Q based on DCO ratios in (HI,xn γ) (1996Ka43); M2 is ruled out by T $_{1/2}$. B(E2)(W.u.)=2.3 8.
	185.8\$ 3	100\$ 11	(E2)	0.180	
2126.66	1135.1\$ 3	7\$ 3			
	1200.8\$ 3	5.0\$ 17			
	1462.2\$ 3	100\$ 33			
	1581.8\$ 3	6.7\$ 17			
	2127.1\$ 3	15.0\$ 17			
2218.33	146.95\$ 20	31\$ 4			
	288.17\$ 10	100\$ 11	M1,E2	0.0317	Mult.: $\alpha(\text{K})_{\text{exp}}=0.037$ 12 (1999Da05) in (α ,n γ).
	960.5\$ 4	58\$ 5	E2	1.71×10^{-3}	Mult.: $\alpha(\text{K})_{\text{exp}}=0.0013$ 5 (1999Da05) in (α ,n γ).
2244.39	986.8\$ 3	69\$ 19			
	1004.4\$ 3	100\$ 19			
2350.98	1081.2 1	100\$	E2	1.08×10^{-3}	E γ : weighted average of 1081.4 15 (1976Ma09), 1081.04 20 (1999Da05) in (α ,n γ), 1081.2 5 (1979Ha12) in (α ,3n γ), 1081.2 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$, 1080.7 3 (1995Ka09) in (HI,xn γ) Mult.: $a_2/a_0=0.22$ 3, $a_4/a_0=-0.07$ 7 (1979Ha12) in (α ,3n γ), $\alpha(\text{K})_{\text{exp}}=0.0009$ 3 (1999Da05) in (α ,n γ). B(E2)(W.u.)>0.062.
2380.1	1122.3\$ 3	100\$			
2397.5	1157.72\$ 25	100\$			
2442.85	1173.08\$ 20	77\$ 12			
	1185.03\$ 20	100\$ 12			
2512.0	1272.19\$ 25	100\$			
2532.09	1274.29\$ 20	100\$			
2571.1	1313.32\$ 25	100\$			
2645.3	554.67\$ 25	100\$			
2821.5	1563.7\$ 5	100\$			
2921.7	831.1\$ 5	100\$			
3266.1	1150.0\$ 3	100\$			
3301.10	950.17 12	100	E2	1.44×10^{-3}	E γ : weighted average of 950.25 15 (1999Da05) in (α ,n γ), 950.8 5 (1979Ha12) in (α ,3n γ), 950.1 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$, 949.7 3 (1995Ka09) in (HI,xn γ). Mult.: $a_2/a_0=0.26$ 5, $a_4/a_0=-0.24$ 12, $\Delta J=0$ possible (1979Ha12) in (α ,3n γ), R(DCO)=1.03 18 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$. B(E2)(W.u.)>0.12.
	1184.8\$ 3		(E1)	4.26×10^{-4}	Mult.: based on DCO ratios in (HI,xn γ).
3316.06	965.0 2		E2	1.39×10^{-3}	E γ : weighted average of 965.2 3 (1999Da05) in (α ,n γ), 962.2 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$, 964.8 3 (1995Ka09) in (HI,xn γ). Mult.: $a_2/a_0=0.25$ 7, $a_4/a_0=0.05$ 10 (1979Ha12) in (α ,3n γ), R(DCO)=0.99 12 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$. Mult.: based on DCO ratios in (HI,xn γ).
	1199.8\$ 3		(E1)	4.25×10^{-4}	

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sn})$ (continued)

E(level)	E_γ	I_γ	Mult.#	α	Comments
3346.3	1230.2 2	100	E2	8.36×10^{-4}	E γ : weighted average of 1230.4 3 (1999Da05) in (α ,n γ), 1230.3 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$, 1229.9 3 (1995Ka09) in (HI,xn γ), 1230.3 5 (1979Ha12) in (α ,3n γ). Mult.: $a_2/a_0=0.22$ 3, $a_4/a_0=-0.014$ 15 (1979Ha12) in (α ,3n γ). B(E2)(W.u.)>0.032.
3474.41	158.2 † 2	38.9 † 14	(E1)	0.0496	E γ : weighted average of 157.8 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$, 158.4 3 (1995Ka09) in (HI,xn γ), 158.4 3 (1999Da05) in (α ,n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43); R(DCO)=0.73 5 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$. Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43); $a_2/a_0=0.06$ 15, $a_4/a_0=-0.020$ 20 (1979Ha12) in (α ,3n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43).
	173.4 † 3	100 6	(E1)	0.0383	E γ : weighted average of 1176.3 3 (1995Ka09) in (HI,xn γ), 1176.8 5 (1999Da05) in (α ,n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43); $a_2/a_0=0.06$ 15, $a_4/a_0=-0.020$ 20 (1979Ha12) in (α ,3n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43).
	208.4 † 3		(M1)	0.0744	
	1358.4 † 3		E2	7.10×10^{-4}	
3527.4	1176.4 3	100			E γ : weighted average of 1176.3 3 (1995Ka09) in (HI,xn γ), 1176.8 5 (1999Da05) in (α ,n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43); $a_2/a_0=0.06$ 15, $a_4/a_0=-0.020$ 20 (1979Ha12) in (α ,3n γ). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43). Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43).
3864.2	389.8 † 3	100 †	(M1+E2)	0.01468	E γ : others: 389.9 3 (1996Ch37) in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$, 390.0 (1979Ha12) in (α ,3n γ). Mult.: MUL=E2 from (HI,xn γ) (1996Ka43) based on DCO ratios; in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37) MUL=(M1), based on R(DCO)=1.06 20.
3926.5	452.0 † 3		(M1)	0.01015	
	580.3 † 3		(M1)	0.00553	
4262.0	945.9 † 3				
	961 † 1		(E2)	1.41×10^{-3}	Mult.: R(DCO)=1.4 3 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
4451.2	1135 † 1	100 †	(E2)	9.79×10^{-4}	
4609.5	1135.1 † 3	100 †	E2	9.79×10^{-4}	Mult.: R(DCO)=1.05 2 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
4984.7	1120.5 † 3	100 †	(E2)	1.01×10^{-3}	
5130.4	1203.9 † 3	100 †	(E2)	8.70×10^{-4}	
5172.0	721 † 1		(E1)	1.05×10^{-3}	
	910 † 1				
5285.7	834 † 1				
	1023.7 † 3		(E2)	1.22×10^{-3}	
5450.5	841.0 † 3	100 †	(M1)	0.00231	Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43), mul=M1+E2 from R(DCO)=0.47 6 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
5849.8	865.1 † 3	100 †	(E2)	0.00179	
5992.8	707 † 1		(E1)	1.10×10^{-3}	
	821 † 1		(E2)	0.00202	
6224.2	938.5 † 3	100 †	(E2)	1.48×10^{-3}	Mult.: R(DCO)=1.03 8 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
6337.1	886.6 † 3	100 †	(E2)	1.69×10^{-3}	Mult.: R(DCO)=0.98 15 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
6824.8	832 † 1	100 †	(E2)	0.00196	
7194.4	857.3 † 3	100 †	(E2)	0.00183	Mult.: R(DCO)=1.01 12 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
7233.2	1009 † 1	100 †	(E2)	1.26×10^{-3}	
7724.8	900 † 1	100 †	(E2)	1.63×10^{-3}	
8123.6	929.2 † 3	100 †	(E2)	1.52×10^{-3}	Mult.: R(DCO)=1.07 22 in $^{94}\text{Mo}(^{19}\text{F},\text{p3n}\gamma)$ (1996Ch37).
8263.2	1030 † 1	100 †	(E2)	1.21×10^{-3}	
8726.8	1002 † 1	100 †	(E2)	1.28×10^{-3}	Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43).
9144.6	1021 † 1	100 †	(E2)	1.23×10^{-3}	
9330.6	790 † 1				
	1207 † 1				
9347.2	1084 † 1	100 †	(E2)	1.08×10^{-3}	
9865.9	1139 † 1	100 †	(E2)	9.72×10^{-4}	
10133.6	803 † 1		(E2)	0.00213	
	989 † 1				
10286.6	1142 † 1	100 †	(E2)	9.66×10^{-4}	
10509.2	1162 † 1	100 †	(E2)	9.33×10^{-4} 14	
11069.6	936 † 1	100 †	(E2)	1.49×10^{-3}	
11149.9	1284 † 1	100 †	(E2)	7.75×10^{-4}	
11583.7	1297 † 1	100 †	(E2)	7.62×10^{-4}	
11704.2	1195 † 1	100 †	(E2)	8.83×10^{-4}	
11799.2	1290 † 1	100 †	(E2)	7.69×10^{-4}	

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sn})$ (continued)

E(level)	E_γ	I_γ	Mult.#	α	Comments
12188.7	1119 [†] 1	100 [†]	(E2)	1.01×10^{-3}	
12344	1194 [†] 1	100 [†]	(E2)	8.84×10^{-4}	
12596	1446 [†] 1	100 [†]	(E2)	6.57×10^{-4}	
12978.2	1179 [†] 1		(E2)	9.06×10^{-4}	Mult.: based on DCO ratios in (HI,xn γ) (1996Ka43).
	1274 [†] 1		(E2)	7.86×10^{-4}	
13092.7	1509 [†] 1	100 [†]	(E2)	6.31×10^{-4}	
13155.2	1356 [†] 1	100 [†]	(E2)	7.12×10^{-4}	
13488.7	1300 [†] 1	100 [†]	(E2)	7.59×10^{-4}	
13771	1175 [†] 1		(E2)	9.12×10^{-4}	
	1427 [†] 1		(E2)	6.67×10^{-4}	
14427	1449 [†] 1	100 [†]	(E2)	6.56×10^{-4}	
14640	1485 [†] 1	100 [†]	(E2)	6.40×10^{-4}	
14833.7	1741 [†] 1	100 [†]	(E2)	5.94×10^{-4}	
14907	1136 [†] 1	100 [†]	(E2)	9.77×10^{-4}	
15012.7	1524 [†] 1	100 [†]	(E2)	6.26×10^{-4}	
16070	1643 [†] 1	100 [†]	(E2)	6.00×10^{-4}	
16226	1319 [†] 1	100 [†]	(E2)	7.42×10^{-4}	
16272	1632 [†] 1	100 [†]	(E2)	6.02×10^{-4}	
16757.7	1924 [†] 1	100 [†]	(E2)	6.08×10^{-4}	
16779	1766 [†] 1	100 [†]	(E2)	5.95×10^{-4}	
17720	1494 [†] 1	100 [†]	(E2)	6.36×10^{-4}	
17907	1837 [†] 1	100 [†]	(E2)	5.98×10^{-4}	
18731	1952 [†] 1	100 [†]	(E2)	6.12×10^{-4}	
18880	2122 [†] 1	100 [†]	(E2)	6.46×10^{-4}	
19397	1677 [†] 1	100 [†]	(E2)	5.97×10^{-4}	
19948	2041 [†] 1	100 [†]	(E2)	6.29×10^{-4}	
20910	2179 [†] 1	100 [†]	(E2)	6.60×10^{-4}	
21275	1878 [†] 1	100 [†]	(E2)	6.02×10^{-4}	
22217	2269 [†] 1	100 [†]	(E2)	6.84×10^{-4}	
23383	2108 [†] 1	100 [†]	(E2)	6.43×10^{-4}	
24743	2526 [†] 1	100 [†]	(E2)	7.64×10^{-4}	

[†] From (HI,xn γ).[‡] From ^{109}Sb ϵ decay.[§] From $^{106}\text{Cd}(\alpha, n\gamma)$.# From 1996Ka43 in (HI,xn γ) based on DCO ratios (values not given by the authors), unless otherwise stated.

Adopted Levels, Gammas (continued)

Adopted Levels, Gammas (continued)

(E) Band 4

(F) Band 5

¹⁰⁹Sb ε Decay 2002Re14,1982Jo03

Parent ¹⁰⁹Sb: E=0; Jπ=(5/2+); T_{1/2}=17.2 s 5; Q(g.s.)=6380 9; %ε+%β⁺ decay=100.

2002Re14: ¹⁰⁹Sb activity produced using E(⁵⁸Ni)=230 MeV beam on ⁵⁴Fe target (470 μg/cm²). Moving Tape Collector, Fragment Mass Analyzer (FMA), Argonne National Laboratory, USA. Detectors: 3 large volume HPGe (two 80 %, one 120 %), 1 LEPS (70 %). Measured: Eγ, Iγ, γγ, γ(t). Comparisons with shell model calculations.

1982Jo03: ¹⁰⁹Sb activity produced in ⁹²Mo + ²⁰Ne and ⁵⁸Ni + ⁵⁸Ni reactions. E(²⁰Ne)=195 MeV from the HI linear accelerator, University of Manchester on a 2 mg/cm² target of ⁹²Mo; helium-jet system and tape with 40 s intervals. E(⁵⁸Ni)=290 MeV using GSI accelerator. Mass separated activity was implanted onto a tape with 32 s intervals. Detectors: plastic scintillator telescope and Ge(Li). Measured: T_{1/2}, Eγ, Iγ, γγ, γ-X, γβ, Q(ε);

1981JoZx reports same as preliminary results.

1976Ox01: ¹⁰⁹Sb activity produced in ¹¹²Sn(p,4n), E(p)=25–65 MeV, McGill University cyclotron. Target: isotopically enriched (79.6 %), metallic powder sealed in thin-walled Be tube. Detectors: two Ge(Li) (96 and 50 cm³). Measured: T_{1/2}, Eγ, Iγ, γγ.

The following gammas: 407, 1273, 1488, 1632, 1836, 2195 reported by 1976Ox01 were not observed in 1982Jo03 and 2002Re14, and certainly belong to other nuclide.

¹⁰⁹Sn Levels

E(level) [†]	Jπ [‡]	T _{1/2} [‡]	Comments
0.0	5/2+	18.2 min 2	configuration: vd _{5/2} .
13.97 7	(7/2+)		configuration: vg _{7/2} .
544.80 13	(1/2+)		Jπ: from 2002Re14 based on the non-observation of γ to the 7/2+ state and shell-model predictions.
			configuration: vs _{1/2} proposed in 2002Re14.
664.42 12	(3/2+)		
678.31 14	(5/2+)		
925.50 13	(3/2+)		configuration: d _{3/2} state.
991.34 17	(3/2+)		
1061.80 15	(3/2+)		
1078.13 9	(7/2+)		
1228.74 18	(3/2+, 5/2+)		
1343.72 13	(7/2+)		
1495.89 13	(3/2+)		
1614.23 19	(3/2+, 5/2+)		
1649.85 15	(3/2+, 5/2+)		
1914.01 16	(3/2+, 5/2+)		
2015.95 17	(3/2+, 5/2+)		
2126.62 16	(3/2+, 5/2+)		

[†] From a least-squares fit to Eγ, by assuming ΔEγ=1 keV when uncertainty is not given.

[‡] From Adopted Levels.

β⁺,ε Data

Eε	E(level)	Iβ ⁺	Iε	Log ft	I(ε+β ⁺) [†]	Comments
(4253 9)	2126.62	1.8 5	0.32 9	5.44 13	2.1 6	
(4364 9)	2015.95	1.45 13	0.234 21	5.60 5	1.68 15	
(4466 9)	1914.01	1.31 18	0.19 3	5.70 7	1.50 21	
(4730 9)	1649.85	2.23 21	0.264 25	5.61 5	2.49 23	
(4766 9)	1614.23	1.78 16	0.204 19	5.73 5	1.98 18	
(4884 9)	1495.89	8.5 7	0.89 8	5.11 4	9.4 8	
(5036 9)	1343.72	0.69 6	0.064 6	6.28 5	0.75 7	
(5151 9)	1228.74	2.19 19	0.189 17	5.83 5	2.38 21	
(5302 9)	1078.13	0.81 9	0.063 7	6.34 6	0.87 10	
(5318 9)	1061.80	19.7 16	1.51 12	4.96 4	21.2 17	Eβ ⁺ _{max} =4332 keV 24 (1982Jo03).
(5389 9)	991.34	0.33 7	0.024 5	6.77 10	0.35 8	
(5455 9)	925.50	27.9 22	1.95 16	4.87 4	29.9 24	I(ε+β ⁺): From log ft=4.87 3 for a similar πd _{5/2} to vd _{3/2} decay in ¹¹¹ Sb ε decay, log f=3.110 7 and T _{1/2} =17.2 s 5.
						Eβ ⁺ _{max} =4416 keV 21 (1982Jo03).
(5702 9)	678.31	9.3 9	0.56 6	5.45 5	9.9 10	
(5716 9)	664.42	4.8 8	0.28 5	5.75 8	5.1 9	Eβ ⁺ _{max} =4674 keV 22 (1982Jo03).
(6366 9)	13.97	1.9 13	0.08 5	6.4 3	2.0 [‡] 14	
(6380 9)	0.0	8 6	0.3 2	5.8 4	8 [‡] 6	

Footnotes continued on next page

¹⁰⁹Sb ε Decay 2002Re14,1982Jo03 (continued)

β⁺,ε Data (continued)

† From intensity balances and %Iβ(ε+β⁺)(925.5-keV level)=29.9 24.

‡ from %Iβ(ε+β⁺)(gs)/%Iβ(ε+β⁺)(13.96-keV level)=4, as suggested in 2002Re14, and the decay scheme.

γ(¹⁰⁹Sn)

I_γ normalization: From intensity balance at the 925.5 keV level and %Iβ(ε+β⁺)(925.5-keV level)= 29.9 24.

E _γ [†]	E(level)	I _γ [‡] #	Mult. [†]	α	I(γ+ce) [#]	Comments
13.97 9	13.97	1.91 18	[M1]	24.9 6	49.5 45	%I _γ =0.51 5, using the calculated normalization. E _γ : from Adopted gammas. I(γ+ce): from %Iβ(ε+β ⁺)(gs)/%Iβ(ε+β ⁺)(13.96-keV level)=4, as suggested in 2002Re14 and the decay scheme. I _γ : from I(γ+ce) and α.
246.6 3	925.50	2.8 1	[M1]	0.0476		%I _γ =0.75 7, using the calculated normalization.
260.8 3	925.50	6.4 2	[M1]	0.0411		%I _γ =1.71 15, using the calculated normalization.
381.3 3	925.50	0.6 2	[M1]	0.01551		%I _γ =0.16 6, using the calculated normalization.
397.5 3	1061.80	3.0 7	[M1]	0.01397		%I _γ =0.80 20, using the calculated normalization.
433.6 3	1495.89	0.5 1	[M1]	0.01125		%I _γ =0.13 3, using the calculated normalization.
446.3 3	991.34	0.4 1	[M1]	0.01048		%I _γ =0.11 3, using the calculated normalization.
516.5 3	1061.80	4 1	[M1]	0.00732		%I _γ =1.1 3, using the calculated normalization.
544.4 3	544.80	11.2 1	[E2]	0.00581		%I _γ =2.99 24, using the calculated normalization. E _γ : Others: 544.4 3 (2002Re14) and 544.8 3 (1982Jo03).
550.2 3	1228.74	0.6 1	[M1]	0.00628		I _γ : Other: 10.6 5 (1982Jo03).
571.3 3	1649.85	0.8 1	[M1,E2]	0.00574		%I _γ =0.16 3, using the calculated normalization.
650.1 3	664.42	1.3 1	[E2]	0.00361		%I _γ =0.21 4, using the calculated normalization.
664.0 3	664.42	39 2	[M1]	0.00401		%I _γ =0.35 4, using the calculated normalization.
664.5 1	678.31	24 2	M1	0.00401		%I _γ =10.4 9, using the calculated normalization.
						%I _γ =6.4 7, using the calculated normalization. E _γ : Others: 664.2 3 (2002Re14), 664.5 3 (1982Jo03), and 664.6 5 (1976Ox01).
665.8 3	1343.72	0.5 1	[M1]	0.00399		I _γ : Others: 63 4 (1982Jo03), 51 7 (1976Ox01, may combine 664.0 γ + 664.2γ).
678.6 1	678.31	20.2 2	M1(+E2)	0.00381		%I _γ =0.13 3, using the calculated normalization.
						%I _γ =5.4 5, using the calculated normalization. E _γ : Others: 678.6 3 (2002Re14) and 678.6 3 (1982Jo03).
685	1914.01	≤1.0	[M1]	0.00373		I _γ : Other: 19 1 (1982Jo03).
687.3 3	1614.23	0.4 1	[M1]	0.00370		%I _γ =0.13 14, using the calculated normalization.
						%I _γ =0.11 3, using the calculated normalization. E _γ : poor fit, level-energy difference=688.74.
831.4 3	1495.89	2.1 6	[M1]	0.00238		%I _γ =0.56 17, using the calculated normalization.
835.0 3	1914.01	0.6 2	[M1,E2]	0.00235		%I _γ =0.16 6, using the calculated normalization.
910.9 3	925.50	2.9 2	[E2]	1.59×10 ⁻³		%I _γ =0.77 8, using the calculated normalization.
925.3 2	925.50	100	M1(+E2)	0.00186		%I _γ =0.77 8, using the calculated normalization.
						%I _γ =26.7 21, using the calculated normalization. E _γ : Others: 925.0 3 (2002Re14), 925.4 3 (1982Jo03), 925.4 3 (1976Ox01).
x932.1 3		0.5 2				I _γ : Others: 100 (1982Jo03, 1976Ox01).
						%I _γ =0.13 6, using the calculated normalization. E _γ : placement by 2002Re14 from 2016 is incorrect, as confirmed in an e-mail reply from one of the authors (J. Ressler to B. Singh) on June 10, 2002. It is however seen in coin with 1078γ.
936.2 3	1614.23	3.2 2	[M1]	0.00181		%I _γ =0.85 9, using the calculated normalization.
951.1 3	1495.89	2.4 2	[M1]	1.75×10 ⁻³		%I _γ =0.64 8, using the calculated normalization.
985.5 3	1649.85	1.1 2	[M1]	1.61×10 ⁻³		%I _γ =0.29 6, using the calculated normalization.
991.2 3	991.34	1.8 1	M1(+E2)	1.59×10 ⁻³		%I _γ =0.48 5, using the calculated normalization.
1024.4 3	2015.95	0.5 1	[M1]	1.48×10 ⁻³		%I _γ =0.13 3, using the calculated normalization.
1047.7 3	1061.80	4.8 1	[E2]	1.16×10 ⁻³		%I _γ =0.13 3, using the calculated normalization.
1061.8 3	1061.80	67.9 7	M1(+E2)	1.37×10 ⁻³		%I _γ =1.28 11, using the calculated normalization.
						%I _γ =18.1 15, using the calculated normalization. E _γ : Others: 1061.7 3 (1982Jo03), 1061.6 3 (1976Ox01).
						I _γ : Others: 75 5 (1982Jo03), 74 4 (1976Ox01).

Continued on next page (footnotes at end of table)

^{109}Sb ϵ Decay 2002Re14,1982Jo03 (continued) $\gamma(^{109}\text{Sn})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$	Mult. †	α	Comments
1064.0 3	1078.13	0.86 6	M1 (+E2)	1.36×10^{-3}	%I γ =0.230 24, using the calculated normalization. E γ : From adopted gammas. Other: 1064 keV (2012Re14). I γ : From adopted gammas. Authors in 2002Re14 adopted a value based on branching ratio from in-beam γ -ray studies of 1999Da05.
1078.0 1	1078.13	3.8 1	M1 (+E2)	1.32×10^{-3}	%I γ =1.01 9, using the calculated normalization. E γ : Others: 1078 keV (2012Re14) and 1078.0 keV 3 (1982Jo03). I γ : Other: 3.9 2 (1982Jo03).
1090.8 3	2015.95	0.5 1	[M1]	1.29×10^{-3}	%I γ =0.13 3, using the calculated normalization.
1104.4 3	1649.85	2.7 2	[M1, E2]	1.25×10^{-3}	%I γ =0.72 8, using the calculated normalization. E γ : poor fit, level-energy difference=1105.16.
1135.1 3	2126.62	0.4 2	[M1]	1.18×10^{-3}	%I γ =0.11 6, using the calculated normalization.
^x 1175.3 3		2.8 1			%I γ =0.75 7, using the calculated normalization.
1200.8 3	2126.62	0.3 1	[M1]	1.05×10^{-3}	%I γ =0.08 3, using the calculated normalization.
1214.4 3	1228.74	1.1 1	[M1, E2]	1.02×10^{-3}	%I γ =0.29 4, using the calculated normalization.
1229.3 3	1228.74	7.7 1	[M1]	9.98×10^{-4}	%I γ =2.06 17, using the calculated normalization.
1249.4 3	1914.01	1.8 5	[M1]	9.66×10^{-4}	%I γ =0.48 14, using the calculated normalization.
1343.64 13	1343.72	2.3 1	M1	8.44×10^{-4}	%I γ =0.61 6, using the calculated normalization. E γ : From adopted gammas. Others: 1343.7 keV 3 (2012Re14) and 1343.5 3 (1982Jo03). I γ : Other: 2.2 2 (1982Jo03).
1351.1 3	2015.95	0.7 1	[M1]	8.36×10^{-4}	%I γ =0.19 3, using the calculated normalization.
1369.6 3	1914.01	0.8 1	[M1, E2]	8.18×10^{-4}	%I γ =0.21 4, using the calculated normalization.
1462.2 3	2126.62	6 2	[M1]	7.42×10^{-4}	%I γ =1.6 6, using the calculated normalization.
1482.2 3	1495.89	1.7 1	[E2]	6.41×10^{-4}	%I γ =0.45 5, using the calculated normalization.
1496.0 2	1495.89	28.3 2	[M1]	7.21×10^{-4}	%I γ =7.6 6, using the calculated normalization. E γ : From adopted gammas. Others: 1496.1 keV 3 (2012Re14) and 1495.8 3 (1982Jo03). I γ : Other: 30 2 (1982Jo03).
1581.8 3	2126.62	0.4 1	[M1, E2]	6.80×10^{-4}	%I γ =0.11 3, using the calculated normalization.
1601.4 3	1614.23	3.8 2	[M1]	6.72×10^{-4}	%I γ =1.01 10, using the calculated normalization. E γ : poor fit, level-energy difference=1600.26.
1636.3 3	1649.85	1.6 2	[M1, E2]	6.61×10^{-4}	%I γ =0.43 7, using the calculated normalization.
1650.4 3	1649.85	3.1 2	[M1]	6.57×10^{-4}	%I γ =0.83 9, using the calculated normalization.
^x 1760.4 3		2.6 1			%I γ =0.69 6, using the calculated normalization.
1914.7 3	1914.01	1.9 1	[M1]	6.35×10^{-4}	%I γ =0.51 5, using the calculated normalization.
2016.2 3	2015.95	4.6 2	[M1]	6.44×10^{-4}	%I γ =1.23 11, using the calculated normalization.
2127.1 3	2126.62	0.9 1	[M1]	6.63×10^{-4}	%I γ =0.24 4, using the calculated normalization.

 † From Adopted Gammas. ‡ From 2002Re14. $^{\#}$ For absolute intensity per 100 decays, multiply by 0.267 21. x γ ray not placed in level scheme.

Decay Scheme

Intensities: relative I_γ

(5/2+) 0.0 17.2 s
¹⁰⁹Sb₅₈
 %ε+%β⁺=100
 Q⁺=6380⁹

¹⁰⁹Sb ε Decay 2002Re14,1982Jd03 (continued)

$^{94}\text{Mo}(^{19}\text{F},\text{p}3\text{n}\gamma)$ 1996Ch37

1996Ch37: E(^{19}F)=88 MeV, 14 UD BARC-TIFR Pelletron accelerator, India. Target: 2 mg/cm² (99% enrichment) on a 25 mg/cm² Au backing. Detectors: 5 Compton-suppressed Ge, 14 element NaI Multiplicity Filter. Measured: E γ , I γ , $\gamma\gamma$. DCO DCO ratios correspond to 75° and 15° geometry.

 ^{109}Sn Levels

E(level) [†]	J π [‡]	Comments
0.0	5/2+ [§]	
14.0	(7/2+) [§]	E(level): round-off value from Adopted Levels.
1258.9 3	11/2+	
1270.0# 3	11/2-	
2091.6 5	15/2+	
2351.2# 5	15/2-	
3301.2# 5	19/2-	
3316.5 5	19/2-	
3321.9? 6	19/2+	
3474.5 6	21/2-	
3864.4 6		
4263.0 6	(23/2)-	
4610.3 6	25/2-	
4985.2 7		
5287.1 7	(27/2)-	
5451.7 7	27/2-	
6225.9 8	(31/2)-	
6338.6 8	31/2-	
7196.3 8	35/2-	
8125.9 9	39/2-	
9147.5 9	43/2-	

[†] From a least-squares fit to E γ .

[‡] From 1996Ch37.

[§] From Adopted Levels.

(A): $\text{vh}_{11/2}$ coupled to core vibrations.

 $\gamma(^{109}\text{Sn})$

E γ [†]	E(level)	I γ [†]	Mult. [†]	Comments
157.8 3	3474.5	28 1	M1+E2	R(DCO)=0.73 5.
173.4 3	3474.5	72 4	M1+E2	R(DCO)=0.78 5.
389.9 3	3864.4	18.6 1	M1+E2	R(DCO)=1.06 20.
^x 721				
^x 821				
832.7 3	2091.6	50 2		
841.4 3	5451.7	13.6 1	M1+E2	R(DCO)=0.47 6.
857.7 3	7196.3	9.5 5	E2	R(DCO)=1.01 12.
886.9 3	6338.6	13 1	E2	R(DCO)=0.98 15.
929.6 3	8125.9	2.5 1	E2	R(DCO)=1.07 22.
938.8 3	6225.9	12 1	(E2)	R(DCO)=1.03 18.
950.1 3	3301.2	42 2	E2	R(DCO)=1.03 18.
961.8 3	4263.0	14 1	(E2)	R(DCO)=1.4 3.
965.2 3	3316.5	35.3 18	E2	R(DCO)=0.99 12.
1021.6 3	9147.5	<2		
1024.1 3	5287.1	10 1		
1081.2 3	2351.2	90 4	E2	R(DCO)=1.09 9.
1120.8 3	4985.2	12 1		
1135.8 3	4610.3	31 2	E2	R(DCO)=1.05 12.
^x 1136.0 3				
1230.3 3	3321.9?	25 1		E γ : feeds directly the ground state in Adopted Gammas.
1244.9 3	1258.9	70 3		
1256.0 3	1270.0	100 5		

[†] From 1996Ch37. $\Delta I\gamma=5\%$ is assumed by the evaluators based on the quoted upper limit in 1996Ch37.

^x γ ray not placed in level scheme.

¹⁰⁶Cd(α,nγ) 1999Da05,1976Ma09

1999Da05: E(α)=15, 16, 17, 18, 19, 20 MeV, 20 MeV for γγ data, beam from the Debrecen cyclotron. Targets: 0.4–2.5 mg/cm²–thick self-supporting one and 5 mg/cm²–thick (rolled) metal one isotopically enriched to 77.3% in ¹⁰⁶Cd. Detectors: a superconducting magnetic lens plus Si(Li) electron spectrometer, two HPGe detectors (20 % and 25%) Measured :Eγ, Iγ, γγ, γ(θ), α(K)exp (normalized to 1293.558 keV E2 in ¹¹⁶Sn). Deduced levels, Jπ, γ-ray multiplicities, branching ratios, conversion coefficients. Comparisons with shell model calculations.

1976Ma09: E(α)=15–18 MeV. Measured: Eγ, Iγ, γγ at 18 MeV, excitation functions, and α(K)exp (normalized to 632.66γ, E2 in ¹⁰⁶Cd).

1981JoZX: E(α)=12.5–18.0 MeV. Measured: Eγ, n-γ, γ-γ, γ(θ).

1995Ka09: E(α)=23 MeV. Measured Eγ, γγ, γ(t).

1984Ka16: E(α)=20 MeV, T_{1/2} using γ(t) method.

1996ViZZ: E(α)=27 MeV, Eγ, Iγ, γγ.

1986En06: E(α)=20–27 meV. Measured T_{1/2} using the γ(t) method.

The level scheme is from 1999Da05, unless otherwise stated.

¹⁰⁹Sn Levels

E(level) [†]	Jπ [‡]	T _{1/2}	Comments
0.0	5/2+		
14.0 10	7/2+		E(level): the existence of this level is confirmed by 1999Da05, based on γγ-coincidences.
544.86 15	(3/2)+		
678.60 10	5/2+		
925.6 5	3/2+		
991.1 3	≤5/2+		
1061.7 3	(3/2)+		
1078.05 10	7/2+		
1239.77 12	9/2+	≤0.2 ns §	
1257.84 9	11/2+		
1269.85 11	11/2–		
1343.56 25	7/2+		
1495.8 5	3/2, 5/2(+)		
1614.4 4	≤5/2(+)		
1649.5 5	(5/2, 7/2+)		
1677.1 5	9/2, 11/2(+)		
1715.1 4	7/2, 9/2(+)		
1883.57 23	11/2+		
1930.25 10	13/2+		
1992.2 4	9/2(+)		
2050.0 4	11/2(+)		
2071.34 15	13/2+		
2090.65 15	15/2+	7 ns I	T _{1/2} : from γ(t) in 1986En06. The same value is also reported in 1984Ka16, 1995Ka09 using 833γ(t) and 1244γ(t), as well as the 185.6γ(t). However, the latter γ rays is not in coincidence with the 883 and 1244γ.
2116.1 3	17/2(+)		
2218.40 13	15/2+		
2244.41 23	7/2(+)		
2350.90 23	15/2–	≤0.2 ns §	
2380.1 4	13/2(+)		
2397.5 3	13/2(+)		
2442.91 17	13/2		
2512.0 3	9/2, 11/2(+)		
2532.14 22			
2571.2 3	7/2, (9/2+)		
2645.3 3			
2821.6 5	9/2(+)		
2921.7 6			
3266.1 4	(19/2+)		
3301.1 3	19/2(–)	≤0.2 ns §	
3316.2 4	19/2(–)	≤0.2 ns §	
3346.5 4	21/2(+)	≤0.2 ns §	
3474.6 4	21/2(+)	≤0.2 ns §	
3527.7 6	(19/2–)		

[†] From a least-squares fit to Eγ.

[‡] From 1999Da05, based on deduced γ-ray multiplicities using ce data, γ(θ), and side-feeding excitation functions of populated states.

§ From 1995Ka09, using γ(t) method (see also 1984Ka16).

$^{106}\text{Cd}(\alpha, n\gamma)$ 1999Da05, 1976Ma09 (continued) $\gamma(^{109}\text{Sn})$

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. [‡]	Comments
12.8	14.0	>69		E γ : seen in $\gamma\gamma$ coinc in 1995Ka09. I γ : From the intensity balance using a $\alpha=26.23$ (1999Da05).
25.5 5	2116.1	14 5		I γ : from the relative intensity of the 185 γ and 832 γ in the 1150 +1230 gates.
146.95 20	2218.40	17 2		
158.4 3	3474.6	6 2		
160.45 15	2090.65	30 3		E γ : Others: 161.1 (1996ViZZ). I γ : Others: 6.1 (1996ViZZ).
173.48 20	3474.6	9 1		E γ : Other: 174.2 (1996ViZZ). I γ : Other: 7.4 (1996ViZZ).
185.8 3	2116.1	18 2		
^x 246.5		2.5		E γ , I γ : from 1996ViZZ.
^x 261.6		4.9		E γ , I γ : from 1996ViZZ.
288.17 10	2218.40	55 6	M1, E2	Mult.: $\alpha(\text{K})_{\text{exp}}=0.037$ 12 (1999Da05).
^x 389.8		6.5		E γ , I γ : from 1996ViZZ.
^x 407.2 4		7.8 12		E γ , I γ : from 1976Ma09.
^x 416.9 6		4 1		E γ , I γ : from 1976Ma09.
437.3 4	1677.1	9 4		
446.3 5	991.1	7 2		
^x 452.0		3.8		E γ , I γ : from 1996ViZZ.
544.86 [§] 15	544.86	86 4	M1, E2	E γ : Others: 544.9 2 (1976Ma09), 543.0 (1996ViZZ). I γ : Others: 32 3 (1976Ma09), 32.8 (1996ViZZ). Mult.: $a_2/a_0=-0.17$ 2, $a_4/a_0=0.032$ (1981JoZX); $a_2/a_0=-0.37$ 16, $\alpha(\text{K})_{\text{exp}}=0.0043$ 14 (1999Da05); $\alpha(\text{K})_{\text{exp}}=0.0048$ 9 (1976Ma09).
554.67 25	2645.3	16 2		
660.43 10	1930.25	46 6		
664.58 10	678.60	313 15	M1, E2	E γ : Others: 664.5 4 (1976Ma09), 664.1 (1996ViZZ). I γ : Others: 152 15 (1976Ma09), 32.8 (1996ViZZ). Mult.: $a_2/a_0=-0.33$ 2, $a_4/a_0=0.05$ 2 (1981JoZX); $a_2/a_0=-0.50$ 12, $\alpha(\text{K})_{\text{exp}}=0.0025$ 8 (1999Da05); $\alpha(\text{K})_{\text{exp}}=0.0030$ 6 (1976Ma09).
672.45 10	1930.25	80 6	M1, E2	E γ : Others: 673.0 4 (1976Ma09), 672.9 (1996ViZZ). I γ : Others: 38 4 (1976Ma09), 31.9 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0040$ 16 (1999Da05).
678.73 25	678.60	85 9		E γ : Others: 678.7 2 (1976Ma09), 678.7 (1996ViZZ). I γ : Others: 34 3 (1976Ma09), 8.2 (1996ViZZ).
690.42 20	1930.25	101 6	(E2)	Mult.: $a_2/a_0=0.05$ 3, $a_4/a_0=0.013$ (1981JoZX). E γ : Others: 690.1 (1996ViZZ). I γ : Other: 7.4 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0040$ 14 (1999Da05).
734.2 4	1992.2	42 4		
752.6 5	1992.2	9 3		
805.52 20	1883.57	91 6	(E2)	E γ : Others: 805.1 (1976Ma09), 804.8 (1996ViZZ). I γ : Others: 26 (1976Ma09), 35 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0018$ 6 (1999Da05), $\alpha(\text{K})_{\text{exp}}=0.0022$ 4 (1976Ma09).
813.44 15	2071.34	93 6	M1, E2	E γ : Others: 813.4 2 (1976Ma09), 812.9 (1996ViZZ). I γ : Others: 25 3 (1976Ma09), 19.5 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0026$ 8.
831.1 5	2921.7	22 8		
832.71 20	2090.65	298 21	E2	E γ : Others: 832.7 (1976Ma09), 832.2 (1996ViZZ); composite γ . I γ : Others: 63 (1976Ma09), 57.0 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0018$ 6 (1999Da05), $\alpha(\text{K})_{\text{exp}}=0.0017$ 3 (1976Ma09).
^x 887.7		18 3		E γ , I γ : from 1976Ma09, also seen in 1996ViZZ.
^x 891.3		4.6		E γ , I γ : from 1996ViZZ.
925.6 [§] 5	925.6	70 8	M1, E2	E γ : Others: 925.6 (1976Ma09), 925.3 (1996ViZZ). I γ : Others: 33 (1976Ma09), 13.1 (1996ViZZ). Mult.: $a_2/a_0=-0.03$ 1, $a_4/a_0=0.01$ 1 (1981JoZX) $\alpha(\text{K})_{\text{exp}}=0.0016$ 6 (1999Da05).
935.8 3	1614.4	14 3		
^x 945.9		3.3		E γ , I γ : from 1996ViZZ.
950.25 15	3301.1	19 4		E γ : Other: 949.8 (1996ViZZ). I γ : Other: 31.8 (1996ViZZ).
960.5 4	2218.40	32 3	(E2)	E γ : Other: 961.0 (1996ViZZ). I γ : Other: 5.6 (1996ViZZ). Mult.: $\alpha(\text{K})_{\text{exp}}=0.0013$ 5 (1999Da05).

Continued on next page (footnotes at end of table)

$^{106}\text{Cd}(\alpha, n\gamma)$ 1999Da05, 1976Ma09 (continued) $\gamma(^{109}\text{Sn})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger}$	Mult. [‡]	Comments
965.2 3	3316.2	16 3		E γ : Other: 964.8 (1996ViZZ). I γ : Other: 5.4 (1996ViZZ).
971.9 3	2050.0	27 6		
986.8 3	2244.41	18 5		
991.1 [§] 3	991.1	37 5	M1, E2	Mult.: $a_2/a_0=-0.20$ 2, $a_4/a_0=0.02$ 1 (1981JoZX), $\alpha(K)\text{exp}=0.0010$ 4 (1999Da05).
1004.4 3	2244.41	26 5		
1036.5 3	1715.1	48 4		
1061.7 [§] 3	1061.7	53 4	M1, E2	E γ : Others: 1062.8 (1976Ma09), 1062.8 (1996ViZZ); composite γ . I γ : Others: 20 (1976Ma09), 13 (1996ViZZ). Mult.: $a_2/a_0=-0.36$ 3, $a_4/a_0=0.10$ 3 (1981JoZX); $a_2/a_0=-0.22$ 20, $\alpha(K)\text{exp}=0.0011$ 4 (1999Da05).
1064.0 3	1078.05	58 4	M1, E2	Mult.: $\alpha(K)\text{exp}=0.0009$ 3 (1999Da05).
1078.05 10	1078.05	258 16	M1, E2	E γ : Others: 1078.7 10 (1976Ma09), 1080.7 (1996ViZZ); composite γ . I γ : Others: 62 (1976Ma09), 63.9 (1996ViZZ). Mult.: $a_2/a_0=-0.82$ 5, $a_4/a_0=0.22$ 5 (1981JoZX), $\alpha(K)\text{exp}=0.0010$ 3 (1999Da05).
1081.04 20	2350.90	166 12	(E2)	E γ : Others: 1081.4 15 (1976Ma09), 1080.7 (1996ViZZ); composite γ . I γ : Others: 62 (1976Ma09), 63.9 (1996ViZZ). Mult.: $\alpha(K)\text{exp}=0.0009$ 3.
1104.6 4	1649.5	20 6		
1122.3 3	2380.1	74 4		
^x 1135.1		3 7		E γ , I γ : from 1996ViZZ.
1150.0 3	3266.1	6 2		
1157.72 25	2397.5	34 7		
1173.08 20	2442.91	20 3		
1176.8 5	3527.7	8 3		E γ : Other: 1176.3 (1996ViZZ). I γ : Other: 1.6 (1996ViZZ).
1185.03 20	2442.91	26 3		E γ : Other: 1184.8 (1996ViZZ). I γ : Other: 11.0 (1996ViZZ).
1225.8 3	1239.77	39 4		
1230.4 3	3346.5	27 14		E γ : Others: 1230 (1976Ma09), 1229.8 (1996ViZZ). I γ : Other: 14.8 (1996ViZZ).
1239.67 15	1239.77	409 18	E2	E γ : Other: 1239.5 (1996ViZZ). I γ : Other: 55.8 (1996ViZZ). Mult.: $a_2/a_0=0.24$ 3, $a_4/a_0=-0.19$ 3 (1981JoZX), $\alpha(K)\text{exp}=0.0009$ 3 (1999Da05).
1243.83 10	1257.84	1000 34	(E2)	E γ : Others: 1243.80 15 (1976Ma09), 1243.5 (1996ViZZ). I γ : Others: 237 60 (1976Ma09), 185 (1996ViZZ). Mult.: $a_2/a_0=0.25$ 3, $a_4/a_0=-0.18$ 3 (1981JoZX), $\alpha(K)\text{exp}=0.0007$ 2 (1999Da05), $\alpha(K)\text{exp}=0.0006$ 2 (1976Ma09).
1255.93 15	1269.85	398 17	M2 (+E3)	E γ : Others: 1255.8 2 (1976Ma09), 1255.8 (1996ViZZ). I γ : Others: 100 (1976Ma09), 100 (1996ViZZ). Mult.: $a_2/a_0=0.15$ 3, $a_4/a_0=-0.20$ 3 (1981JoZX), $\alpha(K)\text{exp}=0.0019$ 6 (1999Da05), $\alpha(K)\text{exp}=0.0016$ 3 (1976Ma09).
1272.19 25	2512.0	34 6		
1274.29 20	2532.14	49 12		
1313.32 25	2571.2	31 8		
1343.55 25	1343.56	93 5	M1, E2	E γ : Others: 1343.7 2 (1976Ma09), 1343.7 (1996ViZZ). I γ : Others: 31 5 (1976Ma09), 10.7 (1996ViZZ). Mult.: $a_2/a_0=-0.23$ 3, $a_4/a_0=-0.02$ 3 (1981JoZX), $\alpha(K)\text{exp}=0.0007$ 2 (1999Da05), $\alpha(K)\text{exp}=0.00060$ 13 (1976Ma09).
1495.8 [§] 5	1495.8	16 4		
1563.7 5	2821.6	14 3		

[†] From 1999Da05, unless otherwise stated.[‡] From $\gamma(0)$ and conversion coefficients.[§] Feeds the ground state or the 14.0 level (1999Da05).^x γ ray not placed in level scheme.

$^{108}\text{Cd}(\alpha, 3n\gamma)$ 1979Ha12

1979Ha12: E(α)=30–67 MeV, SF cyclotron, Institute of Nuclear Study, University of Tokyo, Target: 1.1 mg/cm² (82.7 % ^{108}Cd). Detectors: one Ge LEPS (FWHM 528 eV at 136 keV), two Ge(Li) (FWHM 2.2 keV at 1.33 MeV). Measured: E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, I γ from 44 MeV data.

Other: 1969Ya05 (E(α)=50 MeV, 336.9 γ , 1084.2 γ , 1104.9 γ , 1241.6 γ , 1257.0 γ are shown in single spectrum).

The level scheme in 1979Ha12 are proposed by assuming 1243.8 γ and 1255.8 γ feeding ground state, which in fact feed a level at E=14 keV according to $\gamma\gamma$ -coincidence measurements in ^{109}Sb EC decay (2002Re14) and in ($\alpha, n\gamma$) (1999Da05).

Therefore, all the levels in 1979Ha12 have to be moved up by about 14 keV, see Adopted Levels.

 ^{109}Sn Levels

E(level) [†]	J π [‡]	Comments
0.0	5/2+ [§]	
14.0	(7/2+) [§]	E(level): round-off value from Adopted Levels.
1257.8 5	11/2+	
1269.8# 5	11/2-	
2090.5 7	15/2+	
2351.0# 7	15/2-	
3301.8# 9	19/2-	
3313.5 9	(19/2-)	
3320.8 9		
3475.2 10		
3865.2 12		

[†] From a least-squares fit to E γ 's (by evaluators), with the energy of the first excited state fixed at E=14.0 keV, the round-off value from Adopted Levels. Placements of γ -ray transitions are based on Adopted Gammas and different from placements in 1979Ha12. See comments on level scheme.

[‡] From 1979Ha12.

[§] From Adopted Levels.

(A): $\text{vh}_{11/2}$ coupled to core vibrations.

 $\gamma(^{109}\text{Sn})$

E γ [†]	E(level)	I γ [†]	Mult. [†]	Comments
173.4 5	3475.2	13 2	(M1+E2)	Mult.: $a_2/a_0=0.06$ 15, $a_4/a_0=-0.020$ 20.
390.0 5	3865.2	21 3		
832.7 5	2090.5	38 4	E2	Mult.: $a_2/a_0=0.296$ 14, $a_4/a_0=-0.14$ 3.
950.8 5	3301.8	26 4	E2	Mult.: $a_2/a_0=0.26$ 5, $a_4/a_0=-0.24$ 12, $\Delta J=0$ possible.
962.5 5	3313.5	11 3	(E2)	Mult.: $a_2/a_0=0.25$ 7, $a_4/a_0=0.05$ 10.
^x 966.1 5		15 3		
1081.2 5	2351.0	44 6	E2	Mult.: $a_2/a_0=0.22$ 3, $a_4/a_0=-0.077$.
1230.3 5	3320.8	16 3	E2	Mult.: $a_2/a_0=0.22$ 3, $a_4/a_0=-0.014$ 15.
1243.8 5	1257.8	79 9		
1255.8 5	1269.8	100	M2	Mult.: $a_2/a_0=0.158$ 11, $a_4/a_0=0.006$ 27.

[†] from 1979Ha12. $\Delta E\gamma$ were assigned by the evaluators.

^x γ ray not placed in level scheme.

Coulomb Excitation 2012Di13

2012Di13: E=2.87 MeV/nucleon ^{109}Sn radioactive beam was produced at the REX-ISOLDE facility at CERN by bombarding a 27 g/cm² LaC_x target with a 1.4-GeV proton beam with a maximum intensity of about 3×10^{13} protons per pulse. The secondary target is 99.93% isotopically enriched ^{58}Ni . Scattered particles were detected by a double-sided silicon strip detector (DSSSD) and γ rays were detected by the MINIBALL γ -ray detector array. Measured $E\gamma$, $I\gamma$, reaction yields, particle- γ -coin. Deduced levels, $J\pi$, B(E2) using the GOSIA2 code. Comparison with shell-model calculations.

 ^{109}Sn Levels

E(level) [†]	$J\pi^{\ddagger}$	Comments
0.0	5/2+	
14	7/2+	
664.5	(3/2+)	B(E2) $\uparrow$ =0.013 +8-11.
678.7	5/2+	B(E2) $\uparrow$ <0.012.
925.4	(3/2)+	B(E2) $\uparrow$ =0.029 +14-15.
991.1	1/2+	B(E2) $\uparrow$ <0.028.
		$J\pi$: from 2012Di13; (3/2)+ in Adopted Levels.
1078	(7/2)+	B(E2) $\uparrow$ =0.060 +20-22.
1240	9/2+	B(E2) $\uparrow$ =0.085 +32-34.

[†] Rounded values from Adopted Levels.

[‡] From Adopted Levels, unless otherwise.

 $\gamma(^{109}\text{Sn})$

$E\gamma$	E(level)	$I\gamma$
664 [†]	664.5	0.82 [†] 8
665 [†]	678.7	0.82 [†] 8
678	678.7	0.11 6
925	925.4	0.60 7
991	991.1	0.22 6
1064 [‡]	1078	0.93 [‡] 10
1078 [‡]	1078	0.93 [‡] 10
1240	1240	0.72 8

[†] Not resolved; combined intensity is listed for 664 γ +665 γ .

[‡] Not resolved; combined intensity is listed for 1064 γ +1078 γ and may also contain a contribution from a 1062 γ .

 $^{112}\text{Sn}(^3\text{He}, ^6\text{He})$ 1978Pa11

1978Pa11: E=70 MeV ^3He beams with typical intensities of 1 μA were produced from the Michigan State University cyclotron. The target was 80.04% enriched ^{112}Sn with a thickness of 850 $\mu\text{g}/\text{cm}^2$. Reaction products were momentum analyzed with an Enge split-pole magnetic spectrograph and detected by a two-wire charge-division gas proportional counter for position and energy loss information. Time of flight and light output information were provided by a plastic scintillator backing the proportional counters. Measured $\sigma(E(^6\text{He}))$. Deduced levels, mass excess.

 ^{109}Sn Levels

E(level) [†]
0.0
1277 15

[†] From 1978Pa11.

(HI,xnγ) 1996Ka43,1995Ka09

1996Ka43,1998KaZZ: ⁵⁴Fe(⁵⁹Co,3pn), E(⁵⁹Co)=230 MeV, LBL accelerator. Target: 2 foils of 400 μg/cm² self-supported.

Detectors: 36 Ge detectors Gammasphere. Measured: γγ, γγγ, DCO. only level scheme is given.

1995Ka09: ⁵⁵Mn(⁵⁸Ni,3pn), E(⁵⁸Ni)=240 MeV, VICKSI accelerator, Berlin. Target: 2 mg/cm² on 23 mg/cm² Au backing.

Detectors: OSIRIS spectrometer. Measured: Eγ, Iγ, γγ, also ¹⁰⁶Cd(α,n), Rossendorf cyclotron, Target: 10 mg/cm²

Measured:γγ, γ(t) Detectors: LEPS, Ge(Li).

1998KaZZ : private communication through e-mail on 30 March 1998, the placement of band 3a and 3b was modified, compared to 1996Ka43.

¹⁰⁹Sn Levels

E(level)	Jπ [†]	T _{1/2} [‡]	Comments
0.0	5/2+		configuration: vd _{5/2} .
13.1 3	7/2+		configuration: vg _{7/2} .
1239.0 § 3	9/2+	≤0.2 ns	
1256.7 § 4	11/2+		
1268.6 @ 4	11/2-	2.0 ns 2	T _{1/2} : Other: 2.0 ns 3 using the centroid shift method in 1982An17.
1928.8 § 3	13/2+		
2089.1 § 4	15/2+		
2114.3 § 4	17/2+	7 ns 1	
2349.4 @ 4	15/2-	≤0.2 ns	
3264.3 # 4	(19/2+)		
3299.1 @ 4	19/2-	≤0.2 ns	
3314.2 4	19/2-	≤0.2 ns	
3344.3 # 5	(21/2+)	≤0.2 ns	
3472.6 4	21/2+	≤0.2 ns	
3525.7 5	(19/2-)		
3862.4 # 5	(23/2+)		
3924.6 5	(23/2+)		
4260.1 & 5	23/2-		
4449.4 8	23/2-		
4607.7 d 5	25/2+		
4982.9 6	(27/2+)		
5128.5 6	(27/2+)		
5170.2 b 8	25/2(+)		
5283.8 & 5	27/2-		
5448.7 d 6	27/2(+)		
5848.0 7	(31/2+)		
5991.0 b 9	29/2(+)		
6222.3 & 6	31/2-		
6335.3 d 7	31/2(+)		
6823.0 b 14	33/2(+)		
7192.6 d 7	35/2(+)		
7231.3 & 12	35/2-		
7723.0 b 17	37/2(+)		
8121.8 d 8	39/2(+)		
8261.3 & 16	39/2-		
8538.8 e 16	(37/2-, 39/2+)		
8725.0 b 20	41/2(+)		
9142.9 d 12	(43/2+)		
9328.9 e 12	(41/2-, 43/2+)		
9345.3 & 19	43/2-		
9864.0 b 22	45/2(+)		
10131.9 e 13	(45/2-, 47/2+)		
10284.9 d 16	(47/2+)		
10507.3 & 21	47/2-		
11067.9 e 16	(49/2-, 51/2+)		
11148.0 b 25	49/2(+)		
11581.9 d 19	(51/2+)		
11702.3 a 23	(51/2-)		
11797.3 & 23	(51/2-)		
12186.9 e 19	(53/2-, 55/2+)		
12342 b 3	53/2(+)		
12594 c 3	(53/2+)		
12976.3 a 24	(55/2-)		
13090.9 d 21	(55/2+)		
13153.3 & 25	(55/2-)		

Continued on next page (footnotes at end of table)

(HI,xnγ) 1996Ka43,1995Ka09 (continued)

¹⁰⁹Sn Levels (continued)

E(level)	Jπ [†]	E(level)	Jπ [†]	E(level)	Jπ [†]
13486.9 ^e 22	(57/2-, 59/2+)	16224 ^c 3	(65/2+)	19395 ^c 4	(73/2+)
13769 ^c 3	(57/2+)	16270 ^{&} 3	(63/2-)	19946 ^a 3	(71/2-)
14425 ^a 3	(59/2-)	16756 ^d 3	(63/2+)	20908 ^e 3	(73/2-, 75/2+)
14638 ^{&} 3	(59/2-)	16777 ^e 3	(65/2-, 67/2+)	21273 ^c 4	(77/2+)
14831.9 ^d 24	(59/2+)	17718 ^c 4	(69/2+)	22215 ^a 4	(75/2-)
14905 ^c 3	(61/2+)	17905 ^a 3	(67/2-)	23381 ^c 4	(81/2+)
15010.9 ^e 24	(61/2-, 63/2+)	18729 ^e 3	(69/2-, 71/2+)	24741 ^a 4	(79/2-)
16068 ^a 3	(63/2-)	18878 ^d 3	(67/2+)		

[†] From 1996Ka43,1998KaZZ, based on previous known Jπ's and γ-ray properties based, DCO ratios, and band assignments.

[‡] from 1995Ka09, unless otherwise stated.

§ v(d_{5/2})⊗v(d_{5/2}g_{7/2})⁺².

v(d_{5/2})⊗v(d_{5/2}g_{7/2})⁺⁴ and/or v(g_{7/2})⊗v(d_{5/2}g_{7/2})⁺⁴.

@ v(h_{11/2})⊗v(d_{5/2}g_{7/2})⁺².

& (A): Band 1.

a (B): Band 2.

b (C): Band 3a.

c (D): Band 3b.

d (E): Band 4.

e (F): Band 5.

γ(¹⁰⁹Sn)

E(level)	Eγ [†]	Mult.§	E(level)	Eγ [†]	Mult.§	E(level)	Eγ [†]	Mult.§
13.1	12.8		5170.2	721 [‡] 1	(E1)	12342	1194 [‡] 1	(E2)
1239.0	1239.3 3	(E2)		910 [‡] 1		12594	1446 [‡] 1	(E2)
1256.7	1243.4 3	(E2)	5283.8	834 [‡] 1		12976.3	1179 [‡] 1	(E2)
1268.6	29 [‡] 1			1023.7 3	(E2)		1274 [‡] 1	(E2)
	1255.5 3	M2+E3	5448.7	841.0 3	(M1)	13090.9	1509 [‡] 1	(E2)
1928.8	672.0 3	(M1)	5848.0	865.1 3	(E2)	13153.3	1356 [‡] 1	(E2)
	690.1 3	(E2)	5991.0	707 [‡] 1	(E1)	13486.9	1300 [‡] 1	(E2)
2089.1	160.4 3	(M1)		821 [‡] 1	(E2)	13769	1175 [‡] 1	(E2)
	832.2 3	(E2)	6222.3	938.5 3	(E2)		1427 [‡] 1	Q
2114.3	25.2 3		6335.3	886.6 3	(E2)	14425	1449 [‡] 1	(E2)
	185.6 3	(E2)	6823.0	832 [‡] 1	(E2)	14638	1485 [‡] 1	(E2)
2349.4	1080.7 3	(E2)	7192.6	857.3 3	(E2)	14831.9	1741 [‡] 1	(E2)
3264.3	1150.0 3		7231.3	1009 [‡] 1	(E2)	14905	1136 [‡] 1	(E2)
3299.1	949.7 3	(E2)	7723.0	900 [‡] 1	(E2)	15010.9	1524 [‡] 1	(E2)
	1184.8 3	(E1)	8121.8	929.2 3	(E2)	16068	1643 [‡] 1	(E2)
3314.2	964.8 3	(E2)	8261.3	1030 [‡] 1	(E2)	16224	1319 [‡] 1	(E2)
	1199.8 3	(E1)	8725.0	1002 [‡] 1	(E2)	16270	1632 [‡] 1	(E2)
3344.3	1229.9 3		9142.9	1021 [‡] 1	(E2)	16756	1924 [‡] 1	(E2)
3472.6	158.4 3	(E1)	9328.9	790 [‡] 1		16777	1766 [‡] 1	
	173.4 3	(E1)		1207 [‡] 1		17718	1494 [‡] 1	(E2)
	208.4 3	D	9345.3	1084 [‡] 1	(E2)	17905	1837 [‡] 1	(E2)
	1358.4 3	(E2)	9864.0	1139 [‡] 1	(E2)	18729	1952 [‡] 1	
3525.7	1176.3 3		10131.9	803 [‡] 1	(E2)	18878	2122 [‡] 1	(E2)
3862.4	389.8 3	(E2)		989 [‡] 1		19395	1677 [‡] 1	(E2)
3924.6	452.0 3	(M1)	10284.9	1142 [‡] 1	(E2)	19946	2041 [‡] 1	(E2)
	580.3 3	(M1)	10507.3	1162 [‡] 1	(E2)	20908	2179 [‡] 1	
4260.1	945.9 3	(E2)	11067.9	936 [‡] 1	(E2)	21273	1878 [‡] 1	(E2)
	961.0 3	(E2)	11148.0	1284 [‡] 1	(E2)	22215	2269 [‡] 1	(E2)
4449.4	1135 [‡] 1	(E2)	11581.9	1297 [‡] 1	(E2)	23381	2108 [‡] 1	(E2)
4607.7	1135.1 3	(E2)	11702.3	1195 [‡] 1	(E2)	24741	2526 [‡] # 1	(E2)
4982.9	1120.5 3	(E2)	11797.3	1290 [‡] 1	(E2)			
5128.5	1203.9 3	(E2)	12186.9	1119 [‡] 1	(E2)			

[†] from 1995Ka09; ΔEγ estimated by evaluators.

[‡] from 1996Ka43; ΔEγ estimated by evaluators.

§ From DCO ratios in 1996Ka43, but values were not given by the authors.

Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Q(β⁻)=-8536 7; S(n)=11877 8; S(p)=1470 8; Q(α)=965 12 2012Wa38.

¹⁰⁹Sb Levels

Cross Reference (XREF) Flags

A ¹⁰⁹Te ε Decay
B ¹¹³I α Decay
C ⁵⁴Fe(⁵⁸Ni,3pγ)

E(level) [†]	Jπ [‡]	XREF	T _{1/2}	Comments
0.0 ^d	(5/2 ⁺)	ABC	17.2 s 5	%ε+%β ⁺ =100. Jπ: from analogy to ¹¹¹ Sb, ¹¹³ Sb. T _{1/2} : using Limitation of Relative Statistical Weight method and values of 18.3 s 5 (using 925.4γ(t) in 1976Ox01), 16.67 s 15 (γ(t) in 1982Jo03), and 17.3 s 5 (using 545γ(t) and 925γ(t) in 2002Re14). configuration: πd _{5/2} .
402.0 4	(1/2 ⁺)	A		Jπ: from systematics of similar states in odd-A Sb isotopes; in agreement with shell model calculations (2002Re28). configuration: πd _{5/2} ⊗2 ⁺ multiplet.
752.3 4	(3/2 ⁺)	A		Jπ: 752.3γ to (5/2 ⁺); in agreement with shell model calculations (2002Re28). configuration: πd _{5/2} ⊗2 ⁺ multiplet.
832.21 ^e 21	(7/2 ⁺)	A C		Jπ: 832.2γ D+Q to (5/2 ⁺), systematics of similar states in odd-A Sb isotopes. configuration: πg _{7/2} , possibly with πd _{5/2} ⊗2 ⁺ admixtures.
1100.76 ^d 21	(9/2 ⁺)	A C		Jπ: 1100.7γ E2 to (5/2 ⁺), band assignment. configuration: πd _{5/2} ⊗2 ⁺ multiplet.
1330.8 4	(3/2, 5/2, 7/2)	A		Jπ: 1330.8γ to (5/2 ⁺); direct population in in ¹⁰⁹ Te ec decay (Jπ=5/2 ⁺).
1341.04 ^e 21	(9/2 ⁺)	C		Jπ: 1341.1γ (E2) to (5/2 ⁺); band assignment.
1500.9 ^g 4	(11/2 ⁻)	C		Jπ: 400.2γ E1 to (9/2 ⁺), band assignment.
1591.8 6	(3/2, 5/2 ⁺)	A		Jπ: 1189.8γ to (1/2 ⁺); direct population in in ¹⁰⁹ Te ec decay (Jπ=5/2 ⁺).
1619.5? 4	(3/2, 5/2, 7/2)	A		Jπ: 1619.5γ to (5/2 ⁺); direct population in in ¹⁰⁹ Te ec decay (Jπ=5/2 ⁺).
1837.4 4	(3/2, 5/2 ⁺)	A		Jπ: 1435.4γ to (1/2 ⁺); direct population in in ¹⁰⁹ Te ec decay (Jπ=5/2 ⁺).
1854.66 ^e 23	(11/2 ⁺)	C		Jπ: 513.4γ M1+E2 to (9/2 ⁺), band assignment.
1969.1 5		A		
2019?		A		
2045.5? 4		A		
2092.1 ^d 3	(13/2 ⁺)	C		Jπ: 991.4γ E2 to (9/2 ⁺), band assignment.
2106.3 5		A		
2193.89 ^e 25	(13/2 ⁺)	C		Jπ: 852.9γ E2 to (9/2 ⁺), 339.1γ M1+E2 to (11/2 ⁺), band assignment.
2271.6 ^e 3	(15/2 ⁺)	C		Jπ: 179.5γ M1 to (13/2 ⁺), 416.7γ (E2) to (11/2 ⁺); band assignment.
2580.6 ^g 4	(15/2 ⁻)	C		Jπ: 1079.7γ E2 to (11/2 ⁻); band assignment.
2650.5 ^e 4	(17/2 ⁺)	C		Jπ: 379.1γ M1(+E2) to (15/2 ⁺), band assignment.
2820.9 ^b 7	(17/2 ⁺)	C		Jπ: 241γ to (15/2 ⁻), 549γ to (15/2 ⁺); band assignment.
2826.7 8	(17/2 ⁻)	C		Jπ: 1417γ from (21/2 ⁻), 176γ to (17/2 ⁺).
3214.7 ^b 7	(19/2 ⁺)	C		Jπ: 394γ to (17/2 ⁺); band assignment.
3300.9 ^d 4	(17/2 ⁺)	C		Jπ: 1029.4γ to (15/2 ⁺), 1208.8γ to (13/2 ⁺); band assignment.
3377.4 4	(19/2 ⁺)	C		Jπ: 1105.6γ (E2) to (15/2 ⁺).
3487.9 ^g 4	(19/2 ⁻)	C		Jπ: 907.4γ E2 to (15/2 ⁻), 837.3γ D to (17/2 ⁺); band assignment.
3534.7 ^b 7	(21/2 ⁺)	C		Jπ: 320.1γ M1(+E2) to (19/2 ⁺); band assignment.
3589.3 9	(19/2 ⁻)	C		Jπ: 1009γ to (15/2 ⁻).
3750.4 ^f 4	(21/2 ⁻)	C		Jπ: 262.5γ M1+E2 to (19/2 ⁻), 371.1γ E1 to (19/2 ⁺), band assignment.
3761.7 4	(21/2 ⁺)	C		Jπ: 1111.3γ (E2) to (17/2 ⁺), 384.1γ to (19/2 ⁺).
3805.3 9	(19/2 ⁻)	C		Jπ: 1224γ to (15/2 ⁻).
3873.6 ^b 7	(23/2 ⁺)	C		Jπ: 338.9γ (M1+E2) to (21/2 ⁺), 658.8γ to (19/2 ⁺); band assignment.
3930.3 ^f 4	(23/2 ⁻)	C	84 ps 7	Jπ: 179.9γ (M1) to (21/2 ⁻); band assignment. T _{1/2} : from Recoil Distance method (1994Is01).
4067.5 5	(19/2 ⁻)	C		Jπ: 176.3γ from (21/2 ⁻).
4234.0 ^b 8	(25/2 ⁺)	C		Jπ: 360.5γ M1(+E2) to (23/2 ⁺), 699.4γ to (21/2 ⁺); band assignment.
4243.8 4	(21/2 ⁻)	C		Jπ: 756.0γ (M1+E2) to (19/2 ⁻).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

¹⁰⁹Sb Levels (continued)

E(level) [†]	Jπ [‡]	XREF	T _{1/2}	Comments
4245.4 4	(21/2-)	C		Jπ: 757.4γ (M1+E2) to (19/2-).
4456.0 7	(23/2-)	C		Jπ: 968γ to (19/2-), 706γ to (21/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation.
4484.2 ^f 5	(25/2-)	C		Jπ: 554.0γ (M1+E2) to (23/2-); band assignment.
4487.0 ^c 5	(23/2-)	C		Jπ: 241.5γ and 243.4γ M1(+E2) to (21/2-); band assignment.
4600.8 12	(27/2-)	C		Jπ: 2030γ from (31/2-); proposed by 1996Sc29 in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
4626.4 ^b 8	(27/2+)	C		Jπ: 392.4γ M1(+E2) to (25/2+), 752.6γ to (23/2+); band assignment.
4684.1 9	(23/2-)	C		Jπ: 878γ to (19/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
4805.8 ^c 5	(25/2-)	C		Jπ: 318.4γ M1(+E2) to (23/2-).
4959.5 7	(25/2-)	C		Jπ: 275γ to (23/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
4980.4 ^f 5	(27/2-)	C		Jπ: 1050.0γ E2 to (23/2-), 496.3γ to (25/2-); band assignment.
5043.4 ^b 8	(29/2+)	C		Jπ: 416.9γ (M1+E2) to (27/2+), 809.4γ to (25/2+); band assignment.
5165.2 ^c 5	(27/2-)	C		Jπ: 359.1γ M1(+E2) to (25/2-), 678.5γ to (23/2-); band assignment.
5189.7 9	(27/2-)	C		Jπ: 384γ to (25/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
5487.9 8	(31/2+)	C		Jπ: 444.5γ to (29/2+), 862γ to (27/2+); proposed by 1996Sc29 in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
5488.1 ^f 5	(29/2-)	C		Jπ: 1003.8γ (E2) to (25/2-), 508γ to (27/2-); band assignment.
5505.4 ^b 10	(31/2+)	C		Jπ: 462γ to (29/2+), 879γ to (27/2+); band assignment.
5561.7 9	(27/2-)	C		Jπ: 756γ to (25/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
5568.9 ^c 5	(29/2-)	C		Jπ: 403.6γ (M1+E2) to (27/2-), 763γ to (25/2-); band assignment.
5716.8 12		C		
5798.8 12		C		
5824.0 ^f 5	(31/2-)	C		Jπ: 843.7γ to (27/2-); band assignment.
5892.6 7	(29/2-)	C		Jπ: 331γ to (27/2-), 933γ to (25/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
5976.1 9	(31/2-)	C		Jπ: 407γ to (29/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
5983.4 ^b 11	(33/2+)	C		Jπ: 478γ to (31/2+), 940γ to (29/2+); band assignment.
5985.2 8	(33/2+)	C		Jπ: 497γ to (31/2+), 942γ to (29/2+); proposed by 1996Sc29 in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
5997.1 ^c 5	(31/2-)	C		Jπ: 428.2γ (M1+E2) to (29/2-), 832.1γ to (27/2-); band assignment.
6157.3 9	(31/2-)	C		Jπ: 1177γ to (27/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
6335.6 ^f 5	(33/2-)	C		Jπ: 511.6γ to (31/2-); band assignment.
6451.6 ^c 6	(33/2-)	C		Jπ: 454.4γ to (31/2-), 882.4γ to (29/2-); band assignment.
6508.4 ^b 12	(35/2+)	C		Jπ: 525γ to (33/2+), 1003γ to (31/2+); band assignment.
6511.1 9	(35/2+)	C		Jπ: 526γ to (33/2+), 1023γ to (31/2+); proposed by 1996Sc29 in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
6570.2 13		C		
6630.9 7	(31/2-)	C		Jπ: 738γ to (29/2-), 2030γ to (27/2-); from 1996Sc29 and 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
6668.1 ^f 10	(35/2-)	C		Jπ: 844γ to (31/2-); band assignment.
6840.2 14	(31/2-)	C		Jπ: proposed by 1996Sc29 in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
6844.2 10	(31/2-)	C		Jπ: proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ).
6915.3 ^c 6	(35/2-)	C		Jπ: 463.3γ to (33/2-), 918.6γ to (31/2-); band assignment.
6949.2 13		C		
7041.4 ^b 13	(37/2+)	C		Jπ: 533γ to (35/2+), 1058γ to (33/2+); band assignment.
7349.6 ^f 12	(37/2-)	C		Jπ: 1014γ to (33/2-); band assignment.
7437.3 [‡] 7	(35/2-)	C		Jπ: 806γ to (31/2-); band assignment.
7465.3 14	(35/2-)	C		Jπ: 1308γ to (31/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
7482.5 ^c 9	(37/2-)	C		Jπ: 567γ to (35/2-), 1031γ to (33/2-); band assignment.
7606.2 10	(35/2-)	C		Jπ: 762γ to (31/2-); proposed by 1998LaZU in ⁵⁴ Fe(⁵⁸ Ni,3pγ) based on angular correlation data.
7683.8 ^c 10	(39/2-)	C		Jπ: 1015.7γ to (35/2-); band assignment.
8228.2 [‡] 10	(39/2-)	C	449 fs +6I-49	Jπ: 791γ to (35/2-); band assignment.
9089.2 [‡] 15	(43/2-)	C	283 fs +32-23	Jπ: 861γ to (39/2-); band assignment.
9089.2+x [#]	(43/2+)	C		Jπ: band assignment.
10058.0+x [#] 10	(47/2+)	C		Jπ: 968γ to (43/2+); band assignment.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

109Sb Levels (continued)

E(level) [†]	Jπ [‡]	XREF	T _{1/2}	Comments
10066.2§ 18	(47/2-)	C	175 fs +22-19	Jπ: 977γ to (43/2-); band assignment.
10066.2+wa	(49/2-)	C		Jπ: band assignment.
10066.2+y@	(49/2+)	C		Jπ: band assignment.
11093.0+x# 15	(51/2+)	C		Jπ: 1035γ to (47/2+); band assignment.
11159.2§ 20	(51/2-)	C	103 fs 10	Jπ: 1093γ to (47/2-); band assignment.
11169.0+y@ 10	(53/2+)	C		Jπ: 1102γ to (49/2+); band assignment.
11350.0+wa 10	(53/2-)	C		Jπ: 1283γ to (49/2-); band assignment.
12216.0+x# 18	(55/2+)	C		Jπ: 1123γ to (51/2+); band assignment.
12362.3§ 23	(55/2-)	C	74 fs +8-10	Jπ: 1203γ to (51/2-); band assignment.
12362.3+z&	(59/2+)	C		Jπ: band assignment.
12394.0+y@ 15	(57/2+)	C		Jπ: 1225γ to (53/2+); band assignment.
12879.0+wa 15	(57/2-)	C		Jπ: 1529γ to (53/2-); band assignment.
13439.0+x# 20	(59/2+)	C		Jπ: 1223γ to (55/2+); band assignment.
13688.3§ 25	(59/2-)	C	43 fs +4-6	Jπ: 1326γ to (55/2-); band assignment.
13704.0+z& 10	(63/2+)	C		Jπ: 1341γ to (59/2+); band assignment.
13708.0+y@ 18	(61/2+)	C		Jπ: 1314γ to (57/2+); band assignment.
14640.0+wa 18	(61/2-)	C		Jπ: 1761γ to (57/2-); band assignment.
14781.0+x# 23	(63/2+)	C		Jπ: 1342γ to (59/2+); band assignment.
15114.0+y@ 20	(65/2+)	C		Jπ: 1406γ to (61/2+); band assignment.
15164§ 3	(63/2-)	C	35 fs 6	Jπ: 1476γ to (59/2-); band assignment.
15233.0+z& 15	(67/2+)	C		Jπ: 1529γ to (63/2+); band assignment.
16284.0+x# 25	(67/2+)	C		Jπ: 1503γ to (63/2+); band assignment.
16577.1+wa 20	(65/2-)	C		Jπ: 1937γ to (61/2-); band assignment.
16624.0+y@ 23	(69/2+)	C		Jπ: 1510γ to (65/2+); band assignment.
16812§ 3	(67/2-)	C	21 fs 5	Jπ: 1648γ to (63/2-); band assignment.
16957.0+z& 18	(71/2+)	C		Jπ: 1724γ to (67/2+); band assignment.
17962+x# 3	(71/2+)	C		Jπ: 1678γ to (67/2+); band assignment.
18273.1+y@ 25	(73/2+)	C		Jπ: 1649γ to (69/2+); band assignment.
18637.1+wa 23	(69/2-)	C		Jπ: 2060γ to (65/2-); band assignment.
18661§ 3	(71/2-)	C	20 fs 5	Jπ: 1849γ to (67/2-); band assignment.
18886.1+z& 20	(75/2+)	C		Jπ: 1929γ to (71/2+); band assignment.
19842+x# 3	(75/2+)	C		Jπ: 1880γ to (71/2+); band assignment.
20124+y@ 3	(77/2+)	C		Jπ: 1851γ to (73/2+); band assignment.
20758§ 4	(75/2-)	C	13 fs +4-3	Jπ: 2097γ to (71/2-); band assignment.
21044.1+z& 23	(79/2+)	C		Jπ: 2158γ to (75/2+); band assignment.
21958+x# 3	(79/2+)	C		Jπ: 2116γ to (75/2+); band assignment.
22242+y@ 3	(81/2+)	C		Jπ: 2118γ to (77/2+); band assignment.
23143§ 4	(75/2-)	C		Jπ: 2385γ to (71/2-); band assignment.
23504.1+z& 25	(83/2+)	C		Jπ: 2460γ to (79/2+); band assignment.
24374+x# 4	(83/2+)	C		Jπ: 2416γ to (79/2+); band assignment.
24662+y@ 3	(85/2+)	C		Jπ: 2420γ to (81/2+); band assignment.
25880§ 4	(83/2-)	C		Jπ: 2737γ to (79/2-); band assignment.
26314+z& 3	(87/2+)	C		Jπ: 2810γ to (83/2+); band assignment.
27196+x# 4	(87/2+)	C		Jπ: 2822γ to (83/2+); band assignment.
27394+y@ 4	(89/2+)	C		Jπ: 2732γ to (85/2+); band assignment.

[†] From a least-squares fit to E_γ.

[‡] From deduced γ-ray multipolarities, decay pattern and apparent band structures.

§ (A): Band 1; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²], at high spin π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²]⊗v[(h_{11/2})²(d_{5/2}g_{7/2})⁶]; Terminating state Jπ=(83/2-).

(B): Band 2, α=-1/2; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²]⊗v[(h_{11/2})⁺³(g_{7/2}d_{5/2})⁺⁵].

@ (C): Band 3, α=+1/2; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²]⊗v[(h_{11/2})⁺³(g_{7/2}d_{5/2})⁺⁵].

& (D): Band 4; Configuration=π[(h_{11/2})⁺²(d_{5/2}g_{7/2})⁺¹(g_{9/2})⁻²]⊗v[(h_{11/2})⁺²(d_{5/2}g_{7/2})⁺⁶]; Terminating state Jπ=(87/2+).

a (E): Band 5; Configuration=π[(h_{11/2})⁺¹(d_{5/2}g_{7/2})⁺¹(g_{9/2})⁻¹]⊗v[(h_{11/2})⁺²(g_{7/2}d_{5/2})⁺⁶].

b (F): Band 6; Configuration=π[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻¹].

c (G): Band 7; Configuration=π[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻¹]⊗Jπ⁻, where Jπ⁻=5- or 7- are the two-neutron states of the ¹⁰⁸Sn core.

d (H): Band 8; Configuration=πd_{5/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

e (I): Band 9; Configuration=πg_{7/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

f (J): Band 10.

g (K): Band 11; Configuration=πh_{11/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

Adopted Levels, Gammas (continued)

$\gamma(^{109}\text{Sb})$						
E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [§]	$\delta^{\S\#}$	α	Comments
402.0	402.0 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$				
752.3	752.3 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$				
832.21	832.2 3	100	D+Q	≈ -0.1		Mult.: $a_2/a_0 = -0.34$ 5, $a_4/a_0 = 0.02$ 9 (1994Is01), both for 832.1 γ and 832.2 γ .
1100.76	268.6 3	3 1	(M1)		0.0417	Mult.: $a_2/a_0 = -0.19$ 8, $a_4/a_0 = 0.15$ 12 (1994Is01).
	1100.7 3	100	E2		1.11×10^{-3}	Mult.: $a_2/a_0 = 0.27$ 2, $a_4/a_0 = -0.08$ 4 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
1330.8	1330.8 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$				
1341.04	508.6 3	21 7				
	1341.1 3	100 31	(E2)		7.67×10^{-4}	Mult.: $a_2/a_0 = 0.25$ 8, $a_4/a_0 = -0.20$ 12 (1994Is01).
1500.9	400.2 3	100	E1		0.00431	Mult.: $a_2/a_0 = -0.22$ 3, $a_4/a_0 = +0.05$ 7 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
1591.8	1189.8 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$				
	1592 $\frac{3}{2}^+$ @	≤ 91 $\frac{3}{2}^+$				
1619.5?	1619.5 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$				
1837.4	1085.0 $\frac{3}{2}^+$ 4	≤ 67 $\frac{3}{2}^+$				
	1435.4 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$ 60				
1854.66	513.4 3	100 33	M1+E2	$\approx +0.28$	≈ 0.00803	Mult.: $a_2/a_0 = 0.15$ 3, $a_4/a_0 = +0.04$ 7 (1994Is01), Magnetic Multipole (from Polarization anisotropy 1994Is01).
	753.6 3	27 13				
	1022.6 3	33 13				
1969.1	1136.9 $\frac{3}{2}^+$ 4	100 $\frac{3}{2}^+$ 24				
	1969 $\frac{3}{2}^+$ @	≤ 48 $\frac{3}{2}^+$				
2019?	918 $\frac{3}{2}^+$ @	≤ 100 $\frac{3}{2}^+$				
	1186 $\frac{3}{2}^+$ @	100 $\frac{3}{2}^+$ 30				
2045.5?	2045.5 $\frac{3}{2}^+$ @ 4	100 $\frac{3}{2}^+$				
2092.1	237 $\frac{3}{2}^+$ @					
	991.4 3	100	E2		1.39×10^{-3}	Mult.: $a_2/a_0 = 0.29$ 3, $a_4/a_0 = -0.10$ 7 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
2106.3	1274.1 $\frac{3}{2}^+$ @ 4	100 $\frac{3}{2}^+$				
2193.89	339.1 3	100 30	M1+E2	$\approx +0.1$	≈ 0.0228	Mult.: $a_2/a_0 = -0.10$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01), both for 338.9 γ and 339.1 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
	852.9 3	100 10	E2		0.00196	Mult.: $a_2/a_0 = 0.26$ 5, $a_4/a_0 = -0.02$ 9 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
	1093.3 3	80 15	(E2)		1.12×10^{-3}	Mult.: $a_2/a_0 = 0.11$ 8, $a_4/a_0 = -0.01$ 12 (1994Is01).
2271.6	77.8 3	90 25	(M1)		1.267 23	Mult.: $a_2/a_0 = -0.21$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01).
	179.5 3	100 30	(M1)		0.1219	Mult.: $a_2/a_0 = -0.27$ 3, $a_4/a_0 = -0.02$ 7 (1994Is01) both for 179.5 γ and 179.9 γ .
	416.7 3	20 5	(E2)		0.01322	Mult.: $a_2/a_0 = -0.12$ 3, $a_4/a_0 = 0.07$ 7 (1994Is01) both for 416.7 γ and 416.9 γ .
2580.6	488.6 3	9 4				
	1079.7 3	100 7	E2		1.15×10^{-3}	Mult.: $a_2/a_0 = 0.29$ 2, $a_4/a_0 = -0.06$ 4 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
2650.5	379.1 3	100	M1 (+E2)	≈ -0.1	≈ 0.01719	Mult.: $a_2/a_0 = -0.29$ 3, $a_4/a_0 = 0.04$ 4 (1994Is01), Magnetic Multipole (from Polarization anisotropy 1994Is01).
2820.9	241 1					
	549 1					
2826.7	176 1	100				
3214.7	394 1					
	564 1					
3300.9	1029.4 3	33 17				
	1208.8 3	100				
3377.4	727.1 3	7 3				
	1105.6 3	100 10	(E2)		1.10×10^{-3}	Mult.: $a_2/a_0 = 0.30$ 3, $a_4/a_0 = -0.21$ 7 (1994Is01).
3487.9	187.0 3	15.4 26				

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sb})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ^{\$}	$\delta^{\S\#}$	α	Comments
3487.9	837.3 3 907.4 3	18 5 100 21	(E1) E2		1.70×10^{-3}	Mult.: $a_2/a_0 = -0.18$ 8, $a_4/a_0 = +0.16$ 12 (1994Is01). Mult.: $a_2/a_0 = 0.31$ 5, $a_4/a_0 = -0.16$ 9 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
3534.7	320.1 3		M1 (+E2)	$\approx +0.1$	≈ 0.0265	Mult.: $a_2/a_0 = -0.10$ 3, $a_4/a_0 = 0.07$ 7 (1994Is01), both for 318.4 γ and 320.1 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
3589.3	714 1 1009 1	100				
3750.4	262.5 3	100 6	M1+E2	≈ -0.1	≈ 0.0444	Mult.: $a_2/a_0 = -0.35$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01), Magnetic Multipole (from Polarization anisotropy 1994Is01).
	373.1 3	55 6	E1		0.00513	Mult.: $a_2/a_0 = -0.21$ 3, $a_4/a_0 = 0.03$ 7 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
	1100@					
3761.7	384.1 3 1111.3 3	17 17 100 50	(E2)		1.09×10^{-3}	Mult.: $a_2/a_0 = 0.25$ 8, $a_4/a_0 = -0.25$ 12 (1994Is01).
3805.3	1224 1	100				
3873.6	338.9 3	100 31	(M1+E2)	$\approx +0.1$	≈ 0.0229	Mult.: $a_2/a_0 = -0.10$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01), both for 338.9 γ and 339.1 γ .
	658.8 3	19 6				
3930.3	168.6 3 179.9 3	9.1 22 100 30	[E1] (M1)		0.0433 0.1212	B(E1)(W.u.) = 5.5×10^{-5} 21. Mult.: $a_2/a_0 = -0.27$ 3, $a_4/a_0 = 0.02$ 7 (1994Is01), for both 179.5 γ and 179.9 γ , mixed Multipole (from Polarization anisotropy 1994Is01).
						B(M1)(W.u.) = 0.037 16.
4234.0	360.5 3	100 30	M1 (+E2)	$\approx +0.1$	≈ 0.0195	Mult.: $a_2/a_0 = -0.10$ 3, $a_4/a_0 = 0.06$ 7 (1994Is01), both for 359.1- and 360.5 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
	699.4 3 176.3 3	29 12 29 14				
4243.8	756.0 3	100 43	(M1+E2)	≈ -0.1	≈ 0.00321	Mult.: $a_2/a_0 = -0.42$ 5, $a_4/a_0 = 0.04$ 9 (1994Is01) both for 756.0 γ and 757.4 γ .
	1417 1					
4245.4	757.4 3	100	(M1+E2)		0.00320	Mult.: $a_2/a_0 = -0.42$ 5, $a_4/a_0 = 0.04$ 9 (1994Is01) for both 756.0 γ and 757.4 γ .
4456.0	706 1 968 1					
4484.2	554.0 3	100	(M1+E2)	≈ -0.1	≈ 0.00672	Mult.: $a_2/a_0 = -0.42$ 5, $a_4/a_0 = 0.04$ 9 (1994Is01), mixed Multipole (from Polarization anisotropy 1994Is01).
4487.0	241.5 3	75 13	M1 (+E2)	$\approx +0.1$	≈ 0.0553	Mult.: $a_2/a_0 = -0.07$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01), for both 241.5 γ and 243.3 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
	243.3 3	100 13	M1 (+E2)	$\approx +0.1$	≈ 0.0542	Mult.: $a_2/a_0 = -0.07$ 3, $a_4/a_0 = 0.04$ 7 (1994Is01), for both 241.5 γ and 243.3 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
4626.4	392.4 3	100 20	M1 (+E2)	$\approx +0.1$	≈ 0.01576	Mult.: $a_2/a_0 = -0.14$ 5, $a_4/a_0 = 0.14$ 9 (1994Is01), Magnetic Multipole (from Polarization anisotropy 1994Is01).
	752.6 3 878 1	27 13				
4684.1	1095 1					
4805.8	318.4 3	100	M1 (+E2)	$\approx +0.1$	≈ 0.0268	Mult.: $a_2/a_0 = -0.10$ 3, $a_4/a_0 = 0.07$ 7 (1994Is01), for both 318.4- and 320.1 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
	275 1 504 1					
4959.5	1029 1					
4980.4	496.3 3	4 4				

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sb})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ^{\$}	$\delta^{\S\#}$	α	Comments
4980.4	1050.0 3	100 15	E2		1.23×10^{-3}	Mult.: $a_2/a_0=0.35$ 3, $a_4/a_0=-0.18$ 7 (1994Is01), Electric Multipole (from Polarization anisotropy 1994Is01).
5043.4	416.9 3	100 30	(M1+E2)	$\approx +0.1$	≈ 0.01354	Mult.: $a_2/a_0=-0.12$ 3, $a_4/a_0=0.07$ 7 (1994Is01) for both 416.7 γ and 416.9 γ .
	809.4 3	50 20				
5165.2	359.1 3	100 29	M1 (+E2)	$\approx +0.1$	≈ 0.0197	Mult.: $a_2/a_0=-0.10$ 3, $a_4/a_0=0.06$ 7 (1994Is01), for both 359.1 γ and 360.5 γ , Magnetic Multipole (from Polarization anisotropy 1994Is01).
	678.5 3	18 6				
5189.7	384 1	100				
5487.9	444.5 3	100				
	862 1					
5488.1	508 1					
	1003.8 3	100	(E2)		1.35×10^{-3}	Mult.: $a_2/a_0=0.28$ 8, $a_4/a_0=0.12$ 12 (1994Is01).
5505.4	462 1					
	879 1					
5561.7	756 1	100				
5568.9	403.6 3	100 17	(M1+E2)	$\approx +0.1$	≈ 0.01468	Mult.: $a_2/a_0=-0.08$ 5, $a_4/a_0=-0.01$ 9 (1994Is01).
	763.0 3	42 17				
5824.0	843.7 3	100				
5892.6	331 1					
	703 1					
	912 1					
	933 1					
5976.1	407 1	100				
5983.4	478 1					
	940 1					
5985.2	497 1					
	942 1					
5997.1	428.2 3	100 29	(M1+E2)	$\approx +0.1$	≈ 0.01266	Mult.: $a_2/a_0=-0.05$ 5, $a_4/a_0=0.03$ 9 (1994Is01).
	832.1 3	57 29				
6157.3	1177 1	100				
6335.6	511.6 3	80 40				
	847.5 3	100 40				
6451.6	454.4 3	100 40				
	882.4 3	60 20				
6508.4	525 1					
	1003 1					
6511.1	526 1					
	1023 1					
6630.9	738 1					
	832 1					
	914 1					
	1143 1					
	1650 1					
	2030 1					
6668.1	844 1	100				
6915.3	463.3 3	100 33				
	918.6 3	100 33				
7041.4	533 1					
	1058 1					
7349.6	1014 1	100				
7437.3	488 1					
	593 1					
	806 1					
	867 1					
	1280 1					
	1440 1					
	1461 1					
	1614 1					
7465.3	1308 1	100				
7482.5	567 1					

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Sb})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult.§	α	Comments
7482.5	1031 1				
7606.2	762 1				
	766 1				
	938 1				
7683.8	1015.7 3	100			
8228.2	622 1				
	791 1	100	[E2]	0.00234	B(E2)(W.u.)=131 +16-15.
9089.2	861 1	100	[E2]	0.00192	B(E2)(W.u.)=136 +12-13.
10058.0+x	968 1	100			
10066.2	977 1	100	[E2]	1.44×10^{-3}	B(E2)(W.u.)=117 +15-13.
11093.0+x	1035 1	100			
11159.2	1093 1	100	[E2]	1.12×10^{-3}	B(E2)(W.u.)=114 11.
11169.0+y	1102 1	100			
11350.0+w	1283 1	100			
12216.0+x	1123 1	100			
12362.3	1203 1	100	[E2]	9.25×10^{-4}	B(E2)(W.u.)=98 +15-10.
12394.0+y	1225 1	100			
12879.0+w	1529 1	100			
13439.0+x	1223 1	100			
13688.3	1326 1	100	[E2]	7.80×10^{-4}	B(E2)(W.u.)=104 +15-10.
13704.0+z	1341 1	100			
13708.0+y	1314 1	100			
14640.0+w	1761 1	100			
14781.0+x	1342 1	100			
15114.0+y	1406 1	100			
15164	1476 1	100	[E2]	6.79×10^{-4}	B(E2)(W.u.)=75 13.
15233.0+z	1529 1	100			
16284.0+x	1503 1	100			
16577.1+w	1937 1	100			
16624.0+y	1510 1	100			
16812	1648 1	100	[E2]	6.28×10^{-4}	B(E2)(W.u.)=72 17.
16957.0+z	1724 1	100			
17962+x	1678 1	100			
18273.1+y	1649 1	100			
18637.1+w	2060 1	100			
18661	1849 1	100	[E2]	6.22×10^{-4}	B(E2)(W.u.)=42 11.
18886.1+z	1929 1	100			
19842+x	1880 1	100			
20124+y	1851 1	100			
20758	2097 1	100	[E2]	6.59×10^{-4}	B(E2)(W.u.)=35 +10-8.
21044.1+z	2158 1	100			
21958+x	2116 1	100			
22242+y	2118 1	100			
23143	2385 1	100			
23504.1+z	2460 1	100			
24374+x	2416 1	100			
24662+y	2420 1	100			
25880	2737 1	100			
26314+z	2810 1	100			
27196+x	2822 1	100			
27394+y	2732 1	100			

† From $^{54}\text{Fe}(^{58}\text{Ni}, 3p\gamma)$, unless otherwise stated.‡ From ^{109}Te ϵ decay.§ From $^{54}\text{Fe}(^{58}\text{Ni}, 3p\gamma)$, based on $\gamma(\theta)$, γ -linear polarization (1994Is01) and the apparent band structures.# If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

Adopted Levels, Gammas (continued)

(E) band 5;

(F) band 6;

(G) band 7;

(H) band 8;

 $^{109}_{51}\text{Sb}_{58}$

Adopted Levels, Gammas (continued)

(I) band 9;

(J) band 10

(K) band 11;

 $^{109}_{51}\text{Sb}_{58}$

¹⁰⁹Te ε Decay 2002Re28

Parent ¹⁰⁹Te: E=0.0; Jπ=(5/2+); T_{1/2}=4.4 s 2; Q(g.s.)=8536 7; %ε+%β⁺ decay=96.1 13.

¹⁰⁹Te-Q(ε): From 2012Wa38.

2002Re28: ¹⁰⁹Te was produced using E(⁵⁸Ni)=230 MeV and 260 MeV beams on a ⁵⁴Fe (617 μg/cm²) target at Argonne National Laboratory. Fragment Mass Analyzer. Detectors: 3 large volume HPGe and Moving Tape Collector. Measured: Eγ, Iγ, γγ, and γ(t).

¹⁰⁹Sb Levels

E(level) [†]	Jπ [‡]	T _{1/2} [‡]	E(level) [†]	Jπ [‡]
0.0	(5/2+)	17.2 s 5	1619.5? 4	(3/2, 5/2, 7/2)
402.0 4	(1/2+)		1837.4 4	(3/2, 5/2+)
752.3 4	(3/2+)		1968.8 6	
831.9 4	(7/2+)		2019?	
1100.7 4	(9/2+)		2045.5? 4	
1330.8 4	(3/2, 5/2, 7/2)		2106.0? 6	
1591.8 6	(3/2, 5/2+)			

[†] From a least-squares fit to γ-ray energies.

[‡] From Adopted Levels.

γ(¹⁰⁹Sb)

Iγ normalization: Decay scheme is incomplete (pandemonium) and tentative, thus it was not normalized and no log ft values and Iβ were deduced.

Eγ [‡]	E(level)	Iγ [‡]	Eγ [‡]	E(level)	Iγ [‡]	Eγ [‡]	E(level)	Iγ [‡]
268.6 4	1100.7	≤10	1085.0 4	1837.4	≤10	1435.4 4	1837.4	15 9
402.0 4	402.0	50 3	x1101.1 [‡] §			x1447.1 [‡] §		
752.3 4	752.3	100	1101.0 4	1100.7	30 4	1592 [§]	1591.8	≤10
x760 [†]			1136.9 4	1968.8	21 5	1619.5 4	1619.5?	10 1
x796 [†]			1186 [§]	2019?	10 3	x1621 [†]		
831.6 4	831.9	79 5	1189.8 4	1591.8	11 4	1969 [§]	1968.8	≤10
918 [§]	2019?	≤10	x1255.1 [‡] §			2045.5 [§] 4	2045.5?	7 1
x959 [†]			1274.1 [§] 4	2106.0?	27 11			
x964 [†]			1330.8 4	1330.8	32 4			

[†] In coincidence with some of the placed transitions (2002Re28).

[‡] From 2002Re28.

§ Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.

Decay Scheme

Intensities: relative Iγ

¹¹³I α Decay 1981Sc17,1977Ki11

Parent ¹¹³I: E=0.0; Jπ=(5/2+); T_{1/2}=6.6 s 2; Q(g.s.)=2707 10; %α decay=3.31×10⁻⁵.

¹¹³I-α decay: Estimate from α decay transmission calculations in 1981Sc17.

1981Sc17: Activity ⁵⁸Ni(⁵⁸Ni,xpyn), E(⁵⁸Ni)=290 MeV, GSI online mass separator, heavy-ion accelerator UNILAC.

Measured: Eα, T_{1/2}.

¹⁰⁹Sb Levels

E(level)	Jπ	T _{1/2}	Comments
0.0	5/2+	17.2 s 5	Jπ,T _{1/2} : From Adopted Levels.

α radiations

Eα	E(level)	Iα [‡]	HF [†]	Comments
2610 40	0.0	100	≈1	Eα: From 1981Sc17.

[†] r₀(¹⁰⁹Sb)=1.57 5, taken from r₀(¹¹⁰Te), deduced by assuming HF=1.0.

⁵⁴Fe(⁵⁸Ni,3pγ) 1996Sc29,1994Is01,1998LaZU

1996Sc29: E(⁵⁸Ni)=243 MeV, 88 inch Cyclotron at the Lawrence Berkeley National Laboratory. Target: thin target consisting of two-self supporting of 500 μg/cm² (97 % isotopically enriched) and a backed target consisting of a 500 μg/cm² foil backed on 15 mg/cm² Au. Detectors: Gammasphere γ-ray spectrometer (Earlier Implementation), 24 BGO-suppressed Ge detectors. Measured: Eγ, γγ, γγγ.

1998LaZU: same as 1996Sc29.

1994Is01,1993IsZx: E(⁵⁸Ni)=225 MeV, JAERI, Japan. Target: 2.1 mg/cm² (98 % enriched) on a 10.3 mg/cm² Au backing. Detectors: 6 Ge detectors, charged particle multiplicity filter (Si Box). Measured: Eγ, Iγ, γγ, γ(θ), linear polarization.

1994Ja06: E(⁵⁸Ni)=243 MeV, TASCC facility at Chalk River Laboratory, Canada. Target: Thin, self supporting and Au-backed target. Detectors: 24 Compton-suppressed HPGe, 71 BGO. Measured: Eγ, γγ, γγγ.

1998Wa02: they used same facility as 1996Sc29, determined lifetimes using the Doppler-shift attenuation method for band 1. Deduced quadrupole moments for rotational states, in support of the phenomenon of smooth band termination. The level scheme is from 1996Sc29 and 1998LaZU, unless otherwise noted.

¹⁰⁹Sb Levels

E(level) [†]	Jπ [‡]	T _{1/2} [§]	Comments
0.0 e	5/2+		
832.2 f 4	7/2+		
1100.8 e 4	9/2+		
1341.0 f 4	9/2+		
1500.9 h 6	11/2-		
1854.7 f 4	11/2+		
2092.1 e 5	13/2+		
2193.9 f 4	13/2+		
2271.6 f 5	15/2+		
2580.6 h 6	15/2-		
2650.5 f 6	17/2+		
2820.9 8	(17/2+)		
2826.6 9	17/2-		
3214.7 8	(19/2+)		
3300.9 e 6	17/2+		
3377.4 6	19/2+		
3487.9 h 6	19/2-		
3534.8 8	(21/2+)		
3589.3 10	19/2-		
3750.4 g 6	21/2-		
3761.7 6	21/2+		
3805.3 10	19/2-		
3873.6 c 8	(23/2+)		

Continued on next page (footnotes at end of table)

$^{54}\text{Fe}(^{58}\text{Ni}, 3\text{p}\gamma)$ 1996Sc29, 1994Is01, 1998LaZU (continued) ^{109}Sb Levels (continued)

E(level) [†]	J $\pi^{\ddagger}$	T _{1/2} [§]	Comments
3930.3 g 7	23/2-	84 ps 7	T _{1/2} : from 1994Is01 by recoil distance method (RDM).
4067.5 9			
4234.1 c 8	(25/2+)		
4243.8 7	21/2-		
4245.4 7	21/2-		
4455.9 8	23/2-		
4484.2 g 7	25/2-		
4487.0 d 7	23/2-		
4600.8 13	(27/2-)		
4626.4 c 8	(27/2+)		
4684.1 9	23/2-		
4805.7 d 8	25/2-		
4959.5 8	25/2-		
4980.4 g 7	27/2-		
5043.4 c 8	(29/2+)		
5165.1 d 8	27/2-		
5189.7 10	(27/2-)		
5488.0 8	(31/2+)		
5488.1 g 9	29/2-		
5505.4 c 10	(31/2+)		
5561.7 10	(27/2-)		
5568.9 d 8	29/2-		
5716.8 13			
5798.8 13			
5823.9 g 8	31/2-		
5892.7 8	(29/2-)		
5976.0 10	(31/2-)		
5983.4 c 11	(33/2+)		
5985.2 10	(33/2+)		
5997.0 d 8	31/2-		
6157.3 10	(31/2-)		
6335.5 g 8	33/2-		
6451.5 d 8	33/2-		
6508.4 c 12	(35/2+)		
6511.1 11	(35/2+)		
6570.2 13			
6630.8 9	(31/2-)		
6668.0 g 11	35/2-		
6840.1 15	(31/2-)		
6844.2 12	(31/2-)		
6915.3 d 9	35/2-		
6949.2 13			
7041.4 c 13	(37/2+)		
7349.5 g 13	37/2-		
7437.2 # 8	(35/2-)		
7465.3 14	(35/2-)		
7482.4 d 11	37/2-		
7606.1 11	(35/2-)		
7683.7 d 12	39/2-		
8228.2 # 12	(39/2-)	449 fs +61-49	
9089.2 # 15	(43/2-)	283 fs +32-23	
9089.2+x [@]	(43/2+)		
10058.0+x [@] 10	(47/2+)		
10066.2 # 18	(47/2-)	175 fs +22-19	
10066.2+w ^b	(49/2-)		
10066.2+y ^{&}	(49/2+)		
11093.0+x [@] 15	(51/2+)		
11159.2 # 21	(51/2-)	103 fs 10	
11169.0+y ^{&} 10	(53/2+)		
11350.0+w ^b 10	(53/2-)		
12216.0+x [@] 18	(55/2+)		
12362.2 # 23	(55/2-)	74 fs +8-10	
12362.2+z ^a	(59/2+)		

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⁵⁴Fe(⁵⁸Ni,3pγ) 1996Sc29,1994Is01,1998LaZU (continued)

¹⁰⁹Sb Levels (continued)

E(level) [†]	Jπ [‡]	T _{1/2} [§]	E(level) [†]	Jπ [‡]	T _{1/2} [§]
12394.0+y& 15	(57/2+)		18637.1+w ^b 23	(69/2-)	
12879.0+w ^b 15	(57/2-)		18661# 3	(71/2-)	20 fs 5
13439.0+x@ 20	(59/2+)		18886.1+z ^a 20	(75/2+)	
13688# 3	(59/2-)	43 fs +4-6	19842+x@ 3	(75/2+)	
13704.0+z ^a 10	(63/2+)		20124+y& 3	(77/2+)	
13708.0+y& 18	(61/2+)		20758# 4	(75/2-)	13 fs +4-3
14640.0+w ^b 18	(61/2-)		21044.1+z ^a 23	(79/2+)	
14781.0+x@ 23	(63/2+)		21958+x@ 3	(79/2+)	
15114.0+y& 20	(65/2+)		22242+y& 3	(81/2+)	
15164# 3	(63/2-)	35 fs 6	23143# 4	(79/2-)	
15233.0+z ^a 15	(67/2+)		23504.1+z ^a 25	(83/2+)	
16284.0+x@ 25	(67/2+)		24374+x@ 4	(83/2+)	
16577.1+w ^b 20	(65/2-)		24662+y& 3	(85/2+)	
16624.0+y& 23	(69/2+)		25880# 4	(83/2-)	
16812# 3	(67/2-)	21 fs 5	26314+z ^a 3	(87/2+)	
16957.0+z ^a 18	(71/2+)		27196+x@ 4	(87/2+)	
17962+x@ 3	(71/2+)		27394+y& 4	(89/2+)	
18273.1+y& 25	(73/2+)				

[†] From a least-squares fit to E_γ.

[‡] From 1996Sc29, 1994Is01 and 1998LaZU, based on deduced γ-ray transition multipolarities and the observed band structures, unless otherwise stated. 1994Ja06 give different spin-parity assignments for the high-spin states.

[§] From 1998Wa02, unless otherwise noted.

(A): Band 1; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²], at high spin π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²]⊗v[(h_{11/2})²(d_{5/2}g_{7/2})⁶]; Terminating state Jπ=(83/2-).

@ (B): Band 2, α=-1/2; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²] ⊗ v[(h_{11/2})⁺³(g_{7/2}d_{5/2})⁺⁵].

& (C): Band 3, α=+1/2; Configuration=π(h_{11/2})⁺¹[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻²] ⊗ v[(h_{11/2})⁺³(g_{7/2}d_{5/2})⁺⁵].

a (D): Band 4; Configuration=π[(h_{11/2})⁺²(d_{5/2}g_{7/2})⁺¹(g_{9/2})⁻²] ⊗ v[(h_{11/2})⁺²(d_{5/2}g_{7/2})⁺⁶]; Terminating state Jπ=(87/2+).

b (E): Band 5; Configuration=π[(h_{11/2})⁺¹(d_{5/2}g_{7/2})⁺¹(g_{9/2})⁻¹] ⊗ v[(h_{11/2})⁺²(g_{7/2}d_{5/2})⁺⁶].

c (F): Band 6; Configuration=π[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻¹].

d (G): Band 7; Configuration=π[(d_{5/2}g_{7/2})⁺²(g_{9/2})⁻¹]⊗Jπ⁻, where Jπ⁻=5- or 7- are the two-neutron states of the ¹⁰⁸Sn core.

e (H): Band 8; Configuration=πd_{5/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

f (I): Band 9; Configuration=πg_{7/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

g (J): Band 10.

h (K): Band 11; Configuration=πh_{11/2}⁺¹⊗Jπ(¹⁰⁸Sn core).

γ(¹⁰⁹Sb)

Eγ [†]	E(level)	Iγ [§]	Mult.@	δ [§]	Comments
77.8 5	2271.6	18# 5	D		Mult.: a ₂ /a ₀ =-0.21 3, a ₄ /a ₀ =+0.04 7 (1994Is01).
168.6 5	3930.3	4 I			
176 I	2826.6				Eγ: 1994Is01 placed a 176.3γ from the E=4244 level.
176.3 5	4243.8	2 I			Eγ: placed by 1994Is01. 1996Sc29 placed a 176γ from the E=2827 level.
179.5& 5	2271.6	20& 6	D		Mult.: a ₂ /a ₀ =-0.27 3, a ₄ /a ₀ =-0.02 7 (1994Is01), for both 179.5γ and 179.9 γ.
179.9& 5	3930.3	44& 13	D		Mult.: a ₂ /a ₀ =-0.27 3, a ₄ /a ₀ =+0.02 7 (1994Is01) for both 179.5γ and 179.9γ, mixed Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
187.0 5	3487.9	6 I			
237 ^a	2092.1				Eγ: from 1994Ja06 only.
241 I	2820.9				
241.5 5	4487.0	12# 2	M1 (+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.07 3, a ₄ /a ₀ =+0.04 7 (1994Is01), both for 241.5γ and 243.3γ; Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
243.3 5	4487.0	16# 2	M1 (+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.07 3, a ₄ /a ₀ =+0.04 7 (1994Is01), for both 241.5γ and 243.3 γ; Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
262.5 5	3750.4	31# 2	M1 (+E2)	≈-0.1	Mult.: a ₂ /a ₀ =-0.35 3, a ₄ /a ₀ =+0.04 7 (1994Is01), Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
268.6 5	1100.8	3# 1	D		Mult.: a ₂ /a ₀ =-0.19 8, a ₄ /a ₀ =+0.15 12 (1994Is01).
275 I	4959.5				

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⁵⁴Fe(⁵⁸Ni,3pγ) 1996Sc29,1994Is01,1998LaZU (continued)

γ(¹⁰⁹Sb) (continued)

Eγ [†]	E(level)	Iγ [§]	Mult.@	δ [§]	Comments
318.4& 5	4805.7	23#& 6	M1(+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.07 7 (1994Is01), both for 318.4γ and 320.1γ; Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
320.1& 5	3534.8	17#& 5	M1(+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.07 7 (1994Is01), both for 318.4γ and 320.1γ; Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
331 [‡] 1	5892.7				
338.9& 5	3873.6	16& 5	D+Q	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.04 7 (1994Is01), for both 338.9γ and 339.1γ.
339.1& 5	2193.9	20& 6	M1+E2	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.04 7 (1994Is01), for both 338.9γ and 339.1γ, Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
359.1 ^b 5	5165.1	17 ^{#b} 5	M1(+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.06 7 (1994Is01), for both 359.1γ and 360.5γ; Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
360.5 ^b 5	4234.1	17 ^{#b} 5	M1(+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.10 3, a ₄ /a ₀ =+0.06 7 (1994Is01) both for 359.1γ and 360.5γ Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
373.1 5	3750.4	17# 2	E1		Mult.: a ₂ /a ₀ =-0.21 3, a ₄ /a ₀ =+0.03 7 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
379.1 5	2650.5	35 5	M1(+E2)	≈-0.1	Mult.: a ₂ /a ₀ =-0.29 3, a ₄ /a ₀ =+0.04 4 (1994Is01), Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
384 [‡] 1	5189.7				Eγ: 1994Is01 placed a 384.1γ from the E=3762 level.
384.1 5	3761.7	1 1			Eγ: not given by 1996Sc29, seen and placed in 1994Is01. 1998LaZU placed a 384γ from a level at E=5190, Jπ=(27/2-).
392.4 5	4626.4	15# 3	M1(+E2)	≈+0.1	Mult.: a ₂ /a ₀ =-0.14 5, a ₄ /a ₀ =+0.14 9 (1994Is01), Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
394 1	3214.7				
400.2 5	1500.9	53# 5	E1		Mult.: a ₂ /a ₀ =-0.22 3, a ₄ /a ₀ =+0.05 7 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
403.6 5	5568.9	12# 2	D+Q	≈+0.1	Mult.: a ₂ /a ₀ =-0.08 5, a ₄ /a ₀ =-0.01 9 (1994Is01).
407 [‡] 1	5976.0				
416.7& 5	2271.6	4& 1	Q		Eγ: seen and placed only in 1994Is01.
					Mult.: a ₂ /a ₀ =-0.12 3, a ₄ /a ₀ =+0.07 7 (1994Is01), for both 416.7γ and 416.9 γ.
416.9& 5	5043.4	10& 3	D+Q	≈+0.1	Mult.: a ₂ /a ₀ =-0.12 3, a ₄ /a ₀ =+0.07 7 (1994Is01), both for 416.7γ and 416.9 γ.
428.2 5	5997.0	7# 2	D+Q	≈+0.1	Mult.: a ₂ /a ₀ =-0.05 5, a ₄ /a ₀ =+0.03 9 (1994Is01).
444.5 5	5488.0	3 1			
454.4 5	6451.5	5 2			
*462.0 5		4 2			
462 1	5505.4				
463.3 5	6915.3	3 1			
478 1	5983.4				
488 1	7437.2				Eγ: 1994Is01 placed a 488.6γ from the 2580 level.
488.6 5	2580.6	4 2			
496.3 5	4980.4	1 1			
497 1	5985.2				
504 [‡] 1	4959.5				
508 1	5488.1				
508.6 5	1341.0	6 2			
511.6 5	6335.5	4# 2			
513.4 5	1854.7	15# 5	M1+E2	≈+0.28	Mult.: a ₂ /a ₀ =+0.15 3, a ₄ /a ₀ =+0.04 7 (1994Is01), Magnetic Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
525 1	6508.4				
526 1	6511.1				
533 1	7041.4				
549 1	2820.9				
554.0 5	4484.2	18# 3	D+Q	≈-0.1	Mult.: a ₂ /a ₀ =-0.42 5, a ₄ /a ₀ =+0.04 9 (1994Is01), mixed Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
564 1	3214.7				
567 1	7482.4				
593 1	7437.2				

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$^{54}\text{Fe}(^{58}\text{Ni}, 3\text{p}\gamma)$ 1996Sc29, 1994Is01, 1998LaZU (continued) $\gamma(^{109}\text{Sb})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\S}$	Mult.@	$\delta^{\S}$	Comments
622 1	8228.2				
658.8 5	3873.6	3 1			
678.5 5	5165.1	3 1			
699.4 5	4234.1	5 2			
703 $\frac{1}{2}$ 1	5892.7				
706 $\frac{1}{2}$ 1	4455.9				
714 1	3534.8				
727.1 5	3377.4	2 1			$E\gamma$: not given by 1996Sc29, seen and placed in 1994Is01 and 1994Ja06.
728 $\frac{1}{2}$ 1	5892.7				
738 1	6630.8				
752.6 5	4626.4	4 2			
753.6 5	1854.7	4 2			
756.0 ^b 5	4243.8	7 [#] b 3	D+Q	≈ -0.1	Mult.: $a_2/a_0 = -0.42$ 5, $a_4/a_0 = +0.04$ 9 (1994Is01), for both 756.0 γ and 757.4 γ .
756 $\frac{1}{2}$ 1	5561.7				
757.4 ^b 5	4245.4	7 [#] b 3	D+Q		Mult.: $a_2/a_0 = -0.42$ 5, $a_4/a_0 = +0.04$ 9 (1994Is01), both for 756.0 γ and 757.4 γ .
762 1	7606.1				
763.0 5	5568.9	5 2			
766 1	7606.1				
791 1	8228.2				
806 1	7437.2				
809.4 5	5043.4	5 2			
832 1	6630.8				
832.1 ^{&} 5	5997.0	4 ^{&} 2			
832.2 ^{&} 5	832.2	18 ^{&} 4	D+Q	≈ -0.1	Mult.: $a_2/a_0 = -0.34$ 5, $a_4/a_0 = +0.02$ 9 (1994Is01), for both 832.1 γ and 832.2 γ . Mult.: $a_2/a_0 = -0.18$ 8, $a_4/a_0 = +0.16$ 12 (1994Is01).
837.3 5	3487.9	7 [#] 2	D		
843.7 5	5823.9	13 [#] 2			
844 1	6668.0				
847.5 5	6335.5	5 2			
852.9 5	2193.9	20 [#] 2	E2		Mult.: $a_2/a_0 = +0.26$ 5, $a_4/a_0 = -0.02$ 9 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
861 1	9089.2				
862 1	5488.0				
867 1	7437.2				
878 $\frac{1}{2}$ 1	4684.1				
879 1	5505.4				
882.4 5	6451.5	3 1			
^x 903 1					$E\gamma$: only given in 1994Ja06, placed as a transition from the (43/2 ⁺) level in band 2.
907.4 5	3487.9	39 8	E2		Mult.: $a_2/a_0 = +0.31$ 5, $a_4/a_0 = -0.16$ 9 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
912 $\frac{1}{2}$ 1	5892.7				
914 1	6630.8				
918.6 5	6915.3	3 1			
933 1	5892.7				
938 $\frac{1}{2}$ 1	7606.1				
940 1	5983.4				
942 1	5985.2				
968 $\frac{1}{2}$ 1	4455.9				$E\gamma$: 1996Sc29 placed a 968 γ from the (47/2 ⁺) level in band 2.
	10058.0+x				
977 1	10066.2				
991.4 5	2092.1	30 [#] 6	E2		Mult.: $a_2/a_0 = +0.29$ 3, $a_4/a_0 = -0.10$ 7 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
1003 1	6508.4				
1003.8 5	5488.1	6 [#] 2	Q		Mult.: $a_2/a_0 = +0.28$ 8, $a_4/a_0 = +0.12$ 12 (1994Is01).
^x 1005 1					$E\gamma$: only given in 1994Ja06, placed as a transition from the (49/2 ⁺) level in band 3.
1009 $\frac{1}{2}$ 1	3589.3				
1014 1	7349.5				
1015.7 5	7683.7	4 2			$E\gamma$: placed as deexciting a 35/2 ⁻ level in 1994Is01.
1022.6 5	1854.7	5 2			

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⁵⁴ Fe(⁵⁸ Ni,3pγ) 1996Sc29,1994Is01,1998LaZU (continued)				
γ(¹⁰⁹ Sb) (continued)				
Eγ [†]	E(level)	Iγ [§]	Mult. [@]	Comments
1023 1	6511.1			
1029 [‡] 1	4959.5			Eγ: 1994Is01 placed a 1029.4γ from the 3301 level.
1029.4 5	3300.9	2 1		Eγ: not given by 1996Sc29, seen and placed by 1994Is01. 1998LaZU placed a 1029γ from a level at E=4960, Jπ=(25/2-).
1031 1	7482.4			
1035 1	11093.0+x			
1050.0 5	4980.4	26 [#] 4	E2	Mult.: a ₂ /a ₀ =+0.35 3, a ₄ /a ₀ =-0.18 7 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
1058 1	7041.4			
1079.7 5	2580.6	46 [#] 3	E2	Mult.: a ₂ /a ₀ =+0.29 2, a ₄ /a ₀ =-0.06 4 (1994Is01), Electric Multipole (from polarization anisotropy, Fig.2 in 1994Is01).
1093 1	11159.2			
1093.3 5	2193.9	16 [#] 3	Q	Eγ: not given by 1996Sc29, seen and placed in 1994Is01 and 1994Ja06. Mult.: a ₂ /a ₀ =+0.11 8, a ₄ /a ₀ =-0.01 12 (1994Is01).
1095 [‡] 1	4684.1			
1100 ^a	3750.4			Eγ: from 1994Ja06 only.
1100.7 5	1100.8	100 [#]	E2	Mult.: a ₂ /a ₀ =+0.27 2, a ₄ /a ₀ =-0.08 4 (1994Is01), Electric Multipole (Fig.2 in 1994Is01, polarization anisotropy).
1102 1	11169.0+y			
1105.6 5	3377.4	30 [#] 3	Q	Mult.: a ₂ /a ₀ =+0.30 3, a ₄ /a ₀ =-0.21 7 (1994Is01).
1111.3 5	3761.7	6 [#] 3	Q	Mult.: a ₂ /a ₀ =+0.25 8, a ₄ /a ₀ =-0.25 12 (1994Is01).
1123 1	12216.0+x			
1143 [‡] 1	6630.8			
1177 [‡] 1	6157.3			
1203 1	12362.2			
1208.8 5	3300.9	6 3		
1223 1	13439.0+x			
1224 [‡] 1	3805.3			
1225 1	12394.0+y			
1280 1	7437.2			
1283 1	11350.0+w			
1308 [‡] 1	7465.3			
1314 1	13708.0+y			
1326 1	13688			
1341 1	13704.0+z			
1341.1 5	1341.0	29 9	Q	Mult.: a ₂ /a ₀ =+0.25 8, a ₄ /a ₀ =-0.20 12 (1994Is01).
1342 1	14781.0+x			
1406 1	15114.0+y			
1417 1	4243.8			
1440 [‡] 1	7437.2			
1461 [‡] 1	7437.2			
1476 1	15164			
1503 1	16284.0+x			
1510 1	16624.0+y			
1529 1	12879.0+w			
	15233.0+z			
1614 [‡] 1	7437.2			
1648 1	16812			
1649 1	18273.1+y			
1650 [‡] 1	6630.8			
1678 1	17962+x			
1724 1	16957.0+z			
1761 1	14640.0+w			
1849 1	18661			
1851 1	20124+y			
1880 1	19842+x			
1929 1	18886.1+z			
1937 1	16577.1+w			
2030 1	6630.8			
2060 1	18637.1+w			
2097 1	20758			
2116 1	21958+x			
2118 1	22242+y			

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$^{54}\text{Fe}(^{58}\text{Ni},3\text{p}\gamma)$ 1996Sc29,1994Is01,1998LaZU (continued) $\gamma(^{109}\text{Sb})$ (continued)

$E\gamma^\dagger$	E(level)
2158 <i>I</i>	21044.1+z
2385 <i>I</i>	23143
2416 <i>I</i>	24374+x
2420 <i>I</i>	24662+y
2460 <i>I</i>	23504.1+z
2732 <i>I</i>	27394+y
2737 <i>I</i>	25880
2810 <i>I</i>	26314+z
2822 <i>I</i>	27196+x

[†] Energies with decimal point are from 1994Is01 with $\Delta E\gamma=0.5$ keV assumed by evaluators. The other energies are from the level scheme of 1996Sc29 and/or 1998LaZU with $\Delta E\gamma=1$ keV assumed by evaluators.

[‡] From 1998LaZU only.

[§] From 1994Is01, unless otherwise stated.

[#] From 1994Is01, taken from a singles spectrum.

[@] From 1994Is01 based on $\gamma(0)$, γ -linear polarization and 1996Sc29 based on coincidences and systematics. DCO were measured in 1994Ja06.

[&] Multiply placed; intensity suitably divided.

^a Placement of transition in the level scheme is uncertain.

^b Multiply placed; undivided intensity given.

^x γ ray not placed in level scheme.

Adopted Levels, Gammas

Q(β⁻)=-10042 7; S(n)=10005 7; S(p)=2559 7; Q(α)=3198 6 2012Wa38.

¹⁰⁹Te Levels

Cross Reference (XREF) Flags

A ¹¹³Xe α Decay
B ⁵⁸Ni(⁵⁴Fe,2pnγ)
C ⁵⁴Fe(⁵⁸Ni,2pnγ)
D ⁵⁸Ni(⁵⁸Ni,α2pnγ)

E(level) [†]	Jπ [‡]	XREF	T _{1/2} [§]	Comments
0.0 [#]	(5/2 ⁺)	ABCD	4.4 s 2	%ε+%β ⁺ =96.1 13; %α=3.9 13; %β ⁺ p=9.4 31; %β ⁺ α<0.0043. %α: from 1981Sc17; other: 4 3 from 1979Sc22. %β ⁺ p is from %α=3.9 13 and I(β ⁺ p)/I(α)=2.40 4 in 1985Ti02. %β ⁺ α is from 1985Ti02. Jπ: systematics of neighboring odd-N Te isotopes; favored α decay to Jπ=(5/2 ⁺), ¹⁰⁵ Sn g.s.; shell model predicts predominant vd _{5/2} character. T _{1/2} : weighted average of 5.3 s 4 (using 3080-keVα(t) in 1965Ma12 and β ⁺ p(t) in 1965Si04. Note, that in the original publications those values were assigned to ¹⁰⁸ Te, but the reported T _{1/2} and Eα are consistent with the adopted properties of ¹⁰⁹ Te), 4.2 s 2 (using (β ⁺ p(t)) in 1967Ka01), 4.9 s 4 (unweighted average of 5.3 s 7 (3080-keVα(t)) and 4.5 s 3 (β ⁺ p(t)) in 1977Bo15), 4.1 s 2 (recommended in 1977Ki11 from 4.3 s 3 (3080-keVα(t)) and 4.03 s 15 (β ⁺ p(t))) and 4.6 s 3 from (ε+β ⁺)γ(t) in 2002Re28. configuration: vd _{5/2} ¹ . Eα=3080 15 keV (1978Ro19), 3040 keV 30 (1977Ki11) and 3080 keV 30 (1965Ma12). Jπ: 98.1γ M1(+E2) to (5/2 ⁺); band assignment. configuration: vg _{7/2} ¹ . Jπ: 265.4γ (M1+E2) to (5/2 ⁺). Jπ: 538.2γ M1(+E2) to (5/2 ⁺), band assignment. Jπ: 424.8γ E2 to (5/2 ⁺), 592.0γ M1+E2 to (7/2 ⁺), band assignment. Jπ: 763.1γ E2 to (5/2 ⁺). Jπ: 674.5γ E2 to (7/2 ⁺), band assignment. Jπ: 326.2γ (E1) to (9/2 ⁺), 317.2γ (E1) to (11/2 ⁺), band assignment. configuration: vh _{11/2} ¹ . Jπ: 682.9γ to (7/2 ⁺); band assignment. Jπ: 661.7γ E2 to (9/2 ⁺); band assignment. Jπ: 760.2γ E2 to (11/2 ⁺); band assignment. Jπ: 494.3γ E2 to (11/2 ⁻); band assignment. Jπ: 715.1γ to (11/2 ⁺); band assignment. Jπ: 861γ to (11/2 ⁻), 1179γ to (11/2 ⁺); band assignment. Jπ: 609.0γ E2 to (15/2 ⁻); band assignment. Jπ: 853.7 E2 to (15/2 ⁺); band assignment. Jπ: 304γ to (19/2 ⁻), 547.0γ to (13/2 ⁻); band assignment. Jπ: 695.2γ E2 to (19/2 ⁻); band assignment. Jπ: 991.5γ to (15/2 ⁺); band assignment. Jπ: 663.3γ E2 to (17/2 ⁻); band assignment. Jπ: 1042.1γ E2 to (19/2 ⁺); band assignment. Jπ: 889.5γ E2 to (23/2 ⁻); band assignment. Jπ: 796.2γ to (21/2 ⁻); band assignment. Jπ: 1035.3γ to (23/2 ⁺); band assignment. Jπ: 895.9γ (E1) to (27/2 ⁻); band assignment. Jπ: 933.9γ E2 to (27/2 ⁻); band assignment. Jπ: 886.7γ to (25/2 ⁻); band assignment.
98.12 [@] 10	(7/2 ⁺)	BCD		
265.4 ^{&} 3	(5/2 ⁺)	BCD		
538.04 [#] 21	(7/2 ⁺)	BCD		
690.23 ^{&} 13	(9/2 ⁺)	BCD	24 ps 5	
763.10 15	(9/2 ⁺)	BCD	3.1 ps 20	
772.00 [@] 22	(11/2 ⁺)	BCD		
1089.14 ^a 14	(11/2 ⁻)	BCD	67.0 ps 21	
1220.9 [#] 7	(11/2 ⁺)	D		
1351.9 ^{&} 4	(13/2 ⁺)	BCD		
1531.7 [@] 4	(15/2 ⁺)	BCD		
1583.50 ^a 17	(15/2 ⁻)	BCD	9.7 ps 10	
1936.0 [#] 9	(15/2 ⁺)	D		
1950.4 ^b 5	(13/2 ⁻)	D		
2192.55 ^a 20	(19/2 ⁻)	BCD	3.8 ps 9	
2385.3 [@] 4	(19/2 ⁺)	BCD		
2497.5 ^b 4	(17/2 ⁻)	D		
2887.80 ^a 22	(23/2 ⁻)	BCD		
2927.6 [#] 11	(19/2 ⁺)	D		
3160.3 ^b 5	(21/2 ⁻)	D		
3427.2 [@] 5	(23/2 ⁺)	B D		
3777.30 ^a 24	(27/2 ⁻)	BCD		
3957.3 ^b 6	(25/2 ⁻)	D		
4462.4 [@] 7	(27/2 ⁺)	B D		
4673.2 ^c 3	(29/2 ⁺)	BCD		
4711.2 ^a 3	(31/2 ⁻)	BCD		
4844.1 ^b 8	(29/2 ⁻)	D		
4963.0 [?]		D		
5198.3 7		D		
5511.2 9		D		
5550.6 ^c 3	(33/2 ⁺)	BCD		Jπ: 877.3γ E2 to (29/2 ⁺), 839.5γ (E1) to (31/2 ⁻); band assignment.
5614.0 [@] 10	(31/2 ⁺)	D		Jπ: 1151.6γ to (27/2 ⁺); band assignment.
5727.0 ^a 3	(35/2 ⁻)	BCD		Jπ: 1015.8γ E2 to (31/2 ⁻); band assignment.
5793.1 ^b 10	(33/2 ⁻)	D		Jπ: 949.0γ to (29/2 ⁻); band assignment.
5901.1 11		D		
6353.6 13		D		
6399.2 ^c 4	(37/2 ⁺)	BCD		Jπ: 672.1γ (E1) to (35/2 ⁻), 848.7γ E2 to (33/2 ⁺), band assignment.
6756.3 ^a 5	(39/2 ⁻)	BCD		Jπ: 1029.4γ E2 to (35/2 ⁻); band assignment.
6801.2 ^b 12	(37/2 ⁻)	D		Jπ: 1008.1γ to (33/2 ⁻); band assignment.

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Adopted Levels, Gammas (continued)

¹⁰⁹Te Levels (continued)

E(level) [†]	Jπ [‡]	XREF	Comments
7388.5 ^c 4	(41/2+)	CD	Jπ: 632.6γ (E1) to (39/2-), 989.2γ E2 to (37/2+); band assignment.
7990.3 ^a 11	(43/2-)	CD	Jπ: 1234γ (E2) to (39/2-); band assignment.
8106.0 ^b 7	(41/2-)	D	Jπ: 1308γ to (37/2-); band assignment.
8362.5 ^c 5	(45/2+)	CD	Jπ: 974.0γ E2 to (41/2+); band assignment.
9217.3 ^a 15	(47/2-)	D	Jπ: 1227γ (E2) to (43/2-); band assignment.
9411 ^c	(49/2+)	D	Jπ: 1048γ to (45/2+); band assignment.
9650.4 ^d 8	(49/2+)	D	Jπ: 1287.9γ to (45/2+); band assignment.
10881.4 ^d 13	(53/2+)	D	Jπ: 1231γ (E2) to (49/2+); band assignment.
12257.4 ^d 16	(57/2+)	D	Jπ: 1376γ to (53/2+); band assignment.
13751.4 ^d 21	(61/2+)	D	Jπ: 1493γ to (57/2+); band assignment.

[†] From a least-squares fit to Eγ.

[‡] From deduced γ-ray transition multipolarities based on measured DCO ratios and γ(θ) and the observed band structures, unless otherwise stated.

§ From 2012Pr10 in ⁵⁸Ni(⁵⁴Fe,2pnγ) using the RDDS method, unless otherwise stated.

(A): Band based on the Jπ=5/2+ (d_{5/2}) ground state.

@ (B): Band based on the Jπ=7/2+ (g_{7/2}) state at 98 keV.

& (C): Band based on the Jπ=5/2+ state 265 keV.

a (D): Band based on the Jπ=11/2- (h_{11/2}) state at 1090 keV.

b (E): Band based on the Jπ=(13/2-) state at 1951 keV.

c (F): Band based on the Jπ=29/2+ state at 4675 keV.

d (G): Band based on the Jπ=(49/2+) state at 9651 keV.

γ(¹⁰⁹Te)

E(level)	Eγ [†]	Iγ [†]	Mult. [‡]	δ§#	α	Comments
98.12	98.1 1	100	M1 (+E2)	≤+0.09	0.723 12	Eγ: from ⁵⁴ Fe(⁵⁸ Ni,2pnγ) (1995Do13). Mult.: a ₂ /a ₀ =-0.25 8, a ₄ /a ₀ =-0.00 9 (2000Bo29), R(DCO)=0.90 10 (2000Bo29), R=0.99 13 (1995Do13), DCO=0.7 1 (1995Pa01).
265.4	265.4 3	100	(M1+E2)		0.0470	Eγ: weighted average of 265.5 3 from 2000Bo29, 265.0 6 from 2012Pr10, and 265.2 5 from 1995Do13. Mult.: R(DCO)=0.71 6 (2000Bo29).
538.04	538.2 3	100	M1 (+E2)	-0.09 9	0.00784 12	Eγ: weighted average of 538.5 3 from 2000Bo29, 538.0 6 from 2012Pr10, and 537.6 5 from 1995Do13. Mult.: a ₂ /a ₀ =-0.43 13, (a ₄ /a ₀ set to 0.0) (2000Bo29); R(DCO)=0.80 6 (2000Bo29), DCO=0.5 (1998De44).
690.23	152.5 5	<3	[M1]		0.209 4	Eγ: weighted average of 152.5 6 from 2000Bo29 and 152.4 6 from 2012Pr10. B(M1)(W.u.)=0.003 3.
	424.8 6	29 3	E2		0.01307	Mult.: a ₂ /a ₀ =+0.17 12, a ₄ /a ₀ =-0.02 15 (2000Bo29); R(DCO)=0.97 5 (2000Bo29).
	592.0 1	100 5	M1+E2	+0.102 23	0.00622	B(E2)(W.u.)=12 3. Eγ: weighted average of 592.1 3 from 2000Bo29, 592.4 3 from 2012Pr10, and 591.9 1 from 1995Do13. Mult.: a ₂ /a ₀ =-0.10 4, (a ₄ /a ₀ set to 0.0) (2000Bo29); R(DCO)=0.69 3 (2000Bo29), R=0.94 17 (1995Do13), DCO=1.0 1 (1995Pa01), DCO=0.8 (1998De44).
763.10	74 1	<2.3	[M1]		1.61 7	B(M1)(W.u.)=0.0033 8; B(E2)(W.u.)=0.08 4.
	225.1 3	30.0 16	M1+E2		0.0727	B(M1)(W.u.)=0.15 +18-15. Eγ: weighted average of 225.3 3 from 2000Bo29, 225.0 6 from 2012Pr10, and 224.6 5 from 1995Do13. Mult.: R(DCO)=0.75 4 (2000Bo29), DCO=0.6 1 (1995Pa01), DCO=0.6 (1998De44).
	665.8 6	<2.3	M1+E2		0.00471	Mult.: DCO=0.7 (1998De44).

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Te})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	α	Comments
763.10	763.1 2	100 5	E2	0.00270	E_{γ} : weighted average of 763.2 3 from 2000Bo29, 763.0 3 from 2012Pr10, and 763.0 3 from 1995Do13. Mult.: $a_2/a_0=+0.28$ 4, (a_4/a_0 set to 0.0) (for 760.3+763.2 γ) (2000Bo29); R(DCO)=0.88 3 (2000Bo29), R=1.51 25 (1995Do13), DCO=1.2 1 (1995Pa01), DCO=1.1 (1998De44). B(E2)(W.u.)=17 11.
772.00	674.5 3	100	E2	0.00366	E_{γ} : weighted average of 674.5 3 from 2000Bo29, 675.0 3 from 2012Pr10, and 674.2 2 from 1995Do13. Mult.: R(DCO)=0.88 7 (for 672.2 γ +674.5 γ) (2000Bo29), R=1.6 3 (1995Do13), DCO=1.1 (1998De44).
1089.14	317.2 3	27.5 13	(E1)	0.00818	E_{γ} : others: 317.0 3 (2012Pr10), 316.2 2 (1995Do13). Mult.: $a_2/a_0=+0.33$ 11, (a_4/a_0 set to 0.0) (2000Bo29); R(DCO)=1.02 8 (2000Bo29), DCO=0.5 (1998De44). R=1.7 7 from 1995Do13. B(E1)(W.u.)= 1.72×10^{-5} 12.
	326.2 2	93 5	(E1)	0.00761	E_{γ} : weighted average of 326.5 3 from 2000Bo29, 326.0 3 from 2012Pr10, and 326.1 2 from 1995Do13. Mult.: $a_2/a_0=+0.21$ 3, $a_4/a_0=-0.05$ 3, R(DCO)=0.61 3, $\delta(Q/D)=0.03$ 4 (2000Bo29); $a_2/a_0=-0.33$ 6, $\delta(Q/D)=0$, DCO=0.6 (1998De44); R=0.75 10 (1995Do13), DCO=0.6 1 (1995Pa01). B(E1)(W.u.)= 5.3×10^{-5} 4.
	398.8 1	100 5	(E1)	0.00458	E_{γ} : weighted average of 399.2 3 from 2000Bo29, 399.0 3 from 2012Pr10, and 398.7 1 from 1995Do13. Mult.: $a_2/a_0=-0.23$ 3, $a_4/a_0=+0.01$ 4, $\delta(Q/D)=-0.025$ 25, R(DCO)=0.64 3 (2000Bo29); R=0.80 12 (1995Do13), DCO=0.5 (1998De44). B(E1)(W.u.)= 3.14×10^{-5} 22.
1220.9	682.9 6	100			E_{γ} : other: 580.6 6 (2012Pr10).
1351.9	580.0 6	<23			Mult.: DCO AP 1.0 from 1998De44 could indicate E2 character.
	661.7 4	100 9	E2	0.00385	E_{γ} : weighted average of 661.3 6 from 2000Bo29 and 662.0 6 from 2012Pr10. Mult.: R(DCO)=0.98 8 (2000Bo29).
1531.7	760.2 3	100	E2	0.00272	E_{γ} : weighted average of 760.3 6 from 2000Bo29, 760.3 6 from 2012Pr10, and 760.1 3 from 1995Do13. Mult.: $a_2/a_0=+0.28$ 4, (a_4/a_0 set to 0.0)(for 760.3 γ +763.2 γ), R(DCO)=0.88 3 (2000Bo29); R=1.4 4 (1995Do13).
1583.50	232 1	<1	[E1]	0.0188 4	B(E1)(W.u.)= 1.2×10^{-5} +13-12.
	494.3 1	100	E2	0.00843	E_{γ} : weighted average of 494.5 3 from 2000Bo29, 494.4 3 from 2012Pr10, and 494.3 1 from 1995Do13. Mult.: $a_2/a_0=+0.283$ 21, $a_4/a_0=+0.003$ 26, R(DCO)=1.10 4 (2000Bo29); R=1.47 22 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1.0 (1998De44). B(E2)(W.u.)=63 7.
1936.0	715.1 6	100			
1950.4	861.0 6				
	1179 1				
2192.55	609.0 1	100	E2	0.00477	E_{γ} : weighted average of 609.1 3 from 2000Bo29, 609.0 3 from 2012Pr10, and 609.0 1 from 1995Do13. Mult.: $a_2/a_0=+0.331$ 21, $a_4/a_0=0.108$ 25, R(DCO)=1.02 3 (2000Bo29); R=1.57 19 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1 (1998De44). B(E2)(W.u.)=56 13.
2385.3	853.7 2	100	E2	0.00207	E_{γ} : weighted average of 853.8 3 from 2000Bo29, 853.8 3 from 2012Pr10, and 853.3 5 from 1995Do13. Mult.: R(DCO)=0.90 7 (for 848.8 γ +853.8 γ) (2000Bo29); R=1.5 5 (1995Do13).
2497.5	304 1				
	547.0 6				
	966.0 3				
2887.80	695.2 1	100	E2	0.00339	E_{γ} : weighted average of 695.2 3 from 2000Bo29, 695.0 3 from 2012Pr10, and 695.2 1 from 1995Do13. Mult.: $a_2/a_0=+0.330$ 22, $a_4/a_0=0.01$ 3 R(DCO)=1.00 3 (2000Bo29); R=1.57 20 (1995Do13), DCO=1.2 1 (1995Pa01), DCO=1.0 (1998De44).

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Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Te})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult. [‡]	α	Comments
2927.6	991.5 6	100			
3160.3	271.0 6	<14			
	663.3 6	100 10	E2	0.00382	Mult.: R(DCO)=1.03 7 (2000Bo29).
	775.3 6	38 4			
3427.2	1042.1 3	100	E2	1.32×10^{-3}	E_{γ} : other: 1042.6 6 (2012Pr10).
					Mult.: R(DCO)=0.98 6 (2000Bo29).
3777.30	889.5 1	100	E2	0.00188	E_{γ} : weighted average of 889.6 3 from 2000Bo29, 889.6 3 from 2012Pr10, and 889.5 1 from 1995Do13.
					Mult.: $a_2/a_0=+0.38$ 3, (a_4/a_0 set to 0.0), R(DCO)=1.01 5 (2000Bo29); R=1.47 19 (1995Do13), DCO=1.0 1 (1995Pa01), DCO=0.9 (1998De44).
3957.3	530.7 6	<19			
	796.2 6	100 10			
4462.4	1035.3 6	100			
4673.2	895.9 1	100	(E1)	7.57×10^{-4}	E_{γ} : weighted average of 895.7 3 from 2000Bo29, 895.9 3 from 2012Pr10, and 895.9 1 from 1995Do13.
					Mult.: $a_2/a_0=-0.31$ 7, (a_4/a_0 set to 0.0), $\delta(Q/D)=-0.04$ 5, R(DCO)=0.62 8 (2000Bo29); $a_2/a_0=-0.25$ 4, DCO=0.5 (1998De44); R=1.0 4 (1995Do13).
4711.2	933.9 1	100	E2	1.68×10^{-3}	E_{γ} : weighted average of 933.7 3 from 2000Bo29, 933.7 3 from 2012Pr10, and 933.9 1 from 1995Do13.
					Mult.: $a_2/a_0=+0.35$ 4, $a_4/a_0=+0.09$ 5, R(DCO)=1.01 4 (2000Bo29); R=1.60 24 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1.0 (1998De44).
4844.1	382 1	<33			
	886.7 6	100 10			
5198.3	234.9 [@] 6	<59			
	1421.0 6	100 10			
5511.2	312.9 6	100			
5550.6	839.5 3	59 6	(E1)	8.62×10^{-4}	E_{γ} : weighted average of 839.6 6 from 2000Bo29, 839.9 6 from 2012Pr10, and 839.3 3 from 1995Do13.
					Mult.: $a_2/a_0=-0.42$ 16, $a_4/a_0=+0.17$ 20, $\delta(Q/D)=-0.11$ 12, R(DCO)=0.87 7 (2000Bo29); $a_2/a_0=-0.26$ 9, DCO=0.5 (1998De44); R=0.84 23 (1995Do13).
	877.3 2	100 5	E2	0.00194	E_{γ} : weighted average of 877.4 3 from 2000Bo29, 877.3 3 from 2012Pr10, and 877.0 4 from 1995Do13.
					Mult.: $a_2/a_0=+0.26$ 8, $a_4/a_0=+0.11$ 10, R(DCO)=0.89 6 (2000Bo29); $a_2/a_0=+0.39$ 8, $a_4/a_0=-0.14$ 3, DCO=0.9 (1998De44); R=1.6 5 (1995Do13).
5614.0	1151.6 6	100			
5727.0	1015.8 2	100	E2	1.40×10^{-3}	E_{γ} : weighted average of 1015.8 3 from 2000Bo29, 1015.7 3 from 2012Pr10, and 1015.9 2 from 1995Do13.
					Mult.: $a_2/a_0=+0.18$ 5, $a_4/a_0=-0.08$ 6, R(DCO)=0.96 5 (2000Bo29); R=1.9 4 (1995Do13).
5793.1	949.0 6	100			
5901.1	389.9 6	100			
6353.6	452.5 6	100			
6399.2	672.1 3	22 2	(E1)	1.37×10^{-3}	E_{γ} : weighted average of 672.2 6 from 2000Bo29, 672.2 6 from 2012Pr10, and 672.0 4 from 1995Do13.
					Mult.: $a_2/a_0=-0.27$ 8, DCO=0.5 (1998De44); R(DCO)=0.88 7 (for 672.2 γ +674.5 γ) (2000Bo29), R=1.2 5 (1995Do13).
	848.7 2	100 10	E2	0.00210	E_{γ} : weighted average of 848.8 3 from 2000Bo29, 848.5 6 from 2012Pr10, and 848.7 2 from 1995Do13.
					Mult.: $a_2/a_0=+0.38$ 8, $a_4/a_0=-0.14$ 3, DCO=1.1 (1998De44); R(DCO)=0.90 7 (for 848.8 γ +853.8 γ) (2000Bo29), R=1.5 4 (1995Do13).
6756.3	1029.4 4	100	E2	1.36×10^{-3}	E_{γ} : weighted average of 1029.2 6 from 2000Bo29, 1029.4 6 from 2012Pr10, and 1029.5 5 from 1995Do13.
					Mult.: R(DCO)=1.19 13 (2000Bo29), R=1.0 4 (1995Do13), DCO=1.0 (1998De44).
6801.2	1008.1 6	100			
7388.5	632.6 6	11 1	(E1)	1.56×10^{-3}	Mult.: $a_2/a_0=-0.27$ 5, DCO=0.6 (1998De44), R(DCO)=0.58 8 (2000Bo29).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{109}\text{Te})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult. [‡]	α	Comments
7388.5	989.2 2	100 5	E2	1.48×10^{-3}	$E\gamma$: weighted average of 989.4 3 from 2000Bo29 and 989.0 3 from 1995Do13. Mult.: $a_2/a_0=+0.21$ 6, (a_4/a_0 set to 0.0), R(DCO)=0.93 6 (2000Bo29); R=1.2 4 (1995Do13), DCO=1.0 (1998De44).
7990.3	1234 1	100	(E2)	9.36×10^{-4}	Mult.: R(DCO)=1.20 9 for the composite peak of 1227+1231+1234 (2000Bo29).
8106.0?	1308 [@] 1	100			
8362.5	974.0 3	100	E2	1.53×10^{-3}	$E\gamma$: weighted average of 973.4 6 from 2000Bo29 and 974.2 3 from 1995Do13. Mult.: $a_2/a_0=+0.51$ 12, (a_4/a_0 set to 0.0), R(DCO)=0.93 6 (2000Bo29); R=1.0 4 (1995Do13), DCO=1.0 (1998De44).
9217.3	1227 1	100	(E2)	9.46×10^{-4}	Mult.: R(DCO)=1.20 9 the composite peak of 1227+1231+1234 (2000Bo29).
9411	1048 [@] 1	100			
9650.4	1287.9 6	100			
10881.4	1231 1	100	(E2)	9.40×10^{-4}	Mult.: R(DCO)=1.20 9 the composite peak of 1227+1231+1234 (2000Bo29).
12257.4	1376 1	100			
13751.4?	1493 [@] 1	100			

[†] From $^{58}\text{Ni}(^{58}\text{Ni}, \alpha 2p n \gamma)$ (2000Bo29), unless otherwise stated.

[‡] Based on measured $\gamma(0)$ in 2000Bo29 ($^{58}\text{Ni}(^{58}\text{Ni}, \alpha 2p n \gamma)$) and 1998De44 ($^{54}\text{Fe}(^{58}\text{Ni}, 2p n \gamma)$), R(DCO) in 2000Bo29 and intensity ratios R in 1995Do13 ($^{54}\text{Fe}(^{58}\text{Ni}, 2p n \gamma)$), DCO ratios in 1995Pa01 and 1998De44 ($^{54}\text{Fe}(^{58}\text{Ni}, 2p n \gamma)$). For R(DCO) the expected values are ≈ 1.0 for $\Delta J=2$, and $\Delta J=0$, dipole transitions, and ≈ 0.63 for $\Delta J=1$, dipole transitions (2000Bo29); intensity ratio R is expected to be 1.5 for stretched E2 transition and 0.8 for stretched dipole transitions (1995Do13); DCO values GE 1.0 indicate stretched quadrupole transitions, while values ≈ 0.65 are expected for pure stretched dipole transitions (1995Pa01).

[§] From 2000Bo29 in $^{58}\text{Ni}(^{58}\text{Ni}, \alpha 2p n \gamma)$ using angular distribution data.

[#] If no value given it was assumed $\delta=0.00$ for E2/M1, $\delta=1.00$ for E3/M2 and $\delta=0.10$ for the other multipolarities.

[@] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

Adopted Levels, Gammas (continued)

¹¹³Xe α Decay 1978Ro19,1979Sc22

Parent ¹¹³Xe: E=0.0; J π =(5/2+); T_{1/2}=2.74 s 8; Q(g.s.)=3087 8; % α decay=0.010 10.

¹¹³Xe-% α decay: From estimated upper limit of % α <0.020 in 1985Ti05. A value of % α =0.035 was estimated by 1978Ro19.

1979Sc22: activity using E(⁵⁸Ni)= 290 MeV beam on a ⁵⁸Ni (4 mg/cm²) target, UNILAC GSI; Tantalum catcher, GSI mass separator; Detector: Windmill system, Δ E-E telescopes. Measured: E α .

Others: 1978Ro19, 1973Ha37, 1979Ew02.

¹⁰⁹Te Levels

E(level)	J π	T _{1/2}	Comments
0.0	(5/2+)	4.4 s 2	J π , T _{1/2} : From Adopted Levels.

α radiations

E α	E(level)	I $\alpha^{\dagger}$	HF ‡	Comments
2978 8	0.0	100	≤ 2.7	E α : From Q α . Measured E α =2985 keV 15 (1979Sc22) and 2990 keV 30 (1978Ro19).

† r₀(¹⁰⁹Te)=1.64 6, taken from r₀(¹⁰⁸Te), deduced by assuming HF=1.0.

‡ For α intensity per 100 decays, multiply by 0.00010 10.

⁵⁴Fe(⁵⁸Ni,2pn γ) 1995Do13,1995Pa01,1998De44

1995Do13: E(⁵⁸Ni)=270 MeV, accelerator facilities at the Neils Bohr institute. Target:10 mg/cm² of ⁵⁴Fe (99.8% enriched). Detectors: NORDball array (15 BGO-shielded Ge detectors and 30 BaF2 calorimeter in backward hemisphere), 11 liquid scintillators, 4 π charged-particle array (21 Δ E-type Si detectors). Measured: E γ , I γ , $\gamma\gamma$, p- $\gamma\gamma$, n- $\gamma\gamma$, angular correlation intensity ratio, R, corresponding to 143° and 79°+101°.

1995Pa01: E(⁵⁸Ni)=240 MeV, Tandem Van de Graff accelerator at Daresbury. Target= 400 μ g/cm² self-supporting foil of ⁵⁴Fe. Detectors: EUROGAM array (45 escape-suppressed HPGe detectors), Recoil separator, Recoil-decay tagging method using double sided Si strip detector (DSSD). Measured: E γ , I γ , particle- $\gamma\gamma$, recoil- $\gamma\gamma$, DCO ratios that correspond to average 90° and 134° geometry.

1998De44: E(⁵⁸Ni)=220 MeV, Tandem XTU, Legnaro National Laboratory. Target= 400 μ g/cm² self-supporting ⁵⁴Fe foil. Detectors: 4 π GASP spectrometer (40 Compton-suppressed Ge detectors with BGO), charged-particle array Si-ball ISIS (40 Δ E-E Si telescopes covering about 70% of the total solid angle). Measured: E γ , I γ , γ (θ), $\gamma\gamma$, 2p- $\gamma\gamma$, $\gamma\gamma\gamma$, DCO using triple coincidence. The reported γ -ray energies in 1998De44 are 1 keV higher than those reported by others.

DCO ratios are shown only in Figure 3 in 1998De44.

Level scheme is that reported by 1998De44, unless otherwise noted.

¹⁰⁹Te Levels

E(level) †	J $\pi^{\ddagger}$	Comments
0.0	5/2+	
98.11 10	7/2+	
265.4 4	(5/2+)	E(level), J π : from 1995Do13.
537.9 4	7/2	
690.01 13	9/2+	
762.75 19	9/2+	
772.40 18	(11/2)	
1088.73 $\S$ 15	11/2-	
1351.5 6	13/2+	
1532.5 4	(15/2+)	E(level), J π : from 1995Do13.
1583.04 $\S$ 18	15/2-	
2192.05 $\S$ 21	19/2-	
2385.8 6	(19/2+)	E(level): from 1995Do13 only. J π : From Adopted Levels.
2887.25 $\S$ 23	23/2-	
3776.75 $\S$ 25	27/2-	
4672.7 $\#$ 3	29/2(+)	
4710.6 $\S$ 3	31/2-	
5549.9 $\#$ 4	33/2(+)	
5726.5 $\S$ 4	35/2-	
6398.6 $\#$ 4	37/2(+)	

Continued on next page (footnotes at end of table)

$^{54}\text{Fe}(^{58}\text{Ni},2\text{pn}\gamma)$ 1995Do13,1995Pa01,1998De44 (continued) ^{109}Te Levels (continued)

E(level) [†]	$J\pi^{\ddagger}$
6755.8 § 6	39/2-
7387.7 # 5	41/2(+)
7989.8 § 12	43/2-
8361.9 # 6	45/2(+)
9279.8 § 16	47/2-
10656.8 § 19	(51/2-)
12079.8 § 21	(55/2-)

[†] From a least-squares fit to E γ .[‡] From 1998De44 based on measured DCO ratios and $\gamma(\theta)$, and band structure, unless otherwise stated.§ (A): Band based on the $J\pi=11/2-$ state at 1088 keV (1998De44).# (B): Band based on the $J\pi=29/2(+)$ state at 4673 keV (1998De44). $\gamma(^{109}\text{Te})$

E $\gamma^{\dagger}$	E(level)	I $\gamma^{\dagger}$	Mult. @	Comments
98.1 1	98.11	46 15	(M1+E2)	E γ : Other: 97.8 5 (1995Pa01). I γ : Other: <10 (1995Pa01). Mult.: R=0.99 13 (1995Do13), DCO=0.7 1 (1995Pa01). DCO=1.0 from 1998De44 indicates E2.
224.6 5	762.75	5 2	(M1+E2)	E γ : Other: 225.1 5 (1995Pa01). I γ : Other: <10 (1995Pa01). Mult.: DCO=0.6 1 (1995Pa01), DCO=0.6 (1998De44). Mult.: DCO=0.5 (1998De44).
233.1 1	1583.04		D	
265.2 2	265.4	5 2		
316.2 2	1088.73	11 2	D	Mult.: DCO=0.5 (1998De44). R=1.7 7 from 1995Do13 could indicate E2.
326.1 2	1088.73	51 5	(E1)	E γ : Other: 327.3 5 (1995Pa01). I γ : Other: 29 (1995Pa01). Mult.: R=0.75 10 (1995Do13), DCO=0.6 1 (1995Pa01), DCO=0.6 (1998De44), $a_2/a_0=-0.33$ 6 and $\delta(Q/D)=0$ (1998De44).
398.7 1	1088.73	41 4	(E1)	E γ : Other: 399.6 5 (1995Pa01). Mult.: R=0.80 12 (1995Do13), DCO=0.5 (1998De44).
424.5 # 5	690.01	6 3		
440.1 1	537.9			
494.3 1	1583.04	100	E2	E γ : Other: 494.6 5 (1995Pa01). Mult.: R=1.47 22 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1.0 (1998De44).
537.6 5	537.9	5 2	(M1+E2)	E γ : Other: 538.0 5 (1995Pa01). I γ : Other: <10 (1995Pa01). Mult.: DCO=0.5 (1998De44).
580.1 1	1351.5			Mult.: DCO AP 1.0 from 1998De44 indicates E2 character.
591.9 1	690.01	40 4	(M1+E2)	E γ : Other: 593.0 5 (1995Pa01). I γ : Other: 14 (1995Pa01). Mult.: R=0.94 17 (1995Do13), DCO=1.0 1 (1995Pa01), DCO=0.8 (1998De44).
602.1 1	7989.8			
609.0 1	2192.05	99 9	E2	E γ : Other: 609.4 5 (1995Pa01). I γ : Other: 95 (1995Pa01). Mult.: R=1.57 19 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1 (1998De44).
633.1 1	7387.7		(E1)	Mult.: $a_2/a_0=-0.27$ 5, DCO=0.6 (1998De44).
662.1 1	1351.5			
666.1 1	762.75		(M1+E2)	Mult.: DCO=0.7 (1998De44).
672.0 4	6398.6	13 2	(E1)	Mult.: R=1.2 5 (1995Do13), DCO=0.5 (1998De44), $a_2/a_0=-0.27$ 8 (1998De44).
674.2 2	772.40	28 5	E2	Mult.: R=1.6 3 (1995Do13), DCO=1.1 (1998De44).
695.2 1	2887.25	96 9	E2	E γ : Other: 695.5 5 (1995Pa01). I γ : Other: 94 (1995Pa01). Mult.: R=1.57 20 (1995Do13), DCO=1.2 1 (1995Pa01), DCO=1.0 (1998De44).
^x 726.4 § 5		12 § 2		
^x 757.2 § 5		10 § 1		
760.1 3	1532.5	15 4	E2	E γ : not seen in 1998De44. Mult.: R=1.4 4 (1995Do13).

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$^{54}\text{Fe}(^{58}\text{Ni},2\text{pn}\gamma)$ 1995Do13,1995Pa01,1998De44 (continued) $\gamma(^{109}\text{Te})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult. @	Comments
763.0 3	762.75	44 6	E2	E γ : Other: 763.3 5 (1995Pa01). I γ : Other: 32 (1995Pa01). Mult.: R=1.51 25 (1995Do13), DCO=1.2 1 (1995Pa01), DCO=1.1 (1998De44).
839.3 3	5549.9	15 5	(E1)	Mult.: R=0.84 23 (1995Do13), DCO=0.5 (1998De44), $a_2/a_0=-0.26$ 9 (1998De44).
848.7 2	6398.6	17 5	E2	Mult.: R=1.5 4 (1995Do13), DCO=1.1 (1998De44), $a_2/a_0=+0.38$ 8, $a_4/a_0=-0.14$ 3.
853.3 5	2385.8	9 2	E2	E γ : not seen in 1998De44. Mult.: R=1.5 5 (1995Do13).
877.0 4	5549.9	14 4	E2	Mult.: R=1.6 5 (1995Do13), DCO=0.9 (1998De44), $a_2/a_0=+0.39$ 8, $a_4=-0.14$ 3 (1998De44).
889.5 1	3776.75	88 8	E2	E γ : Other: 889.9 5 (1995Pa01). I γ : Other: 90 (1995Pa01). Mult.: R=1.47 19 (1995Do13), DCO=1.0 1 (1995Pa01), DCO=0.9 (1998De44).
895.9 1	4672.7	20 4	(E1)	Mult.: R=1.0 4 (1995Do13), DCO=0.5 (1998De44), $a_2/a_0=-0.25$ 4 (1998De44).
933.9 1	4710.6	61 6	E2	E γ : Other: 933.9 5 (1995Pa01). I γ : Other: 90 (1995Pa01). Mult.: R=1.60 24 (1995Do13), DCO=1.1 1 (1995Pa01), DCO=1.0 (1998De44).
974.2 3	8361.9	7 3	E2	Mult.: R=1.0 4 (1995Do13), DCO=1.0 (1998De44).
989.0 3	7387.7	16 3	E2	E γ : Other: 990.9 5 (1995Pa01). Mult.: R=1.2 4 (1995Do13), DCO=1.0 (1998De44).
1015.9 2	5726.5	28 2	E2	E γ : Other: 1016.1 3 (1995Pa01). I γ : Other: 70 (1995Pa01). Mult.: R=1.9 4 (1995Do13), DCO=1.0 (1998De44).
1029.5 5	6755.8	6 3	E2	E γ : Other: 1032.0 5 (1995Pa01). Mult.: R=1.0 4 (1995Do13), DCO=1.0 (1998De44).
1234 ‡ 1	7989.8			
1290 ‡ 1	9279.8			
1377 ‡ 1	10656.8			
1423 ‡ 1	12079.8			

† From 1995Do13, unless otherwise states. $I\gamma$ are normalized to $I\gamma(494.3)=100$.

‡ From 1998De44 only. $\Delta E=1$ keV assumed by evaluators.

§ Seen only in 1995Pa01 and placed as a 757.2 γ -726.4 γ cascade to E=690 level.

$^\#$ From 1995Do13 only.

$^\circledast$ From 1995Pa01, 1998De44 and 1995Do13, based on angular correlation intensity ratio, R, from 1995Do13, DCO ratios from 1995Pa01 and 1998De44 (see Fig. 3 in 1998De44) and $\gamma(\theta)$ from 1998De44. R is expected to be 1.5 for stretched E2 transitions and 0.8 for stretched dipole transitions (1995Do13). DCO values ≥ 1.0 indicate stretched quadrupole transitions, while values of ≈ 0.65 are expected for pure stretched dipole transitions (1995Pa01).

$^\&$ Placement of transition in the level scheme is uncertain.

$^\times$ γ ray not placed in level scheme.

$^{58}\text{Ni}(^{54}\text{Fe}, 2\text{pn}\gamma)$ 2012Pr10

2012Pr10: $E(^{54}\text{Fe})=206$ MeV from K130 accelerator facility at Jyvaskyla University. Target=1 mg/cm² self-supporting ^{58}Ni foil. Detectors: RITU gas-filled separator and GREAT spectrometer at the focal plane, where the recoiling nuclei implanted into a pair of DDSD detectors, PRE-JUROGAM II array (12 four-way segmented Clover Ge detectors). Measured: $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, level lifetimes using the Recoil Distance Doppler-shift method (RDDS) using a plunger device in conjunction with the Recoil-decay tagging method.

 ^{109}Te Levels

$E(\text{level})^\dagger$	$J\pi^\S$	$T_{1/2}^\ddagger$	$E(\text{level})^\dagger$	$J\pi^\S$	$T_{1/2}^\ddagger$	$E(\text{level})^\dagger$	$J\pi^\S$
0.0 [#]	5/2+		1352.4 ^{& 5}	13/2+		4464.4 ^{@ 12}	(27/2+)
97.86 ^{@ 24}	7/2+		1532.9 ^{@ 7}	15/2+		4673.4 ^{b 7}	29/2+
265.2 ^{& 5}	5/2+		1583.8 ^{a 4}	15/2-	9.7 ps 10	4711.1 ^{a 7}	31/2-
538.1 ^{# 4}	7/2+		2192.8 ^{a 5}	19/2-	3.8 ps 9	5550.7 ^{b 8}	33/2+
690.3 ^{& 3}	9/2+	24 ps 5	2386.7 ^{@ 8}	19/2+		5726.8 ^{a 8}	35/2-
763.27 ^{# 24}	9/2+	3.1 ps 20	2887.9 ^{a 6}	23/2-		6399.2 ^{b 9}	37/2+
772.6 ^{@ 3}	11/2+		3429.1 ^{@ 10}	23/2+		6756.3 ^{a 10}	39/2-
1089.4 ^{a 3}	11/2-	67.0 ps 21	3777.5 ^{a 7}	27/2-			

[†] From a least-squares fit to $E\gamma$.

[‡] From the RDDS method (2012Pr10).

[§] From 2012Pr10, based on multipolarities as given in $^{58}\text{Ni}(^{58}\text{Ni}, \alpha 2\text{pn}\gamma)$ (2000Bo29).

[#] (A): Band based on the $J\pi=5/2+$ ground state.

[@] (B): Band based on the $J\pi=7/2+$ state at 98 keV.

[&] (C): Band based on the $J\pi=5/2+$ state 265 keV.

^a (D): Band based on the $J\pi=11/2-$ state at 1089 keV.

^b (E): Band based on the $J\pi=29/2+$ state at 4673 keV.

 $\gamma(^{109}\text{Te})$

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\dagger$	Mult. [‡]	$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\dagger$	Mult. [‡]
74 1	763.27	<1		672.2 6	6399.2	7.8 16	E1
98.2 3	97.86	12.9 13	M1+E2	675.0 3	772.6	23 2	E2
152.4 6	690.3	<1		695.0 3	2887.9	87 9	E2
225.0 6	763.27	7.1 14	M1+E2	760.3 6	1532.9	8 2	E2
232 1	1583.8	<1		763.0 3	763.27	45 5	E2
265.0 6	265.2	10 2	M1+E2	839.9 6	5550.7	2.7 6	E1
317.0 3	1089.4	12.9 13	E1	848.5 6	6399.2	9.4 19	E2
326.0 3	1089.4	55 6	E1	853.8 3	2386.7	17.8 18	E2
399.0 3	1089.4	58 6	E1	877.3 3	5550.7	10.5 11	E2
424.8 6	690.3	8.1 16	E2	889.6 3	3777.5	65 7	E2
494.4 3	1583.8	100	E2	895.9 3	4673.4	11.3 11	E1
538.0 6	538.1	2 1	M1+E2	933.7 3	4711.1	38 4	E2
580.0 6	1352.4	<1		1015.7 3	5726.8	15.2 15	E2
592.4 3	690.3	32 3	M1+E2	1029.4 6	6756.3	1.7 3	E2
609.0 3	2192.8	94 9	E2	1035.3 6	4464.4	3 1	
662.0 6	1352.4	<1		1042.4 6	3429.1	3.7 7	E2
665.8 6	763.27	<1					

[†] From 2012Pr10.

[‡] Taken by 2012Pr10 from the $\gamma(0)$ data in $^{58}\text{Ni}(^{58}\text{Ni}, \alpha 2\text{pn}\gamma)$ (2000Bo29).

⁵⁸Ni(⁵⁸Ni,α2pnγ) 2000Bo29

2000Bo29: E(⁵⁸Ni)=250 MeV, 88-Inch cyclotron at the Lawrence Berkeley National Laboratory. Target= 500 μg/cm², two self-supporting (isotopically enriched > 97%) foils of ⁵⁸Ni. Detectors: GAMMASPHERE array (83 HPGe detectors), Microball array (95 CsI scintillators covering 97% of 4 π) and 15 NE213 liquid scintillators for neutrons detection. Measured: Eγ, Iγ, γγ, γ(θ), particle-γγ, γγγ, angular distribution (γ(θ)) and DCO (R(DCO)) ratios.

¹⁰⁹Te Levels

E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]
0.0 [§]	5/2+	2889.1 ^{& 6}	23/2-	5902.6 ¹²	
98.2 ^{# 4}	7/2+	2927.8 ^{§ 11}	(19/2+)	6355.1 ¹⁴	
265.5 ^{@ 3}	5/2+	3160.9 ^{a 6}	(21/2-)	6400.6 ^{b 8}	37/2+
538.28 ^{§ 24}	7/2+	3427.5 ^{# 7}	23/2+	6757.5 ^{& 9}	39/2-
690.5 ^{@ 3}	9/2+	3778.7 ^{& 7}	27/2-	6801.6 ^{a 12}	(37/2-)
763.43 ²³	9/2+	3957.7 ^{a 7}	(25/2-)	7390.1 ^{b 8}	41/2+
772.3 ^{# 4}	11/2+	4462.7 ^{# 9}	(27/2+)	7991.5 ^{& 13}	43/2-
1089.8 ^{& 3}	11/2-	4674.5 ^{b 7}	29/2+	8106.0 ^{?a}	(41/2-)
1221.2 ^{§ 7}	11/2+	4712.4 ^{& 7}	31/2-	8363.5 ^{b 10}	45/2+
1352.1 ^{@ 5}	13/2+	4844.5 ^{a 9}	(29/2-)	9218.5 ^{& 17}	(47/2-)
1531.9 ^{# 6}	15/2+	4963.0		9411 ^b	(49/2+)
1584.4 ^{& 4}	15/2-	5199.8 ^{? 9}		9651.4 ^{c 12}	(49/2+)
1936.3 ^{§ 9}	(15/2+)	5512.7 ¹¹		10882.4 ^{c 16}	(53/2+)
1950.9 ^{a 6}	(13/2-)	5551.9 ^{b 7}	33/2+	12258.4 ^{c 19}	(57/2+)
2193.8 ^{& 5}	19/2-	5614.3 ^{# 11}	(31/2+)	13751.4 ^{?c 21}	(61/2+)
2385.6 ^{# 6}	19/2+	5728.3 ^{& 8}	35/2-		
2497.8 ^{a 6}	(17/2-)	5793.5 ^{a 11}	(33/2-)		

[†] From a least-squares fit to Eγ.

[‡] From 2000Bo29, based on the deduced γ-ray transition multipolarities using γγ(θ) and R(DCO), and the observed band structures.

[§] (A): Band based on the Jπ=5/2+ ground state.

[#] (B): Band based on the Jπ=7/2+ state at 98 keV.

[@] (C): Band based on the Jπ=5/2+ state 265 keV.

[&] (D): Band based on the Jπ=11/2- state at 1090 keV.

^a (E): Band based on the Jπ=(13/2-) state at 1951 keV.

^b (F): Band based on the Jπ=29/2+ state at 4675 keV.

^c (G): Band based on the Jπ=(49/2+) state at 9651 keV.

γ(¹⁰⁹Te)

Eγ [†]	E(level)	Iγ [†]	Mult. [§]	δ [#]	Comments
74 ¹	763.43	<1			
98.4 ⁶	98.2	8.1 ⁸	M1(+E2)	+0.03 ⁶	Mult.: R(DCO)=0.90 ¹⁰ ; a ₂ /a ₀ =-0.25 ⁸ , a ₄ /a ₀ =-0.00 ⁹ .
152.5 ⁶	690.5	<1			
225.3 ³	763.43	13.1 ⁷	M1+E2		Mult.: R(DCO)=0.75 ⁴ .
232 ¹	1584.4	<1			
234.9 ^{@ 6}	5199.8?	<1			
265.5 ³	265.5	11.0 ⁶	M1+E2		Mult.: R(DCO)=0.71 ⁶ .
271.0 ⁶	3160.9	<1			
304 ¹	2497.8	<1			
312.9 ⁶	5512.7	<1			
317.2 ³	1089.8	16.8 ⁸	(E1)		Mult.: R(DCO)=1.02 ⁸ ; δ(Q/D)=-0.12 ²³ ; a ₂ /a ₀ =+0.33 ¹¹ , (a ₄ /a ₀ set to 0.0).
326.5 ³	1089.8	57 ³	(E1)		Mult.: R(DCO)=0.61 ³ ; δ(Q/D)=+0.03 ⁴ ; a ₂ /a ₀ =-0.21 ³ , a ₄ /a ₀ =-0.05 ³ .
382 ¹	4844.5	<1			
389.9 ⁶	5902.6	<1			
399.2 ³	1089.8	61 ³	(E1)		Mult.: R(DCO)=0.64 ³ ; δ(Q/D)=-0.025 ²⁵ ; a ₂ /a ₀ =-0.23 ³ , a ₄ /a ₀ =+0.01 ⁴ .
424.8 ⁶	690.5	9.8 ¹⁰	E2		Mult.: R(DCO)=0.97 ⁵ ; a ₂ /a ₀ =+0.17 ¹² , a ₄ /a ₀ =-0.02 ¹⁵ .
452.5 ⁶	6355.1	<1			
494.5 ³	1584.4	100.0	E2		Mult.: R(DCO)=1.10 ⁴ a ₂ /a ₀ =+0.283 ²¹ , a ₄ /a ₀ =+0.003 ²⁶ .
530.7 ⁶	3957.7	<1			
538.5 ³	538.28	10.7 ⁵	M1(+E2)	-0.09 ⁹	Mult.: R(DCO)=0.80 ⁶ ; a ₂ /a ₀ =-0.43 ¹³ , (a ₄ /a ₀ set to 0.0).
547.0 ⁶	2497.8	<1			
580.0 ⁶	1352.1	<1			
592.1 ³	690.5	33.5 ¹⁷	M1+E2	+0.102 ²³	Mult.: R(DCO)=0.69 ³ a ₂ /a ₀ =-0.10 ⁴ , (a ₄ /a ₀ set to 0.0).

Continued on next page (footnotes at end of table)

⁵⁸Ni(⁵⁸Ni,α2pγ) 2000Bo29 (continued)

γ(¹⁰⁹Te) (continued)

Eγ [†]	E(level)	Iγ [†]	Mult. [§]	Comments
609.1 3	2193.8	90 5	E2	Mult.: R(DCO)=1.02 3; a ₂ /a ₀ =+0.331 21, a ₄ /a ₀ =+0.108 25.
632.6 6	7390.1	3.3 3	(E1)	Mult.: R(DCO)=0.58 8.
661.3 6	1352.1	4.4 4	E2	Mult.: R(DCO)=0.98 8.
663.3 6	3160.9	7.2 7	E2	Mult.: R(DCO)=1.03 7.
665.8 6	763.43	<1		
672.2 6	6400.6	4.4 4	(E1)	Mult.: R(DCO)=0.88 7 for 672.2+674.5γ.
674.5 3	772.3	27.0 14	E2	Mult.: R(DCO)=0.88 7 for 672.2+674.5γ.
682.9 6	1221.2	8.2 8		
695.2 3	2889.1	80 4	E2	Mult.: R(DCO)=1.00 3; a ₂ /a ₀ =+0.330 22, a ₄ /a ₀ =+0.01 3.
715.1 6	1936.3	6.7 7		
760.3 6	1531.9	8.3 8	E2	Mult.: R(DCO)=0.88 3; a ₂ /a ₀ =+0.28 4, (a ₄ /a ₀ set to 0.0), for 760.3γ+763.2γ.
763.2 3	763.43	43.7 22	E2	Mult.: R(DCO)=0.88 3; a ₂ /a ₀ =+0.28 4, (a ₄ /a ₀ set to 0.0), for 760.3+763.2γ.
775.3 6	3160.9	2.7 3		
796.2 6	3957.7	5.2 5		
839.6 6	5551.9	8.6 9	(E1)	Mult.: R(DCO)=0.87 7; δ(Q/D)=-0.11 12; a ₂ /a ₀ =-0.42 16, a ₄ /a ₀ =+0.17 20.
848.8 3	6400.6	20.2 20	E2	Mult.: R(DCO)=0.90 7 for 848.8+853.8γ.
853.8 3	2385.6	20.2 20	E2	Mult.: R(DCO)=0.90 7, for 848.8+853.8γ.
861.0 6	1950.9	<1		
877.4 3	5551.9	14.5 7	E2	Mult.: R(DCO)=0.89 6; a ₂ /a ₀ =+0.26 8, a ₄ /a ₀ =+0.11 10.
886.7 6	4844.5	3.0 3		
889.6 3	3778.7	63 3	E2	Mult.: R(DCO)=1.01 5; a ₂ /a ₀ =+0.38 3, (a ₄ /a ₀ set to 0.0).
895.7 3	4674.5	14.7 7	(E1)	R(DCO)=0.62 8; δ(Q/D)=-0.04 15; a ₂ /a ₀ =-0.31 7, (a ₄ /a ₀ set to 0.0).
933.7 3	4712.4	34.3 17	E2	R(DCO)=1.01 4; a ₂ /a ₀ =+0.35 4, a ₄ /a ₀ =+0.09 5.
949.0 6	5793.5	<1		
*957 1		<1		
966.0 3	2497.8	<1		
973.4 6	8363.5	9.3 9	E2	Mult.: R(DCO)=0.93 6; a ₂ /a ₀ =+0.51 12, (a ₄ /a ₀ set to 0.0).
989.4 3	7390.1	30.6 15	E2	Mult.: R(DCO)=0.93 6 a ₂ /a ₀ =+0.21 6, (a ₄ /a ₀ set to 0.0).
991.5 6	2927.8	3.9 4		
1008.1 6	6801.6	<1		
1015.8 3	5728.3	18.0 9	E2	Mult.: R(DCO)=0.96 5; a ₂ /a ₀ =+0.18 5, a ₄ /a ₀ =-0.08 6.
1029.2 6	6757.5	7.8 8	E2	Mult.: R(DCO)=1.19 13.
1035.3 6	4462.7	4.9 5		
1042.1 3	3427.5	10.1 5	E2	Mult.: R(DCO)=0.98 6.
1048@ 1	9411	<1		
1151.6 6	5614.3	1.1 1		
1179 1	1950.9	<1		
1227 1	9218.5	7.5 [‡] 8	E2	Mult.: R(DCO)=1.20 9 for 1227+1231+1234.
1231 1	10882.4	7.5 [‡] 8	E2	Mult.: R(DCO)=1.20 9 for 1227+1231+1234.
1234 1	7991.5	7.5 [‡] 8	E2	Mult.: R(DCO)=1.20 9 for 1227+1231+1234.
1287.9 6	9651.4	<1		
1308@ 1	8106.0?	<1		
1376 1	12258.4	<1		
1421.0 6	5199.8?	1.7 17		
1493@ 1	13751.4?	<1		

[†] From 2000Bo29.

[‡] For the composite peak of 1227+1231+1234.

[§] From 2000Bo29, based on γ(θ) and R(DCO), unless otherwise noted. Angular correlation asymmetry ratios R(DCO) were determined at angles of ≈90° and ≈50° (or 130°) with gates on ΔJ=2, quadrupole transitions (sum gate on 494γ and 609γ). Expected values of this ratio are ≈1.0 for ΔJ=2, quadrupole and ΔJ=0, dipole transitions; and ≈0.63 for ΔJ=1, dipole transitions.

[#] From 2000Bo29, using angular distribution data.

[@] Placement of transition in the level scheme is uncertain.

^{*} γ ray not placed in level scheme.

Adopted Levels, Gammas

Q(β⁻)=-11500 SY; S(n)=13100 SY; S(p)=-819.5 19; Q(α)=3918 21 2012Wa38.

¹⁰⁹I Levels

Cross Reference (XREF) Flags

A ⁵⁸Ni(⁵⁴Fe,p2nγ)
B ⁵⁴Fe(⁵⁸Ni,p2nγ)

E(level) [†]	Jπ	XREF	T _{1/2}	Comments
0.0	(1/2 ⁺ , 3/2 ⁺)	AB	92.8 μs 8	%p=99.986 4; %α=0.014 4. %α: from 2007Ma35. Jπ: from comparison between experimental and theoretical proton-decay half-lives using a deformed single particle Nilsson model (1999Ma05). non-favored α-decay (HF=37 12 with r ₀ (¹⁰⁵ Sb)=1.67 3, unweighted average of 1.632 14 (¹⁰⁴ Sn) and 1.70 6 (¹⁰⁶ Te)) to Jπ=(5/2 ⁺) in ¹⁰⁵ Sb. Note, that Jπ=5/2 ⁺ (d _{5/2}), if a spherical shape is assumed. T _{1/2} : unweighted average of 93.5 μs 3 (2007Ma35) and 92 μs 1 (2007Pe32). Others: 103 μs 5 (1995Ho26), 100 μs 5 (1993Se04), 109 μs 17 (1987Gi02) and >25 μs (1984Fa04). E(α)=3774 keV 20 (2007Ma35). E(p)=813 keV 4 (1995Ho26) and 830 keV 80 (1984Fa04).
x [‡]	(7/2 ⁺)	A		configuration: π1/2+[420] (g _{7/2}). The assignment is tentative. Jπ: proposed by 2007Pe32 based on systematics of odd-A iodine isotopes and self-consistent cranking calculations.
593.90+x [‡] 20	(11/2 ⁺)	A	10.7 ps 13	configuration: π1/2+[420] (g _{7/2}). The assignment is tentative. Jπ: 593.9γ E2 to (7/2 ⁺); band assignment.
1142.1+x [§] 3	(11/2 ⁻)	A		T _{1/2} : From recoil-decay tagging and RDDS method (2011Pr12). Jπ: proposed by 2007Pe32 based on systematics of odd-A iodine isotopes and self-consistent cranking calculation; 548.2γ (E1) to (11/2 ⁺). configuration: π1/2-[550] (h _{11/2}). The assignment is tentative.
1312.0+x [‡] 3	(15/2 ⁺)	A		Jπ: 718.1γ E2 to (11/2 ⁺); band assignment.
1650.3+x [#] 5	(13/2 ⁻)	A		Jπ: 1056.4γ (E1) to (11/2 ⁺); band assignment.
1680.0+x [§] 3	(15/2 ⁻)	A		Jπ: 537.8γ E2 to (11/2 ⁻); band assignment.
2146.9+x [#] 5	(17/2 ⁻)	A		Jπ: 496.6γ E2 to (13/2 ⁻); band assignment.
2193.7+x [‡] 4	(19/2 ⁺)	A		Jπ: 881.7γ E2 to (15/2 ⁺); band assignment.
2346.1+x [§] 4	(19/2 ⁻)	A		Jπ: 661.1γ E2 to (15/2 ⁻); band assignment.
2790.6+x [#] 6	(21/2 ⁻)	A		Jπ: 643.7γ E2 to (17/2 ⁻); band assignment.
3083.8+x [§] 5	(23/2 ⁻)	A		Jπ: 737.7γ E2 to (19/2 ⁻); band assignment.
3112.6+x [‡] 6	(23/2 ⁺)	A		Jπ: 918.9γ to (19/2 ⁺); band assignment.

[†] From a least-squares fit to E_γ.

[‡] (A): πg_{7/2} band.

[§] (B): πh_{11/2} intruder orbital.

[#] (C): πg_{7/2}⊗v(h_{11/2}g_{7/2}). The πg_{7/2}⊗3- configuration is also possible.

γ(¹⁰⁹I)

E(level)	E _γ [†]	I _γ [†]	Mult. [§]	α	Comments
593.90+x	593.9 2	100	E2	0.00536	Mult.: R(θ)=1.0 I used for normalization in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32). B(E2)(W.u.)=23 3.
1142.1+x	548.2 2	100	(E1)	0.00226	Mult.: R(θ)=1.0 I suggests ΔJ=0, dipole transition in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
1312.0+x	718.1 2	100	E2	0.00330	Mult.: R(θ)=1.1 I in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
1650.3+x	1056.4 4	100	(E1)	5.84×10 ⁻⁴	Mult.: R(θ)=0.7 I suggests ΔJ=1, dipole transition in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
1680.0+x	368.1 3	<19			
	537.8 [‡] 2	100	E2	0.00700	Mult.: R(θ)=1.0 I in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
2146.9+x	496.6 2	100	E2	0.00873	Mult.: R(θ)=1.2 2 in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
2193.7+x	881.7 3	100	E2	0.00203	Mult.: R(θ)=1.2 2 in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
2346.1+x	666.1 2	100	E2	0.00399	Mult.: R(θ)=1.1 I in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
2790.6+x	643.7 [‡] 2	100	E2	0.00435	Mult.: R(θ)=1.2 2 in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
3083.8+x	737.7 3	100	E2	0.00309	Mult.: R(θ)=1.2 2 in ⁵⁸ Ni(⁵⁴ Fe,p2nγ) (2007Pe32).
3112.6+x	918.9 4	100			

Footnotes continued on next page

Adopted Levels, Gammas (continued)
 $\gamma(^{109}\text{I})$ (continued)

[†] From $^{58}\text{Ni}(^{54}\text{Fe}, p2n\gamma)$ (2007Pe32).

[‡] Possible doublet.

[§] Based on $R(\text{angular})$ in 2007Pe32; $R(\theta) = I\gamma(\theta = 157.6^\circ, 133.6^\circ) / I\gamma(\theta = 94.2^\circ, 85.8^\circ)$, normalized to $R=1.0$ for 593.9γ .

⁵⁴Fe(⁵⁸Ni,p2n γ) 1999Yu02

1999Yu02: E(⁵⁸Ni)=220 MeV, ATLAS superconducting Linear accelerator, Argonne National Laboratory,USA. Target: 500 $\mu\text{g}/\text{cm}^2$, self-supporting foil. Detectors: GAMMASPHERE array (consisting of 101 Compton-suppressed Ge detectors), fragment mass separator (FMA), position-sensitive parallel- grid avalanche counter, double-sided silicon detector (DSSD). Recoil-decay tagging method. Measured: E γ , I γ , $\gamma\gamma$, p- $\gamma\gamma$.

Other: 1995Pa01, but their level scheme is different compared to 1999Yu02 and the adopted one.

¹⁰⁹I Levels

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0 x?	(1/2+, 3/2+)	92.8 μs 8	J π , T _{1/2} : from Adopted Levels.
729+x?			
1372.4+x? §	(11/2-)		The lower intensity of the depopulating 643.4 γ , compared to the 593.4 γ that feeds this level indicates that this level may be isomeric.
1965.8+x? §	(15/2-)		
2503.1+x?			
2682.8+x? §	(19/2-)		
3240.1+x?			
3563.8+x? §	(23/2-)		
3788.1+x?			
3906.2+x?			
4620.8+x? §	(27/2-)		

[†] From a least-squares fit to E γ .

[‡] From 1999Yu02.

§ (A): $\pi\text{h}11/2$ band (1999Yu02). The assignment is tentative.

$\gamma(^{109}\text{I})$

E γ [†]	E(level)	I γ [†]	E γ [†]	E(level)	I γ [†]	E γ [†]	E(level)	I γ [†]
^x 495.8 5		17 3	666.1 5	3906.2+x?	30 4	^x 836 1		28 6
537.3 5	2503.1+x?	36 4	717 1	2682.8+x?	63 6	881 1	3563.8+x?	44 8
548.0 5	3788.1+x?	30 4	729 [‡] 1	729+x?	35 4	^x 920 1		20 5
593.4 5	1965.8+x?	100 7	737 1	3240.1+x?	40 5	1057 1	4620.8+x?	39 7
643.4 [‡] 5	1372.4+x?	48 5	^x 820 1		15 3			

[†] From 1999Yu02.

[‡] Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

⁵⁸Ni(⁵⁴Fe,p2n γ) ²⁰⁰⁷Pe32,2011Pr12

2007Pe32,2007CeZX: E(⁵⁴Fe)=195 MeV, JYFL accelerator facility, University of Jyväskylä; production cross section of $\sigma=10$ μ b. Target: 1 mg/cm², self-supported, 99.8% isotopically enriched. Detectors: JUROGAM array of 43 HPGe detectors, RITU recoil separator in conjunction with GREAT focal-plane spectrometer, double-sided silicon strip detector. Measured; E γ , I γ , p γ , p $\gamma\gamma$, T_{1/2}, angular-intensity ratio (R); Recoil-decay-tagging technique.

2011Pr12,2012Cu03: E(⁵⁴Fe)=206 MeV from JYFL K130 cyclotron. The recoiling ¹⁰⁹I nuclei were separated using the RITU separator and implanted in a DSSD detector at the focal plane. Detector system GREAT was used in conjunction with the recoil-decay tagging technique. Measured E γ , I γ , T_{1/2} recoil-distance Doppler shift technique using PRE-JUROGAM II array consisting of 12 segmented clover detectors and 15 single-crystal Ge detectors.

¹⁰⁹I Levels

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0	(1/2+, 3/2+)	92 μ s 1	J π : from Adopted Levels.
x [§]	(7/2+)		E(level): it is not clear whether this level corresponds to the g.s.
593.90+x [§] 20	(11/2+)	10.7 ps 13	T _{1/2} : from recoil-distance doppler-shift technique using the differential decay curve method and the 594 γ (2011Pr12).
1142.1+x [#] 3	(11/2-)		
1312.0+x [§] 3	(15/2+)		
1650.3+x [@] 5	(13/2-)		
1680.0+x [#] 3	(15/2-)		
2146.9+x [@] 5	(17/2-)		
2193.7+x [§] 4	(19/2+)		
2346.1+x [#] 4	(19/2-)		
2790.6+x [@] 6	(21/2-)		
3083.8+x [#] 5	(23/2-)		
3112.6+x [§] 6	(23/2+)		

[†] From a least-squares fit to E γ .

[‡] From 2007Pe32, based on measured Mult, the observed band structures and systematics of neighboring odd-A, I isotopes.

[§] (A): $\pi g_{7/2}$ band.

[#] (B): $\pi h_{11/2}$ band.

[@] (C): $\pi g_{7/2} \otimes v(g_{7/2}, h_{11/2})$, but admixtures with $\pi g_{7/2} \otimes 3-$ are also possible.

 $\gamma(^{109}\text{I})$

E γ [†]	E(level)	I γ [†]	Mult. [§]	Comments
368.1 3	1680.0+x	<5		
496.6 2	2146.9+x	20 1	E2	Mult.: R(0)=1.2 2.
537.8 [‡] 2	1680.0+x	27 1	E2	Mult.: R(0)=1.0 1.
548.2 2	1142.1+x	23 1	(E1)	Mult.: R(0)=1.0 1 suggests $\Delta J=0$, dipole transition.
593.9 2	593.90+x	100 3	E2	Mult.: R(0)=1.0 1.
^x 603.8 2		17 1		
643.7 [‡] 2	2790.6+x	33 2	E2	Mult.: R(0)=1.2 2.
666.1 2	2346.1+x	23 1	E2	Mult.: R(0)=1.1 1.
^x 708.2 3		10 1		
718.1 2	1312.0+x	49 2	E2	Mult.: R(0)=1.1 1.
^x 729.2 3		13 2		
737.7 3	3083.8+x	17 1	E2	Mult.: R(0)=1.2 2.
^x 760.0 4		7 1		
^x 819.5 4		15 1		
^x 837.4 3		23 1		
^x 860.2 5		6 1		
881.7 3	2193.7+x	23 1	E2	Mult.: R(0)=1.2 2.
918.9 4	3112.6+x	10 1		
^x 938.4 4		11 1		
^x 952.8 5		6 1		
1056.4 4	1650.3+x	29 2	(E1)	Mult.: R(0)=0.7 1 suggests $\Delta J=1$, dipole transition.

[†] From 2007Pe32.

[‡] Possible doublet.

[§] Based on R(0) in 2007Pe32, where R(0)=I γ (0=157.6°,133.6°)/I γ (0=94.2°,85.8°), normalised to R(0)=1.0 for 593.9 γ .

^x γ ray not placed in level scheme.

Adopted Levels

S(n)=11720 CA; S(p)=810 SY; Q(α)=4217 7.
S(n) from 1997Mo25.
S(p) and Q(α) from 2012Wa38, ΔS(p)=330.

¹⁰⁹Xe Levels

E(level)	Jπ	T _{1/2}	Comments
0 . 0	(7 / 2 +)	13 ms 2	%α=100. Jπ: HF=3.8 11 to the excited Jπ=(7/2+) level in the daughter ¹⁰⁵ Te nucleus, deduced using r ₀ (¹⁰⁵ Te)=1.672 22, from HF=1.00 in ¹¹⁰ Xe α decay. Note that HF=9.0 18 to the Jπ=(5/2+) ground state; systematics of neighboring odd-A Xe,Te and Sn isotopes. configuration: νg _{7/2} orbital. T _{1/2} : From recoil-α(Δt) decay in 2006Li41. Eα=3918 9 (Iα=30 6) and 4062 7 (Iα=70 6) (2006Li41); Eα=3910 10 (Iα=31 7) and 4063 4 (Iα=69 7) (2010Da17).

NUCLEAR DATA SHEETS

REFERENCES FOR A=109

- 1937Ja01 D.A.Jackson, H.Kuhn – Proc.Roy.Soc.(London) 158A, 372 (1937)
 1940Al01 L.W.Alvarez, A.C.Helmholz, E.Nelson – Phys.Rev. 57, 660 (1940)
 1945Wi11 M.L.Wiedenbeck – Phys.Rev. 67, 92 (1945)
 1947Br05 H.Bratt, P.C.Gugelot, O.Huber, H.Medicus, P.Preiswerk, P.Scherrer, R.Steffen – Helv.Phys.Acta 20, 153 (1947)
 1948Mo33 D.L.Mock, B.C.Waddell, L.W.Fagg, R.A.Tobin – Phys.Rev. 74, 1536 (1948)
 1949Ma20 E.C.Mallary, M.L.Pool – Phys.Rev. 76, 1454 (1949)
 1950Co60 J.M.Cork, W.C.Rutledge, A.E.Stoddard, C.E.Branyan, J.LeBlanc – Phys.Rev. 79, 938 (1950)
 1950Cr26 M.F.Crawford, A.L.Schawlow, F.M.Kelly, W.M.Gray – Can.J.Research 28A, 558 (1950)
 1950Gu54 J.R.Gum, M.L.Pool – Phys.Rev. 80, 315 (1950)
 1951Ka46 J.H.Kahn – Thesis, Univ.Tennessee (1951); ORNL-1089 (1951)
 1951Mc11 C.L.McGinnis – Phys.Rev. 81, 734 (1951)
 1951Wo15 E.J.Wolicki, B.Waldman, W.C.Miller – Phys.Rev. 82, 486 (1951)
 1953Av25 P.Avignon – J.Phys.Radium 14, 636 (1953)
 1953Br73 J.Brunner, O.Huber, R.Joly, D.Maeder – Helv.Phys.Acta 26, 588A (1953)
 1953De26 E.der Mateosian – Phys.Rev. 92, 938 (1953)
 1953Nu04 R.H.Nussbaum, A.H.Wapstra, N.F.Verster, H.Cerfontain – Physica 19, 385 (1953)
 1954Be41 G.Bertolini, A.Bisi, E.Lazzarini, L.Zappa – Nuovo Cimento 11, 539 (1954)
 1954Mo38 J.Moreau – J.Phys.Radium 15, 380 (1954)
 1954So05 P.B.Sogo, C.D.Jeffries – Phys.Rev. 93, 174 (1954)
 1954Wa15 A.H.Wapstra – Ark.Fys. 7, 265 (1954)
 1955Mc51 F.K.McGowan, P.H.Stelson – Phys.Rev. 99, 127 (1955)
 1956Ku51 D.N.Kundu, C.L.McGinnis – Priv.Comm. (November 1956)
 1956Pe56 M.D.Petroff – Thesis, Univ.California (1956); UCRL-3538 (1956)
 1957Ma16 R.L.Macklin, N.H.Lazar, W.S.Lyon – Phys.Rev. 107, 504 (1957)
 1957St87 T.Stribel – Z.Naturforsch. 12a, 939 (1957)
 1957Wa05 A.H.Wapstra, W.van der Eijk – Nucl.Phys. 4, 325 (1957); Erratum Nucl.Phys. 4, 695 (1957)
 1958Gu09 G.Gueben, J.Govaerts – Inst.Interuniv.Sci.Nucleaires (Bruxelles), Monographie No.2 (1958)
 1958Ma43 L.L.Marino, W.B.Ewbank, W.A.Nierenberg, H.A.Shugart, H.B.Silsbee – Phys.Rev. 111, 286 (1958)
 1958Mc02 F.K.McGowan, P.H.Stelson – Phys.Rev. 109, 901 (1958)
 1958Sc03 U.Schindewolf – Phys.Rev. 109, 1280 (1958)
 1959Ma19 L.L.Marino – Thesis, Univ.California (1959); UCRL-8721; See Also 58Ma43
 1959Pi49 W.R.Pierson – MIT-LNS Progr.Report p.24 (May 1959); AECU-4525 (1959)
 1959St28 J.W.Starner – Bull.Am.Phys.Soc. 4, No.2, 99, L2 (1959)
 1960Cr05 M.Crut, D.R.Sweetman, N.S.Wall – Nuclear Phys. 17, 655 (1960)
 1962Br15 H.W.Brandhorst, Jr., J.W.Cobble – Phys.Rev. 125, 1323 (1962)
 1962Ec02 S.F.Eccles – Physica 28, 251 (1962)
 1962No06 M.Nozaawa – Nucl.Phys. 36, 411 (1962)
 1963By02 F.W.Byron, Jr., M.N.McDermott, R.Novick – Phys.Rev. 132, 1181 (1963)
 1963Cu02 B.Cujec – Phys.Rev. 131, 735 (1963)
 1963Po10 G.Poelz, U.Schmidt-Rohr – Phys.Verh. 14, 117 (1963)
 1964Bo12 H.W.Boyd, J.H.Hamilton, A.R.Sattler, P.F.A.Goudsmit – Physica 30, 124 (1964)
 1964Br27 K.Brandi, R.Engelmann, V.Hepp, E.Kluge, H.Krehbiel, U.Meyer-Berkhout – Nucl. Phys. 59, 33 (1964)
 1964Ro17 B.Rosner – Phys.Rev. 136, B664 (1964)
 1964We09 W.Weirauch – Z.Phys. 181, 273 (1964)
 1965Al15 K.F.Alexander, H.F.Brinckmann, C.Heiser, G.Lang, W.Neubert, H.Rotter – Phys.Lett. 17, 322 (1965)
 1965De15 A.G.Demin, Y.P.Kushakevich – Yadern.Fiz. 1, 198 (1965); Soviet J.Nucl.Phys. 1, 138 (1965)
 1965Kh04 D.E.Khulelidze, V.L.Chikhladze, V.G.Onufriev – Izv.Akad.Nauk SSSR, Ser.Fiz. 29, 729 (1965); Bull.Acad.Sci.USSR, Phys.Ser. 29, 732 (1966)
 1965Le03 J.C.Legg, G.Roy, M.A.Crosby – Bull.Am.Phys.Soc. 10, No.1, 104, JD9 (1965)
 1965Le06 H.Leutz, K.Schneckenberger, H.Wenninger – Nucl.Phys. 63, 263 (1965)
 1965Ma12 R.D.Macfarlane, A.Siivola – Phys.Rev.Lett. 14, 114 (1965)
 1965Mo06 R.B.Moler, R.W.Fink – Phys.Rev. 139, B282 (1965); See Also 69Fi05
 1965Se08 S.K.Sen, I.O.Durosinmi-Etti – Phys.Lett. 18, 144 (1965)
 1965Si04 A.T.Siivola – Phys.Rev.Lett. 14, 142 (1965)
 1965St18 G.M.Stinson, R.G.Summers-Gill – Phys.Can. 21, No.2, 42, Abstr. 12.7 (1965)
 1966Du01 I.O.Durosinmi-Etti, D.R.Brundrit, S.K.Sen – Proc.Intern.Conf.Internal Conversion Process, Nashville, Tenn. (1965), J.H.Hamilton, Ed., Academic Press, Inc., New York, p.201 (1966)
 1966En05 D.W.Engelkemeir – Priv.Comm., quoted by 1966Fr12 unpublished (1966)
 1966Fr12 M.S.Freedman, F.T.Porter, F.Wagner – Phys.Rev. 151, 886 (1966); Priv.Comm. (June 1967)
 1966He11 R.L.Heath, J.E.Cline – IDO-17188 (June 1966)
 1966Ja01 J.F.W.Jansen, A.H.Wapstra – Proc.Intern.Conf.Internal Conversion Process, Nashville, Tenn. (1965), J.H.Hamilton, Ed., Academic Press, Inc., New York, p.237 (1966)
 1966Ma39 I.Martinson, N.G.E.Johansson, S.Borg, T.Alvager – Ark.Fys. 31, 307 (1966)
 1966Mc06 A.L.McCarthy, T.W.Conlon – Phys.Rev. 147, 881 (1966)
 1966We01 W.Weirauch, W.-D.Schmidt-Ott, F.Smend, A.Flammersfeld – Z.Phys. 192, 351 (1966)
 1966We22 J.M.Weiss, J.A.Nolen, Jr. – TID-23239, p.20 (1966)
 1967Ab07 I.A.Abrams, L.L.Pelekis – Program and Theses, Proc. 17th All-Union Conf. Nucl. Spectroscopy and Struct. At. Nuclei, Kharkov, p. 30 (1967)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 1967B108 J.L.Black, W.Gruhle – Nucl.Phys. A93, 1 (1967)
 1967Br07 C.Brun, H.Dubost, B.Gatty, M.Lefort, X.Tarrago – Nucl.Phys. A95, 337(1967)
 1967Co24 B.L.Cohen, J.B.Moorhead, R.A.Moyer – Phys.Rev. 161, 1257 (1967)
 1967DiZZ C.G.Diethrich – Thesis, Univ.Michigan (1967); COO-1112-168 (1967)
 1967Fr16 K.Fritze, K.Griffiths – Radiochim.Acta 7, 59 (1967)
 1967Gr25 K.Griffiths, K.Fritze – Z.Anal.Chem. 226, 122 (1967)
 1967Ka01 V.A.Karnaukhov, G.M.Ter-Akopyan, L.S.Vertogradov, L.A.Petrov – Nucl.Phys. A90, 23 (1967)
 1967Li10 J.Libert – Nucl.Phys. A102, 477 (1967)
 1967Mi11 V.Middelboe – Kgl.Danske Videnskab.Selskab, Mat.-Fys.Medd. 35, No.8 (1966)
 1967Na18 T.Nagahara, M.Hattori, K.Kitao – Radioisotopes (Tokyo) 16, 8344 (1967)
 1967Pi05 W.R.Pierson, R.H.Marsh – Nucl.Phys. A104, 511 (1967)
 1967Sc22 F.J.Schima, J.M.R.Hutchinson – Nucl.Phys. A102, 667 (1967)
 1968BaZY W.E.Barnes, H.T.Easterday – RLO-1062-681 p.8 (1968)
 1968Be22 G.Berzins, M.E.Bunker, J.W.Starner – Nucl.Phys. A114, 512 (1968)
 1968BeZV R.B.Begzhanov, K.Sabirov, K.Salikhbaev, M.M.Khodzhaev – Program and Theses, Proc.18th Ann.Conf.Nucl.Spectroscopy and Struct. of At.Nuclei, Riga, p.41 (1968)
 1968Co32 B.L.Cohen, R.A.Moyer, J.B.Moorhead, L.H.Goldman, R.C.Diehl – Phys.Rev. 176, 1401 (1968)
 1968Ea01 L.V.East, H.M.Murphy, Jr., E.R.Lewis – Nucl.Phys. A107, 382 (1968)
 1968Fo03 C.Foin, A.Gizon, J.Oms – Nucl.Phys. A113, 241 (1968)
 1968Fu05 T.Furuta, J.R.Rhodes – Int.J.Appl.Radiat.Isotop. 19, 483 (1968)
 1968Gr02 G.Graeffe, G.E.Gordon – Nucl.Phys. A107, 67 (1968)
 1968Iv02 E.A.Ivanov, A.Iordachescu, G.Pascovici – Rev.Roumaine Phys. 13, 879 (1968)
 1968Re04 S.A.Reynolds, J.F.Emery, E.I.Wyatt – Nucl.Sci.Eng. 32, 46 (1968)
 1968Sm08 F.Smend, W.Weirauch, W.-D.Schmidt-Ott – Z.Phys. 214, 437 (1968)
 1968St17 W.M.Stewart, N.Baron, R.F.Leonard – Phys.Rev. 171, 1316 (1968)
 1969Ab04 E.Abramson, I.Plessner, Z.Vager, J.P.Wurm – Phys.Letters 29B, 304 (1969)
 1969Ab09 E.Abramson, R.A.Eisenstein, I.Plessner, Z.Vager – Nucl.Phys. A138, 609 (1969)
 1969Be37 I.Ben-Zvi, A.E.Blaugrund, Y.Dar, G.Goldring, Y.Wolfson – Nucl.Phys. A135, 153 (1969)
 1969Bo29 M.Boivin, Y.Cauchois, Y.Heno – Nucl.Phys. A137, 520 (1969)
 1969Bu04 V.R.Burmistrov, V.A.Shilin, V.A.Didorenko – Izv.Akad.Nauk Kaz.SSR, Ser.Fiz.Mat. No.2, 22 (1969)
 1969Di16 V.A.Didorenko, Y.A.Andreev, V.R.Burmistrov, S.P.Karetskaya – Izv.Akad.Nauk SSSR, Ser.Fiz. 33, 1685 (1969); Bull.Acad.Sci.USSR, Phys.Ser. 33, 1546 (1970)
 1969HeZY R.L.Heath – Proc.Int.Conf.on Radioactivity in Nuclear Spectroscopy, Vanderbilt Univ., Nashville, U.S.A., J.H.Hamilton, J.C.Manthuruthil, Eds., Vol.1, p.23 (1969)
 1969La06 N.S.Laulainen, M.N.McDermott – Phys.Rev. 177, 1615 (1969)
 1969PI08 B.Plansky – Nucl.Instr.Methods 73, 205 (1969)
 1969Ro03 R.L.Robinson, F.K.McGowan, P.H.Stelson, W.T.Milner, R.O.Sayer – Nucl.Phys. A123, 193 (1969)
 1969Sc12 W.C.Schick, Jr., W.L.Talbert, Jr. – Nucl.Phys. A128, 353 (1969)
 1969Sh06 C.G.Shugart, J.R.Curry, G.A.Lock, P.A.Moore, P.J.Riley – Phys.Rev. 178, 1836 (1969)
 1969WiZX J.B.Wilhelmy – Thesis, Univ.California (1969); UCRL-18978 (1969)
 1969Ya05 T.Yamazaki, G.T.Ewan – Nucl.Phys. A134, 81 (1969)
 1970Ab02 E.Abramson, R.A.Eisenstein, I.Plessner, Z.Vager, J.P.Wurm – Nucl.Phys. A144, 321 (1970)
 1970Ba37 E.Bashandy – Z.Phys. 236, 130 (1970)
 1970Be79 R.B.Begzhanov – Izv.Akad.Nauk Uzb.SSR, Ser.Fiz.-Mat.Nauk No.4, 56 (1970)
 1970Bo22 M.Bormann, H.H.Bissem, E.Magiera, R.Warnemunde – Nucl.Phys. A157, 481 (1970)
 1970Di05 R.C.Diehl, B.L.Cohen, R.A.Moyer, L.H.Goldman – Phys.Rev. C1, 2086 (1970)
 1970Fo01 J.L.C.Ford, Jr., R.L.Robinson, P.H.Stelson, T.Tamura, C.-Y.Wong – Nucl.Phys. A142, 525 (1970)
 1970Go39 W.Goedbloed, S.C.Goverse, C.P.Gerner, A.Brinkman, J.Blok – Nucl.Instrum.Methods 88, 197 (1970)
 1970Gr13 R.C.Greenwood, R.G.Helmer, R.J.Gehrke – Nucl.Instrum.Methods 77, 141 (1970)
 1970Jo20 W.John, F.W.Guy, J.J.Wesolowski – Phys.Rev. C2, 1451 (1970)
 1970MiZS T.R.Miller, M.Takeda – Bull.Amer.Phys.Soc. 15, No.12, 1610, DB10 (1970)
 1970Ra37 D.E.Raeside – Nucl.Instrum.Methods 87, 7 (1970)
 1970Ri06 J.Rivier, R.Moret – Nucl.Phys. A149, 337 (1970)
 1970Ro14 R.L.Robinson, F.K.McGowan, P.H.Stelson, W.T.Milner – Nucl.Phys. A150, 225 (1970)
 1970RoZS W.M.Roney, H.W.Kugel, G.M.Heestand, R.R.Borchers, R.Kalish – Proc.Intern.Conf.Nucl.Reactions Induced by Heavy Ions, Heidelberg, Germany (1969), R.Bock, W.R.Hering, Eds., North-Holland Publishing Co., Amsterdam, p.419 (1970); R.R.Borchers – Priv.Comm. (May 1972)
 1970Sh05 S.Shastry, H.Bakhru, I.M.Ladenbauer-Bellis – Phys.Rev. C1, 1835 (1970)
 1970Wa05 R.L.Watson, J.B.Wilhelmy, R.C.Jared, C.Rugge, H.R.Bowman, S.G.Thompson, J.O.Rasmussen – Nucl.Phys. A141, 449 (1970)
 1971Ba08 H.Bakhru, I.M.Ladenbauer-Bellis, I.Rezanka – Phys.Rev. C3, 937 (1971)
 1971Ho29 F.F.Hopkins, G.W.Phillips, J.R.White, C.F.Moore, P.Richard – Phys.Rev. C4, 1927 (1971)
 1971Ri02 M.T.Riccatto – Radiochim.Acta 15, 3 (1971)
 1972Br02 D.S.Brenner, M.L.Pertman – Nucl.Phys. A181, 207 (1972)
 1972Bu41 V.R.Burmistrov, V.A.Shilin – Izv.Akad.Nauk SSSR, Ser.Fiz. 36, 2499 (1972); Bull.Acad.Sci.USSR, Phys.Ser. 36, 2173 (1973)
 1972Ca16 J.L.Campbell, L.A.McNelles – Nucl.Instrum.Methods 101, 153 (1972)
 1972Ch56 M.B.Chatterjee, B.B.Baliga – Indian J.Pure Appl.Phys. 10, 517 (1972)
 1972Ja01 H.C.Jain, S.K.Bhattacharjee, C.V.K.Baba – Nucl.Phys. A178, 437 (1972)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 1972Sp09 P.W.Spence, M.N.McDermott – Phys.Lett. 42A, 273 (1972)
- 1972Th16 M.J.Throop, I.Hall, I.M.Naqib, D.J.Thomas, B.Wakefield – Phys.Lett. 41B, 585 (1972)
- 1973Au07 R.L.Auble, F.E.Bertrand, Y.A.Ellis, D.J.Horen – Phys.Rev. C8, 2308 (1973)
- 1973BuZX V.R.Burmistrov, V.A.Didorenko – Program and Theses, Proc.23rd Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Tbilisi, p.59 (1973)
- 1973ChWJ N.B.Chatterjee, B.B.Baliga – INDC(SEC)–35/L P97 (1973)
- 1973ChZN N.B.Chatterjee, B.B.Baliga – BARC–695, p.21 (1973)
- 1973Co10 C.W.Cottrell – Nucl.Phys. A204, 161 (1973)
- 1973Ha37 E.Hagberg, P.G.Hansen, B.Jonson, B.G.G.Jorgensen, E.Kugler, T.Mowinckel – Nucl.Phys. A208, 309 (1973)
- 1973Ho22 F.F.Hopkins, J.R.White, C.F.Moore, P.Richard – Phys.Rev. C8, 380 (1973)
- 1973IsZT J.H.Broadhurst, M.E.Cage, D.L.Clark, G.W.Greenlees, G.Isaak, J.M.Moss – COO–1265–142, p.166 (1973)
- 1973Le29 J.Legrand, M.Blondel, P.Magnier – Nucl.Instrum.Methods 112, 101 (1973)
- 1974ClZX R.G.Clark, L.E.Glendenin, W.L.Talbert, Jr. – Proc.Symp.Phys.Chem.Fission, 3rd, Rochester, N.Y. (1973), Int.At.En.Agency, Vienna, Vol.2, p.221 (1974)
- 1974Er05 K.I.Erokhina, R.K.Zhigulevichus, I.K.Lemberg, A.A.Pasternak – Izv.Akad.Nauk SSSR, Ser.Fiz. 38, 1679 (1974); Bull.Acad.Sci.USSR, Phys.Ser. 38, No.8, 102 (1974)
- 1974Ho17 W.Hogervorst, C.Ekstrom, S.Ingelman, G.Wannberg – Phys.Scr. 9, 317 (1974)
- 1974Mi02 T.R.Miller, M.Takeda – Nucl.Phys. A221, 392 (1974)
- 1974Sa25 W.Sahm, A.Schwenk – Z.Naturforsch. 29a, 1763 (1974)
- 1975Ch07 K.C.Chan, B.L.Cohen, L.Shabason – Phys.Rev. C11, 1064 (1975)
- 1975Di12 W.Dietrich, A.Backlin, C.O.Lannergard, I.Ragnarsson – Nucl.Phys. A253, 429 (1975)
- 1975El10 F.El-Bedewi, Z.Miligi, H.Hanafi – Acta Phys. 38, 153 (1975)
- 1975Fe12 P.Fettweis, P.del Marmol – Z.Phys. A275, 359 (1975)
- 1975Ma32 B.Martin, D.Merkert, J.L.Campbell – Z.Phys. A274, 15 (1975)
- 1975Me22 M.Meyer, R.Beraud, J.Daniere, R.Rougnny, J.Rivier, J.Treherne, D.Barneoud – Phys.Rev. C12, 1858 (1975)
- 1975Na01 H.J.Nagy, G.Schupp, R.R.Hurst – Phys.Rev. C11, 205 (1975)
- 1976ChZD E.Cheifetz, A.Wolf – Proc.Int.Conf.Nuclei Far from Stability, 3rd, Cargese, France, R.Klapisch, Ed., CERN–76–13, p.471 (1976)
- 1976Dr07 O.Dragoun, V.Brabec, M.Rysavy, J.Plch, J.Zderadicka – Z.Phys. A279, 107 (1976)
- 1976EiZY M.Eibert, A.K.Gaigalas, D.M.Gordon, R.E.Shroy, D.B.Fossan – Bull.Am.Phys.Soc. 21, 95 JE4 (1976)
- 1976Fu06 G.H.Fuller – J.Phys.Chem.Ref.Data 5, 835 (1976)
- 1976GaZQ P.W.Gallagher, E.W.Schneider, M.D.Glascock, W.B.Walters, R.A.Meyer – Bull.Am.Phys.Soc. 21, No.4, 633, HF3 (1976)
- 1976KaYO N.Kaffrell, G.Franz, G.Klein, K.Summerer, G.Tittel, N.Trautmann, G.Herrmann, H.Ahrens – CERN–76–13, p.483 (1976)
- 1976Ma09 G.C.Madueme, L.O.Edvardson, L.Westerberg – Phys.Scr. 13, 17 (1976)
- 1976MaYL V.Matschoss, K.Bachmann – Proc.Int.Conf.Nuclei Far From Stability, Cargese, Corsica, p.59 (1976); CERN 76–13 (1976)
- 1976Ox01 K.Oxorn, A.J.Houdayer, S.K.Mark – Z.Phys. A279, 289 (1976)
- 1976PoZU A.V.Poelgeest, W.H.A.Hesselink, J.Zalmstra, H.Verheul – Proc.Nuclei Far from Stability, Cargese, Corsica, p.A45 (1976)
- 1976Sm04 J.W.Smits, R.H.Siemssen – Nucl.Phys. A261, 385 (1976)
- 1976Tr02 N.Trautmann, N.Kaffrell, H.Ahrens, P.F.Dittner – Phys.Rev. C13, 872 (1976)
- 1976Va25 S.Y.Van der Werf, B.Fryszczyn, L.W.Put, R.H.Siemssen – Nucl.Phys. A273, 15 (1976)
- 1977An01 R.E.Anderson, J.J.Kraushaar, I.C.Oelrich, R.M.DelVecchio, R.A.Naumann, E.R.Flynn, C.E.Moss – Phys.Rev. C15, 123 (1977)
- 1977Ba57 H.Bartsch, K.Huber, U.Kneissl, H.Krieger – Z.Phys. A283, 199 (1977)
- 1977Ba87 I.F.Barchuk, G.V.Belykh, V.I.Golyshkin, A.F.Ogorodnik, M.M.Tuchinskij – Probl.Yad.Fiz.Kosm.Luchei 7, 37 (1977)
- 1977Be19 I.Berkes, G.Marest, R.Haroutunian – Phys.Rev. C15, 1839 (1977)
- 1977Bo04 H.E.Bosch, V.M.Silbergleit, M.Davidson, J.Davidson – Can.J.Phys. 55, 175 (1977)
- 1977Bo15 R.N.Boyd, H.Clement, G.D.Gunn – Nucl.Phys. A283, 434 (1977)
- 1977ChYJ M.B.Chatterjee, B.B.Beliga – INDC(SEC)–61/LN, p.116 (1977)
- 1977ChYZ N.B.Chatterjee, B.B.Baliga, R.Bhattacharya – BARC–897, p.24 (1977)
- 1977Gi11 J.E.Gindler, L.E.Glendenin – Inorg.Nucl.Chem.Lett. 13, 95 (1977)
- 1977Ki11 R.Kirchner, O.Klepper, G.Nyman, W.Reisdorf, E.Roeckl, D.Schardt, N.Kaffrell, P.Peuser, K.Schneeweiss – Phys.Lett. 70B, 150 (1977)
- 1977Sh05 S.Shastry, T.W.Debiak, E.V.Mason, Jr., J.D.Yesso, R.L.Wolke – Z.Phys. A280, 377 (1977)
- 1977SmZM J.W.Smith, S.Y.van der Werf – KVI 1976 Ann.Rept., p.33 (1977)
- 1977SmZX J.W.Smits – Thesis, Univ.Groningen (1977)
- 1977Va05 C.W.E.van Eijk, J.Wijnhorst – Phys.Rev. C15, 1068 (1977)
- 1978Fr16 G.Franz, G.Herrmann – J.Inorg.Nucl.Chem. 40, 945 (1978)
- 1978Fr21 G.Franz – J.Inorg.Nucl.Chem. 40, 1467 (1978)
- 1978He21 R.G.Helmer, R.C.Greenwood, R.J.Gehrke – Nucl.Instrum.Methods 155, 189 (1978)
- 1978Ka10 M.Kanazawa, S.Ohya, T.Tamura, Z.-i.Matamoto, N.Mutsuro – J.Phys.Soc.Jpn. 44, 25 (1978)
- 1978Mo22 T.Morii – Nucl.Instrum.Methods 151, 489 (1978)
- 1978Pa11 R.C.Pardo, E.Kashy, W.Benenson, L.W.Robinson – Phys.Rev. C18, 1249 (1978)
- 1978Pr08 I.Prochazka, T.I.Kracikova, V.Jahelkova, Z.Hons, M.Fiser, J.Jursik – Czech.J.Phys. B28, 134 (1978)
- 1978Ro19 E.Roeckl, R.Kirchner, O.Klepper, G.Nyman, W.Reisdorf, D.Schardt, K.Wien, R.Fass, S.Mattsson – Phys.Lett. 78B, 393 (1978)
- 1978Sh08 G.A.Shevelev, A.G.Troitskaya, V.M.Kartashov – Izv.Akad.Nauk SSSR, Ser.Fiz. 42, 211 (1978); Bull.Acad.Sci.USSR, Phys.Ser. 42, No.1, 184 (1978)

REFERENCES FOR A=109 (CONTINUED)

- 1978Sp09 G.D.Sprouse, O.Hausser, H.R.Andrews, T.Faestermann, J.R.Beene, T.K.Alexander – Hyperfine Interactions 4, 229 (1978)
- 1978St01 D.C.Stromswold, D.O.Elliott, Y.K.Lee, L.E.Samuels, J.A.Grau, F.A.Rickey, P.C.Simms – Phys.Rev. C17, 143 (1978)
- 1978Ta06 Y.Tagishi, K.Katori, M.Sasagase, M.Sato, T.Aoki, T.Mikumo – Phys.Rev.Lett. 41, 16 (1978)
- 1979Bo26 H.G.Borner, W.F.Davidson, J.Almeida, J.Blachot, J.A.Pinston, P.H.M.Van Assche – Nucl.Instrum.Methods 164, 579 (1979)
- 1979Ew02 G.T.Ewan, E.Hagberg, P.G.Hansen, B.Jonson, S.Mattsson, G.Nyman, E.Roeckl, D.Schardt, P.Tidemand-Petersson, The ISOLDE Collaboration – Phys.Lett. 84B, 173 (1979)
- 1979Ha12 E.Hashimoto, Y.Shida, G.C.Madueme, N.Yoshikawa, M.Sakai, S.Ohya – Nucl.Phys. A318, 145 (1979)
- 1979Oh02 S.Ohya, Y.Shida, O.Hashimoto, N.Yoshikawa, M.Ishii – Nucl.Phys. A325, 408 (1979)
- 1979Pl04 J.Plch, P.Dryak, J.Zderadicka, E.Schonfeld, A.Szorenyi – Czech.J.Phys. B29, 1071 (1979)
- 1979Sc22 D.Schardt, R.Kirchner, O.Klepper, W.Reisdorf, E.Roeckl, P.Tidemand-Petersson, G.T.Ewan, E.Hagberg, B.Jonson, S.Mattsson, G.Nyman – Nucl.Phys. A326, 65 (1979)
- 1979Va04 C.W.E.van Eijk, J.Wijnhorst, M.A.Popelier – Phys.Rev. C19, 1047 (1979)
- 1979Va13 A.van Poelgeest, W.H.A.Hesselink, J.Bron, J.J.A.Zalmstra, M.J.Uitzinger, H.Verheul, S.J.Feenstra, J.van Klinken – Nucl.Phys. A327, 12 (1979)
- 1980Ca02 R.F.Casten, G.J.Smith, M.R.Macphail, D.Breitig, W.R.Kane, M.L.Stelts, S.F.Mughabghab, J.A.Cizewski, H.G.Borner, W.F.Davidson, K.Schreckenbach – Phys.Rev. C21, 65 (1980)
- 1980Da23 R.I.Davidonis, R.K.Zhirkulevichus, R.A.Kalinauskas, V.I.Kershulis, K.V.Makaryunas – Izv.Akad.Nauk SSSR, Ser.Fiz. 44, 1060 (1980); Bull.Acad.Sci.USSR, Phys.Ser. 44, No.5, 139 (1980)
- 1980Sc23 O.Scholten, M.N.Harakeh, J.Van Der Plicht, L.W.Put, R.H.Siemssen, S.Y.Van Der Werf, M.Sekiguchi – Nucl.Phys. A348, 301 (1980)
- 1981Bu17 V.P.Burminsky, O.D.Kovrigin – Izv.Akad.Nauk SSSR, Ser.Fiz. 45, 123 (1981)
- 1981Fl02 E.R.Flynn, F.Ajzenberg-Selove, R.E.Brown, J.A.Cizewski, J.W.Sunier – Phys.Rev. C24, 902 (1981); Erratum Phys.Rev. C25, 2851 (1982)
- 1981Ha26 E.Hagan, E.Zech, G.Eska – Z.Phys. A300, 339 (1981)
- 1981JoZX M.G.Johnston, I.S.Grant, P.Misaelides, P.J.Nolan, P.Peuser, R.Kirchner, O.Klepper, E.Roeckl, P.Tidemand-Petersson – Proc.Int.Conf.Nuclei Far from Stability, Helsingor, Denmark, Vol.2, p.469 (1981); CERN-81-09 (1981)
- 1981Sc17 D.Schardt, T.Batsch, R.Kirchner, O.Klepper, W.Kurciewicz, E.Roeckl, P.Tidemand-Petersson – Nucl.Phys. A368, 153 (1981)
- 1981SeZW H.A.Selic, E.Cheifetz, J.B.Wilhelmy – JUL-Spez-99, p.69 (1981)
- 1981Va11 R.Vaninbrouck, G.Grosse, W.Zehner – Int.J.Appl.Radiat.Isotop. 32, 589 (1981)
- 1982An17 W.Andrejscheff, M.Senba, N.Tsoupas, Z.Z.Ding – Nucl.Instrum.Methods 204, 123 (1982)
- 1982Av07 D.K.Avasthi, V.K.Mittal, I.M.Govil – Phys.Rev. C26, 1310 (1982)
- 1982Aw03 Z.Awwad, T.Bayomy, N.A.Mansour, F.Asfour, M.R.El-Aasser – ATOMKI Kozlem. 24, 123 (1982)
- 1982Br19 R.A.Braga, R.W.Fink – Phys.Rev. C26, 1302 (1982)
- 1982HoZF D.D.Hoppes, F.J.Schima – NBS-SP-626, p.117 (1982)
- 1982HoZJ D.D.Hoppes, J.M.R.Hutchinson, F.J.Schima, M.P.Unterweger – NBS-SP-626, p.85 (1982)
- 1982Jo03 M.G.Johnston, I.S.Grant, P.Misaelides, P.J.Nolan, P.Peuser, R.Kirchner, O.Klepper, E.Roeckl, P.Tidemand-Petersson – J.Phys.(London) G8, 1405 (1982)
- 1982La25 F.Lagoutine, J.Legrand – Int.J.Appl.Radiat.Isotop. 33, 711 (1982)
- 1983BaZT E.Barnard, C.Dednam, D.Mingay – INDC(SAF)-007/G, p.1 (1983)
- 1983Ch34 M.B.Chatterjee, B.B.Baliga, R.Bhattacharya – Czech.J.Phys. B33, 990 (1983)
- 1983Ch42 M.B.Chatterjee, B.B.Baliga – Fizika(Zagreb) 15, 273 (1983)
- 1983Ta06 E.M.Takagui, F.C.Sampaio, O.Dietzsch – Phys.Rev. C27, 1993 (1983)
- 1984Ba72 D.Bazzacco, F.Brandolini, P.Pavan, C.Rossi Alvarez, R.Zannoni, M.De Poli – Nuovo Cim. 84A, 106 (1984)
- 1984Fa04 T.Faestermann, A.Gillitzer, K.Hartel, P.Kienle, E.Nolte – Phys.Lett. 137B, 23 (1984)
- 1984Ka16 L.Kaubler, W.Enghardt, H.J.Keller, L.Kostov, H.Prade, F.Stary – ATOMKI Kozlem. 26, 27 (1984)
- 1984ShZL G.A.Shevelev – Program and Theses, Proc.34th Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Alma-Ata, p.92 (1984)
- 1984Wo08 L.D.Wood, H.H.Bolotin, I.Morrison, R.A.Bark, H.Yamada, A.E.Stuchbery – Nucl.Phys. A427, 639 (1984)
- 1985Ed01 R.Eder, E.Hagn, E.Zech – Phys.Rev. C31, 190 (1985)
- 1985Ti02 P.Tidemand-Petersson, R.Kirchner, O.Klepper, E.Roeckl, D.Schardt, A.Plochocki, J.Zylicz – Nucl.Phys. A437, 342 (1985)
- 1985Ti05 W.Tiereth, Z.Basrak, N.Bischof, H.Frohlich, H.Voit – Nucl.Phys. A440, 143 (1985)
- 1985Ul03 G.Ulm, J.Eberz, G.Huber, H.Lochmann, R.Menges, R.Kirchner, O.Klepper, T.Kuhl, P.O.Larsson, D.Marx, D.Murnick, D.Schardt – Z.Phys. A321, 395 (1985)
- 1986Ba14 D.Ballon, Y.Niv, S.Vajda, N.Benczer-Koller, L.Zamick, G.A.Leander – Phys.Rev. C33, 1461 (1986)
- 1986Be01 I.Berkes, O.El Hajjaji, B.Hlimi, G.Marest, R.Coussement, F.Hardeman, P.Put, G.Scheveneels – Phys.Rev. C33, 390 (1986)
- 1986En06 W.Enghardt, H.Prade, H.U.Jager, L.Kaubler, H.-J.Keller, F.Stary, L.K.Kostov – Ann.Phys.(Leipzig) 43, 424 (1986)
- 1986KaZS N.Kaffrell, J.Rogowski, H.Tetzlaff, N.Trautmann, M.Skalberg, G.Skarnemark, J.Alstad, K.Wolfsberg – Univ.Mainz, 1985 Ann.Rept., p.7 (1986)
- 1986KuZV M.F.Kudoyarov, A.A.Pasternak, V.V.Trishin, Yu.N.Lobach, I.P.Tkachuk – Program and Theses, Proc.36th Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Kharkov, p.85 (1986)
- 1987Eb01 J.Eberz, U.Dinger, G.Huber, H.Lochmann, R.Menges, G.Ulm, R.Kirchner, O.Klepper, T.U.Kuhl, D.Marx – Z.Phys. A326, 121 (1987)
- 1987Eb02 J.Eberz, U.Dinger, G.Huber, H.Lochmann, R.Menges, R.Neugart, R.Kirchner, O.Klepper, T.Kuhl, D.Marx, G.Ulm, K.Wendt, and the ISOLDE Collaboration – Nucl.Phys. A464, 9 (1987)
- 1987Gi02 A.Gillitzer, T.Faestermann, K.Hartel, P.Kienle, E.Nolte – Z.Phys. A326, 107 (1987)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 1987Ka29 N.Kaffrell, P.Hill, J.Rogowski, H.Tetzlaff, N.Trautmann, E.Jacobs, P.de Gelder, D.de Frenne, K.Heyde, S.Borjesson, G.Skarnemark, J.Alstad, N.Biasi, M.N.Harakeh, W.A.Sterrenburg, K.Wolfsberg – Nucl.Phys. A470, 141 (1987)
- 1987Ku09 T.Kuhl, R.Kirchner, O.Klepper, D.Marx, U.Dinger, J.Eberz, G.Huber, H.Lochmann, R.Menges, G.Ulm – Nucl.Instrum.Methods Phys.Res. B26, 419 (1987)
- 1987KuZV M.F.Kudoyarov, E.V.Kuzmin, Yu.N.Lobach, A.A.Pasternak, I.P.Tkachuk, V.V.Trishin – Program and Theses, Proc.37th Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Yurmala, p.81 (1987)
- 1987Wa27 Y.Watanabe, I.Kumabe, M.Hyakutake, N.Koori, K.Ogawa, K.Akagi, N.Oda – Phys.Rev. C36, 1325 (1987)
- 1988Ba60 C.Ballaux, B.M.Coursey, D.D.Hoppes – Appl.Radiat.Isot. 39, 1131 (1988)
- 1988Br31 D.E.Brown, K.S.Krane – Nucl.Phys. A489, 100 (1988)
- 1988Ch25 A.E.Champagne, G.E.Dodge, R.T.Kouzes, M.M.Lowry, A.B.McDonald, M.W.Roberson – Phys.Rev. C38, 900 (1988)
- 1988Ch35 M.B.Chatterjee, R.Bhattacharya, B.B.Baliga – Nuovo Cim. 100A, 239 (1988)
- 1988I101 K.Ilakovic, G.Jerbic-Zorc, M.Bozin, R.Pesic, V.Horvat – Fizika(Zagreb) 20, 91 (1988)
- 1988Ku25 I.Kumabe, Y.Inenaga, M.Hyakutake, N.Koori, Y.Watanabe, K.Ogawa, K.Orito – Phys.Rev. C38, 2531 (1988)
- 1988Vi03 I.N.Vishnevsky, M.Yu.Kirichenko, Yu.N.Lobach, O.B.Melnikov, I.P.Tkachuk, V.V.Trishin – Izv.Akad.Nauk SSSR, Ser.Fiz. 52, 43 (1988); Bull.Acad.Sci.USSR, Phys.Ser. 52, No.1, 40 (1988)
- 1988Vi07 I.N.Vishnevsky, M.F.Kudoyarov, E.V.Kuzmin, Yu.N.Lobach, A.A.Pasternak, I.P.Tkachuk, V.V.Trishin – Ukr.Fiz.Zh. 33, 651 (1988)
- 1989Gr23 M.Graefenstedt, P.Jurgens, U.Keyser, F.Munnich, F.Schreiber, K.Balog, T.Winkelmann, H.R.Faust – Z.Phys. A334, 239 (1989)
- 1989Hi01 Y.Hino, Y.Kawada – Appl.Radiat.Isot. 40, 79 (1989)
- 1989Lo08 M.Loiselet, O.Naviliat-Cuncic, J.Vervier – Nucl.Phys. A496, 559 (1989)
- 1990Ab06 A.Abzouzi, M.S.Antony, V.B.Ndoko Ndongue, D.Oster – J.Radioanal.Nucl.Chem. 145, 361 (1990)
- 1990Al43 T.Altzitzoglou, J.Rogowski, M.Skalberg, J.Alstad, G.Herrmann, N.Kaffrell, G.Skarnemark, W.Talbert, N.Trautmann – Radiochim.Acta 51, 145 (1990)
- 1991Bu17 V.V.Bulgakov, A.V.Kaznovetsky, V.I.Kirishchuk, S.A.Kovalenko, V.T.Kupryashkin, A.P.Lashko, N.V.Strilchuk, A.I.Feoktistov, I.P.Shapovalova – Izv.Akad.Nauk SSSR, Ser.Fiz. 55, 2147 (1991); Bull.Acad.Sci.USSR, Phys.Ser. 55, No.11, 65 (1991)
- 1992An19 M.S.Antony, D.Oster, A.Hachem – J.Radioanal.Nucl.Chem. 166, 63 (1992)
- 1992Ay02 J.Aysto, A.Astier, T.Enqvist, K.Eskola, Z.Janas, A.Jokinen, K.-L.Kratz, M.Leino, H.Penttila, B.Pfeiffer, J.Zylicz – Phys.Rev.Lett. 69, 1167 (1992)
- 1992KaZM K.Kawade, H.Yamamoto, A.Tanaka, A.Hosoya, T.Katoh, T.Iida, A.Takahashi – JAERI-M 92-027, p.364 (1992)
- 1992PeZX H.Penttila – Thesis, Univ.Jyvaskyla (1992)
- 1992ScZZ U.Schotzig, H.Schrader, K.Debertin – Proc.Inter.Conf.Nuclear Data for Science and Technology, Julich, Germany, p.562 (1992)
- 1992Sh35 N.Shinohara, S.Ichikawa, S.Baba, K.Tsukada, T.Ohtsuki, J.Alstad – Radiochim.Acta 56, 127 (1992)
- 1992Si05 K.P.Singh, D.K.Avasthi, I.M.Govil – Phys.Rev. C45, 2498 (1992)
- 1992Un01 M.P.Unterweger, D.D.Hoppes, F.J.Schima – Nucl.Instrum.Methods Phys.Res. A312, 349 (1992)
- 1993IsZX T.Ishii, A.Makishima, M.Shibata, M.Ogawa, M.Ishii – Japan Atomic Energy Res.Inst.Tandem VDG Ann.Rept., 1992, p.138 (1993)
- 1993Se04 P.J.Sellin, P.J.Woods, T.Davinson, N.J.Davis, K.Livingston, R.D.Page, A.C.Shotter, S.Hofmann, A.N.James – Phys.Rev. C47, 1933 (1993)
- 1994ByZZ V.T.Bykov, K.S.Goncharov, V.A.Kuzmenko, V.V.Remaev – Program and Thesis, Proc.44th Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Kharkov, p.53 (1994)
- 1994Is01 T.Ishii, A.Makishima, M.Shibata, M.Ogawa, M.Ishii – Phys.Rev. C49, 2982 (1994)
- 1994Ja06 V.P.Janzen, D.R.LaFosse, H.Schnare, D.B.Fossan, A.Galindo-Uribarri, J.R.Hughes, S.M.Mullins, E.S.Paul, L.Persson, S.Pilotte, D.C.Radford, I.Ragnarsson, P.Vaska, J.C.Waddington, R.Wadsworth, D.Ward, J.Wilson, R.Wyss – Phys.Rev.Lett. 72, 1160 (1994)
- 1994Ju05 S.Juutinen, P.Simecek, C.Fahlander, R.Julin, J.Kumpulainen, A.Lampinen, T.Lonnroth, A.Maj, S.Mitarai, D.Muller, J.Nyberg, M.Piiparinen, M.Sugawara, I.Thorslund, S.Tormanen, A.Virtanen – Nucl.Phys. A577, 727 (1994)
- 1994Ra37 G.Ratel – Nucl.Instrum.Methods Phys.Res. A345, 289 (1994)
- 1994Re06 P.H.Regan, J.S.Middleton, K.R.Pohl, J.E.Bush, P.E.Raines, D.P.Balamuth, S.M.Mullins, D.Ward, A.Galindo-Uribarri, V.P.Janzen, S.Pilotte – Phys.Rev. C49, 1885 (1994)
- 1995Bu14 K.Butler-Moore, R.Aryaeinejad, J.D.Cole, Y.Dardenne, R.G.Greenwood, J.H.Hamilton, A.V.Ramayya, W.-C.Ma, B.R.S.Babu, J.O.Rasmussen, M.A.Stoyer, S.Y.Chu, K.E.Gregorich, M.Mohar, S.Asztalus, S.G.Prussin, K.J.Moody, R.W.Lougheed, J.F.Wild – Phys.Rev. C52, 1339 (1995)
- 1995Do13 Zs.Dombradi, B.M.Nyako, G.E.Perez, A.Algora, C.Fahlander, D.Seweryniak, J.Nyberg, A.Atac, B.Cederwall, A.Johnson, A.Kerek, J.Kownacki, L.-O.Norlin, R.Wyss, E.Adamides, E.Ideguchi, R.Julin, S.Juutinen, W.Karczmarczyk, S.Mitarai, M.Piiparinen, R.Schubart, G.Sletten, S.Tormanen, A.Virtanen – Phys.Rev. C51, 2394 (1995)
- 1995Ho26 S.Hofmann – Radiochim.Acta 70/71, 93 (1995)
- 1995Ka09 L.Kaubler, H.Prade, J.Reif, R.Schwengner, G.Winter, H.Grawe, J.Heese, H.Kluge, K.-H.Maier, R.Schubart, K.-M.Spohr – Z.Phys. A351, 123 (1995)
- 1995Pa01 E.S.Paul, P.J.Woods, T.Davinson, R.D.Page, P.J.Sellin, C.W.Beausang, R.M.Clark, R.A.Cunningham, S.A.Forbes, D.B.Fossan, A.Gizon, J.Gizon, K.Hauschild, I.M.Hibbert, A.N.James, D.R.LaFosse, I.Lazarus, H.Schnare, J.Simpson, R.Wadsworth, M.P.Waring – Phys.Rev. C51, 78 (1995)
- 1995Sc24 S.Schoedder, G.Lhersonneau, A.Wohr, G.Skarnemark, J.Alstad, A.Nahler, K.Eberhardt, J.Aysto, N.Trautmann, K.-L.Kratz – Z.Phys. A352, 237 (1995)
- 1996Ch37 R.S.Chakravarthy, R.G.Pillay – Phys.Rev. C54, 2771 (1996)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 1996Ka43 L.Kaubler, H.Schnare, D.B.Fossan, A.V.Afanasjev, W.Andrejscheff, R.G.Allatt, J.DeGraaf, H.Grawe, I.M.Hibbert, I.Y.Lee, A.D.Macchiavelli, N.O'Brien, K.-H.Maier, E.S.Paul, H.Prade, I.Ragnarsson, J.Reif, R.Schubart, R.Schwengner, I.Thorslund, P.Vaska, R.Wadsworth, G.Winter – *Z.Phys. A* 356, 235 (1996)
- 1996Me09 T.Mehren, B.Pfeiffer, S.Schoedder, K.-L.Kratz, M.Huhta, P.Dendooven, A.Honkanen, G.Lhersonneau, M.Oinonen, J.-M.Parmonen, H.Penttila, A.Popov, V.Rubchenya, J.Aysto – *Phys.Rev.Lett.* 77, 458 (1996)
- 1996Po07 K.R.Pohl, P.H.Regan, J.E.Bush, P.E.Raines, D.P.Balamuth, D.Ward, A.Galindo-Uribarri, V.P.Janzen, S.M.Mullins, S.Pilotte – *Phys.Rev. C* 53, 2682 (1996)
- 1996Sc29 H.Schnare, D.R.LaFosse, D.B.Fossan, J.R.Hughes, P.Vaska, K.Hauschild, I.M.Hibbert, R.Wadsworth, V.P.Janzen, D.C.Radford, S.M.Mullins, C.W.Beausang, E.S.Paul, J.DeGraaf, I.-Y.Lee, A.O.Macchiavelli, A.V.Afanasjev, I.Ragnarsson – *Phys.Rev. C* 54, 1598 (1996)
- 1996ViZZ I.N.Vishnevsky, V.I.Nikolaev, O.A.Purtov, V.V.Trishin – Program and Thesis, Proc. 46th Ann.Conf.Nucl.Spectrosc.Struct.At.Nuclei, Moscow, p.83 (1996)
- 1997Bh06 P.Bhattacharyya, C.T.Zhang, B.Fornal, P.J.Daly, Z.W.Grabowski, I.Ahmad, T.Lauritsen, L.R.Morss, W.R.Phillips, J.L.Durell, M.J.Leddy, A.G.Smith, W.Urban, B.J.Varley, N.Schulz, E.Lubkiewicz, M.Bentaleb, J.Blomqvist – *Phys.Rev. C* 56, R2363 (1997)
- 1997Hw03 J.K.Hwang, A.V.Ramayya, J.H.Hamilton, L.K.Peker, J.Kormicki, B.R.S.Babu, T.N.Ginter, G.M.Ter-Akopian, Yu.Ts.Oganessian, A.V.Daniel, W.C.Ma, P.G.Varmette, J.O.Rasmussen, S.J.Asztalos, S.Y.Chu, K.E.Gregorich, A.O.Macchiavelli, R.W.Macleod, J.Gilat, J.D.Cole, R.Aryaeinejad, K.Butler-Moore, M.W.Drigert, M.A.Stoyer, Y.X.Dardenne, J.A.Becker, L.A.Bernstein, R.W.Lougheed, K.J.Moody, S.G.Prussin, H.C.Griffin, R.Donangelo – *Phys.Rev. C* 56, 1344 (1997)
- 1997Ko51 J.Kownacki, M.Lipoglavsek, L.-O.Norlin, J.Nyberg, D.Sewerniak, J.Cederkall, M.Palacz, J.Persson, A.Atac, B.Cederwall, C.Fahlander, H.Grawe, A.Johnson, A.Kerek, W.Klamra, M.Karny, F.Liden, A.Likar, R.Schubart, R.Wyss, E.Adamides, G.de Angelis, P.Bednarczyk, Zs.Dombradi, D.Foltescu, M.Gorska, E.Ideguchi, D.Jerrestam, R.Julin, S.Juutinen, S.Mitarai, E.Makela, G.Perez, M.Piipainen, M.de Poli, H.A.Roth, T.Shizuma, O.Skeppstedt, G.Sletten, S.Tormanen, T.Vass, A.Virtanen – *Nucl.Phys. A* 627, 239 (1997)
- 1997Ma75 R.H.Martin, K.I.W.Burns, J.G.V.Taylor – *Nucl.Instrum.Methods Phys.Res. A* 390, 267 (1997)
- 1997Mo25 P.Moller, J.R.Nix, K.-L.Kratz – *At.Data Nucl.Data Tables* 66, 131 (1997)
- 1997VaZS P.Vaska – State Univ.of New York Stony Brook (1997)
- 1998De44 G.de Angelis, C.Fahlander, A.Gadea, E.Farnea, D.Bazzacco, N.Belcari, N.Biasi, P.G.Bizzeti, A.Bizzeti-Sona, D.de Acuna, M.De Poli, H.Grawe, A.Johnson, G.Lo Bianco, S.Lunardi, D.R.Napoli, J.Nyberg, P.Pavan, J.Persson, C.Rossi Alvarez, D.Dudolph, R.Schubart, P.Spolaore, R.Wyss, F.Xu – *Phys.Lett.* 437B, 236 (1998)
- 1998Ha65 J.H.Hamilton, E.F.Jones, P.M.Gore, A.V.Ramayya, R.S.Dodder, C.J.Beyer, J.K.Hwang, X.Q.Zhang, S.J.Zhu, A.P.de Lima, J.Kormicki, J.D.Cole, R.Aryaeinejad, W.C.Ma, G.M.Ter-Akopian, Yu.Ts.Oganessian, A.V.Daniel, J.O.Rasmussen, S.J.Asztalos, I.Y.Lee, A.O.Macchiavelli, M.A.Stoyer, R.W.Lougheed, S.G.Prussin, R.Donangelo – *Nuovo Cim.* 111A, 633 (1998)
- 1998Hw02 J.K.Hwang, A.V.Ramayya, J.H.Hamilton, L.K.Peker, J.Kormicki, B.R.S.Babu, T.N.Ginter, C.J.Beyer, G.M.Ter-Akopian, Yu.Ts.Oganessian, A.V.Daniel, W.C.Ma, P.G.Varmette, J.O.Rasmussen, S.J.Asztalos, S.Y.Chu, K.E.Gregorich, A.O.Macchiavelli, R.W.Macleod, J.Gilat, J.D.Cole, R.Aryaeinejad, K.Butler-Moore, M.W.Drigert, M.A.Stoyer, L.A.Bernstein, R.W.Lougheed, K.J.Moody, S.G.Prussin, H.C.Griffin, R.Donangelo – *J.Phys.(London)* G24, L9 (1998)
- 1998Hw04 J.K.Hwang, A.V.Ramayya, J.H.Hamilton, L.K.Peker, J.Kormicki, B.R.S.Babu, T.N.Ginter, C.J.Beyer, J.O.Rasmussen, J.Gilat, S.J.Asztalos, S.Y.Chu, K.E.Gregorich, A.O.Macchiavelli, R.W.Macleod, G.M.Ter-Akopian, Yu.Ts.Oganessian, A.V.Daniel, W.C.Ma, P.G.Varmette, J.D.Cole, R.Aryaeinejad, K.Butler-Moore, M.W.Drigert, M.A.Stoyer, L.A.Bernstein, R.W.Lougheed, K.J.Moody, S.G.Prussin, H.C.Griffin, R.Donangelo, S.J.Zhu – *Phys.Rev. C* 57, 2250 (1998); Erratum *Phys.Rev. C* 58, 3013 (1998)
- 1998KaZZ L.Kaubler – Priv.Comm. (1998)
- 1998Ku22 T.Kutsarova, A.Minkova, M.-G.Porquet, I.Deloncle, E.Gueorguieva, F.Azaiez, S.Bouneau, C.Bourgeois, J.Duprat, B.J.P.Gall, C.Gautherin, F.Hoellinger, R.Lucas, N.Schulz, H.Sergolle, Ts.Venkova, A.Wilson – *Phys.Rev. C* 58, 1966 (1998)
- 1998LaZU G.J.Lane, D.B.Fossan, J.M.Sears, J.F.Smith, J.A.Cameron, R.M.Clark, I.M.Hibbert, V.P.Janzen, R.Krucken, I.-Y.Lee, A.O.Macchiavelli, C.M.Parry, R.Wadsworth – *Contrib. Nuclear Structure '98*, Gatlinburg, p.73 (1998)
- 1998Lh02 G.Lhersonneau, B.Pfeiffer, J.Alstad, P.Dendooven, K.Eberhardt, S.Hankonen, I.Klockl, K.-L.Kratz, A.Nahler, R.Malmbeck, J.P.Omtvedt, H.Penttila, S.Schoedder, G.Skarneemark, N.Trautmann, J.Aysto – *Eur.Phys.J. A* 1, 285 (1998)
- 1998Wa02 R.Wadsworth, R.M.Clark, J.A.Cameron, D.B.Fossan, I.M.Hibbert, V.P.Janzen, R.Krucken, G.J.Lane, I.Y.Lee, A.O.Macchiavelli, C.M.Parry, J.M.Sears, J.F.Smith, A.V.Afanasjev, I.Ragnarsson – *Phys.Rev.Lett.* 80, 1174 (1998)
- 1998Zh39 S.-J.Zhu, C.-Y.Gan, J.H.Hamilton, A.V.Ramayya, B.R.S.Babu, M.Sakhaee, W.C.Ma, G.-L.Long, J.-K.Deng, L.-Y.Zhu, M.Li, L.-M.Yang, J.Kormicki, J.D.Cole, R.Aryaeinejad, Y.K.Dardenne, M.W.Drigert, J.O.Rasmussen, M.A.Stoyer, S.Y.Chu, K.E.Gregorich, M.F.Mohar, S.G.Prussin, I.Y.Lee, N.R.Johnson, F.K.McGowan – *Chin.Phys.Lett.* 15, 793 (1998)
- 1999Da05 I.Danko, Zs.Dombradi, Z.Gacsi, J.Gulyas, A.Krasznahorkay, N.Sandulescu, J.Blomqvist, R.J.Liotta – *Nucl.Phys. A* 646, 3 (1999)
- 1999Ge01 J.Genevey, F.Ibrahim, J.A.Pinston, H.Faust, T.Friedrichs, M.Gross, S.Oberstedt – *Phys.Rev. C* 59, 82 (1999)
- 1999Ho25 M.Houry, R.Lucas, M.-G.Porquet, Ch.Theisen, M.Girod, M.Aiche, M.M.Aleonard, A.Astier, G.Barreau, F.Becker, J.F.Chemin, I.Deloncle, T.P.Doan, J.L.Durell, K.Hauschild, W.Korten, Y.Le Coz, M.J.Leddy, S.Perries, N.Redon, A.A.Roach, J.N.Scheurer, A.G.Smith, B.J.Varley – *Eur.Phys.J. A* 6, 43 (1999)
- 1999Ma05 E.Maglione, L.S.Ferreira, R.J.Liotta – *Phys.Rev. C* 59, R589 (1999)
- 1999Ve12 Ts.Venkova, M.-G.Porquet, I.Deloncle, B.J.P.Gall, H.De Witte, P.Petkov, A.Bauchet, T.Kutsarova, E.Gueorguieva, J.Duprat, C.Gautherin, F.Hoellinger, R.Lucas, A.Minkova, N.Schulz, H.Sergolle, E.A.Stefanova, A.Wilson – *Eur.Phys.J. A* 6, 405 (1999)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 1999Yu02 C.-H.Yu, A.Galindo-Uribarri, S.D.Paul, M.P.Carpenter, C.N.Davids, R.V.F.Janssens, C.J.Lister, D.Seweryniak, J.Uusitalo, B.D.MacDonald – *Phys.Rev. C* 59, R1834 (1999)
- 2000Bo29 A.J.Boston, E.S.Paul, C.J.Chicara, M.Devlin, D.B.Fossan, S.J.Freeman, D.R.LaFosse, G.J.Lane, M.Leddy, I.Y.Lee, A.O.Macchiavelli, P.J.Nolan, D.G.Sarantites, J.M.Sears, A.T.Semple, J.F.Smith, K.Starosta – *Phys.Rev. C* 61, 064305 (2000)
- 2000Ch04 C.J.Chicara, S.J.Asztalos, B.Busse, R.M.Clark, M.Cromaz, M.A.Deleplanque, R.M.Diamond, P.Fallon, D.B.Fossan, D.G.Jenkins, S.Juutinen, N.S.Kelsall, R.Krucken, G.J.Lane, I.Y.Lee, A.O.Macchiavelli, R.W.MacLeod, G.Schmid, J.M.Sears, J.F.Smith, F.S.Stephens, K.Vetter, R.Wadsworth, S.Frauentorf – *Phys.Rev. C* 61, 034318 (2000)
- 2000He14 R.G.Helmer, C.van der Leun – *Nucl.Instrum.Methods Phys.Res. A* 450, 35 (2000)
- 2000Yo07 E.Yoshida, T.Kobayashi, Y.Kojima, K.Shizuma – *Nucl.Instrum.Methods Phys.Res. A* 449, 217 (2000)
- 2001Ha09 S.Harissopulos, A.Dewald, A.Gelberg, K.O.Zell, P.von Brentano, J.Kern – *Nucl.Phys. A* 683, 157 (2001)
- 2002Re14 J.J.Ressler, W.B.Walters, D.S.Brenner, C.N.Davids, A.Heinz, G.-L.Poli, J.Shergur, D.Seweryniak – *Phys.Rev. C* 65, 044330 (2002)
- 2002Re28 J.J.Ressler, W.B.Walters, C.N.Davids, D.J.Dean, A.Heinz, M.Hjorth-Jensen, D.Seweryniak, J.Shergur – *Phys.Rev. C* 66, 024308 (2002)
- 2002Un02 M.P.Unterweger – *Appl.Radiat.Isot. 56*, 125 (2002)
- 2002Ve08 Ts.Venkova, M.-G.Porquet, A.Astier, A.Bauchet, I.Deloncle, S.Lalkovski, N.Bufoin, L.Donadille, O.Dorvaux, B.J.P.Gall, R.Lucas, M.Meyer, A.Minkova, A.Prevoist, N.Redon, N.Schulz, O.Stezowski – *Eur.Phys.J. A* 15, 429 (2002)
- 2004Lu20 Y.X.Luo, J.O.Rasmussen, J.H.Hamilton, A.V.Ramayya, J.K.Hwang, S.J.Zhu, P.M.Gore, S.C.Wu, I.Y.Lee, P.Fallon, T.N.Ginter, G.M.Ter-Akopian, A.V.Daniel, M.A.Stoyer, R.Donangelo, A.Gelberg – *Phys.Rev. C* 70, 044310 (2004)
- 2004Sc04 H.Schrader – *Appl.Radiat.Isot. 60*, 317 (2004)
- 2005Gy02 Gy.Gyurky, Z.Elekes, Zs.Fulop, G.Kiss, E.Somorjai, A.Palumbo, M.Wiescher – *Phys.Rev. C* 71, 057302 (2005)
- 2006B102 J.Blachot – *Nucl.Data Sheets* 107, 355 (2006)
- 2006Ko27 K.Kossert, H.Janssen, R.Klein, M.K.H.Schneider, H.Schrader – *Appl.Radiat.Isot. 64*, 1031 (2006)
- 2006Li41 S.N.Liddick, R.Grzywacz, C.Mazzocchi, R.D.Page, K.P.Rykaczewski, J.C.Batchelder, C.R.Bingham, I.G.Darby, G.Drafta, C.Goodin, C.J.Gross, J.H.Hamilton, A.A.Hecht, J.K.Hwang, S.Ilyushkin, D.T.Joss, A.Korgul, W.Krolas, K.Lagergren, K.Li, M.N.Tantawy, J.Thomson, J.A.Winger – *Phys.Rev.Lett. 97*, 082501 (2006)
- 2006Ur01 W.Urban, Ch.Droste, T.Rzaca-Urban, A.Zlomaniec, J.L.Durell, A.G.Smith, B.J.Varley, I.Ahmad – *Phys.Rev. C* 73, 037302 (2006)
- 2006Wu01 C.Y.Wu, H.Hua, D.Cline, A.B.Hayes, R.Teng, D.Riley, R.M.Clark, P.Fallon, A.Goergen, A.O.Macchiavelli, K.Vetter – *Phys.Rev. C* 73, 034312 (2006)
- 2007CeZX B.Cederwall, B.Hadinia, M.Sandzelius, E.S.Paul, M.Petri, K.Andgren, E.Ganioglu, I.G.Darby, M.R.Dimmock, S.Eeckhaudt, T.Grahn, P.T.Greenlees, E.Ideguchi, P.M.Jones, D.T.Joss, R.Julin, S.Juutinen, A.Khaplanov, M.Leino, L.Nelson, M.Niikura, M.Nyman, R.D.Page, J.Pakarinen, P.Rahkila, J.Saren, C.Scholey, J.Sorri, J.Uusitalo, R.Wadsworth, R.Wyss – *Proc.Inter.Conf.Proton Emitting Nuclei and Related Topics (PROCON 2007)*, Lisbon, Portugal, 17–23 June 2007, L.S.Ferreira Ed. p.156 (2007); *AIP Conf.Proc.* 961 (2007)
- 2007Ma35 C.Mazzocchi, R.Grzywacz, S.N.Liddick, K.P.Rykaczewski, H.Schatz, J.C.Batchelder, C.R.Bingham, C.J.Gross, J.H.Hamilton, J.K.Hwang, S.Ilyushkin, A.Korgul, W.Krolas, K.Li, R.D.Page, D.Simpson, J.A.Winger – *Phys.Rev.Lett. 98*, 212501 (2007)
- 2007Pe32 M.Petri, E.S.Paul, B.Cederwall, I.G.Darby, M.R.Dimmock, S.Eeckhaudt, E.Ganioglu, T.Grahn, P.T.Greenlees, B.Hadinia, P.Jones, D.T.Joss, R.Julin, S.Juutinen, S.Ketelhut, A.Khaplanov, M.Leino, L.Nelson, M.Nyman, R.D.Page, P.Rahkila, M.Sandzelius, J.Saren, C.Scholey, J.Sorri, J.Uusitalo, R.Wadsworth – *Phys.Rev. C* 76, 054301 (2007)
- 2007TiZZ J.Timar, B.M.Nyako, G.Berek, J.Gal, G.Kalinka, A.Krasznahorkay, J.Molnar, L.Zolnai, S.M.Mullins, R.A.Bark, E.A.Gueorguieva, F.S.Komati, J.J.Lawrie, T.Malwela, S.H.T.Murray, J.F.Sharpey-Schafer, P.Joshi, R.Wadsworth, J.N.Scheurer, K.Juhasz, S.M.Maliage, T.M.Ramashidza, P.Vymers, C.M.Petrache, G.K.Mabala – *Atomki 2007 Ann.Rept.*, p.27 (2007)
- 2007ZhZX Y.Zheng, E.Ideguchi, S.Ota, A.Yoshida, T.Morikawa, M.Liu, T.Murakami, S.Shimoura, M.Niikura, S.Michimasa, D.Suzuki, T.Nakao, M.Kurokawa, T.Koike, T.Fukuchi, T.Suzuki – *CNS-REP-76*, p.19 (Tokyo) (2007)
- 2008Da12 P.Datta, S.Roy, S.Pal, S.Chattopadhyay, S.Bhattacharya, A.Goswami, M.S.Sarkar, J.A.Sheikh, Y.Sun, P.V.Madhusudhana Rao, R.K.Bhowmik, R.Kumar, N.Madhavan, S.Muralithar, R.P.Singh, H.C.Jain, P.K.Joshi, Amita – *Phys.Rev. C* 78, 021306 (2008)
- 2008Di11 H.B.Ding, S.J.Zhu, J.H.Hamilton, A.V.Ramayya, J.K.Hwang, K.Li, S.H.Liu, Y.X.Luo, J.O.Rasmussen, C.T.Goodin, I.Y.Lee, A.V.Daniel, G.M.Ter-Akopian, J.G.Wang, X.L.Che, L.Gu, W.C.Ma – *Phys.Rev. C* 77, 057302 (2008)
- 2008Go18 M.Gorchtein – *Phys.Rev. C* 77, 065501 (2008)
- 2008Ki07 T.Kibedi, T.W.Burrows, M.B.Trzhaskovskaya, P.M.Davidson, C.W.Nestor, Jr. – *Nucl.Instrum.Methods Phys.Res. A* 589, 202 (2008)
- 2008Kr05 M.Krticka, R.B.Firestone, D.P.McNabb, B.Sleaford, U.Agvaanluvsan, T.Belgya, Z.S.Revay – *Phys.Rev. C* 77, 054615 (2008)
- 2009Di12 H.-B.Ding, S.-J.Zhu, J.H.Hamilton, A.V.Ramayya, J.K.Hwang, K.Li, S.H.Liu, Y.X.Luo, J.O.Rasmussen, C.T.Goodin, I.Y.Lee, J.-G.Wang, X.-L.Che, L.Gu – *Chin.Phys.C* 33, Supplement 1, 154 (2009)
- 2009Go18 C.Goodin, A.V.Ramayya, J.H.Hamilton, N.J.Stone, A.V.Daniel, K.Li, S.H.Liu, J.K.Hwang, Y.X.Luo, J.O.Rasmussen, S.J.Zhu – *Phys.Rev. C* 80, 014318 (2009)
- 2009Pe06 J.Pereira, S.Hennrich, A.Aprahamian, O.Arndt, A.Becerril, T.Elliott, A.Estrade, D.Galaviz, R.Kessler, K.-L.Kratz, G.Lorusso, P.F.Mantica, M.Matos, P.Moller, F.Montes, B.Pfeiffer, H.Schatz, F.Schertz, L.Schnorrenberger, E.Smith, A.Stolz, M.Quinn, W.B.Walters, A.Wohr – *Phys.Rev. C* 79, 035806 (2009)
- 2009Ra17 A.Ray, P.Das, S.K.Saha, A.Goswami, A.De – *Phys.Lett. B* 679, 106 (2009)

NUCLEAR DATA SHEETS

REFERENCES FOR A=109 (CONTINUED)

- 2010Da17 I.G.Darby, R.K.Grzywacz, J.C.Batchelder, C.R.Bingham, L.Cartegni, C.J.Gross, M.Hjorth-Jensen, D.T.Joss, S.N.Liddick, W.Nazarewicz, S.Padgett, R.D.Page, T.Papenbrock, M.M.Rajabali, J.Rotureau, K.P.Rykaczewski – *Phys.Rev.Lett.* 105, 162502 (2010)
- 2010Gu07 L.Gu, S.-J.Zhu, J.H.Hamilton, A.V.Ramayya, J.K.Hwang, S.H.Liu, J.-G.Wang, Y.X.Luo, J.O.Rasmussen, I.Y.Lee, Q.Xu, E.Y.Yeoh, W.C.Ma – *Chin.Phys.Lett.* 27, 062501 (2010)
- 2010Ur03 W.Urban, J.A.Pinston, T.Rzaca-Urban, J.Kurpeta, A.G.Smith, I.Ahmad – *Phys.Rev. C* 82, 064308 (2010)
- 2011BuZZ B.Bucher – *Priv.Comm.* (2011)
- 2011Ni01 S.Nishimura, Z.Li, H.Watanabe, K.Yoshinaga, T.Sumikama, T.Tachibana, K.Yamaguchi, M.Kurata-Nishimura, G.Lorusso, Y.Miyashita, A.Odahara, H.Baba, J.S.Berryman, N.Biasi, A.Bracco, F.Camera, J.Chiba, P.Doornenbal, S.Go, T.Hashimoto, S.Hayakawa, C.Hinke, E.Ideguchi, T.Isobe, Y.Ito, D.G.Jenkins, Y.Kawada, N.Kobayashi, Y.Kondo, R.Krucken, S.Kubono, T.Nakano, H.Sakurai, H.Scheit, K.Steiger, D.Steppenbeck, K.Sugimoto, H.J.Ong, S.Ota, Zs.Podolyak, S.Takano, A.Takashima, K.Tajiri, T.Teranishi, Y.Wakabayashi, P.M.Walker, O.Wieland, H.Yamaguchi – *Phys.Rev.Lett.* 106, 052502 (2011)
- 2011Pr12 M.G.Procter, D.M.Cullen, C.Scholey, P.Ruotsalainen, L.Angus, T.Back, B.Cederwall, A.Dewald, C.Fransen, T.Grahn, P.T.Greenlees, M.Hackstein, U.Jakobsson, P.M.Jones, R.Julin, S.Juutinen, S.Ketelhut, M.Leino, R.Liotta, N.M.Lumley, P.J.R.Mason, P.Nieminen, M.Nyman, J.Pakarinen, T.Pissulla, P.Peura, P.Rahkila, J.Revill, S.V.Rigby, W.Rother, M.Sandzelius, J.Saren, J.Sorri, M.J.Taylor, J.Uusitalo, P.Wady, C.Qi, F.R.Xu – *Phys.Lett. B* 704, 118 (2011)
- 2011Va02 R.Van Ammel, S.Pomme, J.Paepen, G.Sibbens – *Appl.Radiat.Isot.* 69, 785 (2011)
- 2011Wa03 H.Watanabe, T.Sumikama, S.Nishimura, K.Yoshinaga, Z.Li, Y.Miyashita, K.Yamaguchi, H.Baba, J.S.Berryman, N.Biasi, A.Bracco, F.Camera, J.Chiba, P.Doornenbal, S.Go, T.Hashimoto, S.Hayakawa, C.Hinke, E.Ideguchi, T.Isobe, Y.Ito, D.G.Jenkins, Y.Kawada, N.Kobayashi, Y.Kondo, R.Krucken, S.Kubono, G.Lorusso, T.Nakano, M.Kurata-Nishimura, A.Odahara, H.J.Ong, S.Ota, Zs.Podolyak, H.Sakurai, H.Scheit, Y.Shii, K.Steiger, D.Steppenbeck, K.Sugimoto, K.Tajiri, S.Takano, A.Takashima, T.Teranishi, Y.Wakabayashi, P.M.Walker, O.Wieland, F.R.Xu, H.Yamaguchi – *Phys.Lett. B* 696, 186 (2011)
- 2012Cu03 D.M.Cullen, M.G.Procter, M.J.Taylor – *J.Phys.:Conf.Ser.* 381, 012075 (2012)
- 2012Di13 D.D.DiJulio, J.Cederkall, C.Fahlander, A.Ekstrom, M.Hjorth-Jensen, M.Albers, V.Bildstein, A.Blazhev, I.Darby, T.Davinson, H.De Witte, J.Diriken, Ch.Fransen, K.Geibel, R.Gernhauser, A.Gorgen, H.Hess, J.Iwanicki, R.Lutter, P.Reiter, M.Scheck, M.Seidlitz, S.Siem, J.Taprogge, G.M.Tveten, J.Van de Walle, D.Voulot, N.Warr, F.Wenander, K.Wimmer – *Phys.Rev. C* 86, 031302 (2012)
- 2012Fi12 R.Fitzgerald – *J.Res.Natl.Inst.Stand.Technol.* 117, 80 (2012)
- 2012Ka36 D.Kameda, T.Kubo, T.Ohnishi, K.Kusaka, A.Yoshida, K.Yoshida, M.Ohtake, N.Fukuda, H.Takeda, K.Tanaka, N.Inabe, Y.Yanagisawa, Y.Gono, H.Watanabe, H.Otsu, H.Baba, T.Ichihara, Y.Yamaguchi, M.Takechi, S.Nishimura, H.Ueno, A.Yoshimi, H.Sakurai, T.Motobayashi, T.Nakao, Y.Mizoi, M.Matsushita, K.Ieki, N.Kobayashi, K.Tanaka, Y.Kawada, N.Tanaka, S.Deguchi, Y.Satou, Y.Kondo, T.Nakamura, K.Yoshinaga, C.Ishii, H.Yoshii, Y.Miyashita, N.Uematsu, Y.Shiraki, T.Sumikama, J.Chiba, E.Ideguchi, A.Saito, T.Yamaguchi, I.Hachiuma, T.Suzuki, T.Moriguchi, A.Ozawa, T.Ohtsubo, M.A.Famiano, H.Geissel, A.S.Nettleton, O.B.Tarasov, D.Bazin, B.M.Sherrell, S.L.Manikonda, J.A.Nolen – *Phys.Rev. C* 86, 054319 (2012)
- 2012Ku28 J.Kurpeta, W.Urban, A.Plochocki, J.Rissanen, J.A.Pinston, V.-V.Elomaa, T.Eronen, J.Hakala, A.Jokinen, A.Kankainen, I.D.Moore, H.Penttila, A.Saastamoinen, C.Weber, J.Aysto – *Phys.Rev. C* 86, 044306 (2012)
- 2012Ne03 D.Negi, T.Trivedi, A.Dhal, S.Kumar, V.Kumar, S.Roy, M.K.Raju, S.Appannababu, G.Mohanto, J.Kaur, R.K.Sinha, D.Choudhury, D.Singh, R.Kumar, R.P.Singh, S.Muralithar, A.K.Bhati, S.C.Pancholi, R.K.Bhowmik – *Phys.Rev. C* 85, 057301 (2012)
- 2012Pr10 M.G.Procter, D.M.Cullen, C.Scholey, P.Ruotsalainen, L.Angus, T.Back, B.Cederwall, A.Dewald, C.Fransen, T.Grahn, P.T.Greenlees, M.Hackstein, U.Jakobsson, P.M.Jones, R.Julin, S.Juutinen, S.Ketelhut, M.Leino, R.Liotta, N.M.Lumley, P.J.R.Mason, P.Nieminen, M.Nyman, J.Pakarinen, T.Pissulla, P.Peura, P.Rahkila, J.Revill, S.V.Rigby, W.Rother, M.Sandzelius, J.Saren, J.Sorri, M.J.Taylor, J.Uusitalo, P.Wady, C.Qi, F.R.Xu – *Phys.Rev. C* 86, 034308 (2012)
- 2012Re14 I.A.Reyhancan – *Ann.Nucl.Energy* 47, 81 (2012)
- 2012Sm02 A.G.Smith, J.L.Durell, W.R.Phillips, W.Urban, P.Sarriguren, I.Ahmad – *Phys.Rev. C* 86, 014321 (2012)
- 2012St13 E.A.Stefanova, S.Lalkovski, A.Korichi, T.Kutsarova, A.Lopez-Martens, F.R.Xu, H.L.Liu, S.Kisyov, A.Minkova, D.Bazzacco, M.Bergstrom, A.Gorgen, F.Hannachi, B.Herskind, H.Hubel, A.Jansen, T.L.Kho, Zs.Podolyak, G.Schonwasser – *Phys.Rev. C* 86, 044302 (2012)
- 2012Wa38 M.Wang, G.Audi, A.H.Wapstra, F.G.Konde, M.MacCormick, X.Xu, B.Pfeiffer – *Chin.Phys.C* 36, 1603 (2012)
- 2012Wa41 H.Watanabe – *J.Phys.:Conf.Ser.* 381, 012083 (2012)
- 2013Yo02 D.T.Yordanov, D.L.Balabanski, J.Bieron, M.L.Bissell, K.Blaum, I.Budincevic, S.Fritzsche, N.Frommgen, G.Georgiev, Ch.Geppert, M.Hammen, M.Kowalska, K.Kreim, A.Krieger, R.Neugart, W.Nortershauser, J.Papuga, S.Schmidt – *Phys.Rev.Lett.* 110, 192501 (2013)
- 2014StZZ N.J.Stone – *REPT INDC(NDS)-0658* (2014)
- 2014Un01 M.P.Unterwieser, R.Fitzgerald – *Appl.Radiat.Isot.* 87, 92 (2014)
- 2015Bu15 B.Bucher, H.Mach, A.Aprahamian, G.S.Simpson, J.Rissanen, D.G.Ghita, B.Olaizola, W.Kurcewicz, J.Aysto, I.Bentley, T.Eronen, L.M.Fraile, A.Jokinen, P.Karvonen, I.D.Moore, H.Penttila, M.Reponen, E.Ruchowska, A.Saastamoinen, M.K.Smith, C.Weber – *Phys.Rev. C* 92, 064312 (2015)
- 2015Kr07 K.S.Krane – *Appl.Radiat.Isot.* 105, 278 (2015)
- 2015Lo04 G.Lorusso, S.Nishimura, Z.Y.Xu, A.Jungclaus, Y.Shimizu, G.S.Simpson, P.-A.Soderstrom, H.Watanabe, F.Browne, P.Doornenbal, G.Gey, H.S.Jung, B.Meyer, T.Sumikama, J.Taprogge, Zs.Vajta, J.Wu, H.Baba, G.Benzoni, K.Y.Chae, F.C.L.Crespi, N.Fukuda, R.Gernhauser, N.Inabe, T.Isobe, T.Kajino, D.Kameda, G.D.Kim, Y.-K.Kim, I.Kojouharov, F.G.Konde, T.Kubo, N.Kurz, Y.K.Kwon, G.J.Lane, Z.Li, A.Montaner-Piza, K.Moschner, F.Naqvi, M.Niikura, H.Nishibata, A.Odahara, R.Orlandi, Z.Patel, Zs.Podolyak, H.Sakurai, H.Schaffner, P.Schury, S.Shibagaki, K.Steiger, H.Suzuki, H.Takeda, A.Wendt, A.Yagi, K.Yoshinaga – *Phys.Rev.Lett.* 114, 192501 (2015)