Nuclear Data Sheets for A = 42^{*}

JUN CHEN[#] AND BALRAJ SINGH

Department of Physics and Astronomy

McMaster University, Hamilton, ON L8S 4M1, Canada

[#]*Present address: NSCL, MSU, East Lansing, MI 48824, USA*

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Abstract: The experimental data are evaluated for known nuclides of mass number A=42 (Al, Si, P, S, Cl, Ar, K, Ca, Sc, Ti, V, Cr). Detailed evaluated level properties and related information are presented, including adopted values of level and γ -ray energies, decay data (energies, intensities and placement of radiations), and other spectroscopic data. This work supersedes earlier full evaluations of A=42 published by 2001Si10 and 1990En08 (also 1998En04 update).

No excited states are known in ⁴²Al, ⁴²P, ⁴²V and ⁴²Cr, and structure information for ⁴²Si and ⁴²S is quite limited. There are no decay schemes available for the decay of ⁴²Al, ⁴²Si, ⁴²P, ⁴²V and ⁴²Cr, while the decay schemes of ⁴²Cl and ⁴²Ti are incomplete in view of scarcity of data, and large gap between their Q-values and the highest energy levels populated in corresponding daughter nuclei. Structures of ⁴²Ca, ⁴²K, ⁴²Sc and ⁴²Ar nuclides remain the most extensively studied via many different nuclear reactions and decays.

Cutoff Date: Literature available up to May 31, 2016 has been considered.

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

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General Comments: The statistical analysis of γ -ray data and deduced level schemes is carried out through computer codes available at NNDC, BNL website: www.nndc.bnl.gov. The direct feedings to excited states in β^- and ϵ decays have generally been computed from I(γ +ce) intensity balances at each level; the associated log ft values are calculated using the LOGFT code. All Q values have been adopted from 2012Wa38. Static magnetic dipole and electric quadrupole moments have been adopted from 2014StZZ and 2013StZZ, respectively, when available. In cases where weighted averaging procedures have been used, the assigned uncertainty is generally not lower than the lowest in the input dataset. Nuclear charge radii have been adopted from 2013An02

Isospin triplet states (T=1) in A=42 nuclei

E(⁴² Ca)	J π	E(⁴² Sc)	J π	E(⁴² Ti)	J π
0	0+	0	0+	0	0+
1524.71	2+	1586.32	2+	1554.6	2+
1837.31	0+	1873.7	0+	1854.2	0+
2424.15	2+	2486.59	2+	2396.1	(2+)
2752.40	4+	2815.56	4+	2676.6	4+
3189.26	6+	3242	(5-7)+	3043.0	6+
3253.89	4+	3323.8	(3+, 4, 5+)		

Isospin quintuplet states (T=2) in A=42 nuclei

E(⁴² K)	J π	E(⁴² Ca) (E(norm))	J π	E(⁴² K)	J π	E(⁴² Ca) (E(norm))	J π
0	2-	9750(0)	(2-)	699.726	5-	10450(700)	(5)-
106.826	3-	9850(100)	(3-)	783.885	2-	10510(760)	
258.259	4-	10000(250)	(4-)	841.941	3-	10610(860)	
E(norm)=E(level in ⁴² Ca)-9750							

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Skeleton Scheme for A=42

Skeleton Scheme for A=42 (continued)

S(n).....20340^{CA}

$S(n)$11550.05¹⁶
 $S(\alpha)$5471.1³
 $S(p)$3751.22²⁷

$0+$ 0.0
 ${}^{42}_{20}\text{Ca}_{22}$

Ground-State and Isomeric-Level Properties

Nuclide	Level	$J\pi$	$T_{1/2}$	Decay Modes
${}^{42}\text{Al}$	0.0		>170 ns	% β^- =?; % β^-n =?; % β^-2n =?
${}^{42}\text{Si}$	0.0	0+	12.5 ms 35	% β^- =100; % β^-n =?; % β^-2n =?
${}^{42}\text{P}$	0.0		48.5 ms 15	% β^- =100; % β^-n =50 20; % β^-2n =?
${}^{42}\text{S}$	0.0	0+	1.016 s 15	% β^- =100; % β^-n <4
${}^{42}\text{Cl}$	0.0	(2-)	6.8 s 3	% β^- =100
${}^{42}\text{Ar}$	0.0	0+	32.9 y 11	% β^- =100
${}^{42}\text{K}$	0.0	2-	12.355 h 7	% β^- =100
${}^{42}\text{Ca}$	0.0	0+	stable	
${}^{42}\text{Sc}$	0.0	0+	680.79 ms 28	% ϵ +% β^+ =100
	616.28	7+	61.7 s 4	% ϵ +% β^+ =100
${}^{42}\text{Ti}$	0.0	0+	208.65 ms 80	% ϵ +% β^+ =100
${}^{42}\text{V}$	0.0		<55 ns	%p=?
${}^{42}\text{Cr}$	0.0	0+	13.3 ms 10	% ϵ +% β^+ =100; % ϵp =94.4 50
${}^{43}\text{P}$	0.0	1/2+	36.5 ms 15	% β^-n =100
${}^{43}\text{S}$	0.0	(3/2-)	265 ms 15	% β^-n =40 10; ...
${}^{43}\text{Cr}$	0.0	(3/2+)	21.2 ms 7	% ϵp =79.3 30; ...
${}^{45}\text{Fe}$	0.0	(3/2+)	2.45 ms 23	% $\epsilon 3p$ =3.3 15; ...

Adopted Levels

$Q(\beta^-)=24280$ SY; $S(n)=1120$ SY; $S(p)=24360$ CA; $Q(\alpha)=-22760$ CA 2012Wa38,1997Mo25.

Estimated uncertainties (syst,2012Wa38): $\Delta Q(\beta^-)=780$, $\Delta S(p)=1034$, $\Delta S(n)=840$.

$S(p)$ and $Q(\alpha)$ from 1997Mo25; $Q(\beta^-)$ and $S(n)$ from 2012Wa38. Theoretical $S(n)=-2610$ (1997Mo25) differs much from 1120 840 (syst,2012Wa38).

$S(2n)=3280$ 780, $Q(\beta^-n)=20650$ 700 (syst,2012Wa38). Theoretical $S(2p)=53610$ (1997Mo25).

2007Ba71: $W(^{48}\text{Ca},X\gamma)$ $E=141$ MeV/nucleon beam from the National Superconducting Cyclotron Laboratory (NSCL). The fragments were separated with the A1900 fragment separator. Isotopic identification by multiple ΔE signals, magnetic rigidity, total energy and time of flight analysis. Detectors: plastic scintillators, parallel-plate avalanche counters (PPACs) and silicon PIN diodes.

In 2007Ba71, a total of 23 events were assigned to ^{42}Al , establishing particle stability of this nuclide.

 ^{42}Al Levels

E(level)	$T_{1/2}$	Comments
0.0	>170 ns	<p>$\% \beta^- = ?$; $\% \beta^- n = ?$; $\% \beta^- 2n = ?$</p> <p>Theoretical $T_{1/2}=1.4$ ms, $\% \beta^- n=30.9$, $\% \beta^- 2n=33.0$ (2003Mo09).</p> <p>Theoretical $T_{1/2}=8.3$ ms, $\% \beta^- n=26.4$, $\% \beta^- 2n=47.1$ (2016Ma12).</p> <p>E(level): the observed fragments are assumed to be in the g.s. of ^{42}Al.</p> <p>$T_{1/2}$: limiting value estimated from time-of-flight of =170 ns (figure 3 in 2007Ba71) at NSCL facility.</p> <p>Actual half-life is expected to be much longer as suggested by 1 ms from systematics (2012Au07) and 1.8 ms from calculations by 1997Mo25.</p>

Adopted Levels, Gammas

$Q(\beta^-)=15550$ SY; $S(n)=3630$ SY; $S(p)=24620$ SY; $Q(\alpha)=-19940$ SY 2012Wa38.

Estimated uncertainties (syst,2012Wa38): $\Delta Q(\beta^-)=550$, $\Delta S(n)=620$, $\Delta S(p)=780$, $\Delta Q(\alpha)=710$ (2012Wa38).

$S(2n)=5010$ 550, $S(2p)=46620$ 780, $Q(\beta^-n)=13470$ 510 (syst,2012Wa38).

1990Le03: ^{42}Si identified and produced in $^{64}\text{Ni}(^{48}\text{Ca},X)$ reaction at $E=44$ MeV/nucleon, followed by a measurement of fragment spectra versus atomic number.

2004Gr20 (also 2004Gr28,2003Gr22): ^{42}Si produced in $^9\text{Be}(^{48}\text{Ca},X)$ at $E=60$ MeV/nucleon, LISE3 spectrometer at GANIL, isotopic identification by energy loss, time-of-flight and magnetic rigidities, double-sided Si strip (DSSD) detectors for residues. Measured β (residues) time correlations and half-life using scintillation detectors for β rays. Detailed QRPA calculations. Predictions of Gamow-Teller strengths, $I\beta$ and $\% \beta^-n$ for spherical, prolate ($\epsilon=+0.3$) and oblate ($\epsilon=-0.3$) shapes. The measured half-life suggests deformed shape when compared with QRPA calculations.

2006Fr13 (also 2005Fr19), 2006GrZZ: see $^9\text{Be}(^{44}\text{S},X\gamma)$ data-set.

1999YoZW, from fragmentation of ^{48}Ca beam using $^9\text{Be}(^{48}\text{Ca},X)$ and $^{181}\text{Ta}(^{48}\text{Ca},X)$ reactions at 70 MeV/nucleon; measured $T_{1/2}$ and $\% \beta^-n$; according to the authors, the results are preliminary.

Mass measurement: mass excess=15160 580 (2007Ju03).

Recent theory papers: 2016Li07, 2011Li47, 2011Ka03, 2010Sm02 and 2010Ga15 (shell-model calculations), 2010Ha33 (quadrupole moment), 2009Co21 (half-life), 2009No01 and 2009Zi01 (B(E2)).

 ^{42}Si Levels**Cross Reference (XREF) Flags**

A $^9\text{Be}(^{44}\text{S}, ^{42}\text{Si}\gamma)$

B C($^{44}\text{S}, ^{42}\text{Si}\gamma$)

E(level) [†]	$J\pi^{\ddagger}$	XREF	$T_{1/2}$	Comments
0.0	0+	AB	12.5 ms 35	$\% \beta^-n=100$; $\% \beta^-n=?$; $\% \beta^-2n=?$ $\% \beta^-n=103$ 48 (1999YoZW, preliminary result). Theoretical $T_{1/2}=43.4$ ms, $\% \beta^-n=40.4$, $\% \beta^-2n=4.4$ (2003Mo09). Theoretical $T_{1/2}=29.5$ ms, $\% \beta^-n=31.5$, $\% \beta^-2n=11.5$ (2016Ma12). $T_{1/2}$: from $\beta(^{42}\text{Si})$ time correlations followed over 400 ms (2004Gr20). Other: 20 ms 10 (1999YoZW, preliminary result). See also comment for (2+) state.
742 8	(2+)	AB		Low energy of 2+ state and comparison of measured half-life with QRPA calculations (2004Gr20) suggest that ^{42}Si is deformed and that there is collapse of N=28 closed shell at Z=14. But the small production cross section of ^{42}Si in both studies (2006Fr13 and 2006GrZZ) suggest closed shell nature of ^{42}Si .
2173 14	(4+)	B		
2774? 12		B		

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

[‡] From systematics of even-even nuclei.

 $\gamma(^{42}\text{Si})$

E(level)	$E\gamma^{\dagger}$	Comments
742	742 8	$E\gamma$: 770 19 from $^9\text{Be}(^{44}\text{S}, ^{42}\text{Si}\gamma)$.
2173	1431 11	
2774?	2032 [‡] 9	$E\gamma$: possible partial feeding of the 2+ state at 742 keV (2012Ta20).

[†] From C($^{44}\text{S}, ^{42}\text{Si}\gamma$).

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

Adopted Levels, Gammas (continued)Level Scheme **$^9\text{Be}(^{44}\text{S}, ^{42}\text{Si})$ 2007Ba47, 2006Fr13**

2007Ba47 (also 2006GrZZ): determination of first 2+ state in $^9\text{Be}(^{44}\text{S}, ^{42}\text{Si})$ reaction. The 39 MeV/nucleon ^{44}S beam from fragmentation of ^{48}Ca beam at 60 MeV/nucleon in the SSSI device at GANIL facility. Isotopic identification by energy loss and time-of-flight method. The nuclei produced in the second fragmentation were transmitted through the SPEG spectrometer, where a total of 132 nuclei were observed corresponding to a cross section of 0.80 mb 10 in 2007Ba47 (0.102 mb 26 in 2006GrZZ). The γ ray detector array was 4 π Chateau de Crystal consisting of 74 BaF_2 detectors.

2006Fr13 (also 2005Fr19): $E(^{44}\text{S})=98.6$ MeV/nucleon secondary beam produced from fragmentation of ^{48}Ca beam at 140 MeV/nucleon with a ^9Be target. Fragments were separated by A1900 separator at NSCL, MSU facility. The ^{44}S beam impinged another ^9Be target and the residues were analyzed by S-800 spectrograph. The knockout residues were identified by time-of-flight, energy loss measurement, position and angle information. The γ rays were detected in coincidence with knockout residues of ^{42}Si using SeGA array of highly-segmented HPGe detectors.

Total cross section for $^{42}\text{Si}=0.12$ mb 2 in comparison with 0.32 mb from theoretical predictions, or 0.16 mb if suppression factor of ≈ 0.5 is used for two-nucleon shell-model strength. Calculations also predict 90% of the cross section for the population of the g.s., the contribution from the excited states to the total cross section is expected to be small (2006Fr13).

No discrete γ rays observed in this reaction (2006Fr13).

The results suggest Z=14 subshell closure and ^{42}Si as a doubly-magic nucleus (2006Fr13).

 ^{42}Si Levels

E(level)	J π	Comments
0.0	0+	Low energy of 2+ state and comparison of measured half-life with QRPA calculations (2004Gr20) suggest that ^{42}Si is deformed and that there is collapse of N=28 closed shell at Z=14. But the small production cross section of ^{42}Si in both studies (2006Fr13 and 2007Ba47) suggest closed shell nature of ^{42}Si .
770 19	(2+)	E(level): from 2007Ba47.

 $\gamma(^{42}\text{Si})$

E γ	E(level)	Comments
770 19	770	E γ : from 2007Ba47, γ observed in coincidence with ^{42}Si nuclei.

C(^{44}S , $^{42}\text{Si}\gamma$) 2012Ta20

Two-proton removal reaction.

2012Ta20: E=385 MeV/nucleon ^{48}Ca primary beam with an average intensity of 70 pA was produced at the RIBF facility at RIKEN and incident on a 15-mm-thick rotating beryllium target. A secondary ^{44}S beam was analyzed by the BigRIPS fragment separator and accelerated to an energy of 210 MeV/nucleon with an intensity of 4×10^4 pps. The secondary target was a 2.54 g/cm^2 carbon foil. Reaction products were analyzed by the ZeroDegree spectrometer and identified using the energy loss (ionization chamber), magnetic rigidity and time-of-flight (plastic scintillators); γ rays were detected by the DALI2 array of 186 NaI(Tl) detectors surrounding the reaction target (20% efficiency, FWHM=10% at $E_\gamma=1 \text{ MeV}$). Measured E_γ , I_γ , particle- γ -coin. Deduced levels, $J\pi$, rapid deformation development of Si isotopes. Comparison with shell-model calculations.

Total cross section for $^{42}\text{Si}=0.12 \text{ mb}$ 2 for E=210 MeV/nucleon.

 ^{42}Si Levels

E(level) [†]	$J\pi^{\ddagger}$	Comments
0.0	0+	
742 8	2+	
2173? 14	(4+)	E(level): this level is tentatively assigned by 2012Ta20 based on $\gamma\gamma$ -coin as the first 4+ state predicted by shell-model calculations. The resulting energy ratio between the first 4+ and 2+ states ($R_{4/2}$)=2.93 5 is close to the rigid-rotor limit, which contradicts the possibility of a doubly closed structure suggested by the two magic numbers Z=14 and N=28 but supports enhanced quadrupole collectivity. Furthermore, large $R_{4/2}$ value indicates a significant static ground state deformation of ^{42}Si (2012Ta20).
2774? 12		

[†] From E_γ .

[‡] Predicted by shell-model calculations.

 $\gamma(^{42}\text{Si})$

E_γ	E(level)	Comments
742 8	742	
1431 11	2173?	E_γ : placement of this γ -ray is based on $\gamma\gamma$ -coin with the 742 γ -ray. Also yield of this γ -ray is consistent with 100% feeding of the (2+) state.
2032 [†] 9	2774?	E_γ : possible partial feeding of the 2+ state at 742 keV (2012Ta20).
^x 2357 15		

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

^x γ ray not placed in level scheme.

Adopted Levels

$Q(\beta^-)=18650\ 210$; $S(n)=2080\ 220$; $S(p)=18400\ 430$; $Q(\alpha)=-17.63\times 10^3\ 33\ 2012\text{Wa}38$.

$S(2n)=7060\ 240$, $S(2p)=41540\ 550$ (syst), $Q(\beta^-n)=11950\ 210$ (2012Wa38).

^{42}P identified in $^{181}\text{Ta}(^{48}\text{Ca},X)$ reaction at 55 MeV/nucleon (1989Le16), $^9\text{Be}(^{48}\text{Ca},X)$ $E=212$ MeV/nucleon (1979We10).

Mass measurements: 2000Sa21, 2001Sa72, 2007Ju03.

1989Le16: $^{181}\text{Ta}(^{48}\text{Ca},X)$ reaction $E=55$ MeV/nucleon; measured $T_{1/2}$ and $\% \beta^-n$. Other: 1999YoZW, from fragmentation of ^{48}Ca beam using $^9\text{Be}(^{48}\text{Ca},X)$ and $^{181}\text{Ta}(^{48}\text{Ca},X)$ reactions at 70 MeV/nucleon; preliminary values of $T_{1/2}$ and $\% \beta^-n$ reported.

2006Kh08: $\text{Si}(^{42}\text{P},X)$ $E=30-65$ MeV/nucleon; measured energy-integrated reaction σ ; deduced mean radius.

Others: 1989MuZU, 2003Gr22.

 ^{42}P Levels

E(level)	$T_{1/2}$	Comments
0.0	48.5 ms 15	$\% \beta^-=100$; $\% \beta^-n=50\ 20$ (1989Le16); $\% \beta^-2n=?$ Theoretical $T_{1/2}=42.1$ ms, $\% \beta^-n=36.3$, $\% \beta^-2n=12.8$ (2003Mo09). Theoretical $T_{1/2}=219$ ms, $\% \beta^-n=20.6$, $\% \beta^-2n=16.3$ (2016Ma12). $T_{1/2}$: From 2004Gr20 (β^- -decay). Others: 110 ms +40-20 (1989Le16, β^- -decay). Mean radius $r^2_0=1.25\ \text{fm}^2\ 10$ (2006Kh08).

Adopted Levels, Gammas

$Q(\beta^-)=7280$ 140; $S(n)=6700$ 5; $S(p)=19950$ 80; $Q(\alpha)=-15890$ 70 (2012Wa38).

$S(2n)=10943$ 5, $S(2p)=37650$ 230, $Q(\beta^-n)=1600$ 70 (2012Wa38).

^{42}S identified and produced by 1975WiZG using $^{48}\text{Ca}(\alpha,^{10}\text{C})$ at $E=110$ MeV.

Mass measurements: mass excess=-17637.9 27 (2009Ri12), -17700 130 (2000Sa21) (weighted average of -18060 330

(2000Sa21) and -17640 140 from another study quoted by 2000Sa21), 1991Zh24.

^{42}S produced by fragmentation of ^{48}Ca beam (2009Ri12, 2002Az02, 1998WiZX, 1998WiZV); $^{64}\text{Ni}(^{48}\text{Ca}, X)$ $E=60$ MeV/nucleon (1995So03); $\text{Th}(p, X)$ $E=800$ MeV (1991Zh24); $^{238}\text{U}(^{40}\text{Ar}, X)$ $E=263$ MeV (1979Au03); $^9\text{Be}(^{48}\text{Ca}, X)$ $E=212$ MeV (1979We10).

Cross-section measurements: 2006Kh08, 2006Ro34.

 ^{42}S Levels

Cross Reference (XREF) Flags

A ^{42}P β^- Decay (48.5 ms)
 B ^{43}P β^-n Decay (36.5 ms)
 C $^9\text{Be}(^{48}\text{Ca}, X\gamma)$
 D Coulomb Excitation

E(level) [†]	J π	XREF	T _{1/2}	Comments
0.0	0+	CD	1.016 s 15	$\% \beta^- = 100$; $\% \beta^-n < 4$ (1995So03). $\% \beta^-n < 4$ (1995So03), but none observed by 1998WiZX. Theoretical T _{1/2} =2.5 s, $\% \beta^-n = 1.5$ (2003Mo09). Theoretical T _{1/2} =1.26 s, $\% \beta^-n = 7.2$ (2016Ma12). T _{1/2} : weighted average of 1.013 s 15 from 1998WiZX and 1.03 s 3 from 2006Wi10. Other: 0.56 s 6 (1995So03). Mean radius $r^2_0 = 1.251$ fm ² 25 (2006Kh08).
903 5	2+	CD	11.9 ps 20	B(E2) [†] =0.0397 63 (1996Sc31). J π : Coulomb excited from 0+. T _{1/2} : from B(E2) (1996Sc31).
2725 10	(4+) [‡]	C		
2779 11	(2+) [‡]	C		
4245 13		C		

[†] From $E\gamma$ data.

[‡] $\Delta J=2$ quadrupole or $\Delta J=0$, dipole from $\gamma(0)$ for 1821+1875 summed peak, and systematic of neighboring nuclides.

 $\gamma(^{42}\text{S})$

E(level)	E γ	I γ	Mult.	Comments
903	903 5	100	E2	$E\gamma$: weighted average of 890 15 (Coul. ex.) and 904 5 ($^{48}\text{Ca}, X\gamma$). B(E2)(W.u.)=9.1 16.
2725	1821 8	100		
2779	1875 9	100		
4245	1466 8	100		

 ^{42}P β^- Decay (48.5 ms) 2004Gr20, 1989Le16

Parent ^{42}P : $E=0$; $J\pi=?$; T_{1/2}=48.5 ms 15; $Q(g.s.)=18650$ 210; $\% \beta^-$ decay=100.

$^{42}\text{P}-T_{1/2}$: From 2004Gr20. Other: 110 ms +40-20 (1989Le16).

$^{42}\text{P}-Q(\beta^-)$: From 2012Wa38.

No decay details known. ^{42}P also decays to ^{41}S by beta-delayed neutrons ($\% \beta^-n=50$ 20, 1989Le16).

^{43}P β^- n Decay (36.5 ms) 1995So03

Parent ^{43}P : $E=0$; $J\pi=1/2^+$; $T_{1/2}=36.5$ ms 15; $Q(\text{g.s.})=14250$ 370; $\%\beta^-$ n decay=100.

^{43}P - $J, T_{1/2}$: From ^{43}P Adopted Levels in the ENSDF database (March 2015 update).

^{43}P - $Q(\beta^-$ n): From 2012Wa38.

^{43}P - $\%\beta^-$ n decay: $\%\beta^-$ n=100 for ^{43}P decay (1995So03). Other: 1999YoZW.

$\%\beta^-$ n=100 (1995So03). Other: 1999YoZW.

No information is available about population of levels in ^{42}S from this decay.

 $^9\text{Be}(^{48}\text{Ca}, \text{X}\gamma)$ 2002So14, 2002Az02, 2002Gu08

2002So14, 2002Az02, 2002Az01, 2002Gu08: $E=60$ MeV/nucleon ^{48}Ca beam was produced at GANIL. A 2.77 mg/cm² Be target.

Fragments were analyzed with the SPEG spectrometer and γ -rays were detected by an array 25% efficiency at 1.33 MeV of 74 BaF₂ crystals (FWHM=200 keV at 1 MeV, 500 keV at 3 MeV) and three segmented Ge clover detectors (0.12 % efficiency at 1.3 MeV, FWHM=30 keV at 1.3 MeV). Measured $E\gamma$, $I\gamma$, $\gamma(\theta)$, $\gamma\gamma$ -coin. Deduced levels, $J\pi$, branchings.

Comparison with shell-model calculations.

 ^{42}S Levels

E(level) [†]	$J\pi$	Comments
0.0	0+	
904 5	2+	$J\pi$: from Adopted Levels.
2725 10	(4+) [‡]	
2779 11	(2+) [‡]	
4245 13		

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

[‡] $\Delta J=2$ quadrupole or $\Delta J=0$, dipole from $\gamma(\theta)$ for 1821+1875 summed peak, and systematic of neighboring nuclides.

 $\gamma(^{42}\text{S})$

$E\gamma$	E(level)	$I\gamma$
904 5	904	100
1466 8	4245	30
1821 8	2725	70
1875 9	2779	30

Coulomb Excitation 1996Sc31

1996Sc31: $^{197}\text{Au}(^{42}\text{S}, ^{42}\text{S}')$ $E=1.7$ GeV. ^{42}S beam was obtained from fragmentation of ^{48}Ca beam with a ^9Be target.

Measured γ -particle coincidence following Coulomb excitation using position-sensitive NaI detector array.

 ^{42}S Levels

E(level)	$J\pi$ [†]	$T_{1/2}$	Comments
0.0	0+		
890 15	2+	12.8 ps 23	$B(E2)\uparrow=0.0397$ 63 (1996Sc31). $T_{1/2}$: from $B(E2)$, for Adopted $E\gamma=903$ 5, half-life=11.9 ps 20 given in Adopted Levels.

[†] From Adopted Levels.

 $\gamma(^{42}\text{S})$

$E\gamma$	E(level)
890 15	890

Adopted Levels, Gammas

Q(β^-)=9510 140; S(n)=5680 160; S(p)=13190 140; Q(α)=-12.67 $\times 10^3$ 17 2012Wa38.
 S(2n)=13500 150, S(2p)=31420 180, Q(β^- n)=80 140 (2012Wa38).
 1971Ar32: ^{42}Cl produced and identified in $^{232}\text{Th}(^{40}\text{Ar},\text{X})$ reaction at 290 MeV, measured fragment yield.
 1981Vo04: ^{42}Cl produced in U,Nb(p,X) at 600 MeV, measured half-life.
 1998WiZX, 1998WiZV, 1989Mi03, 1981HuZT: studies of ^{42}Cl β decay.
 Mass measurements: 2015Xu14, 1991Zh24, 1990Tu01.
 Cross-section and radius measurements: 2006Kh08, 2006Ro34, 1999Ai02.
 1991Wa19: shell-model calculations, levels, binding energy, β -decay rates.

 ^{42}Cl Levels

Cross Reference (XREF) Flags

A ^{42}S β^- Decay (1.016 s)
 B ^{43}S β^- n Decay (265 ms)
 C $^{208}\text{Pb}(^{40}\text{Ar},\text{X}\gamma)$

E(level) [†]	J π	XREF	T _{1/2}	Comments
0.0	(2-) [‡]	A C	6.8 s 3	% β^- =100. J π : (3-) in 2006Wi10. T _{1/2} : from 1981Vo04. Mean radius r ₀ ² =1.304 fm ² 54 (2006Kh08). J π : (2-) in 2006Wi10.
118.19 6	(3-) [‡]	A		
522? 1	(4-) [‡]	C		
588.97 6	(1-,2,3+) [§]	A		
639.44 9	(1-,2,3+) [§]	A		
841.91 6	(1-,2,3+) [§]	A		
1025.82 23	(1-,2,3+) [§]	A		
1267.49 7	1+	A		J π : log ft=4.99 from 0+.
1385.69 18		A		
1550.42 9		A		
1576.65? 20		A		
1684.22? 11		A		
1710.92 8		A		
1834.87? 13		A		
2123.31 8	1+	A		J π : log ft=4.13 from 0+.
2221.03? 12		A		
2241.17 25	(1+)	A		J π : log ft=5.5 from 0+, however, due to weak β feeding and incomplete decay scheme, J π is considered as tentative.
2403.2? 4		A		
3029.71 11	1+	A		J π : log ft=4.33 from 0+.

[†] From least-squares fit to E γ data.

[‡] From shell-model calculations (2013Sz02).

[§] Inferred from a comparison with the decay scheme of ^{40}S (2006Wi10).

 $\gamma(^{42}\text{Cl})$

E(level)	E γ	I γ	Mult.	E(level)	E γ	I γ	Mult.
118.19	118.25 10	100		1267.49	1268.8 [‡] 7	12.8 19	[M2]
522?	522 [†] 1	100		1385.69	796.80 20	100	
588.97	470.78 6	100 4		1550.42	1550.52 14	100	
	588.78 9	0.75 15		1576.65?	1458.53 [‡] 23	100	
639.44	521.26 [†] 10	100 20		1684.22?	1684.1 [‡] 3	100	
	638.9 4	28 5		1710.92	160.60 9	52 5	
841.91	202.42 11	2.6 3			685.1 3	41 4	
	252.6 [‡] 4	0.93 24			868.94 14	66 7	
	723.72 7	100 3			1071.6 3	43 10	
	841.95 8	25 3			1121.97 13	100 20	
1025.82	907.5 5	71 33			1592.55 18	65 7	
	1025.9 [‡] 4	100 31		1834.87?	1245.93 [‡] 24	100	
1267.49	425.61 6	44 3		2123.31	288.49 [‡] 12	1.93 24	
	678.43 7	100 6			439.09 [‡] 8	5.4 5	
	1149.42 13	13 3			737.8 3	1.2 4	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Cl})$ (continued)

E(level)	E γ	I γ	Mult.	E(level)	E γ	I γ
2123.31	1281.44 12	100 4		3029.71	808.55 ‡ 15	16.3 26
	1534.26 11	34.0 16			1193.1 ‡ 9	18 3
	2004.93 16	52.0 19			1318.88 11	100 4
	2123.9 5	3.9 5	[M2]		1453.2 ‡ 3	14.4 19
2221.03?	670.55 ‡ 10	100			2187.2 4	29 3
2241.17	1399.1 3	100 11			2440.6 3	26 3
	1652.4 4	45 15			2911.7 5	20 3
2403.2?	1814.2 ‡ 4	100				

† Note two γ rays of nearly the same energy.

‡ Placement of transition in the level scheme is uncertain.

 ^{42}S β^- Decay (1.016 s) 2006Wi10

Parent ^{42}S : E=0; $J\pi=0+$; $T_{1/2}=1.016$ s 15; Q(g.s.)=7280 140; % β^- decay=100.

$^{42}\text{S}-T_{1/2}$: From ^{42}S Adopted Levels.

$^{42}\text{S}-Q(\beta^-)$: From 2012Wa38.

2006Wi10: ^{42}S isotope produced by fragmentation of a ^{48}Ca beam at 70 MeV/nucleon hitting a ^9Be target. The fragments were separated by A1200 fragment separator at NSCL, Michigan facility. Measured E γ , I γ , $\gamma\gamma$, β , $\beta\gamma$ coin using two Ge detectors for γ rays and a plastic scintillator for β rays. Comparisons with Shell-model calculations.

1998WiZX: reported preliminary result of 2006Wi10; measured $T_{1/2}$, E γ , I γ , $\gamma\gamma$ -coin, neutrons. No delayed neutrons were observed by 1998WiZX; 1995So03 reported % $\beta^-n<4$.

2013Sz02 refer to a study of this decay by D. O'Donnell, Ph.D. thesis, University of the West Scotland (2008).

 ^{42}Cl Levels

E(level) †	$J\pi^{\ddagger}$	Comments
0.0	(2-)	
118.19 6	(3-)	
588.96 6	(1-, 2, 3+)	
639.44 9	(1-, 2, 3+)	
841.90 6	(1-, 2, 3+)	
1025.82 23	(1-, 2, 3+)	
1267.48 7	1+	
1385.68 18		
1550.38 10		
1576.61? 19		
1684.16? 11		
1710.91 8		
1834.78? 13		
2123.28 9	1+	
2221.00? 12		
2241.16 25	(1+)	$J\pi$: log $ft=5.5$ from 0+, however, due to weak β feeding and incomplete decay scheme, $J\pi$ is considered as tentative.
2403.1? 4		
3029.76 12	1+	

† From least-squares fit to E γ data.

‡ Strong β^- feeding from 0+. For states below 1.1 MeV, values are inferred from a comparison with the decay scheme of ^{40}S (2006Wi10).

 β^- radiations

E β^-	E(level)	I β^- $^{\ddagger}\$$	Log $ft^{\ddagger}$
(4250 140)	3029.76	16.2 9	4.33 7
(4880# 140)	2403.1?	1.0 2	5.8 1
(5040 140)	2241.16	2.2 3	5.5 1

Continued on next page (footnotes at end of table)

^{42}S β^- Decay (1.016 s) 2006Wi10 (continued) β^- radiations (continued)

$E\beta^-$	E(level)	$I\beta^{-\dagger\ddagger\S}$	$\text{Log } ft^{\ddagger}$
(5160 140)	2123.28	63 3	4.13 6
(5570 140)	1710.91	1.6 8	5.9 2
(5890 140)	1385.68	0.7 2	6.4 2
(6010 140)	1267.48	17.6 11	4.99 6

 † From intensity balance. ‡ Due to large Q value, it is possible that there are unobserved levels above the currently known level at 3030, thus the β -feedings and log ft values are considered as limits only. However, β transitions with large feedings (>15%) are considered as allowed. § Absolute intensity per 100 decays. $^{\#}$ Existence of this branch is questionable. $\gamma(^{42}\text{Cl})$ $I\gamma$ normalization: $\Sigma(I\gamma \text{ to g.s.})=100$, assuming zero feeding to g.s.

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger}$	Mult.	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger}$	Mult.
118.25 10	118.19	100 5		1071.6 3	1710.91	1.3 3	
160.60 9	1710.91	1.57 15		1121.97 13	1710.91	3.0 6	
202.42 11	841.90	0.96 11		1149.42 13	1267.48	1.7 4	
252.6 4	841.90	0.35 9		1193.1 § 9	3029.76	1.6 † 3	
288.49 § 12	2123.28	0.72 9		1245.93 § 24	1834.78?	1.08 18	
425.61 6	1267.48	5.7 4		1268.8 § 7	1267.48	1.65 † 24	[M2]
439.09 § 8	2123.28	2.00 17		1281.44 12	2123.28	37.3 14	
470.78 6	588.96	33.5 12		1318.88 11	3029.76	9.1 4	
521.26 10	639.44	2.0 4		1399.1 3	2241.16	1.76 19	
588.78 9	588.96	0.25 5		1453.2 § 3	3029.76	1.31 17	
638.9 4	639.44	0.55 9		1458.53 § 23	1576.61?	1.21 20	
670.55 § 10	2221.00?	1.84 16		1534.26 11	2123.28	12.7 6	
678.43 7	1267.48	12.9 7		1550.52 14	1550.38	2.85 23	
685.1 3	1710.91	1.22 13		1592.55 18	1710.91	1.94 22	
723.72 7	841.90	37.6 12		1652.4 4	2241.16	0.80 26	
737.8 3	2123.28	0.45 13		1684.1 § 3	1684.16?	1.63 19	
796.80 20	1385.68	1.3 3		1814.2 § 4	2403.1?	1.20 19	
808.55 § 15	3029.76	1.48 24		2004.93 16	2123.28	19.4 7	
841.95 8	841.90	9.4 12		2123.9 § 5	2123.28	1.47 † 17	[M2]
868.94 14	1710.91	1.98 22		2187.2 4	3029.76	2.6 3	
907.5 5	1025.82	0.39 18		2440.6 3	3029.76	2.4 3	
1025.9 4	1025.82	0.55 17		2911.7 5	3029.76	1.8 3	

 † From 1998WiZX only. ‡ For absolute intensity per 100 decays, multiply by 0.87 4. § Placement of transition in the level scheme is uncertain.

^{42}S β^- Decay (1.016 s) 2006Wi10 (continued)

Decay Scheme

^{43}S β^-n Decay (265 ms) 1989Le16

Parent ^{43}S : $E=0$; $J^\pi=(3/2^-)$; $T_{1/2}=265$ ms 15; $Q(\text{g.s.})=4650$ 140; β^-n decay=40 10.

$^{43}\text{S}-J, T_{1/2}$: From Adopted Levels of ^{43}S in the ENSDF database (March 2015 update).

$^{43}\text{S}-Q(\beta^-n)$: From 2012Wa38.

$^{43}\text{S}-\beta^-n$ decay: $\beta^-n=40$ 10 for ^{43}S decay (1989Le16).

$\beta^-n=40$ 10 (1989Le16).

No information is available about population of levels in ^{42}Cl from this decay.

$^{208}\text{Pb}(^{40}\text{Ar},\text{X}\gamma)$ 2013Sz02

2013Sz02 (also 2013Sz01): transfer channel: 1p removal and 3n addition $E(^{40}\text{Ar})=255$ MeV provided by the ECR ion source and accelerated by the superconducting ALPI-Linac accelerator of the Laboratory Nazionali di Legnaro. Target= $300\text{ }\mu\text{g}/\text{cm}^2$ ^{208}Pb . Measured fragments, $E\gamma$, $I\gamma$, time-of-flight, energy loss, $\gamma\gamma$ -, (fragment) γ -coin using the Clara array and magnetic spectrometer Prisma. Deduced level, J, π . Comparison with large-scale shell-model calculations.

 ^{42}Cl Levels

<u>E(level)</u>	<u>$J\pi^\dagger$</u>
0.0	(2-)
522? 1	(4-)

† From 2013Sz02 based on shell-model calculations.

 $\gamma(^{42}\text{Cl})$

<u>$E\gamma$</u>	<u>E(level)</u>	<u>$I\gamma^\ddagger$</u>
x117 †		
x230 †		
x275 †		
x400 †		
522 1	522?	2.0 4
x1225 †		

† Weak γ observed. Authors claim corresponding γ (except the 230 γ) present in ^{42}S β^- decay from the work on β decay by D. O'Donnell, Ph.D. thesis, University of the West Scotland (2008).

‡ Effective number of counts after taking into account detector efficiency. $I\gamma$ from 2013Sz02 divided by 10.

x γ ray not placed in level scheme.

Adopted Levels, Gammas

$Q(\beta^-)=599\ 6$; $S(n)=9426\ 6$; $S(p)=14400\ 70$; $Q(\alpha)=-9986\ 9$ 2012Wa38.

$S(2n)=15525\ 6$, $S(2p)=26163\ 7$ (2012Wa38).

^{42}Ar identified and produced by 1952Ka44 in successive thermal neutron capture in ^{40}Ar , estimated half-life from its decay to ^{42}K .

Mass measurements: mass excess=-34422.7 58 (2001He29).

 ^{42}Ar Levels**Cross Reference (XREF) Flags**

A $^{42}\text{Cl}\ \beta^-$ Decay (6.8 s)

B $^{40}\text{Ar}(t,p)$

C $^{40}\text{Ar}(t,p\gamma)$

D $^{42}\text{Ar}(p,p')$

E $^{208}\text{Pb}(^{40}\text{Ar},X\gamma)$

F $\text{Pb}(^{43}\text{Ar},n\gamma)$

E(level) [†]	J π [§]	XREF	T _{1/2} [#]	Comments
0.0 [@]	0+	ABCDEF	32.9 y 11	% β^- =100. J π : L(t,p)=0. The rms charge radius ($\langle r^2 \rangle$) ^{1/2} =3.4354 fm 39 (2013An02 evaluation). $d\langle r^2 \rangle(^{38}\text{Ar}, ^{42}\text{Ar})=+0.2623\ \text{fm}^2\ 12(\text{stat})\ 62(\text{syst})$ (2008B101, also 2005B133, laser spectroscopy). T _{1/2} : from 1965St09 (β^- -counting). Others: 1964Ho31, 1952Ka44.
1208.22 [@] 13	2+	ABCDEF	2.6 ps +7-6	J π : L(t,p)=2. $\beta_2=0.32\ 5$ (2001Sc01). In a review article by 2008BeZH, Fig. 4 seems to give g factor for the first 2+ states in $^{38,40,42}\text{Ar}$, but from Fig. 3 in 2006Sp01 (reference 18 in 2008BeZH), the isotopes should be $^{36,38,40}\text{Ar}$, instead. It would seem that the x-axis in 2008BeZH is erroneously marked in neutron number.
2413.8 [@] 6	(4+)	ABC EF		J π : L(t,p)=3,4; γ from (6+) supports 4+.
2485.9 3	2+	A C E	0.28 ps 11	Measured upper limit of branching is <10 for transition to g.s.
2512.5 4	(0+ to 4+)	ABC	2.8 ps +21-8	J π : E2 γ to 0+.
3013.7 3	(1,2+)	A C	<83 fs	J π : γ to 2+ and RUL.
3096.1 5	4+	ABC E	>3.5 ps	Measured upper limit of branching is <10 for transition to g.s.
3557.9 4	2+	ABC	<62 fs	J π : $\Delta J=2$, E2(+M3) γ to 2+; L(t,p)=3,4.
3564.3 [@] 6	(6+)	E		Measured upper limit of branching is <5 for transition to g.s. (1973Pr10).
3705 10	(2+)	B		J π : γ to 0+, $\Delta J=0$, dipole γ to 2+.
3820 20		AB		J π : proposed by 2011Sz02 as the members of the 2+, 4+ and 6+ yrast sequence and from comparison with shell model calculations as well.
4005.3 4	2+	BC	0.23 ps 6	J π : L(t,p)=(2). XREF: A(3846). E(level): possible γ to g.s. and 1208 level from a 3846 level in $^{42}\text{Cl}\ \beta^-$.
4013.6 8		A		J π ,E(level): L=2 for 4012 level in (t,p) which is considered as associated with 4005.3 level in (t,p γ). It is possible part of this level may also correspond to 4013.6 level populated in β^- decay.
4045.8 4		A		See comment for 4005.3 level for possible population in (t,p).
4127.5 5	(0+,1,2)	ABC	0.97 ps 21	J π : $\gamma(0)$ of γ to 2+.
4287.1 5	(1,2,3)	BC	<35 fs	Measured upper limit of branching is <5% for transition to g.s.
4405 5	3-,4+	B		J π : γ to 2+; $\gamma(0)$.
4417.3 3		A		J π : L(t,p)=3,4.
4633.9 6	(3-)	ABC	<35 fs	J π : L(t,p)=(3,4); $\Delta J=1\ \gamma$ to 2+.
4887 10	(3-,4+)	B		J π : L(t,p)=(3,4).
4896 10	(3-,4+)	AB		J π : L(t,p)=(3,4).
5000 15		AB		E(level): possible 4902 γ to g.s. from a tentative 4902 level in $^{42}\text{Cl}\ \beta^-$ may correspond to this level, but γ to 0+ is inconsistent with J π =(3-,4+).
5230 15		B		E(level): possible γ to g.s. from a 5015 level in $^{42}\text{Cl}\ \beta^-$.
5292 15		AB		E(level): possible 1284 γ to 4013 level from a 5297 level in $^{42}\text{Cl}\ \beta^-$.
5553 15	2+	B		J π : L(t,p)=2.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{42}Ar Levels (continued)

E(level) [†]	XREF	E(level) [†]	XREF	E(level) [†]	XREF
5763 15	B	7630 [‡] 30	AB	9410 30	B
5945 20	B	7793 15	B	9535 25	B
6090 20	B	7987 15	B	9640 30	B
6170 15	B	8080 30	B	9820 20	B
6357 15	B	8230 30	B	9905 20	B
6490 20	B	8380 20	B	10015 20	B
6614 20	B	8520 20	B	10060 30	B
6742 15	B	8690 20	B	10140 30	B
6880 30	B	8790 20	B	10300 30	B
7060 20	B	8940 30	B	10540 30	B
7140 20	B	9020 30	B	10590 30	B
7275 15	B	9130 30	B	10670 30	B
7355 15	B	9210 20	B	10850 30	B
7540 30	B	9320 30	B		

[†] From adopted E γ data when measured γ -ray energies are available. In other cases weighted averages are taken of values available from different reactions.

[‡] Possible γ to g.s. from a 7648 level in ^{42}Cl β^- .

[§] In (t,p) transfer reaction, target ^{40}Ar $J\pi=0+$.

From DSAM in (t,p γ), unless otherwise noted.

@ (A): Yrast sequence (2011Sz02).

 $\gamma(^{42}\text{Ar})$

E(level)	E γ [†]	I γ [‡]	Mult.#	δ [#]	Comments
1208.22	1208.17 13	100	E2		B(E2)(W.u.)=9.8 +29-21.
2413.8	1205.6 5	100			
2485.9	1277.7 3	100 [§] 4			
	2486.1 8	15.5 [§] 25	E2		B(E2)(W.u.)=0.33 14.
2512.5	1304.3 3	100			
3013.7	1806.2 4	100 7			
	3014.6 8	61 7			
3096.1	1887.8 4	100	E2 (+M3)	+0.07 8	B(E2)(W.u.)<0.76.
3557.9	2349.6 3	100 2	D (+Q)	0.00 7	
	3557.7	11 2	[E2]		B(E2)(W.u.)>0.18.
3564.3	1150.4 3				
4005.3	991.6				
	1519.40 22				
	2797.0				
4013.6	1527.7				
	1598.5@ 8	25 4			
	2805.3 7	100 8			
	4013.4				
4045.8	1560.1 5	32.6 21			
	2837.3 5	100 4			
	4045.6				
4127.5	1641.6				
	2919.2 4	100			
4287.1	3078.8 4				
4417.3	403.9@ 6	8.4 19			
	1404.7 4	15 3			
	1931.7 6	41 4			
	2003.4@ 3	21 4			
	3208.3 3	100 4			
4633.9	3425.5 5	100	D		

[†] Values with uncertainties from (t,p γ), β^- decay or (^{40}Ar ,X γ). Weighted averages are taken when available. Others are from level energy differences.

[‡] From (t,p γ), when a level is populated in β^- decay and in (t,p γ) and others from β^- decay, unless otherwise noted.

[§] From β^- decay.

From (t,p γ).

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

(A) Yrast
sequence
(2011Sz02)

(6+)	3564.3
(4+)	2413.8
2+	1208.22
0+	0.0

$^{42}_{18}\text{Ar}_{24}$

 ^{42}Cl β^- Decay (6.8 s) 1981HuZT,1998WiZX

Parent ^{42}Cl : E=0; $J\pi=(2-)$; $T_{1/2}=6.8$ s 3; Q(g.s.)=9510 140; % β^- decay=100.

^{42}Cl -J, $T_{1/2}$: From Adopted Levels of ^{42}Cl .

^{42}Cl -Q(β^-): From 2012Wa38.

1998WiZX: measured E γ , I γ , $\gamma\gamma$.

1981HuZT, 1989Mi03: measured E γ , I γ , $\gamma\gamma$. 1989Mi03 give $\beta\gamma$ coin results.

 ^{42}Ar Levels

E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]	$J\pi^{\ddagger}$	E(level) [†]
0.0	0+	4181? §		4827? §
1207.7 6	2+	4196? §		4902? §
2413.4 8	(4+)	4266? §		4936? §
2485.0 7	2+	4313? §		4941? §
2511		4352? §		5015? §
3013.1 10	(1, 2+)	4416.5 6		5260? §
3094.9 9	4+	4527? §		5282? §
3556	2+	4566? §		5297? §
3846		4607? §		5506? §
4012.9 7		4619? §		5529? §
4045.1 7		4633	(3-)	5792? §
4057? §		4735? §		6412? §
4131		4812? §		7648? §

[†] From 1981HuZT, except for levels where E γ values are quoted with uncertainties, which are from 1998WiZX.

[‡] From Adopted Levels.

§ Most levels above 4000 keV, reported only by 1981HuZT, are considered as tentative in view of a comment by 1989Mi03 that the level scheme proposed earlier (1981HuZT) has been revised by taking account of source impurities. However, this revision is not available in the literature. The tentative levels are not included in the Adopted Levels, Gammas dataset.

 β^- radiations

E β^-	E(level)	I β^-	Log ft	Comments
(1860 140)	7648?			I β^- : 0.066 (1981HuZT).
(3100 140)	6412?			I β^- : 0.051 (1981HuZT).
(3720 140)	5792?			I β^- : 0.092 (1981HuZT).
(3980 140)	5529?			I β^- : 0.032 (1981HuZT).
(4000 140)	5506?			I β^- : 0.71 (1981HuZT).
(4210 140)	5297?			I β^- : 2.6 (1981HuZT).
(4230 140)	5282?			I β^- : 1.3 (1981HuZT).
(4250 140)	5260?			I β^- : 0.19 (1981HuZT).
(4500 140)	5015?			I β^- : 0.21 (1981HuZT).
(4570 140)	4941?			I β^- : 0.31 (1981HuZT).
(4570 140)	4936?			I β^- : 0.56 (1981HuZT).
(4610 140)	4902?			I β^- : 0.12 (1981HuZT).
(4680 140)	4827?			I β^- : 0.28 (1981HuZT).
(4700 140)	4812?			I β^- : 0.71 (1981HuZT).
(4780 140)	4735?			I β^- : 0.24 (1981HuZT).

Continued on next page (footnotes at end of table)

^{42}Cl β^- Decay (6.8 s) 1981HuZT,1998WiZX (continued) β^- radiations (continued)

$E\beta^-$	E(level)	$I\beta^-$	Log ft	Comments
(4880 140)	4633			$I\beta^-$: 0.50 (1981HuZT).
(4890 140)	4619?			$I\beta^-$: 0.06 (1981HuZT).
(4900 140)	4607?			$I\beta^-$: 2.64 (1981HuZT).
(4940 140)	4566?			$I\beta^-$: 0.19 (1981HuZT).
(4980 140)	4527?			$I\beta^-$: 0.04 (1981HuZT).
(5090 140)	4416.5	17	≈ 5.5	$I\beta^-$: from 1989Mi03. Others: 15 (1998WiZX), 11.6 (1981HuZT). $E(\beta^-)=3959$ 1400 (1989Mi03).
(5160 140)	4352?			$I\beta^-$: 0.10 (1981HuZT).
(5200 140)	4313?			$I\beta^-$: 0.09 (1981HuZT).
(5240 140)	4266?			$I\beta^-$: 0.59 (1981HuZT).
(5310 140)	4196?			$I\beta^-$: 0.21 (1981HuZT).
(5330 140)	4181?			$I\beta^-$: 0.20 (1981HuZT).
(5380 140)	4131			$I\beta^-$: 1.17 (1981HuZT).
(5450 140)	4057?			$I\beta^-$: 0.12 (1981HuZT).
(5460 140)	4045.1	26	≈ 5.4	$I\beta^-$: from 1989Mi03. Others: 19 (1998WiZX), 17.6 (1981HuZT). $E(\beta^-)=4676$ 1052 (1989Mi03).
(5500 140)	4012.9			$I\beta^-$: 4 (1998WiZX), 2.41 (1981HuZT).
(5660 140)	3846			$I\beta^-$: 1.14 (1981HuZT).
(5950 140)	3556			$I\beta^-$: 0.14 (1981HuZT).
(6420 140)	3094.9			$I\beta^-$: 1.52 (1981HuZT).
(6500 140)	3013.1			$I\beta^-$: 1.97 (1981HuZT).
(7000 140)	2511			$I\beta^-$: 0.12 (1981HuZT).
(7030 140)	2485.0			$I\beta^-$: 6 (1998WiZX), 3.7 (1981HuZT).
(7100 140)	2413.4	19	≈ 6.1	$I\beta^-$: from 1989Mi03. Other: 4 (1998WiZX). $\beta\gamma$ coin: $E(\beta^-)=7021$ 640, 7479 230 (1989Mi03).
(8300 140)	1207.7			$I\beta^-$: <5% for g.s.+1208 level (1989Mi03). Other: 30 (1998WiZX). $I\beta=27$ (1981HuZT) is negated in the later work (1989Mi03).
(9510 140)	0.0			$I\beta^-$: <5% for g.s.+1208 level (1989Mi03). $I\beta=20$ (1981HuZT) is negated in the later work (1989Mi03).

 $\gamma(^{42}\text{Ar})$

$E\gamma^\dagger$	E(level)	$I\gamma^\S$	$E\gamma^\dagger$	E(level)	$I\gamma^\S$	$E\gamma^\dagger$	E(level)
403.9 $\frac{3}{2}^+$ @ 6	4416.5	0.9 2	2003.4@ 3	4416.5	2.3 4	4313	4313?
604	5506?		2349	3556		4352	4352?
767	4812?		2485.1 8	2485.0	2.5 4	4527	4527?
1205.7 5	2413.4	9.0# 8	2639	3846		4566	4566?
1207.7 6	1207.7	100.0 6	2805.3 7	4012.9	5.1 4	4607	4607?
1256	4812?		2837.3 5	4045.1	19.0 7	4619	4619?
1269	5282?		2924	4131		4735	4735?
1277.3 5	2485.0	16.1 6	3013	3013.1		4812	4812?
1284	5297?		3059	4266?		4827	4827?
1304	2511		3208.3 3	4416.5	10.7 4	4902	4902?
1404.7 $\frac{3}{2}^+$ 4	4416.5	1.6 3	3359	4566?		4936	4936?
1528	4012.9		3426	4633		4941	4941?
1560.1 5	4045.1	6.0 4	3556	3556		5015	5015?
1572	4057?		3846	3846		5260	5260?
1598.5@ 8	4012.9	1.3 2	4013	4012.9		5506	5506?
1646	4131		4045	4045.1		5529	5529?
1781	4266?		4057	4057?		5792	5792?
1805.4 8	3013.1	1.6 3	4181	4181?		6412	6412?
1887.2 7	3094.9	1.9 3	4196	4196?		7648	7648?
1931.7 6	4416.5	4.4 4	4266	4266?			

† From 1998WiZX for $E\gamma$ data quoted with uncertainty. All other $E\gamma$ values are differences of level energies as given by 1981HuZT.

$\frac{3}{2}$ From 1998WiZX only.

§ From 1998WiZX.

Value of 0.9 8 in 1998WiZX seems a misprint, in view of in-out intensity balance and β^- feeding shown in the level scheme of 1998WiZX. On the other hand, $\%I\beta=19$ (1989Mi03) would imply a much larger intensity or the 1205.7 component of the 1206–1208 doublet.

@ Placement of transition in the level scheme is uncertain.

Decay Scheme

$^{40}\text{Ar}(\text{t},\text{p})$ 1975F108

Target ^{40}Ar $J\pi=0+$.

1975F108 (also 1973Ca13, 1961Ja07): E=20 MeV triton beam was produced from the Los Alamos three-stage electrostatic accelerator facility. Gas target of natural argon, effective thickness of 60 $\mu\text{g}/\text{cm}^2$. Protons were momentum analyzed in a broad range spectrograph and detected in nuclear emulsions along the focal plane, FWHM=35 keV, at angles from 12.5° to 57.5°. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$, L, DWBA analysis.

Other: 1974WaYT.

 ^{42}Ar Levels

E(level)	$L^\ddagger$	$d\sigma/d\Omega$ (mb/sr) (max,c.m.) §	E(level)	$d\sigma/d\Omega$ (mb/sr) (max,c.m.) §
0.0	0	0.31 [#]	7355 15	
1208 5	2	0.31	7540 30	0.16
2415 15	4, 3 ^a	0.041	7630 [†] 30	
2520? 10		0.026	7793 15	
3092 5	4, 3 ^a	0.11	7987 15	
3563 5		0.90	8080 [†] 30	
3705 10	(2)	0.085	8230 [†] 30	0.23 ^{&}
3820 20		0.047 [#]	8380 20	0.35
4012 10	2	0.31	8520 [†] 20	
4130 15		0.034	8690 20	0.34
4296 5		0.22	8790 20	
4405 5	3, 4	0.25	8940 [†] 30	0.30
4642 10	(3, 4)	0.21	9020 30	
4896 10	(3, 4)	0.12	9130 [†] 30	
5000 15		0.23	9210 20	
5230 [†] 15		0.16 [@]	9320 [†] 30	
5292 [†] 15		0.16 [@]	9410 30	
5553 15	2	0.20	9535 25	
5763 15		0.20	9640 [†] 30	
5945 20		0.23 [#]	9820 20	
6090 20		0.13 [#]	9905 20	
6170 15			10015 [†] 20	
6357 [†] 15			10060 30	
6490 [†] 20			10140 30	
6614 20		0.21	10300 [†] 30	
6742 15		0.24	10540 30	
6880 30			10590 [†] 30	
7060 [†] 20			10670 30	
7140 20			10850 [†] 30	
7275 [†] 15		0.36		

[†] Probable doublet.

[‡] As implied by $J\pi$ values given in table 3 of 1975F108. 1975F108 give experimental and calculated (DWBA) $\sigma(\theta)$ distribution curves for the following levels also, but no specific L assignments were made based on these data: 3563 (L=2), 4130 (L=0), 4296 (L=2), 5000 (L=1), 5763 (L=2), 5945 (L=2), 6090 (L=3), 6614 (L=3), 6742 (L=3), 7275 (L=3), 8230 (L=5), 8380 (L=3).

§ At 12.5°, unless otherwise stated.

[#] At 20°.

[@] For 5230+5292.

[&] At 27.5°.

^a L=4 is preferred from comparison to $^{36}\text{Ar}(\text{t},\text{p})$.

 $^{40}\text{Ar}(\text{t},\text{p}\gamma)$ 1974Fi01, 1973Pr10

1974Fi01: E=2.8 MeV triton beam was produced from the Lockheed 3-MV Van de Graaff accelerator. A solid target of natural argon at a temperature of 15 K. Protons were detected in an annular silicon surface barrier detector and γ -rays by a 20-cm³ Ge(Li) detector at 30' and 120'. Measured proton spectrum, $E\gamma$, $I\gamma$. Deduced levels, γ branching ratios, $T_{1/2}$ by DSAM.

1973Pr10: E=2.9 MeV beam from the Lockheed Van de Graaff accelerator. Target of a gas cell of natural argon 6.3 mm thick. Protons were detected by silicon annular detector (FWHM=120 keV) and γ -rays were detected by five NaI(Tl) detectors at 5°, 35°, 45°, 60° and 90° with respect to the beam axis and a 20 cm³ Ge(Li) detector. Measured $E\gamma$, $I\gamma$, $p\gamma(\theta)$. Deduced levels, $J\pi$, mixing ratios, branching ratios.

Other: 1973BaXX.

$^{40}\text{Ar}(\text{t},\text{p}\gamma)$ 1974Fi01,1973Pr10 (continued) **^{42}Ar Levels**

E(level) [†]	J $\pi^{\#}$ @	T _{1/2} [§]	Comments
0.0	0+		
1208.22 13	2+	2.6 ps +7-6	
2415.2 $\ddagger$ 10	(4+)		Measured upper limit of branching is <10% for transition to g.s. (1973Pr10).
2486.8 4	2+	0.28 ps 11	
2512.5 4	(0+ to 4+)	2.8 ps +21-8	Measured upper limit of branching is <10% for transition to g.s. (1973Pr10).
3014.6 4	(1,2+)	<83 fs	
3096.5 5	4+	>3.5 ps	Measured upper limit of branching is <5% for transition to g.s. (1973Pr10).
3557.9 3	2+	<62 fs	
4006.3 4	2+	0.23 ps 6	
4127.5 5	(0+,1,2)	0.97 ps 21	Measured upper limit of branching is <5% for transition to g.s. (1973Pr10).
4287.1 5	(1,2,3)	<35 fs	
4633.9 6	(3-)	<35 fs	

[†] From least-squares fit to E γ data.[‡] From 1973Pr10.[§] From DSAM (1974Fi01).[#] From Adopted Levels, unless otherwise noted.[@] J π =0+,1,2,3,4+ from γ to 2+ and RUL. **$\gamma(^{42}\text{Ar})$** Values of A₂ and A₄ are from 1973Pr10.

E(level)	E $\gamma^{\ddagger}$	I γ	Mult. [@]	$\delta^{\text{@}}$	Comments
1208.22	1208.20 13	100	E2		A ₂ =+0.64 6; A ₄ =-1.56 6.
2415.2	1207 $\ddagger$	>90 $\ddagger$			
2486.8	1278.5 5	82 $\#$ 5			A ₂ =+0.39 11.
	2486.7 6	18 $\#$ 5	E2		A ₂ =+0.45 29; A ₄ =-1.3 3.
2512.5	1304.3 3	100 $\S$			A ₂ =+0.10 8.
3014.6	1806.4 4	62 $\S$ 4			I γ : other: 92 4 (1973Pr10).
	3014.6 8	38 $\S$ 4			δ : -0.40 45 or ∞ for J(3015)=1, -0.12 11 for J(3015)=2 (1973Pr10).
3096.5	1888.2 4	100 $\S$	E2 (+M3)	+0.07 8	A ₂ =+0.53 9; A ₄ =-0.21 10.
					(3012p)(1208 γ)(θ): A ₂ =+0.54 13, A ₄ =+0.10 12 (1973Pr10).
					I γ : other: 8 4 (1973Pr10).
3557.9	2349.6 3	90 $\#$ 2	D (+Q)	0.00 7	A ₂ =+0.87 10; A ₄ =-0.45 10.
					(3092p)(1208 γ)(θ): A ₂ =-0.53 5, A ₄ =-0.45 6 (1973Pr10).
	3558	10 $\#$ 2			A ₂ =+0.47 2; A ₄ =-0.07 2.
4006.3	992 $\ddagger$				(3558p)(1208 γ)(θ): A ₂ =+0.33 12, A ₄ =+0.65 15 (1973Pr10).
	1519.40 22				
	2798 $\ddagger$				
4127.5	2919.2 4	100 $\S$			δ : -0.3 2 or +5.6 30 for J(4127)=2 (1973Pr10).
					A ₂ =+0.17 14; A ₄ =-0.17 17.
					(4127p)(1208 γ)(θ): A ₂ =+0.12 16, A ₄ =-0.08 19 (1973Pr10).
4287.1	3078.8 4				A ₂ =+0.26 4; A ₄ =-0.07 5.
					δ : -0.04 8 or +3.1 10 for J(4287)=2; +0.30 15 for J(4287)=3 (1973Pr10).
4633.9	3425.5 5		D		A ₂ =-0.34 12; A ₄ =+0.10 13.

[†] From 1974Fi01, unless otherwise stated.[‡] From 1973Pr10.[§] From 1974Fi01.[#] Weighted average of 1974Fi01 and 1973Pr10.[@] From p γ (θ) data of 1973Pr10.

$^{40}\text{Ar}(\text{t},\text{p}\gamma)$ 1974Fi01,1973Pr10 (continued)Level Scheme

Intensities: % photon branching from each level

$^{42}\text{Ar}(\text{p},\text{p}')$ 2001Sc01

2001Sc01: E=33 MeV/nucleon ^{42}Ar beam was produced from via fragmentation of a 70 MeV/nucleon ^{48}Ca beam in a ^9Be target at the National Superconducting Cyclotron Laboratory. $(\text{CH}_2)_n$ target. Protons were detected by silicon ΔE -E telescopes. Measured energies and $\sigma(\theta)$. Deduced β_2 for first 2+ state in ^{42}Ar from DWBA calculations and experimental cross sections.

 ^{42}Ar Levels

E(level)	$J\pi$	Comments
0.0	0+	
1208	2+	$\beta_2=0.32$ 5.

 $^{208}\text{Pb}(^{40}\text{Ar},\text{X}\gamma)$ 2011Sz02

2011Sz02 (also 2013Sz01): E=255 MeV ^{40}Ar beam from the superconducting ALPI accelerator of the Laboratory Nazionali di Legnaro. Target=300 $\mu\text{g}/\text{cm}^2$ ^{208}Pb . Projectile-like fragments were identified by spectrometer Prisma by ΔE -E and time-of-flight (TOF) measurements and γ rays were detected by the Clara array, consisting of 24 HPGe clover-type detectors (photo-peak efficiency 3% at 1.33 MeV, FWHM=0.6%-0.9%). Measured $\text{E}\gamma$, $\text{I}\gamma$, (fragment) γ coincidence. Deduced levels, $J\pi$. Comparison with shell model calculations.

 ^{42}Ar Levels

E(level) [†]	$J\pi^{\ddagger}$
0.0 #	0+
1208.0 # 10	2+
2413.0 # 15	(4+) §
2485.5 11	2+
3095.6 12	4+
3563.5 # 15	(6+) §

[†] From least-squares fit to $\text{E}\gamma$ data.

[‡] From Adopted Level, unless otherwise noted.

§ Proposed by 2011Sz02 as the members of the 2+, 4+ and 6+ yrast sequence and from comparison with shell model calculations as well.

(A): yrast sequence (2011Sz02).

$^{208}\text{Pb}(^{40}\text{Ar},\text{X}\gamma)$ $^{2011}\text{Sz02}$ (continued) $\gamma(^{42}\text{Ar})$

<u>$E\gamma$</u>	<u>$E(\text{level})$</u>
1150.4 3	3563.5
1205 1	2413.0
1208 1	1208.0
1277.5 3	2485.5
1887.5 6	3095.6

 $\text{Pb}(^{43}\text{Ar},\text{n}\gamma)$ $^{1997}\text{Wa25}$

Neutron removal from ^{43}Ar beam with a Pb target (acting as an anvil), leading to population of states in ^{42}Ar .
 $^{1997}\text{Wa25}$: ^{43}Ar was produced via fragmentation of 330 MeV/nucleon ^{50}Ti beam on a ^9Be target at GSI. Fragments were selected by the fragment separator FRS and identified by energy-loss ΔE and time-of-flight (TOF) before the 0.9 g/cm² secondary Pb target. Projectile-like reaction products were identified by the Bp-TOF- ΔE method using the large magnetic spectrometer ALADIN, γ -rays were detected by the Darmstadt-Heidelberg Crystal Ball spectrometer (CB) and neutrons were detected by the LAND detector. Measured $E\gamma$, $\gamma\gamma$ -coin, $\text{n}\gamma$ -coin and cross section (100 mb 2 σ).

 ^{42}Ar Levels

<u>$E(\text{level})$</u>
0.0
1208
2414

 $\gamma(^{42}\text{Ar})$

<u>$E\gamma^\dagger$</u>	<u>$E(\text{level})$</u>
1206	2414
1208	1208

† Rounded energies from Adopted Gammas.

Adopted Levels, Gammas

Q(β^-)=3525.22 18; S(n)=7533.80 11; S(p)=9243.5 4; Q(α)=-7648.86 14 2012Wa38.

S(2n)=17629.17 12, S(2p)=22040 30 (2012Wa38).

⁴²K produced and identified by 1950Sa03 using ⁴¹K(d,p) reaction.

2014Pa45, 2014Kr04: E(p)=1.4 GeV incident on UC_x target at ISOLDE-CERN facility. Fragments diffused out of target and surface ionized, then accelerated to 40 kV, followed by mass separation and bunched by gas-filled Paul Trap (ISCOOL). Hyperfine structure was studied by collinear laser spectroscopy using COLLAPS setup at ISOLDE-CERN. Measured hyperfine spectra. Deduced spin, magnetic moment, rms charge radius. Comparison with shell-model calculations. 2014Pa45 present measured hyperfine parameters, hyperfine structure anomalies, spins and magnetic moments, while 2014Kr04 present measured rms radii, isotope shifts and spin determination. Other hyperfine structure measurement: 1982To02.

42K Levels

Cross Reference (XREF) Flags

A ⁴²Ar β^- Decay (32.9 y)
B ⁹Be(³⁶S,2np γ),(³⁷P,4n γ)
C ²⁶Mg(¹⁸O,np γ)
D ²⁷Al(¹⁸O,n2p γ)...

E ⁴⁰Ar(α ,d)
F ⁴¹K(n, γ) E=thermal
G ⁴¹K(n, γ): Resonance
H ⁴¹K(d,p),(d,p γ)

I ⁴²Ca(t,³He)
J ⁴³Ca(d,³He)
K ⁴⁴Ca(p,³He)
L ⁴⁴Ca(d, α),(pol d, α)

E(level) [†]	J π [§]	XREF	T _{1/2} [‡]	Comments
0.0	2-	ABCDEF HIJKL	12.355 h 7	<p>μ=-1.1388 57 (2014Pa45); μ=-1.1425 6 (1969Ch20,2014StZZ). The rms charge radius ($\langle r^2 \rangle$)^{1/2}: 3.4517 fm 70 (2013An02 evaluation). $\delta \langle r^2 \rangle$(⁴⁷K,⁴²K)=+0.034 fm² 6(stat) 89(syst); $\delta \langle r^2 \rangle$(⁴⁷K,⁴²K)=+0.026 fm² 23(stat) 88(syst) for δv(³⁹K,⁴²K)=+351.7 MHz 19 from literature; δv(⁴⁷K,⁴²K)=-506.7 MHz 7(stat) 19(syst) (2014Kr04). Jπ: spin from fitting of hyperfine structure (2014Pa45,2014Kr04) with spin of 1 or 2; former is excluded in the analysis. Also atomic-beam method (1969Ch20,1973CoZG). Parity from L(α,d)=1 and L(d,p)=3. μ: deduced from hyperfine parameters measured relative to those for ³⁹K whose parameters are known very precisely. Statistical uncertainty of 0.0007 and an uncertainty of 0.0057 due to hyperfine anomaly are added in quadrature (2014Pa45). In 1969Ch20, μ is from atomic beam method. Dominant configuration=$\pi 1d_{3/2}^{-1} \otimes v(1f_{7/2}$ or $2p_{3/2})$ (2014Pa45) from comparison with shell-model calculations. T_{1/2}: weighted average of 12.339 h 11 (2005Li66), 12.321 h 25 (2004Un01), 11.97 h 12 (1994Mi03), 12.361 h 3 (1967Go21) and 12.358 h 7 (1962Me06), with uncertainty increased to 0.007 in 1967Go21. Others: 12.37 h 9 (1959Ma27), 12.46 h 7 (1957Wr37), 12.516 h 7 (1953Bu58), 12.44 h 8 (1953Ka26), 12.44 h 10 (1947Si08), 12.47 h 7 (1962Mo21), 12.5 h 2 (1951Si25), 12.4 h 2 (1937Hu01). Adopted (1977En02) neutron-stripping spectroscopic factor=0.34 9 (L=3). Adopted (1977En02) proton-pickup spectroscopic factor=0.46 12 (L=2).</p>
106.826 5	3-	BCDEF HIJ L	0.28 ns 4	J π : γ (0); L(d, ³ He)=2 and L(t, ³ He)=L(d, α)=3.
258.259 6	4-	BCD F HIJKL	130 ps 9	<p>Jπ: γ(0,lin pol); L(d,p)=3 and L(d,³He)=2. T_{1/2}: weighted average of 133 ps 9 in (¹⁸O,npγ) and 123 ps 28 in (¹⁸O,n2pγ).</p>
638.726 7	3-	BC F HIJ L	<1.4 ns	J π : γ (0); L(d, ³ He)=0 and L(d,p)=1+3.
681.942 8	(2,3)	B F HIj kL		J π : γ to 2- and 3-; primary γ from 1+,2+.
699.086 14	5-	BCDEF HIj kL	41 ps 8	J π : γ (0,lin pol); L(α ,d)=L(d, α)=5.
783.885 11	2-	F HI L		J π : L(d,p)=1; π =U (not 0-) in (pol d, α).
841.941 7	3-	B F HI L		J π : γ from 3+; L(d,p)=1; π =n in (pol d, α).
1110.748 9	3+	F HI L		J π : primary γ from 1+,2+; L=4, π =U in (pol d, α).
1143.594 11	4+	BC eF HI k	<1.4 ns	J π : γ (0); L(t, ³ He)=4; gammas to 3- and 5-.
1197.903 10	4-	eF HIj kL		J π : L(d, ³ He)=0; L(d,p)=3; L=3, π =U in (pol d, α).
1254.821 11	2-	B F Hi kL		<p>XREF: L(1268). Jπ: γ to 2- and 4-; L(d,p)=1; L(t,³He)=1+3.</p>

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

 ^{42}K Levels (continued)

E(level) [†]	J π [§]	XREF	T _{1/2} [‡]	Comments
1266.300 9	(1,2,3)-	F Hi L		XREF: L(1268). J π : γ to 2- and 3-; primary γ from 1+, 2+; L(d,p)=1.
1273.537 11	2-	B F i L		XREF: L(1268). J π : γ to 3- and 4-; primary γ from 1+, 2+; L(t, ³ He)=1+3.
1376.02 8	6+	BCD F i	1.11 ns 14	J π : $\Delta J=2$ γ to 4+. T _{1/2} : weighted average of 1.17 ns 8 in (¹⁸ O,np γ) and 0.76 ns 21 in (¹⁸ O,n2p γ).
1377.116 10	(2,3)-	F Hi		J π : γ to 2-; γ from 3+; primary γ from 1+,2+; L(d,p)=1.
1400.01 4	(2,3)	F Hi l		J π : γ to 2-, 3+, and 3-; primary γ from 1+,2+.
1407.911 10	(1-,2,3)	F Hi j l		J π : γ to 2- and 3-; primary γ from 1+,2+.
1453.07 4	(2-,3,4-)	F H j		J π : γ to 4- and from 2-.
1463.653 14	(1-,2,3)	F HI j		J π : γ to 2-, 3-; primary γ from 1+,2+.
1489.31 8	(1- to 5-)	F H j		J π : γ to 3-.
1513.076 23	(1- to 5-)	eF H		J π : gammas to 3-.
1538.74 5	3+	BC eF I L	<3.5 ps	J π : L(d, α)=4 with $\pi=U$; L(α ,d)=4; L(t, ³ He)=2+4.
1691.99 4	(1- to 4-)	F HIJ L		XREF: J(1630). J π : γ to 3- and 2-.
1723.44 3	(2,3,4+)	F Hi		J π : γ to 3+ and 3-; primary γ from 1+,2+.
1745.616 16	(2+,3+)	F Hi L		J π : γ to 3- and 4+; γ from 1+; primary γ from 1+,2+.
1816.875 18	(2,3,4-)	F I		J π : γ to 2- and 3-; γ from 3+.
1842.980 13	(1-,2,3)	F H l		J π : γ to 2- and 3-; primary γ from 1+,2+.
1861.893 9	2-	F HI l		J π : γ to 2- and 4-; primary γ from 1+,2+; L(d,p)=1, and unnatural parity in pol (d, α).
1913.458 16	(2-,3)	F Hi L		J π : γ to 2- and 4-; primary γ from 1+,2+.
1936.12 13	(3- to 6-)	B i l		J π : γ to 4- and 5-.
1937.494 15	(1,2,3)-	F Hi l		J π : gammas to 2- and 3-; primary γ from 1+,2+; L(d,p)=1.
1947.88 9	7+	BCDE l	<1.1 ps	J π : $\gamma(\theta, \text{lin pol})$; L(α ,d)=6; $\Delta J=1$ γ to 6+.
1987.975 19	(0- to 4-)	F HIJ		J π : γ to 2-.
2049.323 14	3+	F HI L		J π ,E(level): gammas to 3- and 4+; primary γ from 1+,2+; unnatural-parity state from (pol d, α), assuming that same level is populated in (d, α) and (n, γ). J π =(2,4)- suggested by 1982Ba55 in (pol d, α) was based on L(d, α)=3 and unnatural-parity, but γ to 4+ forbids 2- and primary γ from 1+,2+ does not allow 4-. The 2056-keV peak in (d, α) was weakly populated in the work of 1977Pa24, it is possible that L(d, α)=4 can also be consistent with the observed $\sigma(\theta)$ pattern, which will give a unique choice of 3+, when combined with unnatural parity assignment for this state. Another unlikely possibility is that the level populated in (d, α) is different from that in (n, γ) giving a (2,4)- level at 2056 keV in (d, α) and a 2+ or 3+ level at 2049 in (n, γ).
2072.009 13	(2,3)-	F HI		J π : gammas to 2- and 4-; primary γ from 1+,2+; L(d,p)=1.
2113.9 3	(0- to 4-)	B j		J π : γ to 2-.
2161.651 22	(2+,3,4+)	F H j		J π : γ to 3- and 4+; primary γ from 1+,2+.
2187.23 4	3+	F Hi L		J π : γ to 2- and 4+; primary γ from 1+,2+; L(d, α)=4 with unnatural parity.
2204.037 24	(2-,3,4+)	F Hi		J π : γ to 4-; primary γ from 1+,2+.
2238.586 25	(1,2,3)-	F Hi		J π : γ to 2-; L(d,p)=1.
2251.081 20	(1-,2,3)	eF HI		J π : γ to 2-; γ from 3-; primary γ from 1+,2+.
2314 14	(3,5)+	e I L		J π : L(d, α)=4 with unnatural parity.
2359.13 10	(4+ to 7-)	B e i		J π : γ to 5- and 6+.
2366.173 13	(2,3)-	F Hi		J π : γ to 2- and 4-; L(d,p)=1.
2388.833 20	3+	F Hi kL		J π : γ to 2-; primary γ from 1+,2+; L(d, α)=4.
2401.800 15	(2,3)-	F H k		J π : γ to 2- and 4-; primary γ from 1+,2+; L(d,p)=1.
2422.160 22	(1-,2,3)	F HI k		J π : γ to 2- and 3-; primary γ from 1+,2+.
2482.146 16	(1,2,3)-	F HI		J π : γ to 2- and 3-; primary γ from 1+,2+; L(d,p)=1.
2524.9 4	(2 to 4)	B		J π : γ to 3- and 3+.
2553.7 2	(0 to 3)-	Hi l		J π : L(d,p)=1.
2573.62 5	(2,3)	F Hi l		J π : γ to 2-, 3- and 3+; primary γ from 1+,2+.
2606.993 24	(1-,2,3)	F H		J π : γ to 2- and 3-; primary γ from 1+,2+.
2627.850 21	(2-,3)	F HI L		J π : γ to 2- and 4-; primary γ from 1+,2+.
2644.288 25	3-	F H		J π : γ to 3- and 4+; L(d,p)=1.
2653.81 6	(2-,3)	F HI j L		J π : γ to 2- and 4-; primary γ from 1+,2+.

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Adopted Levels, Gammas (continued)

 ^{42}K Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
2718.096 13	(2-, 3)	F H j	J π : γ to 2- and 4-; primary γ from 1+, 2+.
2765.961 17	(2+, 3)	B F Hi L	J π : γ to 2- and 4+; primary γ from 1+, 2+.
2802 15		e i L	
2844 12		e I L	XREF: I(2824)L(2858).
2862.81 4	(2-, 3)	eF I L	XREF: I(2862)L(2858).
			J π : γ to 2- and 4-; primary γ from 1+, 2+.
2878.014 24	3-	F i	J π : γ to 2- and 5-; primary γ from 1+, 2+.
2917.12 6	(1- to 4+)	F Hi	J π : γ to 3-; primary γ from 1+, 2+.
2926.10 4	(2, 3)-	F H 1	J π : γ to 2- and 3+; primary γ from 1+, 2+; L(d,p)=1.
2938.61 4	(1-, 2, 3)	F HI 1	J π : γ to 2- and 3-; primary γ from 1+, 2+.
2991.70 14	(5+ to 9+)	B D	J π : γ to 7+.
3008.33 3	3	F 1	J π : γ to 2-, 4+ and 4-; primary γ from 1+, 2+.
3014.47 5	(1, 2, 3)-	F H 1	J π : γ to 3-; primary γ from 1+, 2+; L(d,p)=1.
3021.11 3	(2, 3)-	F H 1	J π : γ to 2- and 4-; primary γ from 1+, 2+; L(d,p)=1.
3032 10	3+	I	J π : L(t, ^3He)=2+4.
3040.21 6	3-	F HI 1	XREF: I(3056).
			J π : γ to 2- and 5-; primary γ from 1+, 2+.
3090 9	1+	I L	J π : L(t, ^3He)=0+2.
3132 15		I	
3168.2 4	(2+ to 6+)	B	J π : γ to 4+.
3195.78 5	(2-, 3)	F H	J π : γ to 2- and 4-; primary γ from 1+, 2+.
3210.57 7	(1+, 2, 3)	F Hi L	J π : γ to 2- and 3+; primary γ from 1+, 2+.
3233.91 4	(3, 4+)	F i	J π : γ to 3-, 4+ and 4-; primary γ from 1+, 2+.
3284.42 4	(2, 3)-	F H	J π : γ to 2- and 4-; primary γ from 1+, 2+; L(d,p)=1.
3287.14 4	(2-, 3, 4+)	F 1	J π : γ to 4-; primary γ from 1+, 2+.
3295.35 8	(2, 3)	F 1	J π : γ to 3- and 4-; primary γ from 1+, 2+.
3304.37 4	1+	F HI 1	XREF: I(3297).
			J π : L(t, ^3He)=0+2.
3323.77 7	3-	F	J π : γ to 2- and 5-; primary γ from 1+, 2+.
3329 10	1+	I	J π : L(t, ^3He)=0+2.
3367.30 4	(1+)	F HI	XREF: I(3377).
			J π : γ to 2-; primary γ from 1+, 2+; L(t, ^3He)=0+2 for 3377 level.
3418.44 3	(2, 3)-	F HI 1	J π : γ to 3+, 3- and 4-; primary γ from 1+, 2+; L(d,p)=1+3.
3421.24 4	(0- to 3)	F i	J π : γ to 2-; primary γ from 1+, 2+.
3497.98 23	(2+ to 9-)	B i 1	J π : γ to (4+ to 7-).
3502.91 4	(2+, 3, 4+)	F Hi 1	J π : γ to 3- and 4+; primary γ from 1+, 2+.
3529.04 7	(0- to 3)	F H 1	J π : γ to 2-; primary γ from 1+, 2+.
3560.10 14	(5+ to 9+)	B D 1	J π : γ to 7+.
3587 15		I	
3621.19 4	(2, 3)	F HI	J π : γ to 2-, 3+ and 3-; primary γ from 1+, 2+.
3658.60 4	(2-, 3)	F Hi	J π : γ to 2- and 4-; primary γ from 1+, 2+.
3674.14 3	(1-, 2, 3)	F Hi	J π : γ to 2- and 3-; primary γ from 1+, 2+.
3696.55 5	(3-, 4+)	F HI	J π : γ to 5-; primary γ from 1+, 2+.
3758 10		I	
3770.70? 8	(0- to 3)	F	J π : γ to 2-; primary γ from 1+, 2+.
3794.61 3	(0- to 3)	F i	J π : γ to 2-; primary γ from 1+, 2+.
3798.15 7	(2-, 3, 4+)	F i	J π : γ to 3+ and 4-; primary γ from 1+, 2+.
3831.75? 6	(1+, 2, 3)	F	J π : γ to 2- and 3+; primary γ from 1+, 2+.
3862.09 6	(1- to 4+)	F i	J π : γ to 3-; primary γ from 1+, 2+.
3876.92 5	(1- to 4+)	F Hi	J π : γ to 3-; primary γ from 1+, 2+.
3888.32 5	(2, 3)-	F Hi	J π : γ to 3+; primary γ from 1+, 2+; L(d,p)=1.
3890.09 4	(0- to 3)	F i	J π : γ to 2-; primary γ from 1+, 2+.
3934.63 7	(2-, 3)	F H	J π : γ to 2-, 3+ and 3-; primary γ from 1+, 2+.
4013.89 4	(0- to 3)	F H	J π : γ to 2-; primary γ from 1+, 2+.
4036.83 5	3-	F i	J π : γ to 2- and 5-; primary γ from 1+, 2+.
4039.93 4	(1, 2, 3)	F Hi	J π : γ to 2- and (3, 4+); primary γ from 1+, 2+.
4053.84 6	(2, 3)-	F Hi	J π : γ to 2- and 3+; primary γ from 1+, 2+; L(d,p)=1(+3).
4092.33 22	(3+ to 9-)	B	J π : γ to (4+ to 7-) and (5+ to 9+).
4103.51 14	(0- to 4+)	F Hi	J π : γ to (2-, 3); primary γ from 1+, 2+.
4105.75? 8	(0- to 3)	F i	J π : γ to 2-; primary γ from 1+, 2+.
4128.35 3	3-	F Hi	J π : γ to 2- and 4+; primary γ from 1+, 2+; L(d,p)=1+3.
4152.35 5	(2-, 3, 4+)	F Hi	J π : γ to 3+, 3- and 4-; primary γ from 1+, 2+.
4154.75 6	(1-, 2, 3)	F i	J π : γ to 2- and 3-; primary γ from 1+, 2+.

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Adopted Levels, Gammas (continued)

 ^{42}K Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
4179.40 10	(2-, 3, 4+)	F H	J π : γ to 4-; primary γ from 1+, 2+.
4259.05 6	(1-, 2, 3)	F	J π : γ to 2- and 3-; primary γ from 1+, 2+.
4389.94 7	(2-, 3, 4+)	F H	J π : γ to 3+ and 4-; primary γ from 1+, 2+.
4416.58 4	(2, 3)-	F H	J π : γ to 2- and 4-; primary γ from 1+, 2+; L(d,p)=1+3.
4428.30 4	(1+, 2, 3)	F H	J π : γ to 2- and 3+; primary γ from 1+, 2+.
4443.13 5	(0- to 4+)	F H	J π : γ to (2,3)-; primary γ from 1+, 2+.
4481.09 5	(2, 3)-	F H	J π : γ to 2-, 3+ and 3-; primary γ from 1+, 2+; L(d,p)=1.
4556.71 7	(1-, 2, 3)	F H	J π : γ to 2- and 3-; primary γ from 1+, 2+.
4576.23 5	(2, 3)-	F H	J π : γ to 3+; L(d,p)=1.
4590.56 5	(2-, 3, 4+)	F H	J π : γ to 3+, 3- and 4-; primary γ from 1+, 2+.
4603.7 6		D	
4612.81 6	(2+, 3)	F	J π : γ to 2- and 4+; primary γ from 1+, 2+.
4660.72 6	(2-, 3)	F	J π : γ to 2- and 4-; primary γ from 1+, 2+.
4715.33 10	(2-, 3)	F	J π : γ to 2- and 4-; primary γ from 1+, 2+.
4746.1 3	(3+ to 10)	B	J π : γ to (5+ to 9+) and (2+ to 9-).
4748.53 7	3-	F H	J π : γ to 2- and 5-; primary γ from 1+, 2+.
4778.05 6	(1- to 4+)	F H	J π : γ to 3-; primary γ from 1+, 2+.
4806.84 5	(1 to 3)-	F H	J π : γ to 2-; primary γ from 1+, 2+; L(d,p)=1.
4853.65 6	(0 to 3)-	F H	J π : γ to 2-; primary γ from 1+, 2+; L(d,p)=1.
4877.21 5	(0 to 4+)	F H	J π : primary γ from 1+, 2+.
4903.53 8	(3-, 4+)	F H	J π : γ to 4- and 5-; primary γ from 1+, 2+.
4938.98 6	(1-, 2, 3)	F	J π : γ to 2- and 3-; primary γ from 1+, 2+.
4942.99 5	(1- to 4-)	F H	J π : γ to 3-; primary γ from 1+, 2+.
4959.72 8	(0- to 4+)	F H	J π : γ to (2,3)-; primary γ from 1+, 2+.
5003.01 5	(1-, 2, 3)	F H	J π : γ to 2- and 3-; primary γ from 1+, 2+.
5064.08 6	(1- to 4+)	F H	J π : γ to 3-; primary γ from 1+, 2+.
5081.15 8	(1-, 2, 3)	F H	J π : γ to 2- and 3-; primary γ from 1+, 2+.
5097.00 5	(0- to 3)	F H	J π : γ to 2-; primary γ from 1+, 2+.
5142		H	
5179.10 6	(0- to 4+)	F H	J π : γ to (2-, 3); primary γ from 1+, 2+.
5246.62 7	(1- to 4+)	F H	J π : γ to 3-; primary γ from 1+, 2+.
5318.97 6	(2-, 3)	F H	J π : γ to 2- and 4-; primary γ from 1+, 2+.
5363.5 4		H	
5380.1 15		H	
5476.93 14	(1+, 2, 3)	F H	J π : γ to 2- and 3+; primary γ from 1+, 2+.
5484.0 6		H	
5555.7 6		H	
5622.5 3		H	
5630.13 13	(4+)	F H	J π : γ to 6+; weak primary γ from 1+, 2+.
5654.6 3		H	
5682.7 3		H	
5697.21 8	(1- to 4+)	F H	J π : γ to 3-; primary γ from 1+, 2+.
5710.68 8	(2-, 3, 4+)	F H	J π : γ to 4-; primary γ from 1+, 2+.
5723.5 6		H	
5737.5 4		H	
5747.7 8		H	
5759.69 6	(1-, 2, 3+)	F H	J π : γ to 1+ and 3-; primary γ from 1+, 2+.
5772.4 6		H	
5789.58 6	(0 to 4+)	F H	J π : primary γ from 1+, 2+.
5809.3 3		H	
5819.4 3		H	
5846.42 12	(1+, 2, 3+)	F H	J π : γ to 1+ and 3+; primary γ from 1+, 2+.
5896.4 4		H	
5927.2 5		H	
5953.67 7	(1 to 3)	F H	J π : γ to 2-; primary γ from 1+, 2+.
5968.7 5		H	
5978.43 8	(4+)	F H	J π : γ to 3- and 6+; weak primary γ from 1+, 2+.
6012.6 5		H	
6450	(0+)	K	T=3.
			J π , T: probable IAS of ^{42}Ar g.s.
(7533.80 15)	1+, 2+	F	J π : s-wave neutron capture in 3/2+ g.s. of ^{41}K .
7534.67 11		G	
7535.78 11	1+, 2+	G	

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Adopted Levels, Gammas (continued) **^{42}K Levels (continued)**

E(level) [†]	J π [§]	XREF	E(level) [†]	J π [§]	XREF
7536.93 11	(0 to 3)-	G	7602.89 13		G
7537.72 11		G	7603.90 13		G
7539.18 11	1+, 2+	G	7607.14 13		G
7539.67 11		G	7607.49 13	(0 to 3)-	G
7540.32 11		G	7609.18 13		G
7541.60 11		G	7610.95 13		G
7542.07 11		G	7611.51 13		G
7544.48 11	(0 to 3)-	G	7611.71 13	(0 to 3)-	G
7544.76 11		G	7614.19 14		G
7546.82 11	(0 to 3)-	G	7614.93 14		G
7548.46 11	(0 to 3)-	G	7615.21 14	(0 to 3)-	G
7548.86 11		G	7617.95 14		G
7549.04 11		G	7620.11 14		G
7550.11 11	1+, 2+	G	7622.15 14	(0 to 3)-	G
7551.36 11		G	7622.98 14		G
7552.04 11		G	7625.14 14		G
7553.24 11		G	7626.42 14		G
7553.61 11	(0 to 3)-	G	7628.19 15		G
7558.31 11	(1+, 2+)	G	7628.48 15		G
7560.18 11		G	7628.72 15		G
7560.27 11	(0 to 3)-	G	7630.24 15		G
7561.43 11		G	7631.99 15	(0 to 3)-	G
7566.12 11		G	7632.67 15		G
7566.20 11		G	7634.80 15		G
7566.85 11		G	7636.71 15		G
7568.49 12		G	7637.84 15		G
7571.43 12	1+, 2+	G	7639.84 15		G
7572.33 12		G	7641.06 15		G
7575.13 12	(1+, 2+)	G	7641.55 15		G
7575.72 12		G	7643.89 15		G
7577.05 12		G	7645.35 15		G
7577.14 12		G	7647.11 15		G
7580.12 12		G	7647.4 3	(0 to 3)-	G
7580.35 12		G	7651.89 16		G
7580.97 12		G	7652.48 15		G
7582.01 12		G	7653.16 16		G
7582.80 12		G	7654.72 16		G
7583.95 12		G	7657.16 16		G
7585.39 12		G	7657.46 17		G
7585.69 12		G	7658.82 17		G
7586.46 12		G	7660.09 17		G
7587.90 12	(0 to 3)-	G	7662.53 17		G
7589.67 12		G	7663.70 17		G
7590.60 12	(1+, 2+)	G	7664.38 17		G
7591.51 12		G	7664.87 17		G
7594.76 13		G	7666.24 18		G
7595.23 13		G	7669.26 18		G
7595.50 13	(0 to 3)-	G	7671.31 18		G
7597.89 13		G	7674.53 18		G
7599.27 13	(0 to 3)-	G	7675.71 18		G
7599.94 13		G	7676.49 18		G
7600.41 13		G	7680.10 18		G
7602.56 13	(0 to 3)-	G	7680.59 18		G

[†] From least-squares adjustment to measured $E\gamma$ data when such data are available. Otherwise weighted averages of available level energies are taken. Uncertainties for neutron resonances include only uncertainty for S(n) and statistical uncertainties for neutron energies.

[‡] From recoil-distance method. Values are from ($^{18}\text{O}, n\gamma$) (1977Ek01), unless otherwise stated.

[§] When L-transfer arguments are used, the target spin-parity is $J\pi=3/2+$ for $^{41}\text{K}(d,p)$; $J\pi=0+$ for $^{42}\text{K}(t,^3\text{He})$, $^{44}\text{Ca}(p,^3\text{He})$ and $^{44}\text{Ca}(d,\alpha)$; $J\pi=7/2-$ for $^{43}\text{Ca}(d,^3\text{He})$. When levels are only seen in (n, γ):Resonance, $J\pi$ values are from s-wave or p-wave assignment in the analysis of neutron-resonance data (2006MuZX). When assigning $J\pi$ to a level based on γ transitions from this level to a level of known $J\pi$, evaluators consider transitions to be E1, M1 or E2.

Adopted Levels, Gammas (continued)

$\gamma(^{42}\text{K})$					
E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. [‡]	$\delta^{\ddagger}$	Comments
106.826	106.817 7	100	M1 (+E2)	+0.01 3	B(M1)(W.u.)=0.065 10; B(E2)(W.u.)<12.
258.259	151.431 3	100	M1 (+E2)	-0.008 16	B(M1)(W.u.)=0.049 4; B(E2)(W.u.)<2.1.
638.726	380.473 13	44 9	(M1+E2)		
	531.908 15	100 16			
	638.717 14	60 9	D		
681.942	575.04 5	0.7 2			
	681.932 12	100.0 2			
699.086	440.854 18	100 2	M1+E2	+0.102 8	B(M1)(W.u.)=0.0059 12; B(E2)(W.u.)=0.94 24.
	592.23 [§] 6	4.6 [§] 3	[E2]		B(E2)(W.u.)=0.96 20.
783.885	783.903 14	100			
841.941	735.099 14	16 2			
	841.895 13	100 15			
1110.748	268.793 8	90 20			
	428.71 5	10 2			
	1110.767 16	100 15			
1143.594	301.50 14	4.5 15			
	444.525 19	38 8	D		
	504.828 16	100 8	D		
	1036.83 3	9.1 15			
1197.903	559.23 3	23 4			
	939.605 17	100 15			
	1091.088 18	67 11			
	1197.99 3	15 3			
1254.821	413.16 16	2.6 7			
	616.118 14	100 13			
	996.511 16	62 9			
	1254.80 3	34 6			
1266.300	584.40 4	12.7 22			
	627.551 15	42 6			
	1266.305 15	100 16			
1273.537	431.566 16	100 15			
	634.65 6	3.2 5			
	1015.233 24	21 3			
	1166.808 25	10.3 17			
1376.02	232.3 2	12.3 5	E2 (+M3)	-0.04 3	$E\gamma, I\gamma$: weighted average from ($^{18}\text{O}, n\gamma$) and ($^{36}\text{S}, 2n\gamma$). B(E2)(W.u.)=9.5 13.
	676.87 11	100 3	E1+M2	+0.025 11	$I\gamma$: from ($^{18}\text{O}, n\gamma$) and ($^{36}\text{S}, 2n\gamma$). B(E1)(W.u.)=1.45 $\times 10^{-6}$ 20; B(M2)(W.u.)=0.009 8.
1377.116	695.189 17	30 5			
	1377.065 16	100 5			
1400.01	289.21 9	37 9			
	761.31 8	9.8 17			
	1399.78 9	100 15			
1407.911	725.96 3	5.2 8			
	1301.008 20	17 3			
	1407.898 16	100 17			
1453.07	198.33 9	100 27			
	1195.02 13	8.9 16			
1463.653	621.727 16	100 15			
	1463.59 3	19 3			
1489.31	851.01 20	100 17			
	1382.2 3	69 17			
1513.076	671.149 23	100 29			
	830.89 9	17 3			
1538.74	395.16 7	100	D		
1691.99	437.24 18	37 10			
	1585.10 4	100 10			
1723.44	612.65 5	100 17			
	881.33 11	4.7 9			
	1084.48 12	4.8 9			
	1616.84 11	7.4 12			
1745.616	602.046 22	88 14			
	903.635 21	100 14			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
1816.875	550.30 10	6.3 12			
	562.07 4	17 3			
	1709.983 25	100 15			
1842.980	569.475 20	40 6			
	1001.005 16	100 15			
	1842.95 3	75 12			
1861.893	408.87 15	2.0 5			
	454.01 3	8.2 18			
	595.618 17	24 4			
	1179.921 16	48 7			
	1223.29 5	2.5 4			
	1603.60 5	5.3 12			
	1754.98 3	14.1 21			
	1861.855 24	100 15			
1913.458	1071.509 20	100 15			
	1655.16 3	40 6			
	1913.8 3	2.1 6			
1936.12	1237.07 $\S$ 16	100 $\S$ 9			
	1677.52 $\S$ 26	82 $\S$ 18			
1937.494	663.2 5	1.9 4			
	1153.61 3	9.5 15			
	1255.52 3	100 15			
	1830.42 23	8.1 12			
	1937.48 3	75 12			
1947.88	571.86 4	100	M1+E2	-0.035 19	B(M1)(W.u.)>0.11.
1987.975	721.66 16	4.4 10			
	1204.080 19	100 15			
	1988.00 8	17 3			
2049.323	905.712 19	42 6			
	1207.363 17	100 15			
2072.009	874.088 19	24 4			
	1433.274 19	33 5			
	1965.10 3	22 3			
	2071.95 4	100 10			
2113.9	2113.8 3	100			$E\gamma$: from ($^{36}\text{S}, 2n\text{p}\gamma$).
2161.651	1018.032 21	100 15			
	1319.32 23	58 10			
2187.23	1043.78 13	76 16			
	1076.51 12	46 9			
	1403.48 5	100 16			
2204.037	949.60 20	8.6 22			
	1945.69 3	100 14			
2238.586	376.71 5	28 7			
	972.20 4	5.0 8			
	2131.9 3	1.0 3			
	2238.56 4	100 10			
2251.081	977.524 18	100 15			
	1568.99 12	5.1 9			
2359.13	422.8 3	49 6			
	983.16 9	100 11			
	1659.91 16	38 5			
2366.173	378.20 5	3.8 10			
	958.215 21	11.0 18			
	989.065 21	9.7 15			
	1684.19 5	2.8 8			
	2107.92 15	0.95 18			
	2259.28 4	55 5			
	2366.13 4	100 10			
2388.833	450.97 12	16 4			
	571.85 5	29 5			
	1011.62 3	48 7			
	1122.74 5	100 21			
	1707.01 7	30 5			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
2388.833	2281.90 10	16.7 23	2878.014	2094.05 11	38 5
	2388.81 5	100 11		2179.04 8	100 11
2401.800	678.34 6	4.1 7		2195.95 10	58 7
	912.69 23	0.61 16		2770.75 13	20 3
	993.863 23	9.7 16		2878.10 16	13.3 22
	1128.20 3	4.3 7	2917.12	1661.8 4	45 7
	1135.40 7	2.0 3		2810.15 6	100 10
	1147.24 22	13.5 19	2926.10	537.17 14	13 3
	2143.43 5	21.3 23		1473.00 7	20 3
	2294.98 3	100 10		1671.20 11	13 3
	2401.72 5	11.0 10		2926.01 5	100 9
2422.160	579.30 6	7.2 12	2938.61	1121.70 5	100 14
	1740.20 3	28 4		1485.60 8	26 5
	1783.51 12	27 4		2096.60 12	28 5
	2315.19 4	100 10		2938.38 6	79 12
	2422.20 11	5.0 6	2991.70	632.68 20	65 7
2482.146	544.68 21	2.9 8		1043.79 14	100 9
	620.244 16	100 15	3008.33	846.59 5	23 4
	1640.18 4	9.6 14		1810.51 10	16 3
	1800.15 4	22 4		1864.68 5	29 5
	2375.35 8	13.1 14		2166.38 6	100 10
	2482.21 20	4.2 7		3008.28 9	32.1 19
2524.9	986.1 4	100 27	3014.47	612.64 5	49 7
	1682.9 5	59 15		1501.85 21	12 3
2573.62	1034.90 7	29 5		2172.71 25	6.8 15
	2466.69 6	100 11		2332.50 11	18.0 22
	2573.54 16	54 14		2907.35 14	100 10
2606.993	861.34 6	43 7	3021.11	817.05 5	19 3
	1229.89 3	100 15		1766.26 3	100 14
	1352.02 7	92 14		2762.47 10	12.4 14
	1968.08 9	38 6		3021.07 8	63 3
2627.850	766.21 9	14 3	3040.21	618.20 8	31 5
	1361.535 23	100 14		2341.09 19	10.8 16
	1785.95 6	60 9		3039.92 8	100 8
	2369.9 3	49 5	3168.2	1054.3 3	100 22
	2520.73 9	31 4		2024.5 6	61 17
	2627.74 10	26 3	3195.78	1787.5 3	67 12
2644.288	706.98 8	11.8 20		1818.32 23	54 8
	920.81 6	14.4 24		1998.11 11	26 5
	1500.37 13	15 3		2411.9 3	26 8
	1962.29 3	100 16		2556.94 7	54 6
	2006.0 3	6.6 20		3195.59 8	100 5
	2537.36 7	29 3	3210.57	1802.57 11	40 6
2653.81	2395.53 6	100 10		3210.46 8	100 5
	2653.56 10	26 3	3233.91	1391.4 3	100 17
2718.096	856.20 3	20 3		1833.88 5	64 10
	1340.942 23	47 7		2035.91 10	72 10
	1451.745 19	100 15		2089.8 4	58 7
	1520.28 4	23 4		3126.83 10	55 3
	1934.16 3	38 6	3284.42	1080.17 10	8.0 14
2765.961	283.78 12	11 3		2086.53 5	80 8
	828.462 16	76 11		2500.45 5	100 10
	1622.53 7	5.2 8		3177.25 16	38.2 22
	2083.94 4	84 9	3287.14	1909.90 5	20 3
	2765.80 4	100 10		2648.38 6	44 5
2862.81	1454.53 12	100 15		3028.89 7	100 5
	1485.60 8	6.6 11	3295.35	2184.45 14	100 14
	1596.62 23	21 3		3188.9 3	20 3
	1665.14 14	3.1 5		3295.16 11	76 6
	2020.83 6	44 4	3304.37	1558.72 3	100 15
2878.014	806.00 3	100 17		2192.79 23	22 4
	964.50 9	26 5		2622.61 16	21 4
	1470.09 6	42 7	3323.77	2624.65 19	20 3

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
3323.77	3065.38 19	11.5 14	3831.75?	3831.32 11	95 6
	3216.47 19	21 3	3862.09	923.66 19	15 3
	3323.69 9	100 3		2116.8 4	64 13
3367.30	1990.20 9	90 14		2138.42 10	59 7
	2101.26 21	28 6		2372.68 11	39 5
	2113.09 23	34 8		2485.3 3	15 3
	2685.17 8	89 10		3180.00 19	100 21
	3367.20 8	100 13		3224.0 3	8.4 16
3418.44	811.49 9	8.6 16		3755.06 9	73 4
	1368.70 23	34 5	3876.92	2413.34 17	21 4
	1430.74 16	4.8 9		2476.79 6	44 4
	1574.5 3	21 5		3034.90 7	100 5
	2163.29 11	17.2 21		3769.86 11	14.3 8
	2220.57 5	100 10	3888.32	1684.17 5	100 27
	2307.39 10	12.4 14		1900.49 9	45 7
	2779.63 6	32 4		2480.28 14	56 8
	3160.04 8	60 3		3206.66 22	17.3 18
3421.24	1217.32 14	11.3 23	3890.09	951.11 14	48 10
	1604.36 5	34 8		1027.03 16	24 5
	3421.09 8	100 6		1976.64 5	100 15
3497.98	1138.78 24	100		3889.93 10	98 6
3502.91	1565.47 5	24 4	3934.63	275.93 12	100 28
	2050.02 10	28 3		2823.40 19	16.1 22
	2125.60 13	14.8 24		3150.87 11	31.7 22
	2359.17 6	100 9		3827.56 12	25.0 17
	2660.49 17	7.9 12	4013.89	2550.12 11	7.1 10
	2820.84 20	9.4 12		2606.4 3	23.2 23
3529.04	2065.16 11	93 13		2740.08 6	37 4
	2262.79 16	43 7		2747.66 7	16.6 18
	2745.19 10	71 9		4013.77 9	100 6
	3528.78 17	100 20	4036.83	2781.84 5	100 12
3560.10	1612.19 11	100		3338.36 23	13.4 12
3621.19	1571.82 4	100 16		4037.2 3	6.9 9
	1759.28 6	35 5	4039.93	806.00 3	100 17
	3514.40 12	23.2 16		1673.71 11	29 5
3658.60	2119.72 14	16.7 24		2632.03 8	56 6
	2384.99 8	41 3		4039.64 15	23.9 22
	2392.14 6	100 9	4053.84	1665.14 14	18 3
	2403.84 7	54 6		2787.39 7	100 10
	2460.9 3	68 7		3269.86 16	13.3 12
	3399.5 3	30.9 18		4053.64 12	28.5 18
3674.14	1602.08 4	100 17	4092.33	1100.67 18	100 10
	1812.50 18	16 3		1732.6 6	36 11
	2832.13 6	92 9	4103.51	2115.55 18	94 21
	2991.87 10	30 4		2189.90 19	100 17
3696.55	1329.81 16	14 3	4105.75?	3321.65 9	100 3
	2243.25 9	44 5		4105.75 12	33 3
	2319.70 8	65 7	4128.35	1877.13 6	44 6
	2585.61 20	8.6 23		1941.22 7	12.9 20
	2997.69 24	9.0 18		2266.55 7	30 3
	3014.6 3	100 6		2381.8 3	36 4
	3589.45 9	98 5		2720.05 25	60 6
3770.70?	2504.34 13	40 5		2751.5 4	37 4
	2987.07 17	32 4		2854.71 10	10.9 12
	3088.47 11	100 9		2862.02 8	46 6
3794.61	1881.10 3	100 16		2984.32 12	12.3 14
	3010.54 8	48 3		3285.6 4	8.7 12
	3112.50 9	39 3		3489.45 8	100 5
	3794.82 12	10.8 8		4127.93 14	9.1 6
3798.15	2397.83 9	100 12	4152.35	1213.51 13	12.1 23
	2687.54 11	68 8		1763.39 7	20 3
	3539.88 13	35 3		3310.40 8	100 5
3831.75?	1644.55 6	100 15		3893.97 9	45.1 23

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
4154.75	2691.07 7	100 10	4612.81	3346.01 23	12.6 17
	3312.74 10	60 4		3468.99 9	100 6
	4154.22 12	36.5 22		4612.3 6	3.8 11
4179.40	2666.13 11	100 14	4660.72	986.45 8	100 17
	2981.69 19	36 6		3252.93 13	75 7
4259.05	2566.86 9	100 11		3394.24 12	69 5
	3417.07 16	45 5		4402.48 21	88 10
	3576.98 11	69 6	4715.33	2898.28 11	100 13
	4258.95 13	47 3		4033.4 4	56 6
4389.94	2023.76 11	100 12		4457.3 3	19 3
	2981.69 19	36 5		4714.7 5	11 3
	3278.85 23	43 7	4746.1	1248.00 27	100 14
	3707.96 12	52 4		1754.4 3	88 15
	4131.35 23	28 3	4748.53	2030.27 8	100 11
4416.58	2014.36 19	62 7		2561.53 12	23 3
	2027.35 19	16 3		4048.9 3	39 3
	2554.93 12	29 4		4747.9 4	8.6 19
	2599.42 8	46 5	4778.05	2012.09 9	100 11
	2952.86 6	77 8		2706.03 12	25 4
	3161.66 8	100 14		2961.11 9	49 6
	3574.58 20	12.7 18		3935.39 19	12.0 14
	3777.70 9	30 3		4095.81 18	13.4 14
	4158.8 3	4.1 9	4806.84	1572.9 3	40 10
	4309.58 12	22.3 14		2179.04 8	59 7
	4416.31 10	99 5		2199.61 13	21 3
4428.30	925.71 24	59 9		2602.76 10	19.6 23
	1565.47 5	36 6		2945.07 14	22 3
	2490.65 7	78 8		3342.50 20	6.3 7
	2964.63 6	76 8		3551.83 10	23.3 13
	3161.82 8	100 14		4022.8 4	100 5
	3317.11 19	8.6 9		4124.2 3	4.7 7
4443.13	1155.99 8	66 11	4853.65	2487.42 7	75 8
	2076.90 5	100 16		4853.29 11	100 5
	2455.04 12	56 7	4877.21	1509.92 4	55 9
4481.09	2493.18 14	21 3		3185.09 9	53 3
	2664.15 12	33 4		3468.99 9	100 6
	3370.05 8	100 14	4903.53	3450.39 13	100 13
	3638.65 16	11.4 10		4203.80 23	11.3 14
	3842.41 12	20.5 14		4645.03 11	54 3
	4374.04 10	71 4	4938.98	2060.99 18	29 6
	4481.16 18	19.0 19		2700.18 10	50 6
4556.71	3092.86 9	57 4		3025.54 9	100 6
	3283.44 18	38 3		4938.54 13	41 3
	3290.62 23	10.0 15	4942.99	1052.88 3	100 16
	3714.28 17	7.9 8		1921.61 15	16 3
	3874.7 4	100 13		4101.15 17	13.0 12
4576.23	1658.94 9	34 6	4959.72	2887.15 22	24 5
	2094.05 11	48 6		3446.56 10	100 6
	2325.11 12	37 5		3582.50 15	39 3
	2504.34 13	26 4	5003.01	2076.86 5	100 12
	3112.50 9	100 6		2580.79 9	37 5
	3465.26 10	56 4		3280.8 7	9.5 25
4590.56	2188.20 18	33 6		4218.71 25	6.0 10
	2774.0 3	21.2 23		4895.7 3	6.0 10
	3077.33 10	23.8 16	5064.08	3220.89 9	84 4
	3126.83 10	31.8 19		3790.36 9	100 6
	3479.73 8	100 5		4425.20 10	86 5
	4331.5 4	7.1 7	5081.15	3814.8 3	34 8
	4483.7 3	11.3 13		4399.00 18	36 3
4603.7	1043.6 5			4442.06 11	100 5
4612.81	1985.20 12	23 4		5080.94 13	78 4
	2408.82 11	35 5	5097.00	1812.50 18	28 5
	2450.82 14	50 9		2523.30 8	100 11

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
5097.00	2695.13 8	70 8	(7533.80)	2436.65 5	5.0 5
	2730.74 11	33 4		2452.36 8	3.5 5
	5096.55 15	22.0 15		2469.81 6	4.5 5
5179.10	1891.92 5	100 16		2530.77 6	5.0 6
	3265.39 16	34 3		2574.57 20	1.8 6
5246.62	3258.0 3	15 3		2590.81 6	3.0 3
	3501.7 3	9.0 15		2594.9 4	1.95 23
	3869.12 10	61 4		2629.79 10	1.89 21
	4404.62 11	100 7		2656.43 7	1.94 20
5318.97	1900.49 9	54 9		2680.15 4	9.4 9
	2441.02 13	45 7		2726.90 4	16.8 17
	3080.1 3	21 3		2755.7 5	2.33 24
	4120.72 11	100 6		2784.8 3	1.73 18
	4534.97 13	49 3		2817.7 3	1.48 15
	4636.57 20	17.6 22		2873.6 4	3.5 4
5476.93	2710.0 4	27 9		2919.9 6	3.8 11
	3659.96 16	100 9		2943.15 5	6.5 6
	4366.0 4	21 6		2957.39 5	5.5 6
	4693.1 4	27 6		2977.04 5	8.2 8
5630.13	2334.63 17	100 15		3052.69 7	12.1 6
	4140.4 3	23 4		3090.55 9	3.23 18
	4254.09 20	38 4		3105.49 7	13.0 6
5697.21	3624.83 14	13.2 11		3117.04 7	19.1 9
	4233.87 22	9.5 11		3144.36 11	4.27 21
	4319.91 10	100 5		3274.47 9	1.82 11
	5057.6 3	6.8 11		3354.22 9	2.52 14
5710.68	1606.95 6	100 16		3379.07 8	3.26 18
	1673.71 11	63 11		3381.31 8	9.8 5
	3459.36 11	72 5		3405.34 7	31.4 15
	5452.25 16	33.7 24		3427.93 8	3.52 21
5759.69	2338.49 8	100 11		3429.87 8	3.79 23
	2341.09 19	27 4		3479.73 8	4.71 24
	2455.04 12	46 6		3493.77 9	2.42 14
	2881.44 24	14 3		3496.67 8	7.2 4
	2896.2 3	20 5		3519.73 8	22 1
	4270.35 16	17.1 16		3599.03 8	5.14 26
5789.58	1749.63 5	100 16		3643.46 8	5.09 29
	3801.25 17	12.2 14		3645.26 10	2.29 18
5846.42	2542.11 13	100 13		3656.63 8	11.1 6
	3080.1 3	42 7		3671.70 8	13.2 6
	4734.5 4	18 5		3701.91 9	1.77 9
5953.67	2332.50 11	50 6		3735.52 9	3.05 17
	2450.82 14	61 12		3738.94 8	11.7 6
	3346.01 23	15.5 20		3763.03 10	1.55 8
	3881.34 20	10.8 14		3837.27 8	14.5 8
	4698.54 11	100 6		3859.48 9	7.9 5
5978.43	3350.64 14	100 12		3875.05 9	12.1 8
	3816.80 14	52 5		3912.28 9	5.30 27
	4465.4 3	7.8 17		4005.79 23	1.58 9
	4601.31 21	14.8 17		4030.70 9	3.91 20
	5339.22 14	43 3		4112.20 9	8.9 5
(7533.80)	1555.50 4	1.80 27		4115.15 9	26.1 14
	1580.32 3	4.5 8		4166.20 10	4.86 24
	1687.08 10	0.64 11		4209.94 10	3.42 18
	1744.03 4	2.2 3		4229.38 11	3.18 17
	1774.09 5	2.3 4		4238.31 11	3.32 17
	1823.18 3	5.2 8		4246.39 12	1.82 11
	1836.55 4	2.1 3		4249.24 10	13.8 8
	1903.41 9	0.77 12		4299.71 9	7.4 4
	2056.85 12	0.95 14		4322.90 9	7.0 4
	2215.11 20	2.7 5		4337.71 9	12.6 6
	2287.12 5	7.0 8		4493.41 10	6.6 3
	2354.55 8	2.0 2		4512.50 9	19.1 9

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{K})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$
(7533.80)	4519.11 10	9.7 5	(7533.80)	5595.93 11	20.8 11
	4525.18 10	13.5 8		5619.90 15	9.2 5
	4594.98 10	7.9 5		5671.50 12	56.2 29
	4607.48 10	6.7 3		5690.44 12	34.2 17
	4616.58 10	4.15 21		5716.54 12	2.83 15
	4655.62 10	8.8 5		5787.79 13	2.35 12
	4670.93 10	7.0 4		5810.00 12	9.5 5
	4767.57 10	62 3		6069.65 13	4.70 24
	4815.35 10	22.1 11		6125.37 13	5.61 29
	4880.6 4	0.94 6		6133.19 16	6.1 3
	4889.17 10	14.2 8		6156.15 13	13.6 8
	4905.67 10	8.9 5		6259.76 13	5.59 29
	4926.46 10	8.9 5		6267.03 13	12.0 6
	4959.88 10	5.58 29		6278.49 13	23.3 12
	5051.32 10	30.5 15		6389.70 14	3.12 15
	5111.39 10	30.5 15		6422.57 13	9.7 5
	5131.64 10	55.9 27		6691.34 14	12.0 6
	5144.68 11	15.6 8		6851.29 14	85 5
	5167.28 10	100 5		6894.52 14	18.9 9
	5282.38 11	8.2 5		7426.34 15	48.6 24
	5294.82 11	40.2 20		7533.16 15	28.2 14
	5328.2 3	1.89 9			
	5346.34 13	0.88 5			
	5371.91 11	5.80 29			
	5461.44 11	38.2 20			
	5484.12 11	27.6 14			

† Primarily from (n, γ), when a level is seen in this reaction; otherwise weighted averages of available values in different datasets are taken.

‡ From $\gamma(\theta, \text{pol})$ in ($^{18}\text{O}, \text{npy}$).

§ From ($^{36}\text{S}, 2\text{npy}$) only.

 ^{42}Ar β^- Decay (32.9 y) 1965St09

Parent ^{42}Ar : $E=0$; $J\pi=0+$; $T_{1/2}=32.9$ y 11; $Q(\text{g.s.})=599$ 6; % β^- decay=100.

$^{42}\text{Ar}-T_{1/2}$: From Adopted Levels of ^{42}Ar .

$^{42}\text{Ar}-Q(\beta^-)$: From 2012Wa38.

1965St09: measured $T_{1/2}$ of ^{42}Ar .

Others:

1964Ho31: measured cross section for production and $T_{1/2}$.

1961Ja07: production of ^{42}Ar isotope.

1952Ka44: identification of ^{42}Ar and $T_{1/2}$.

1990Mi05: measured $\beta\gamma$ coin for ^{42}K decay. ^{42}K isotope obtained from ^{42}Ar decay.

 ^{42}K Levels

E(level)	$J\pi^\dagger$
0.0	2-

† From Adopted Levels.

 β^- radiations

$E\beta^-$	E(level)	$I\beta^-^\dagger$	Log ft
(599 6)	0.0	100	9.32 ^{1u} 17

† Absolute intensity per 100 decays.

9BE(36S,2NPG),(37P,4NG) 1998Mo16,2005IdZZ

1998Mo16: E(^{36}S)=90, 100, 110 MeV ^{36}S beam was produced from the TANDEM accelerator of the University and Technical University Munich. Target of beryllium evaporated onto gold backing. γ -rays were detected with Compton-suppressed HPGe detectors. Measured $\text{E}\gamma$, $\text{I}\gamma$, $\gamma\gamma$ -coin, $\text{p}\gamma$ -coin, recoil- γ coin. Deduced levels, branching ratios.

2005IdZZ: E(^{37}P)=6 MeV/nucleon secondary beam from $^9\text{Be}(^{40}\text{Ar},\text{X})$, E=63 MeV/nucleon primary reaction using RIPS separator at RIKEN facility. Measured $\text{E}\gamma$ using GRAPE array of 14 segmented Ge detectors. Gamma rays of 151, 440 and 570 keV were seen. Deduced 107, 258 and 699 keV levels in ^{42}K from 106–151–440 cascade. It is not clear to the evaluators whether the 570 γ is the same as the 571.9 transition from the 1947 level since no 676.8 γ in cascade with 571.9 γ is not seen by 2005IdZZ.

All data are from $^9\text{Be}(^{36}\text{S},2\text{npy})$ (1998Mo16), unless otherwise stated.

 ^{42}K Levels

E(level) [†]	J π [‡]	E(level) [†]	J π [‡]	E(level) [†]	J π [‡]
0.0	2–	1254.7 3	2–	2524.7 4	(2, 3, 4)
106.80 4	3–	1273.29 13	(2–, 3, 4+)	2765.9 6	(2+, 3)
258.26 5	4–	1375.81 7	6+	2991.51 13	(5+ to 9+)
638.63 4	3–	1538.62 9	3+	3168.1 4	(2+ to 6+)
682.10 11	(2, 3)	1936.06 14		3497.81 23	(2+ to 9–)
699.03 5	5–	1947.68 8	7+	3559.90 14	(5+ to 9+)
841.82 10	3–	2113.8 3		4092.14 22	(3+ to 9–)
1143.46 5	4+	2358.97 10	(4+ to 7–)	4745.9 3	(3+ to 10)

[†] From least-squares fit to $\text{E}\gamma$ data.

[‡] From Adopted Levels.

 $\gamma(^{42}\text{K})$

$\text{E}\gamma$	E(level)	$\text{I}\gamma$ [#]	$\text{E}\gamma$	E(level)	$\text{I}\gamma$ [#]
106.83 [§] 5	106.80	100.0 17	986.1 4	2524.7	0.94 [@] 25
151.48 [‡] 4	258.26	103.5 20	1015.5 4	1273.29	0.91 [@] 25
232.4 4	1375.81	5.95 24	1043.79 14	2991.51	2.74 25
380.39 5	638.63	3.93 15	1054.3 3	3168.1	0.67 [@] 15
395.16 7	1538.62	3.55 19	1100.67 18	4092.14	2.06 [@] 20
422.8 3	2358.97	2.3 3	1138.78 24	3497.81	1.24 [@] 17
431.44 9	1273.29	1.73 26	1237.07 16	1936.06	2.80 [@] 24
440.78 [‡] 4	699.03	77.4 11	1248.00 27	4745.9	1.13 [@] 16
444.43 5	1143.46	5.12 26	^x 1291.4 6		0.45 [@] 13
504.83 4	1143.46	12.41 28	^x 1296.6 6		0.51 [@] 13
531.80 6	638.63	8.8 5	^x 1511.2 5		0.65 [@] 16
^x 542.42 23		5.59 25	1612.19 11	3559.90	2.55 26
571.86 [‡] 4	1947.68	7.7 23	1659.91 16	2358.97	1.78 24
592.23 6	699.03	3.58 21	1677.52 26	1936.06	2.3 [@] 5
616.09 29	1254.7	2.4 3	1682.9 5	2524.7	0.55 [@] 14
632.68 20	2991.51	1.79 20	1732.6 6	4092.14	0.74 [@] 22
638.60 5	638.63	5.7 3	1754.4 3	4745.9	1.00 [@] 17
676.77 4	1375.81	47.8 7	^x 1919.9 4		0.73 [@] 20
682.09 11	682.10	1.72 16	2024.5 6	3168.1	0.41 [@] 11
^x 735.7 [†] 3		0.79 [@] 14	2083.7 5	2765.9	0.71 [@] 14
841.78 10	841.82	4.7 4	2113.8 3	2113.8	2.1 [@] 3
983.16 9	2358.97	4.7 5			

[†] Placement from 842 level as proposed by 1985Kr06 in (n, γ) is discarded since this γ is not observed in coincidence with 107 γ .

[‡] This γ seen in $^9\text{Be}(^{37}\text{P},4\text{n}\gamma)$ (2005IdZZ).

[§] The 106.8 γ was not seen in 2005IdZZ.

[#] For E(^{36}S)=90 MeV, unless otherwise stated.

[@] From recoil-gated spectrum at E(^{36}S)=100 MeV.

^x γ ray not placed in level scheme.

$^{26}\text{Mg}(^{18}\text{O}, \text{n}\text{p}\gamma)$ 1977Ek01

1977Ek01 (also 1975Eg01): E=25, 34 MeV ^{18}O beam was produced from the Utrecht EN tandem accelerator. Target of 180 $\mu\text{g}/\text{cm}^2$ enriched ^{26}Mg (99.42%) evaporated on a 27 μm Ni backing. γ -rays were detected with Compton-suppression Ge(Li) detectors of 25% efficiency and a three-crystal Ge(Li) Compton polarimeter. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma(\text{lin pol})$. Deduced levels, $J\pi$, branching ratios, $T_{1/2}$ by Recoil-distance method (RDM).
Other: 1975Wa04. See $^{27}\text{Al}(^{18}\text{O}, \text{n}2\text{p}\gamma)$ dataset.

 ^{42}K Levels

$E(\text{level})^\dagger$	$J\pi^\S$	$T_{1/2}^\ddagger$
0.0	2- [#]	
106.780 20	3-	284 ps 42
258.13 10	4-	133 ps 9
638.45 12	3-	<1.4 ns
698.82 12	5-	41 ps 8
1143.20 16	4+	<1.4 ns
1375.51 16	6+	1.17 ns 8
1538.2 4	(3, 5)	<3.5 ps
1947.2 3	7+	<1.1 ps

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

[‡] Recoil-distance method (1975Eg01).

[§] From $\gamma(\theta)$ and $\gamma(\text{lin pol})$ in 1977Ek01, unless otherwise noted.

[#] From Adopted Levels.

 $\gamma(^{42}\text{K})$

A_2 , A_4 and Pol values are from 1977Ek01.

$E\gamma$	$E(\text{level})$	$I\gamma^\ddagger$	Mult. [§]	$\delta^\S$	Comments
106.78 [†] 2	106.780	>110	D(+Q)	+0.01 3	$A_2=-0.153$ 18; $A_4=+0.022$ 18. $I\gamma$: sum of feeding intensities.
151.33 [†] 12	258.13	100 3	M1(+E2)	-0.008 16	$A_2=-0.259$ 6. Pol=-0.30 11.
232.3 2	1375.51	7.1 3	E2(+M3)	-0.04 3	$A_2=+0.34$ 5; $A_4=-0.16$ 5.
380.3 2	638.45	4.2 2	(M1+E2)		$A_2=-0.35$ 16; $A_4=+0.29$ 17.
395.0 3	1538.2	7.5 13	D		$A_2=-0.40$ 6.
440.68 [†] 12	698.82	85 3	M1+E2	+0.102 8	$A_2=-0.080$ 8; $A_4=-0.016$ 9. Pol=-0.46 4.
444.4 3	1143.20	5.1 2	D		$A_2=-0.18$ 5.
504.72 18	1143.20	5.3 3	D		$A_2=-0.38$ 6.
531.7 2	638.45	7.0 4			$A_2=+0.28$ 8.
571.7 2	1947.2	37 4	M1+E2	-0.035 19	$A_2=-0.36$ 12. Pol=-0.36 6.
592.1 2	698.82	3.2 9			$I\gamma$: from $I\gamma(592)/I\gamma(441)=3.6$ 10/96.4 10.
638.4 2	638.45	7.0 5	D		$A_2=-0.32$ 12; $A_4=-0.16$ 14.
676.69 [†] 12	1375.51	58.6 18	E1+M2	+0.025 11	$A_2=-0.216$ 10; $A_4=-0.016$ 11. Pol=+0.39 4.

[†] From 1975Eg01, used as calibration line by 1977Ek01.

[‡] For 34 MeV, unless otherwise stated.

[§] From $\gamma(\theta)$ and $\gamma(\text{lin pol})$ in 1977Ek01.

$^{27}\text{Al}(^{18}\text{O},\text{n2p}\gamma), ^{26}\text{Mg}(^{18}\text{O},\text{np}\gamma), ^{26}\text{Mg}(^{19}\text{F},\text{n2p}\gamma)$ 1975Wa04,1975O101

1975Wa04(also 1975O101): E=20–60 MeV. Two Ge(Li) detectors. Measured $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma(\text{lin pol})$. Deduced levels, $J\pi$, branching ratios, lifetimes by recoil-distance method (RDM).

 ^{42}K Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}^{\#}$
0.0	2- $\S$	
106.85 15	3- $\S$	
258.09 18	4-	123 ps 28
698.9 3	5-	<14 ps
1375.9 4	6+	0.76 ns 21
1947.9 5	7+	≤ 0.52 ns [@]
2991.5? 7		
3560.1 5		
4603.7? 7		

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

[‡] From $\gamma(\theta)$ and $\gamma(\text{lin pol})$ in 1975O101, unless otherwise noted.

$\S$ From Adopted Levels.

[#] From recoil-distance method (RDM).

[@] Quoted by 1975Wa04 as ≤ 0.52 ns 14.

 $\gamma(^{42}\text{K})$

A_2 , A_4 and Pol values are from 1975O101.

$E\gamma$	E(level)	$I\gamma$	Mult. [†]	Comments
106.85 15	106.85			
151.24 10	258.09	65.0	D	$A_2=-0.19$ 4.
440.83 20	698.9	40.9	M1	$A_2=-0.16$ 3. Pol=-0.44 12.
572.0 3	1947.9	29.1	M1	$A_2=-0.44$ 4. Pol=-0.36 10.
676.95 20	1375.9	27.6	E1	$A_2=-0.37$ 4; $A_4=-0.16$ 4. Pol=+0.08 11, +0.28 13.
1043.6 $\ddagger\S$ 5	2991.5?			
	4603.7?			
1612.15 20	3560.1			

[†] From $\gamma(\text{lin pol})$ in 1975O101.

$\ddagger$ Multiply placed; undivided intensity given.

$\S$ Placement of transition in the level scheme is uncertain.

 $^{40}\text{Ar}(\alpha,\text{d})$ 1976De24

Target ^{40}Ar $J\pi=0+$.

1976De24: E=34.3 MeV alpha beam was produced from the Princeton azimuthally varying field cyclotron. Natural Argon target. Deuterons were detected in a freon cooled ΔE -E silicon detector telescope followed by a third detector in anti-coincidence, FWHM=110 keV. Measured $\sigma(E_\alpha, \theta)$. Deduced levels, L from DWBA analysis.

1966Ri04: E=44 MeV alpha beam was produced from the Berkeley 88-in. spiral ridge cyclotron. A counter telescope of two lithium drifted silicon crystals. Measured deuteron spectra. FWHM=200 keV.

 ^{42}K Levels

E(level)	L	$d\sigma/dW$ ($\mu\text{b}/\text{sr}$) [†]
0.0	1	32
107 $\ddagger$		15
700 $\ddagger$	5	150
1170 50		50
1534 50	4	300
1950 $\S$ 50	6	700

Continued on next page (footnotes at end of table)

$^{40}\text{Ar}(\alpha, d)$ $^{1976}\text{De24}$ (continued) **^{42}K Levels (continued)**

E(level)	L	$d\sigma/dW$ ($\mu\text{b}/\text{sr}$) [†]
2315 50	4	350
2829 50	4	190

[†] At 20' (c.m.).[‡] Taken by $^{1976}\text{De24}$ from compilation by $^{1973}\text{EnVA}$.[§] 1870 ($^{1966}\text{Ri04}$). **$^{41}\text{K}(\text{n}, \gamma)$ E=thermal $^{1985}\text{Kr06}$**

$^{1985}\text{Kr06}$: thermal neutron beam was produced from the ILL high-flux reactor. Target of a 610 mg KF powder (95.8% in ^{41}K). γ -rays were detected with the ILL curved-crystal Bragg spectrometer and pair spectrometer. Measured E_γ , I_γ . Deduced levels, branching ratios.

$^{2013}\text{Fi01}$: E(n)=thermal provided by the 10-MW Budapest Reactor. Target=natural K. Measured E_γ , I_γ , total radiative neutron σ using a HPGe detector at Budapest reactor facility. Deduced levels, J, π , feedings. Monte Carlo simulations using computer code DICEBOX. Comparison with statistical model calculations, previous studies, and evaluations in the ENSDF database. Authors report energy and intensity data for 31 secondary and 12 primary transitions. The intensities are given in terms of absolute cross section σ_γ in b. See also $^{2011}\text{Fi11}$ for cross section measurement.

All data are from $^{1985}\text{Kr06}$ unless otherwise stated.

Others: $^{1967}\text{Ha28}$, $^{1970}\text{Jo04}$.

 ^{42}K Levels

E(level) [†]	J π [§]	Comments
0.0	2-	
106.828 5	3-	
258.260 6	4-	
638.726 7	3-	
681.942 8	(2, 3)	
699.087 15	5-	
783.885 11	2-	
841.937 7	3-	
1110.744 9	3+	
1143.593 11	4+	
1197.904 10	4-	
1254.821 10	2-	J π : (2,3)- in $^{2013}\text{Fi01}$.
1266.300 9	(1, 2, 3)-	
1273.517 12	2-	J π : (2-,3,4+) in $^{2013}\text{Fi01}$.
1376.10 9	6+	
1377.121 10	(2, 3)-	
1400.03 4	(2, 3)	
1407.912 10	(1-, 2, 3)	
1453.05 4	(2-, 3, 4-)	
1463.649 14	(1-, 2, 3)	
1489.30 8	(1- to 5-)	
1513.069 22	(1- to 5-)	
1538.74 7	3+	
1692.00 4	(1- to 4-)	
1723.44 3	(2, 3, 4+)	
1745.613 16	(2+, 3+)	
1816.879 18	(2, 3, 4-)	J π : (2,3) in $^{2013}\text{Fi01}$.
1842.971 13	(1-, 2, 3)	
1861.893 9	2-	
1913.460 16	(2-, 3)	
1937.492 15	(1, 2, 3)-	
1987.979 19	(0- to 4-)	
2049.320 14	3+	
2072.009 12	(2, 3)-	
2161.645 22	(2+, 3, 4+)	

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⁴¹K(n,γ) E=thermal 1985Kr06 (continued)

⁴²K Levels (continued)

E(level) [†]	Jπ [§]	E(level) [†]	Jπ [§]	E(level) [†]	Jπ [§]
2187.23 4	3+	3367.32 4	(1+)	4481.07 4	(2,3)-
2204.046 24	(2-,3,4+)	3418.44 3	(2,3)-	4556.68 5	(1-,2,3)
2238.589 24	(1,2,3)-	3421.27 4	(0- to 3)	4576.26 4	(2,3)-
2251.062 20	(1-,2,3)	3502.90 4	(2+,3,4+)	4590.56 4	(2-,3,4+)
2366.172 13	(2,3)-	3529.03 7	(0- to 3)	4612.82 6	(2+,3)
2388.835 19	3+	3621.20 3	(2,3)	4660.71 6	(2-,3)
2401.798 14	(2,3)-	3658.59 4	(2-,3)	4715.40 10	(2-,3)
2422.155 21	(1-,2,3)	3674.14 3	(1-,2,3)	4748.54 7	3-
2482.147 15	(1,2,3)-	3696.39 5	(3-,4+)	4778.05 6	(1- to 4+)
2573.63 5	(2,3)	3770.67? 6	(0- to 3)	4806.83 3	(1 to 3)-
2606.996 24	(1-,2,3)	3794.62 3	(0- to 3)	4853.60 4	(0 to 3)-
2627.847 20	(2-,3)	3798.14 6	(2-,3,4+)	4877.25 4	(0 to 4+)
2644.289 24	3-	3831.74? 5	(1+,2,3)	4903.68 7	(3-,4+)
2653.79 6	(2-,3)	3862.04 5	(1- to 4+)	4938.98 6	(1-,2,3)
2718.098 13	(2-,3)	3876.94 4	(1- to 4+)	4942.97 4	(1- to 4-)
2765.960 17	(2+,3)	3888.33 4	(2,3)-	4959.64 8	(0- to 4+)
2862.78 4	(2-,3)	3890.09 4	(0- to 3)	5002.99 4	(1-,2,3)
2878.009 23	3-	3934.62 5	(2-,3)	5064.01 4	(1- to 4+)
2917.10 5	(1- to 4+)	4013.89 4	(0- to 3)	5081.26 6	(1-,2,3)
2926.09 4	(2,3)-	4036.86 4	3-	5097.04 4	(0- to 3)
2938.60 3	(1-,2,3)	4039.96 4	(1,2,3)	5179.13 5	(0- to 4+)
3008.33 3	3	4053.87 5	(2,3)-	5246.63 5	(1- to 4+)
3014.46 4	(1,2,3)-	4103.72 7	(0- to 4+)	5318.95 6	(2-,3)
3021.108 25	(2,3)-	4105.74? 6	(0- to 3)	5476.92 9	(1+,2,3)
3040.19 5	3-	4128.34 3	3-	5630.29 8	(4+)
3195.80 4	(2-,3)	4152.35 4	(2-,3,4+)	5697.22 4	(1- to 4+)
3210.61 6	(1+,2,3)	4154.70 5	(1-,2,3)	5710.61 3	(2-,3,4+)
3233.93 4	(3,4+)	4179.43 7	(2-,3,4+)	5759.69 4	(1-,2,3+)
3284.41 4	(2,3)-	4259.10 5	(1-,2,3)	5789.69 4	(0 to 4+)
3287.16 3	(2-,3,4+)	4389.78 6	(2-,3,4+)	5846.58 8	(1-,2,3+)
3295.35 7	(2,3)	4416.60 3	(2,3)-	5953.50 3	(1,2,3)
3304.36 3	1+	4428.28 3	(1+,2,3)	5978.32 4	4+
3323.73 6	3-	4443.14 4	(0- to 4+)	(7533.80 [‡] 11)	1+,2+ [#]

[†] From least-squares fit to Ey data. The evaluators increase the uncertainties to 0.5 keV for fitting purpose for the following γ-rays in order to get a reasonable reduced $\chi^2=2.3$: 1166.808, 1606.95, 2319.70 and 4005.79.

[‡] From 2012Wa38. Observed de-excitation intensity is 89% of g.s. feeding.

[§] From Adopted Levels.

[#] s-wave capture in ⁴¹K g.s. (Jπ=3/2+).

$\gamma(^{42}\text{K})$

Thermal capture $\sigma_n=1.46$ 3 (2006MuZX).

I_γ normalization: 0.95 7 from Σ(I_γ to g.s.)=100. Thermal capture $\sigma_n=1.46$ 3 (2006MuZX).

E _γ [†]	E(level)	I _γ ^{‡#}	E _γ [†]	E(level)	I _γ ^{‡#}
106.817 7	106.828	33 7	437.24 18	1692.00	0.048 14
151.431 3	258.260	10.7 22	440.854 18	699.087	1.26 25
198.33 9	1453.05	0.37 10	444.525 19	1143.593	0.92 19
268.793 8	1110.744	1.8 4	450.97 12	2388.835	0.069 17
275.93 12	3934.62	0.18 5	454.01 3	1861.893	0.28 6
283.78 12	2765.960	0.17 4	504.828 16	1143.593	2.4 4
289.21 9	1400.03	0.22 5	531.908 15	638.726	5.7 9
301.50 14	1143.593	0.13 3	537.17 14	2926.09	0.044 10
376.71 5	2238.589	0.61 14	544.68 21	2482.147	0.030 8
378.20 5	2366.172	0.15 4	550.30 10	1816.879	0.062 12
380.473 13	638.726	2.5 5	559.23 3	1197.904	0.26 4
395.2 4	1538.74	0.14 3	562.07 4	1816.879	0.17 3
408.87 15	1861.893	0.067 18	569.475 20	1842.971	0.60 9
413.16 16	1254.821	0.059 17	571.85 5	2388.835	0.127 20
428.71 5	1110.744	0.20 4	575.04 5	681.942	0.117 19
431.566 16	1273.517	2.9 6	579.30 6	2422.155	0.104 17

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$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$
584.40 4	1266.300	0.47 8	1043.78 13	2187.23	0.068 14
595.618 17	1861.893	0.83 12	1052.88 3	4942.97	0.162 25
602.046 22	1745.613	0.38 6	1071.509 20	1913.460	0.53 8
612.64 5	3014.46	0.20 3	1076.51 12	2187.23	0.041 8
612.65 5	1723.44	0.81 14	1080.17 10	3284.41	0.041 7
616.118 14	1254.821	2.3 4	1084.48 12	1723.44	0.039 7
618.20 8	3040.19	0.095 16	1091.088 18	1197.904	0.77 12
620.244 16	2482.147	1.05 16	1110.767 16	1110.744	2.0 3
621.727 16	1463.649	1.34 20	1121.70 5	2938.60	0.24 7
627.551 15	1266.300	1.56 23	1122.74 5	2388.835	0.44 9
634.65 6	1273.517	0.094 15	1128.20 3	2401.798	0.133 20
638.717 14	638.726	3.4 5	1135.40 7	2401.798	0.063 10
663.2 5	1937.492	0.037 8	1147.24 22	2401.798	0.42 6
671.149 23	1513.069	0.30 5	1153.61 3	1937.492	0.19 3
676.87 11	1376.10	0.075 14	1155.99 8	4443.14	0.066 11
678.34 6	2401.798	0.128 21	1166.808 25	1273.517	0.30 5
681.932 12	681.942	15.5 23	1179.921 16	1861.893	1.64 25
695.189 17	1377.121	0.92 14	1195.02 13	1453.05	0.033 6
706.98 8	2644.289	0.059 10	1197.99 3	1197.904	0.17 3
721.66 16	1987.979	0.030 7	1204.080 19	1987.979	0.68 10
725.96 3	1407.912	0.157 24	1207.363 17	2049.320	1.44 22
735.099 14	841.937	2.1 3	1213.51 13	4152.35	0.042 8
761.31 8	1400.03	0.058 10	1217.32 14	3421.27	0.060 12
766.21 9	2627.847	0.049 9	1223.29 5	1861.893	0.084 13
783.903 14	783.885	2.8 4	1229.89 3	2606.996	0.157 24
806.00@ 3	2878.009	0.18@ 3	1254.80 3	1254.821	0.79 13
	4039.96	0.18@ 3	1255.52 3	1937.492	2.0 3
811.49 9	3418.44	0.050 9	1266.305 15	1266.300	3.7 6
817.05 5	3021.108	0.093 15	1301.008 20	1407.912	0.51 8
828.462 16	2765.960	1.22 18	1319.32 23	2161.645	0.23 4
830.89 9	1513.069	0.052 9	1329.81 16	3696.39	0.030 6
841.895 13	841.937	13.2 20	1340.942 23	2718.098	0.35 5
846.59 5	3008.33	0.095 15	1352.02 7	2606.996	0.144 22
851.01 20	1489.30	0.021 6	1361.535 23	2627.847	0.35 5
856.20 3	2718.098	0.147 23	1368.70 23	3418.44	0.20 3
861.34 6	2606.996	0.067 11	1377.065 16	1377.121	3.1 5
874.088 19	2072.009	0.52 8	1382.2 3	1489.30	0.014 4
881.33 11	1723.44	0.038 7	1391.4 3	3233.93	0.18 3
903.635 21	1745.613	0.43 6	1399.78 9	1400.03	0.59 9
905.712 19	2049.320	0.61 9	1403.48 5	2187.23	0.090 14
912.69 23	2401.798	0.019 5	1407.898 16	1407.912	3.0 5
920.81 6	2644.289	0.072 12	1430.74 16	3418.44	0.028 5
923.66 19	3862.04	0.028 6	1433.274 19	2072.009	0.71 11
925.71 24	4428.28	0.129 20	1451.745 19	2718.098	0.74 11
^x 934.486 25		0.24 4	1454.53 12	2862.78	0.95 14
939.605 17	1197.904	1.15 17	1463.59 3	1463.649	0.25 4
949.60 20	2204.046	0.036 9	1470.09 6	2878.009	0.075 12
951.11 14	3890.09	0.051 10	1473.00 7	2926.09	0.067 11
958.215 21	2366.172	0.43 7	1485.60@ 8	2862.78	0.063@ 10
964.50 9	2878.009	0.047 8		2938.60	0.063@ 10
972.20 4	2238.589	0.108 17	1500.37 13	2644.289	0.073 15
977.524 18	2251.062	0.78 12	1501.85 21	3014.46	0.048 12
986.45 8	4660.71	0.059 10	1509.92 4	4877.25	0.101 16
989.065 21	2366.172	0.38 6	1520.28 4	2718.098	0.17 3
993.863 23	2401.798	0.30 5	1555.50 4	(7533.80)	0.119 18
996.511 16	1254.821	1.43 21	1558.72 3	3304.36	0.20 3
1001.005 16	1842.971	1.49 22	1565.47@ 5	3502.90	0.080@ 12
1011.62 3	2388.835	0.21 3		4428.28	0.080@ 12
1015.233 24	1273.517	0.61 9	1568.99 12	2251.062	0.040 7
1018.032 21	2161.645	0.40 6	1571.82 4	3621.20	0.19 3
1027.03 16	3890.09	0.025 5	1572.9 3	4806.83	0.12 3
1034.90 7	2573.63	0.081 13	1574.5 3	3418.44	0.12 3
1036.83 3	1143.593	0.20 3	1580.32 3	(7533.80)	0.30 5

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$
1585.10 4	1692.00	0.127 19	$\times$ 1948.89 7		0.087 14
1596.62 23	2862.78	0.20 3	1962.29 3	2644.289	0.50 8
1602.08 4	3674.14	0.24 4	1965.10 3	2072.009	0.48 7
1603.60 5	1861.893	0.18 4	1968.08 9	2606.996	0.060 10
1604.36 5	3421.27	0.18 4	1976.64 5	3890.09	0.106 16
1606.95 6	5710.61	0.083 13	1985.20 12	4612.82	0.042 7
1616.84 11	1723.44	0.060 10	1988.00 8	1987.979	0.112 17
1622.53 7	2765.960	0.084 13	1990.20 9	3367.32	0.088 14
1640.18 4	2482.147	0.101 15	1998.11 11	3195.80	0.067 12
1644.55 6	3831.74?	0.066 10	2006.0 3	2644.289	0.033 10
1655.16 3	1913.460	0.21 3	2012.09 9	4778.05	0.142 16
1658.94 9	4576.26	0.049 8	2014.36 19	4416.60	0.136 15
1661.8 4	2917.10	0.083 13	2020.83 6	2862.78	0.42 4
1665.14@ 14	2862.78	0.029@ 5	2023.76 11	4389.78	0.075 9
	4053.87	0.029@ 5	2027.35 19	4416.60	0.035 6
1671.20 11	2926.09	0.045 8	2030.27 8	4748.54	0.163 17
1673.71@ 11	4039.96	0.052@ 9	$\times$ 2034.26 7		0.25 3
	5710.61	0.052@ 9	2035.91 10	3233.93	0.129 17
1684.17 5	3888.33	0.11 3	2050.02 10	3502.90	0.093 11
1684.19 5	2366.172	0.11 3	2056.85 12	(7533.80)	0.063 9
1687.08 10	(7533.80)	0.042 7	2060.99 18	4938.98	0.034 7
1707.01 7	2388.835	0.131 20	2065.16 11	3529.03	0.086 12
1709.983 25	1816.879	0.98 15	2071.95 4	2072.009	2.16 22
$\times$ 1735.05 3		0.27 4	2076.86 5	5002.99	0.201 24
1740.20 3	2422.155	0.40 6	2076.90 5	4443.14	0.100 16
1744.03 4	(7533.80)	0.146 22	2083.94 4	2765.960	1.35 14
1749.63 5	5789.69	0.147 23	2086.53 5	3284.41	0.41 4
1754.98 3	1861.893	0.48 7	2089.8 4	3233.93	0.104 12
1759.28 6	3621.20	0.066 10	2094.05@ 11	2878.009	0.069@ 9
1763.39 7	4152.35	0.068 11		4576.26	0.069@ 9
1766.26 3	3021.108	0.49 7	2096.60 12	2938.60	0.065 8
1774.09 5	(7533.80)	0.155 24	2101.26 21	3367.32	0.027 6
1783.51 12	2422.155	0.39 6	2107.92 15	2366.172	0.037 7
1785.95 6	2627.847	0.21 3	2113.09 23	3367.32	0.033 8
1787.5 3	3195.80	0.17 3	2115.55 18	4103.72	0.100 22
$\times$ 1797.26 15		0.069 12	2116.8 4	3862.04	0.122 24
1800.15 4	2482.147	0.23 4	2119.72 14	3658.59	0.055 8
1802.57 11	3210.61	0.088 14	$\times$ 2122.20 10		0.089 11
1810.51 10	3008.33	0.069 11	2125.60 13	3502.90	0.049 8
1812.50@ 18	3674.14	0.037@ 7	$\times$ 2128.43 10		0.081 10
	5097.04	0.037@ 7	2131.9 3	2238.589	0.021 7
1818.32 23	3195.80	0.138 21	2138.42 10	3862.04	0.112 13
1823.18 3	(7533.80)	0.34 5	2143.43 5	2401.798	0.66 7
1830.42 23	1937.492	0.161 24	$\times$ 2148.80 9		0.165 18
1833.88 5	3233.93	0.115 18	$\times$ 2156.34 8		0.194 20
1836.55 4	(7533.80)	0.138 21	2163.29 11	3418.44	0.100 12
1842.95 3	1842.971	1.12 17	2166.38 6	3008.33	0.42 4
1861.855 24	1861.893	3.4 5	2172.71 25	3014.46	0.028 6
1864.68 5	3008.33	0.123 19	2179.04@ 8	2878.009	0.179@ 20
$\times$ 1872.97 18		0.021 5		4806.83	0.179@ 20
1877.13 6	4128.34	0.22 3	2184.45 14	3295.35	0.067 9
1881.10 3	3794.62	0.37 6	2188.20 18	4590.56	0.104 19
1891.92 5	5179.13	0.089 14	2189.90 19	4103.72	0.106 18
1900.49@ 9	3888.33	0.049@ 8	2192.79 23	3304.36	0.044 8
	5318.95	0.049@ 8	2195.95 10	2878.009	0.105 12
1903.41 9	(7533.80)	0.051 8	2199.61 13	4806.83	0.060 9
1909.90 5	3287.16	0.083 13	2215.11 20	(7533.80)	0.18 3
1913.8 3	1913.460	0.011 3	2220.57 5	3418.44	0.58 6
1921.61 15	4942.97	0.026 5	2238.56 4	2238.589	2.17 22
1934.16 3	2718.098	0.28 4	$\times$ 2240.56 5		0.38 4
1937.48 3	1937.492	1.50 23	2243.25 9	3696.39	0.098 11
1941.22 7	4128.34	0.064 10	2259.28 4	2366.172	2.14 21
1945.69 3	2204.046	0.42 6	2262.79 16	3529.03	0.040 6

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$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger\#}$
2266.55 7	4128.34	0.151 16	2556.94 7	3195.80	0.137 15
2281.90 10	2388.835	0.075 9	2561.53 12	4748.54	0.038 5
2287.12 5	(7533.80)	0.46 5	2566.86 9	4259.10	0.089 10
2294.98 3	2401.798	3.1 3	2573.54 16	2573.63	0.15 4
$\times$ 2298.87 8		0.125 13	2574.57 20	(7533.80)	0.12 4
2307.39 10	3418.44	0.072 8	2580.79 9	5002.99	0.074 9
2315.19 4	2422.155	1.45 14	2585.61 20	3696.39	0.019 5
2319.70 8	3696.39	0.144 15	2590.81 6	(7533.80)	0.197 20
2325.11 12	4576.26	0.053 7	2594.9 4	(7533.80)	0.129 15
2332.50@ 11	3014.46	0.074@ 9	2599.42 8	4416.60	0.102 11
	5953.50	0.074@ 9	2602.76 10	4806.83	0.059 7
2334.63 17	5630.29	0.047 7	2606.4 3	4013.89	0.169 17
2338.49 8	5759.69	0.123 13	$\times$ 2617.48 9		0.083 9
2341.09@ 19	3040.19	0.033@ 5	2622.61 16	3304.36	0.042 7
	5759.69	0.033@ 5	2624.65 19	3323.73	0.042 6
2354.55 8	(7533.80)	0.132 14	2627.74 10	2627.847	0.091 11
2359.17 6	3502.90	0.33 3	2629.79 10	(7533.80)	0.125 14
2366.13 4	2366.172	3.9 4	2632.03 8	4039.96	0.101 11
2369.9 3	2627.847	0.171 18	2648.38 6	3287.16	0.181 19
2372.68 11	3862.04	0.075 9	2653.56 10	2653.79	0.055 7
2375.35 8	2482.147	0.138 15	2656.43 7	(7533.80)	0.128 13
2381.8 3	4128.34	0.179 18	2660.49 17	3502.90	0.026 4
2384.99 8	3658.59	0.135 14	2664.15 12	4481.07	0.070 9
2388.81 5	2388.835	0.44 5	2666.13 11	4179.43	0.074 10
2392.14 6	3658.59	0.33 3	$\times$ 2672.02 14		0.038 6
2395.53 6	2653.79	0.212 22	$\times$ 2678.09 10		0.102 12
2397.83 9	3798.14	0.096 11	2680.15 4	(7533.80)	0.62 6
2401.72 5	2401.798	0.34 3	2685.17 8	3367.32	0.087 10
2403.84 7	3658.59	0.177 19	2687.54 11	3798.14	0.065 8
2408.82 11	4612.82	0.064 9	2691.07 7	4154.70	0.137 14
2411.9 3	3195.80	0.067 19	2695.13 8	5097.04	0.093 10
2413.34 17	3876.94	0.104 21	2700.18 10	4938.98	0.059 7
2422.20 11	2422.155	0.072 9	2706.03 12	4778.05	0.035 5
2436.65 5	(7533.80)	0.33 3	2710.0 4	5476.92	0.009 3
2441.02 13	5318.95	0.041 6	$\times$ 2717.29 7		0.137 14
2450.82@ 14	4612.82	0.091@ 17	2720.05 25	4128.34	0.30 3
	5953.50	0.091@ 17	2726.90 4	(7533.80)	1.11 11
2452.36 8	(7533.80)	0.23 3	2730.74 11	5097.04	0.044 5
2455.04@ 12	4443.14	0.056@ 7	2740.08 6	4013.89	0.27 3
	5759.69	0.056@ 7	2745.19 10	3529.03	0.065 8
2460.9 3	3658.59	0.224 23	2747.66 7	4013.89	0.121 13
2466.69 6	2573.63	0.28 3	2751.5 4	4128.34	0.184 19
2469.81 6	(7533.80)	0.30 3	2755.7 5	(7533.80)	0.154 16
2476.79 6	3876.94	0.211 21	2762.47 10	3021.108	0.061 7
2480.28 14	3888.33	0.062 9	2765.80 4	2765.960	1.61 16
2482.21 20	2482.147	0.044 7	2770.75 13	2878.009	0.036 5
2485.3 3	3862.04	0.028 6	2774.0 3	4590.56	0.066 7
2487.42 7	4853.60	0.153 16	2779.63 6	3418.44	0.187 20
2490.65 7	4428.28	0.171 18	2781.84 5	4036.86	0.35 4
2493.18 14	4481.07	0.043 6	2784.8 3	(7533.80)	0.114 12
2500.45 5	3284.41	0.51 5	2787.39 7	4053.87	0.165 17
2504.34@ 13	3770.67?	0.038@ 5	$\times$ 2789.74 6		0.27 3
	4576.26	0.038@ 5	2810.15 6	2917.10	0.183 19
$\times$ 2508.15 8		0.097 10	$\times$ 2814.13 20		0.023 4
2520.73 9	2627.847	0.110 12	2817.7 3	(7533.80)	0.098 10
2523.30 8	5097.04	0.132 14	2820.84 20	3502.90	0.031 4
$\times$ 2526.25 7		0.180 19	2823.40 19	3934.62	0.029 4
2530.77 6	(7533.80)	0.33 4	$\times$ 2827.25 9		0.070 8
$\times$ 2533.17 9		0.090 10	2832.13 6	3674.14	0.221 22
2537.36 7	2644.289	0.146 16	$\times$ 2846.09 5		0.33 3
2542.11 13	5846.58	0.045 6	2854.71 10	4128.34	0.054 6
2550.12 11	4013.89	0.052 7	$\times$ 2860.49 10		0.161 22
2554.93 12	4416.60	0.064 9	2862.02 8	4128.34	0.23 3

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$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$
2873.6 4	(7533.80)	0.233 24	3220.89 9	5064.01	0.138 7
2878.10 16	2878.009	0.024 4	3224.0 3	3862.04	0.016 3
2881.44 24	5759.69	0.017 4	$\times$ 3226.97 10		0.079 5
2887.15 22	4959.64	0.016 3	$\times$ 3234.13 12		0.040 3
2896.2 3	5759.69	0.025 6	$\times$ 3238.49 11		0.075 6
2898.28 11	4715.40	0.064 8	$\times$ 3240.73 8		0.180 10
2907.35 14	3014.46	0.41 4	3252.93 13	4660.71	0.044 4
$\times$ 2913.56 9		0.061 7	3258.0 3	5246.63	0.020 4
2919.9 6	(7533.80)	0.25 7	3265.39 16	5179.13	0.030 3
2926.01 5	2926.09	0.34 3	3269.86 16	4053.87	0.022 2
2938.38 6	2938.60	0.190 19	3274.47 9	(7533.80)	0.120 7
2943.15 5	(7533.80)	0.43 4	3278.85 23	4389.78	0.032 5
2945.07 14	4806.83	0.067 10	3280.8 7	5002.99	0.019 5
2952.86 6	4416.60	0.170 17	3283.44 18	4556.68	0.090 8
2957.39 5	(7533.80)	0.36 4	3285.6 4	4128.34	0.043 6
2961.11 9	4778.05	0.069 8	$\times$ 3287.91 16		0.076 7
2964.63 6	4428.28	0.167 17	3290.62 23	4556.68	0.024 3
2977.04 5	(7533.80)	0.54 5	3295.16 11	3295.35	0.051 4
2981.69@ 19	4179.43	0.027@ 4	3310.40 8	4152.35	0.348 18
	4389.78	0.027@ 4	3312.74 10	4154.70	0.082 6
2984.32 12	4128.34	0.061 7	3317.11 19	4428.28	0.019 2
2987.07 17	3770.67?	0.030 4	3321.65 9	4105.74?	0.189 12
2991.87 10	3674.14	0.071 9	3323.69 9	3323.73	0.210 12
2997.69 24	3696.39	0.020 4	3338.36 23	4036.86	0.047 4
3008.28 9	3008.33	0.135 8	3342.50 20	4806.83	0.019 2
3010.54 8	3794.62	0.176 10	3346.01@ 23	4612.82	0.023@ 3
3014.6 3	3696.39	0.222 12		5953.50	0.023@ 3
3021.07 8	3021.108	0.308 16	3350.64 14	5978.32	0.115 14
3025.54 9	4938.98	0.119 7	3354.22 9	(7533.80)	0.166 9
3028.89 7	3287.16	0.407 21	$\times$ 3366.79 11		0.075 6
3034.90 7	3876.94	0.484 24	3367.20 8	3367.32	0.098 13
3039.92 8	3040.19	0.305 23	3370.05 8	4481.07	0.21 3
3052.69 7	(7533.80)	0.80 4	3379.07 8	(7533.80)	0.215 12
3065.38 19	3323.73	0.024 3	3381.31 8	(7533.80)	0.65 3
3077.33 10	4590.56	0.074 5	3394.24 12	4660.71	0.041 3
3080.1@ 3	5318.95	0.019@ 3	3399.5 3	3658.59	0.102 6
	5846.58	0.019@ 3	3405.34 7	(7533.80)	2.07 10
3088.47 11	3770.67?	0.095 8	$\times$ 3410.66 13		0.036 3
3090.55 9	(7533.80)	0.213 12	$\times$ 3414.36 9		0.126 7
3092.86 9	4556.68	0.136 9	3417.07 16	4259.10	0.040 4
3105.49 7	(7533.80)	0.86 4	3421.09 8	3421.27	0.53 3
$\times$ 3110.29 8		0.291 16	3427.93 8	(7533.80)	0.232 14
3112.50@ 9	3794.62	0.145@ 9	3429.87 8	(7533.80)	0.250 15
	4576.26	0.145@ 9	$\times$ 3439.12 10		0.071 4
3117.04 7	(7533.80)	1.26 6	3446.56 10	4959.64	0.066 4
$\times$ 3120.98 16		0.037 3	3450.39 13	4903.68	0.142 18
$\times$ 3123.85 10		0.095 6	$\times$ 3455.18 8		0.203 11
3126.83@ 10	3233.93	0.099@ 6	3459.36 11	5710.61	0.060 4
	4590.56	0.099@ 6	3465.26 10	4576.26	0.081 5
3144.36 11	(7533.80)	0.282 14	3468.99@ 9	4612.82	0.182@ 10
3150.87 11	3934.62	0.057 4		4877.25	0.182@ 10
3160.04 8	3418.44	0.346 19	$\times$ 3474.27 8		0.219 11
3161.66 8	4416.60	0.22 3	3479.73@ 8	4590.56	0.311@ 16
3161.82 8	4428.28	0.22 3		(7533.80)	0.311@ 16
3177.25 16	3284.41	0.195 11	$\times$ 3483.49 15		0.027 3
3180.00 19	3862.04	0.19 4	3489.45 8	4128.34	0.496 25
$\times$ 3181.20 16		0.18 4	3493.77 9	(7533.80)	0.160 9
3185.09 9	4877.25	0.096 5	3496.67 8	(7533.80)	0.472 24
3188.9 3	3295.35	0.013 2	3501.7 3	5246.63	0.012 2
3195.59 8	3195.80	0.255 13	3514.40 12	3621.20	0.044 3
3206.66 22	3888.33	0.019 2	3519.73 8	(7533.80)	1.45 7
3210.46 8	3210.61	0.219 11	$\times$ 3524.37 10		0.109 7
3216.47 19	3323.73	0.044 6	3528.78 17	3529.03	0.092 18

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$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$	$E\gamma^{\dagger}$	E(level)	$I\gamma^{\dagger\#}$
3539.88 13	3798.14	0.034 3	4037.2 3	4036.86	0.024 3
$\times$ 3548.45 20		0.033 3	4039.64 15	4039.96	0.043 4
3551.83 10	4806.83	0.070 4	4048.9 3	4748.54	0.063 4
$\times$ 3565.36 9		0.152 8	4053.64 12	4053.87	0.047 3
3574.58 20	4416.60	0.028 4	$\times$ 4057.92 12		0.055 4
3576.98 11	4259.10	0.061 5	$\times$ 4064.34 11		0.065 4
3582.50 15	4959.64	0.026 2	4095.81 18	4778.05	0.019 2
3589.45 9	3696.39	0.218 11	4101.15 17	4942.97	0.021 2
$\times$ 3594.07 15		0.026 2	4105.75 12	4105.74?	0.062 4
3599.03 8	(7533.80)	0.339 17	4112.20 9	(7533.80)	0.59 3
$\times$ 3610.11 10		0.101 6	4115.15 9	(7533.80)	1.72 9
3624.83 14	5697.22	0.025 2	4120.72 11	5318.95	0.091 5
3638.65 16	4481.07	0.024 2	4124.2 3	4806.83	0.014 2
3643.46 8	(7533.80)	0.336 19	4127.93 14	4128.34	0.045 3
3645.26 10	(7533.80)	0.151 12	4131.35 23	4389.78	0.021 2
3656.63 8	(7533.80)	0.73 4	4140.4 3	5630.29	0.011 2
3659.96 16	5476.92	0.033 3	4154.22 12	4154.70	0.050 3
3671.70 8	(7533.80)	0.87 4	4158.8 3	4416.60	0.009 2
$\times$ 3688.20 8		0.332 17	4166.20 10	(7533.80)	0.321 16
$\times$ 3698.33 15		0.042 3	$\times$ 4173.09 12		0.060 4
3701.91 9	(7533.80)	0.117 6	$\times$ 4182.98 15		0.025 2
3707.96 12	4389.78	0.039 3	4203.80 23	4903.68	0.016 2
3714.28 17	4556.68	0.019 2	4209.94 10	(7533.80)	0.226 12
$\times$ 3727.98 11		0.057 3	$\times$ 4212.71 13		0.055 4
$\times$ 3732.40 14		0.044 3	4218.71 25	5002.99	0.012 2
3735.52 9	(7533.80)	0.201 11	4229.38 11	(7533.80)	0.210 11
3738.94 8	(7533.80)	0.77 4	4233.87 22	5697.22	0.018 2
$\times$ 3752.52 13		0.051 4	4238.31 11	(7533.80)	0.219 11
3755.06 9	3862.04	0.139 8	4246.39 12	(7533.80)	0.120 7
$\times$ 3759.14 12		0.040 3	4249.24 10	(7533.80)	0.91 5
3763.03 10	(7533.80)	0.102 5	4254.09 20	5630.29	0.018 2
3769.86 11	3876.94	0.069 4	4258.95 13	4259.10	0.042 3
3777.70 9	4416.60	0.067 7	4270.35 16	5759.69	0.021 2
3790.36 9	5064.01	0.164 9	$\times$ 4294.41 24		0.014 2
3794.82 12	3794.62	0.040 3	4299.71 9	(7533.80)	0.490 25
3801.25 17	5789.69	0.018 2	4309.58 12	4416.60	0.049 3
3814.8 3	5081.26	0.026 6	4319.91 10	5697.22	0.190 10
3816.80 14	5978.32	0.060 6	4322.90 9	(7533.80)	0.460 23
3827.56 12	3934.62	0.045 3	4331.5 4	4590.56	0.022 2
3831.32 11	3831.74?	0.063 4	4337.71 9	(7533.80)	0.83 4
3837.27 8	(7533.80)	0.96 5	4366.0 4	5476.92	0.007 2
3842.41 12	4481.07	0.043 3	$\times$ 4371.43 10		0.228 12
3859.48 9	(7533.80)	0.52 3	4374.04 10	4481.07	0.149 8
$\times$ 3862.89 9		0.173 9	4399.00 18	5081.26	0.027 2
3869.12 10	5246.63	0.082 5	4402.48 21	4660.71	0.052 6
3874.7 4	4556.68	0.24 3	4404.62 11	5246.63	0.134 9
3875.05 9	(7533.80)	0.80 5	$\times$ 4410.83 15		0.025 2
3881.34 20	5953.50	0.016 2	4416.31 10	4416.60	0.217 11
3889.93 10	3890.09	0.104 6	4425.20 10	5064.01	0.141 8
3893.97 9	4152.35	0.157 8	$\times$ 4432.87 15		0.031 2
$\times$ 3901.54 9		0.166 9	4442.06 11	5081.26	0.076 4
3912.28 9	(7533.80)	0.350 18	4457.3 3	4715.40	0.012 2
$\times$ 3914.57 18		0.040 5	4465.4 3	5978.32	0.009 2
3935.39 19	4778.05	0.017 2	$\times$ 4472.85 14		0.026 2
$\times$ 3943.94 10		0.142 7	4481.16 18	4481.07	0.040 4
$\times$ 3952.66 10		0.169 9	4483.7 3	4590.56	0.035 4
$\times$ 3971.64 15		0.022 2	4493.41 10	(7533.80)	0.435 22
4005.79 23	(7533.80)	0.104 6	$\times$ 4504.02 12		0.073 5
4013.77 9	4013.89	0.73 4	4512.50 9	(7533.80)	1.26 6
$\times$ 4020.19 13		0.034 2	4519.11 10	(7533.80)	0.64 3
4022.8 4	4806.83	0.301 15	4525.18 10	(7533.80)	0.89 5
4030.70 9	(7533.80)	0.258 13	4534.97 13	5318.95	0.045 3
4033.4 4	4715.40	0.036 4	$\times$ 4568.52 11		0.107 6

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{n},\gamma)$ E=thermal 1985Kr06 (continued) $\gamma(^{42}\text{K})$ (continued)

$E\gamma^\dagger$	E(level)	$I\gamma^{\ddagger\#}$	$E\gamma^\dagger$	E(level)	$I\gamma^{\ddagger\#}$
$^{x}4581.67\ 22$		0.015 2	5282.38 11	(7533.80)	0.54 3
4594.98 10	(7533.80)	0.52 3	5294.82 11	(7533.80)	2.65 13
4601.31 21	5978.32	0.017 2	$^{x}5316.71\ 24$		0.013 2
4607.48 10	(7533.80)	0.440 22	5328.2 3	(7533.80)	0.125 6
4612.3 6	4612.82	0.007 2	5339.22 14	5978.32	0.049 3
4616.58 10	(7533.80)	0.274 14	5346.34 13	(7533.80)	0.058 3
4636.57 20	5318.95	0.016 2	5371.91 11	(7533.80)	0.383 19
4645.03 11	4903.68	0.077 4	$^{x}5405.17\ 23$		0.013 1
4655.62 10	(7533.80)	0.58 3	5452.25 16	5710.61	0.028 2
4670.93 10	(7533.80)	0.465 23	5461.44 11	(7533.80)	2.52 13
$^{x}4675.94\ 15$		0.027 2	5484.12 11	(7533.80)	1.82 9
$^{x}4686.38\ 11$		0.081 4	5595.93 11	(7533.80)	1.37 7
4693.1 4	5476.92	0.009 2	5619.90 [§] 15	(7533.80)	0.61 [§] 3
4698.54 11	5953.50	0.148 8	5671.50 12	(7533.80)	3.71 19
$^{x}4709.19\ 22$		0.014 2	5690.44 12	(7533.80)	2.26 11
4714.7 5	4715.40	0.007 2	5716.54 12	(7533.80)	0.187 10
$^{x}4731.14\ 17$		0.020 2	5787.79 13	(7533.80)	0.155 8
4734.5 4	5846.58	0.008 2	5810.00 12	(7533.80)	0.63 3
$^{x}4745.37\ 23$		0.023 3	$^{x}5828.69\ 24$		0.011 1
4747.9 4	4748.54	0.014 3	$^{x}5840.01\ 21$		0.013 1
4767.57 10	(7533.80)	4.11 21	$^{x}5852.66\ 16$		0.030 2
4815.35 10	(7533.80)	1.46 7	$^{x}5858.0\ 5$		0.005 1
$^{x}4826.89\ 16$		0.030 2	$^{x}5959.42\ 18$		0.022 1
$^{x}4830.94\ 17$		0.027 2	$^{x}6047.7\ 4$		0.005 1
4853.29 11	4853.60	0.205 10	6069.65 13	(7533.80)	0.310 16
$^{x}4861.33\ 11$		0.165 9	6125.37 13	(7533.80)	0.370 19
4880.6 4	(7533.80)	0.062 4	6133.19 16	(7533.80)	0.400 20
4889.17 10	(7533.80)	0.94 5	6156.15 13	(7533.80)	0.90 5
4895.7 3	5002.99	0.012 2	6259.76 13	(7533.80)	0.369 19
4905.67 10	(7533.80)	0.59 3	6267.03 13	(7533.80)	0.79 4
4926.46 10	(7533.80)	0.59 3	6278.49 13	(7533.80)	1.54 8
4938.54 13	4938.98	0.049 3	6389.70 14	(7533.80)	0.206 10
4959.88 10	(7533.80)	0.368 19	6422.57 13	(7533.80)	0.64 3
$^{x}4985.71\ 14$		0.042 3	6691.34 14	(7533.80)	0.79 4
$^{x}5031.31\ 12$		0.121 8	6851.29 14	(7533.80)	5.6 3
5051.32 10	(7533.80)	2.01 10	6894.52 14	(7533.80)	1.25 6
5057.6 3	5697.22	0.013 2	7426.34 15	(7533.80)	3.21 16
5080.94 13	5081.26	0.059 3	7533.16 15	(7533.80)	1.86 9
5096.55 15	5097.04	0.029 2			
5111.39 10	(7533.80)	2.01 10			
5131.64 10	(7533.80)	3.69 18			
5144.68 11	(7533.80)	1.03 5			
5167.28 10	(7533.80)	6.6 3			
$^{x}5227.9\ 7$		0.005 2			
$^{x}5239.85\ 22$		0.017 2			

[†] Systematic uncertainties of 5 ppm below 1.5 MeV energy, 10 ppm between 1.5 MeV and 3.0 MeV, and 20 ppm above 3 MeV photon energy are included.

[‡] Intensities are per 100 neutron captures. Systematic uncertainties of 20% below 0.5 MeV, 15% between 0.5 MeV and 2 MeV, 10% between 2.0 MeV and 3.0 MeV, and 5% above 3 MeV are included. To obtain absolute cross section on the scale given in 2013Fi01, multiply listed $I\gamma$ value by an approximate factor of 0.0150. The obtained values of cross sections have been compared with corresponding ones in 2013Fi01 and they are in a good agreement within uncertainties, except for a few γ rays: 454.01, 830.89 and 1121.70, for which the values from 2013Fi01 is significantly higher.

[§] From E(transition)=5620.30, branching=0.65% 3 as listed in table 3 of 1985Kr06.

[#] Absolute intensity per 100 neutron captures.

[@] Multiply placed; undivided intensity given.

^x γ ray not placed in level scheme.

⁴¹K(n,γ): Resonance 2006MuZX

⁴¹K g.s. Jπ=3/2+.

2006MuZX: Compilation of thermal neutron induced σ and resonance parameter data for nuclei of Z=1-100.

Others: 1970StZZ, 1973Si32 (also 1971SiYI) (E=0-400 keV), 1972Ki24, 1984Ma40 (E=11-9850 eV, 2.6-2000 keV).

⁴²K Levels

2gΓ_n=(2J+1)Γ_n.

All resonance parameters including resonance neutron energies, Jπ, L, gΓ_n and Γ_γ are directly adopted from the compilation in 2006MuZX, unless otherwise indicated.

E(level) [†]	2gΓ _n	L	E _n (lab) (keV)	Comments
7532.9?		0	-0.946	Γ _γ =(0.94) eV.
7534.67 11			0.8960 9	gΓ _n Γ _γ /Γ (meV)=5.17 3.
7535.78 11	4.18 eV 4	0	2.030 2	gΓ _n Γ _γ /Γ (meV)=198.8 11. Γ _γ =0.352 eV 4.
7536.93 11	0.24 eV 3	1	3.203 3	gΓ _n Γ _γ /Γ (meV)=112.4 3.
7537.72 11			4.012 4	gΓ _n Γ _γ /Γ (meV)=89.0 3.
7539.18 11	92.2 eV 18	0	5.514 6	gΓ _n Γ _γ /Γ (meV)=260 26. Γ _γ =0.70 eV 7.
7539.67 11			6.012 6	gΓ _n Γ _γ /Γ (meV)=86.4 7.
7540.32 11			6.679 7	gΓ _n Γ _γ /Γ (meV)=3.20 20.
7541.60 11			7.989 8	gΓ _n Γ _γ /Γ (meV)=21.7 6.
7542.07 11			8.475 9	gΓ _n Γ _γ /Γ (meV)=117.7 4.
7544.48 11		1	10.940 10	gΓ _n Γ _γ /Γ (meV)=96.3 24.
7544.76 11			11.230 10	gΓ _n Γ _γ /Γ (meV)=9.6 6.
7546.82 11	5.9 eV 12	1	13.341 13	gΓ _n Γ _γ /Γ (meV)=214.0 22. Γ _γ =0.369 eV 4.
7548.46 11	4.8 eV 12	1	15.022 15	gΓ _n Γ _γ /Γ (meV)=137.6 23. Γ _γ =0.389 eV 7.
7548.86 11			15.430 15	gΓ _n Γ _γ /Γ (meV)=14.0 9.
7549.04 11			15.620 15	gΓ _n Γ _γ /Γ (meV)=135.3 21.
7550.11 11	256 eV 11	0	16.710 17	gΓ _n Γ _γ /Γ (meV)=293 12. Γ _γ =0.78 eV 3.
7551.36 11			17.990 17	gΓ _n Γ _γ /Γ (meV)=144 3.
7552.04 11			18.690 18	gΓ _n Γ _γ /Γ (meV)=11.0 11.
7553.24 11			19.920 20	gΓ _n Γ _γ /Γ (meV)=301 3.
7553.61 11	32.6 eV 8	1	20.298 20	gΓ _n Γ _γ /Γ (meV)=266 4. Γ _γ =0.722 eV 12.
7558.31 11	110 eV 21	[0]	25.118 25	gΓ _n Γ _γ /Γ (meV)=162 7. Γ _γ =1.30 eV 5.
7560.18 11			27.03 3	gΓ _n Γ _γ /Γ (meV)=46 3.
7560.27 11	23.0 eV 8	1	27.12 3	gΓ _n Γ _γ /Γ (meV)=255 6. Γ _γ =0.297 eV 8.
7561.43 11			28.31 3	gΓ _n Γ _γ /Γ (meV)=43.5 24.
7566.12 11			33.12 3	gΓ _n Γ _γ /Γ (meV)=140 5.
7566.20 11			33.20 3	gΓ _n Γ _γ /Γ (meV)=231 6.
7566.85 11	3.42 eV 22		33.86 3	gΓ _n Γ _γ /Γ (meV)=187 8.
7568.49 12			35.54 4	gΓ _n Γ _γ /Γ (meV)=94 5.
7571.43 12	830 eV 15	0	38.56 4	gΓ _n Γ _γ /Γ (meV)=942 41. Γ _γ =1.51 eV 7.
7572.33 12			39.48 4	gΓ _n Γ _γ /Γ (meV)=28 5.
7575.13 12	270 eV 130	[0]	42.35 4	gΓ _n Γ _γ /Γ (meV)=570 19. Γ _γ =0.92 eV 3.
7575.72 12			42.95 4	gΓ _n Γ _γ /Γ (meV)=133 6.
7577.05 12			44.32 4	gΓ _n Γ _γ /Γ (meV)=123 7.
7577.14 12			44.41 4	gΓ _n Γ _γ /Γ (meV)=166 7.
7580.12 12			47.46 5	gΓ _n Γ _γ /Γ (meV)=45 5.
7580.35 12			47.70 5	gΓ _n Γ _γ /Γ (meV)=333 9.
7580.97 12			48.33 5	gΓ _n Γ _γ /Γ (meV)=126 7.
7582.01 12			49.40 5	gΓ _n Γ _γ /Γ (meV)=271 9.
7582.80 12			50.21 5	gΓ _n Γ _γ /Γ (meV)=154 8.
7583.95 12			51.39 5	gΓ _n Γ _γ /Γ (meV)=83 7.
7585.39 12			52.86 5	gΓ _n Γ _γ /Γ (meV)=238 9.
7585.69 12			53.17 5	gΓ _n Γ _γ /Γ (meV)=30 6.
7586.46 12			53.96 5	gΓ _n Γ _γ /Γ (meV)=220 9.
7587.90 12	80 eV 24	1	55.43 6	gΓ _n Γ _γ /Γ (meV)=210 11. Γ _γ =0.242 eV 13.

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{n},\gamma)$: Resonance 2006MuZX (continued) **^{42}K Levels (continued)**

$E(\text{level})^\dagger$	$2g\Gamma_n$	L	$E_n(\text{lab})$ (keV)	Comments
7589.67 12			57.25 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=265 11.
7590.60 12	270 eV 26	[0]	58.20 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=388 24. $\Gamma_\gamma=1.04$ eV 6.
7591.51 12			59.13 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=231 11.
7594.76 13			62.46 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=170 10.
7595.23 13			62.94 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=185 10.
7595.50 13	47 eV	1	63.22 6	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=124 10. $\Gamma_\gamma=0.33$ eV 3.
7597.89 13			65.67 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=191 10.
7599.27 13	190 eV	1	67.08 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=265 22. $\Gamma_\gamma=0.43$ eV 4.
7599.94 13			67.77 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=211 11.
7600.41 13			68.25 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=246 13.
7602.56 13	46.6 eV 5	1	70.45 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=242 17. $\Gamma_\gamma=0.39$ eV 3.
7602.89 13			70.79 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=312 14.
7603.90 13			71.83 7	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=185 11.
7607.14 13			75.15 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=415 19.
7607.49 13	420 eV 120	1	75.50 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=163 24. $\Gamma_\gamma=0.44$ eV 7.
7609.18 13			77.24 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=213 14.
7610.95 13			79.05 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=295 18.
7611.51 13			79.62 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=53.1 26.
7611.71 13	710 eV 120	1	79.83 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=564 76. $\Gamma_\gamma=0.90$ eV 12.
7614.19 14			82.37 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=217 14.
7614.93 14			83.13 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=294 18.
7615.21 14	360 eV 120	1	83.41 8	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=601 29. $\Gamma_\gamma=0.69$ eV 3.
7617.95 14			86.22 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=138 14.
7620.11 14			88.44 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=140 15.
7622.15 14	130 eV 60	1	90.53 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=251.8 21. $\Gamma_\gamma=0.41$ eV 3.
7622.98 14			91.38 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=650 30.
7625.14 14			93.59 9	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=229 19.
7626.42 14			94.90 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=173 18.
7628.19 15			96.71 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=149 18.
7628.48 15			97.01 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=217 21.
7628.72 15			97.26 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=328 21.
7630.24 15			98.81 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=210 22.
7631.99 15	450 eV 150	1	100.61 10	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=526 41. $\Gamma_\gamma=0.85$ eV 7.
7632.67 15			101.30 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=360 30.
7634.80 15			103.49 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=133 19.
7636.71 15			105.44 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=209 23.
7637.84 15			106.60 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=275 24.
7639.84 15			108.65 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=186 23.
7641.06 15			109.90 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=270 30.
7641.55 15			110.40 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=610 40.
7643.89 15			112.80 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=74 21.
7645.35 15			114.30 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=160 30.
7647.11 15			116.10 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=310 30.
7647.4 3	590 eV 200	1	116.44 24	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=550 56. $\Gamma_\gamma=0.63$ eV 6.
7651.89 16	420 eV 90		121.00 12	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=1415 65.
7652.48 15			121.60 11	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=1619 71.
7653.16 16			122.30 12	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=157 28.
7654.72 16			123.90 12	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=243 31.
7657.16 16			126.40 12	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=690 76.
7657.46 17			126.70 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=952 60.
7658.82 17			128.10 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=512 37.
7660.09 17			129.40 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=472 37.
7662.53 17			131.90 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=640 44.

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{n},\gamma)$: Resonance 2006MuZX (continued) **^{42}K Levels (continued)**

$E(\text{level})^\dagger$	$E_n(\text{lab})$ (keV)	Comments
7663.70 17	133.10 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=372 36.
7664.38 17	133.80 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=295 36.
7664.87 17	134.30 13	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=363 37.
7666.24 18	135.70 14	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=284 34.
7669.26 18	138.80 14	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=454 43.
7671.31 18	140.90 14	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=304 36.
7674.53 18	144.20 14	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=454 44.
7675.71 18	145.40 15	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=193 36.
7676.49 18	146.20 15	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=1163 57.
7680.10 18	149.90 15	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=198 50.
7680.59 18	150.40 15	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)=834 56.

† From $E_{\text{c.m.}}+S(\text{n})$ where $S(\text{n})=7533.80$ 11 (2012Wa38) and $E_{\text{c.m.}}$ deduced from $E_n(\text{lab})$ in 2006MuZX.

 $^{41}\text{K}(\text{d},\text{p}),(\text{d},\text{p}\gamma)$ 1985Kr06,1978Li27

Target ^{41}K $J\pi=3/2^+$.

1985Kr06: (d,p) $E=20$ MeV deuteron beam was produced from the TU Munchen Tandem Accelerator with intensity of 1.5 μA .

Target of a 30 $\mu\text{g}/\text{cm}^2$ 95.8% enriched KF evaporated onto a 3.3 $\mu\text{g}/\text{cm}^2$ carbon backing. Protons were momentum analyzed with a Q3D magnetic spectrometer and detected by a proportional counter in the focal plane, FWHM=4.5–5.5 keV. Measured $\sigma(E_p, \theta)$. Deduced levels.

1978Li27: (d,p) $E=10$ MeV deuteron beam was produced from a tandem Van de Graaff accelerator. A 60 $\mu\text{g}/\text{cm}^2$ thickness target of KI (98% enriched in ^{41}K) evaporated onto a carbon backing. Protons were momentum analyzed with a broad-range magnetic spectrograph and detected in a nuclear emulsion, FWHM=35 keV. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

1972Sp04: (d,p) $E=6$ MeV deuteron beam was produced from the University of Iowa Van de Graaff accelerator. A 800 $\mu\text{g}/\text{cm}^2$ target of KCl (95% enrichment in ^{41}K) evaporated onto a 400 $\mu\text{g}/\text{cm}^2$ gold backing. γ -rays were detected with NaI(Tl) crystals. Measured $(151\gamma)(107\gamma)(\theta)$. Limits on mixing ratios deduced for 107 γ and 151 γ .

1970Fr10: (d,p) $E=3.5, 3.7$ MeV. 1 mg/ cm^2 KI target. Ge(Li) detector. Measured E_γ , $p\gamma$ -coin.

1969Ly02: (d,p) $E=12$ MeV beam from the Heidelberg tandem. Target of KNO_3 on a carbon backing. A broad-range magnetic spectrograph. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$, L and spectroscopic factors from DWBA analysis. The authors report 8 groups up to 1260 keV.

1958MoZZ: $E=6$ MeV. Measured proton spectra.

1950Sa03: $E=3.90$ MeV deuteron was produced from the Yale cyclotron. Natural potassium target (93.3% ^{39}K , 0.01% ^{40}K , and 6.7% ^{41}K). Protons were detected by a proportional counter. Measured proton yields. Deduced levels.

 Cross section data from 1978Li27
 Level $d\sigma/d\Omega$ (max) (mb/sr)

0	0.71
107	0.82
256	0.80
632	0.28
693	1.91
780	0.91
840	0.04 (from 1969Ly02 only)
1249	1.72
1371	0.57
1848	3.28
1926	2.32
2057	1.40
2223	0.87
2354	3.93
2390	4.80
2465	2.64
2544	0.61
2632	4.07
2710	
2749	
2900	
2916	2.22

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$^{41}\text{K}(\text{d,p}),(\text{d,p}\gamma)$ 1985Kr06,1978Li27 (continued)

3004	0.42
3193	0.72
3271	2.16
3355	0.33
3402	2.29
3635	0.97
3766	0.14
3873	0.59
3919	0.21
4002	1.89
4039	1.08
4117	3.41
4407	3.01
4466	1.36
4560	3.10
4791	1.60
4839	1.39

Uncertainty in level energy=15 keV

 ^{42}K Levels

E(level) [†]	L [§]	(2J+1)C ² S [§]	Comments
0.0	3	3.0	(2J+1)C ² S: 1.7 (1969Ly02).
106.77 22	1+3	0.16, 2.7	L: 90% L=3, 10% L=1. (2J+1)C ² S: 0.12, 1.5 (1969Ly02).
258.27 16	3	3.3	J π : 2,3 deduced from (151 γ)(107 γ)(θ) (1972Sp04). (2J+1)C ² S: 1.9 (1969Ly02).
638.6 5	1+3	0.1, 0.2	J π : 3,4 deduced from (151 γ)(107 γ)(θ) (1972Sp04). (2J+1)C ² S: 0.02, 0.18 (1969Ly02).
682.0 4			
699.12 15	3	8.1	L,(2J+1)C ² S: for 693 group in 1978Li27. (2J+1)C ² S: 4.26 (1969Ly02).
783.77 17	1 [#]	0.09 [#]	
841.7 4	1 [#]	0.02 [#]	
1111.0 11			
1144.0 3			
1198.3 3	3&		
1254.71 17	1	0.51	L,(2J+1)C ² S: for 1249 group in 1978Li27. Also L=1 quoted by 1982Ba55 from a priv comm from Summers-Gill (at McMaster). (2J+1)C ² S: 0.4 for 1260 group (1969Ly02).
1266.18 18	1&		
1377.7 4	1	0.20	L,(2J+1)C ² S: for 1371 group in 1978Li27.
1399.0 9			
1407.7 9			
1452.0 3			
1463.1 3			
1489.4 3			
1513.19 20			
1692.1 3			
1723.7 5			
1745.9 6			
1787? 12			E(level): 1776 (1958MoZZ) adjusted to 1787 by 1978En02. This level is considered as uncertain (evaluators) since it is not reported in any other study.
1843.6 3			
1861.89 16	1	0.90	L,(2J+1)C ² S: for 1848 group in 1978Li27.
1913.7 4			
1937.43 16	1	0.77	L,(2J+1)C ² S: for 1926 group in 1978Li27.
1988.14 19			
2052.0 7			
2071.92 15	1	0.38	L,(2J+1)C ² S: for 2057 group in 1978Li27.
2160.7 7			
2186.3 7			
2205.0 4			
2238.60 24	1	0.22	L,(2J+1)C ² S: for 2223 group in 1978Li27.
2250.9 16			

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{d,p}),(\text{d,p}\gamma)$ 1985Kr06,1978Li27 (continued) **^{42}K Levels (continued)**

$E(\text{level})^\dagger$	$L^\S$	$(2J+1)C^2S^\S$	Comments
2366.18 16	1	1.1	$L_{(2J+1)C^2S}$: for 2354 group in 1978Li27.
2388.8 3			
2401.78 16	1	1.3	$L_{(2J+1)C^2S}$: for 2390 group in 1978Li27.
2422.13 19			
2455.4? 6			
2482.15 14	1	0.68	$L_{(2J+1)C^2S}$: for 2465 group in 1978Li27.
2553.65 23	1	0.15	$L_{(2J+1)C^2S}$: for 2544 group in 1978Li27.
2573.8 3			
2607.4 3			
2627.67 22			
2644.22 21	1	1.0	$L_{(2J+1)C^2S}$: for 2632 group in 1978Li27.
2652.69 25			
2718.51 20			
2765.74 18			
2917.0 4			
2923.6 11	1	0.54	$L_{(2J+1)C^2S}$: for 2916 group in 1978Li27.
2938.3 3			
3014.2 3	1@	0.82@	
3021.16 20	1@	0.82@	
3040.4 5			
3193.9 4			
3211.6 3	1	0.17	$L_{(2J+1)C^2S}$: for 3193 group in 1978Li27.
3284.4 5	1	0.50	$L_{(2J+1)C^2S}$: for 3271 group in 1978Li27.
3304.1 6			
3368.7 5			
3418.34 24	1+3	0.50, 0.32	L: 80% L=1, 20% L=3. $L_{(2J+1)C^2S}$: for 3402 group in 1978Li27.
3505.3 4			
3527.9 4			
3620.4 3			
3658.91 23			
3674.3 3			
3696.02 22			
3875.9 10			
3888.63 22	1	0.13	$L_{(2J+1)C^2S}$: for 3873 group in 1978Li27.
3934.0 5			
4013.2 4			
4040.1 4			
4054.2 3	1(+3)	0.20, 0.74	L: indication of =50% L=3. $L_{(2J+1)C^2S}$: for 4039 group in 1978Li27.
4102.4 4			
4128.47 23	1+3	0.68, 0.57	$L_{(2J+1)C^2S}$: for 4117 group in 1978Li27.
4153.0 8			
4179.7 3			
4389.5 5			
4416.67 18	1+3	0.59, 0.41	$L_{(2J+1)C^2S}$: for 4407 group in 1978Li27.
4428.00 21			
4443.3 3			
4480.87 24	1	0.28	$L_{(2J+1)C^2S}$: for 4466 group in 1978Li27.
4556.55 20			
4576.29 20	1	0.63	$L_{(2J+1)C^2S}$: for 4560 group in 1978Li27.
4590.1 4			
4749.0 4			
4776.7 5			
4806.87 17	1	0.32	$L_{(2J+1)C^2S}$: for 4791 group in 1978Li27.
4853.65 16	1	0.27	$L_{(2J+1)C^2S}$: for 4839 group in 1978Li27.
4878.6 3			
4902.1 4			
4942.47 25			
4959.4 5			
4974.1? 6			
5003.10 24			
5061.9 5			

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$^{41}\text{K}(\text{d,p}),(\text{d,p}\gamma)$ 1985Kr06,1978Li27 (continued) **^{42}K Levels (continued)**

$E(\text{level})^\dagger$	$E(\text{level})^\dagger$	$E(\text{level})^\dagger$
5080.1 4	5622.5 3	5809.3 3
5096.9 5	5629.6 6	5819.4 3
5142.9 4	5654.6 3	5847.6 4
5176.3 11	5682.7 3	5871.0? 7
5246.39 19	5699.0 3	5896.4 4
5265.5? 9	5709.4 5	5927.2 5
5318.8 4	5723.5 6	5951.6 13
5363.5 4	5737.5 4	5968.7 5
5380.1 15	5747.7 8	5978.5 4
5477.4 13	5759.75 21	6012.6 5
5484.0 6	5772.4 6	
5555.7 6	5789.40 22	

† From 1985Kr06, uncertainties are statistical only.

§ From 1978Li27, unless otherwise stated.

$^\#$ From 1969Ly02.

$^\textcircled{a}$ For 3014+3021. Energy of this group was 3004 group in 1978Li27.

$^\&$ Quoted by 1982Ba55 (priv comm from Summers-Gill at McMaster).

 $\gamma(^{42}\text{K})$

$E\gamma$	$E(\text{level})$	$I\gamma$
107 ‡	106.77	
151 ‡	258.27	
441.5 † 20	699.12	
532 † 2	638.6	
617 † 2	1254.71	
997 † 2	1254.71	§

† From 1970Fr10.

‡ From 1972Sp04.

§ $I\gamma(997)/I\gamma(617)=1$ (1970Fr10).

 $^{42}\text{Ca}(\text{t},^3\text{He})$ 1985Aj03

Target ^{42}Ca $J\pi=0^+$.

1985Aj03: E=25 MeV triton beam was produced from the Los Alamos three-stage Van de Graaff facility. ^3He particles were analyzed with a Q3D spectrometer and detected by a position-sensitive detector. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from CCBA analysis.

 ^{42}K Levels

$E(\text{level})$	$J\pi^\dagger$	Assumed L-transfer ‡	$E(\text{level})$	$J\pi^\dagger$	Assumed L-transfer ‡
0.0	2-	1+3	1413 10		
109 5	3-	3	1469 § 10		
262 8	4-	3+5	1539 15	3+	2+4
640 $^\&$			1688 15	3	
680? $^\textcircled{a}$			1735 15		
702 8	5-	5	1810 § 20		
780 $^\&$			1860? $^\textcircled{a}$		
841 8			1926 15	3-	3
1107 15			1956 15	(4-)	3+5
1145 10	4+	4	1990? $^\textcircled{a}$		
1201 10	2-, 3-		2067 20	3	
1259 $^\#$ 20	2- $^\textcircled{a}$	1+3 $^\textcircled{a}$	2088 20	2-	1+3
1277 $^\#$ 15	2- $^\textcircled{a}$	1+3 $^\textcircled{a}$	2193 15	3+, 4+	
1380 $^\&$			2219 20	2, 3+	

Continued on next page (footnotes at end of table)

$^{42}\text{Ca}(t, ^3\text{He})$ 1985Aj03 (continued) **^{42}K Levels (continued)**

E(level)	$J\pi^\dagger$	Assumed L-transfer ‡	E(level)	$J\pi^\dagger$	Assumed L-transfer ‡
2268 § 15			3225 § 20		
2328 15			3297 10	1+	0+2
2373 15			3329 10	1+	0+2
2409 15	3+	2+4	3377 10	1+	0+2
2434 15			3425 § 15	2	
2496 15			3503 15		
2570 § 15			3587 15		
2626 15			3628 § 15		
2662 § 15			3666 10		
2750 15			3698 10		
2780 15			3758 10		
2824 15			3793 § 15		
2862 10	1+	0+2	3860 15		
2895 10	3		3887 15		
2955 § 15			4042 § 15		
3032 10	3+	2+4	4121 15		
3056 15			4150 § 15		
3097 § 15	1+	0+2			
3132 § 15					

† From comparison of $\sigma(\theta)$ with theoretical CCBA calculations, using assumed L-transfers. For some of the levels, these assignments differ from those in the Adopted Levels. See Adopted Levels for details.

‡ L-transfer assumed in theoretical CCBA calculations.

§ Unresolved multiplet.

1259 and 1277 are not well resolved.

@ Common value for 1259 and 1277 levels.

& Rounded value from Adopted Levels. Weak group in $(t, ^3\text{He})$.

^a Rounded value from Adopted Levels. Not observed in $(t, ^3\text{He})$, but contribution of weak group is not excluded.

 $^{43}\text{Ca}(d, ^3\text{He})$ 1969Yn01

Target ^{43}Ca $J\pi=7/2^-$.

1969Yn01: E=22 MeV deuteron beam was produced from the Argonne cyclotron. Enriched calcium target (81.1% in ^{43}Ca).

Reaction products were detected with a $\Delta E-E$ telescope of surface-barrier detectors, FWHM=70-130 keV. Measured $\sigma(\theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis.

Other: 1975BrZB (also 1973BrXY).

 ^{42}K Levels

E(level)	L	$C^2S^\dagger$	Comments
0.0	2	0.36	
104 40	2	0.70	
252 40	2	0.92	
630	0		E(level), L: from 1973BrXY.
680 40	2	1.07	E(level), L, C^2S : this level is associated with 699, 5- level in Adopted dataset. May contain contribution from 639, 3- level.
1200 40	0	0.53	E(level): probably a doublet in 1973BrXY.
1460 40	(0)	0.08	
1630 40			
2010 40	0	0.27	
2130 40	0	0.27	
2700 40			L: $\sigma(\theta)$ fitted to L=2 and 0, with L=2 fit somewhat preferred.

† 1990En08 give S-factors ($C^2=1$) which are adjusted upward by $\approx 25\%$ based on standardized normalization factors in 1977En02.

$^{44}\text{Ca}(\text{p}, ^3\text{He})$ 1973Du02

1973Du02: E=56 MeV proton beam produced by the Grenoble variable energy cyclotron with intensities of 100 to 600 nA. Targets of self-supported calcium metal foils of about 1 mg/cm³. Reaction products were detected in a ΔE -E silicon counter telescope, FWHM $\approx$ 150 keV. Measured $\sigma(\theta)$. Deduced levels.

 ^{42}K Levels

E(level) [†]	J π	Comments
0.0 [‡]		
260 [‡]		
700 [‡]		
1200 [‡]		
2400 [‡]		
6450	(0+) [§]	T=3.

[†] Read from figure 5 of 1973Du02. Except for the analog state at 6450, all other peak structures are unresolved multiplets.

[‡] T=2 proposed by 1973Du02 for group of states between ground state and 2400 level.

 $^{44}\text{Ca}(\text{d}, \alpha), (\text{pol d}, \alpha)$ 1977Pa24, 1982Ba55

Target ^{44}Ca J π =0+.

1977Pa24: (d, α) E=11 MeV deuteron beam produced at a tandem Van de Graaff accelerator. Enriched calcium target (98.6% in ^{44}Ca). Reaction products were momentum analyzed with a broad-range magnetic spectrograph of Browne-Buechner type and detected with a nuclear emulsion, FWHM=30 keV. Measured $\sigma(E_{\alpha}, \theta)$. Deduced levels, J π , L from DWBA analysis.

1982Ba55: (pol d, α) E=7-8.25 MeV polarized deuteron beam produced at the Lamb-shift, polarized-ion source and FN tandem accelerator at McMaster University. Target of metallic calcium enriched to 98.5% in ^{44}Ca on thin carbon backings. α -particles were momentum analyzed with an Engel split-pole magnetic spectrograph and detected by a position-sensitive, gas-filled, proportional counter in its focal plane, FWHM=25 keV. Measured $\sigma(E_{\alpha}, \theta)$, T₂₀ at 4°. Deduced levels, J π .

1974Fr10: (d, α) E=80.2 MeV deuteron beam produced at the Orsay synchrocyclotron. α -particles were analyzed with an magnetic spectrometer and detected by a position-sensitive detector. Measured $\sigma(E_{\alpha}, \theta)$. Deduced levels, J π from DWBA analysis for a 1910 group.

1974Le08 (also 1973LeYI): (d, α) E=4.0 MeV deuteron beam produced at the Virginia Polytechnic Institute and State University. Target of CaCO₃ (98.55% in ^{44}Ca). α -particles were detected with silicon surface-barrier detectors, FWHM=30-40 keV. Measured $\sigma(E_{\alpha}, \theta)$. Deduced levels, L-transfers for nine states up to 1260 from DWBA analysis.

 ^{42}K Levels

E(level) [†]	J π [‡]	L [§]	d σ /dW (max) ($\mu\text{b}/\text{sr}$) ^c	Comments
0.0	2-#	1+3	80	L: 40%(L=1)+60%(L=3).
103 15		3	30	
253 15	4-#	3+5	32	L: 80%(L=3)+20%(L=5).
636 25			<2	
682	not 0-#			E(level), J π : from 1982Ba55, level not given in 1977Pa24.
691 15	5-@	5	43	
783& 4	2-#		<2	J π : from 1982Ba55.
839 25	(1-, 3-)@	(1)	7	L: from 1974Le08.
				J π : 1982Ba55 give 3-.
1108 15	3+ #b	4b	160	L: 1 (1974Le08).
1201& 3	4-#	3	75	
1268 15	(2, 4) -#b	3b	80	J π : 1982Ba55 give 2-, probably based on L=1 from 1974Le08.
1403 15	(1, 3) + #	2	30	
1536 15	(3, 5) + #	4	70	
1698 ^a 15			33	
1749 ^a 15			27	
1862	2-#			E(level), J π : from 1982Ba55, level not given in 1977Pa24.
1916 ^a 15		6	31	L: from 1974Fr10 for a 1910 group.
1944 ^a 15				

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$^{44}\text{Ca}(\text{d},\alpha),(\text{pol d},\alpha)$ 1977Pa24,1982Ba55 (continued) **^{42}K Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	L [§]	$d\sigma/dW$ (max) ($\mu\text{b}/\text{sr}$) ^c	Comments
2056& 4	(2,4)-#	3	60	$J\pi, L$: 3+ in Adopted Levels based on γ decays and feeding, and $\pi=\text{unnatural}$ in (pol d, α) (1982Ba55). $J\pi=(2,4)-$ was assigned by 1982Ba55 from $L(\text{d},\alpha)=3$ in 1977Pa24 and unnatural parity state in their work. The 2056-keV peak was weakly populated in the work of 1977Pa24, and in evaluators' opinion $L(\text{d},\alpha)=4$ can also satisfy the angular distribution pattern in 1977Pa24, which can give 3+. Other possibility is that level populated in (d, α) is different from that in (n, γ).
2186& 4	(3,5)+#	4	220	
2314& 4	(3,5)+#	4	30	
2394 15		4	35	
2553 15			32	
2625 15			7	L: 20%(L=1)+80%(L=3).
2664 15			9	
2750 15		(2)	35	
2802 15		(2)	33	
2858 15			37	
3021 15		(3)	37	
3093 15			36	
3217 15		(2)	35	
3303 15		(1+3)	62	
3400 ^a 15		(1)	35	
3502 ^a 15			42	
3543 15				

[†] From 1977Pa24, unless otherwise stated.[‡] From L-transfer and (pol d, α) data. $J\pi=0-,1-,2-$ for L=1; $J\pi=1+,2+,3+$ for L=2; $J\pi=2-,3-,4-$ for L=3; $J\pi=3+,4+,5+$ for L=4; $J\pi=4-,5-,6-$ for L=5; $J\pi=5+,6+,7+$ for L=6; 2- for L=1+3; 4- for L=3+5. Specification of natural or unnatural parity state further limits $J\pi$.[§] From 1977Pa24, unless otherwise stated.# Unnatural-parity state, not including $J\pi=0-$, from (pol d, α) (1982Ba55).@ Natural-parity state, not including $J\pi=0+$, from (pol d, α) (1982Ba55).

& From 1982Ba55.

^a Closely-spaced levels not fully resolved.^b 1 in 1974Le08 gives $J\pi=2-$.^c From 1977Pa24.

Adopted Levels, Gammas

Q(β⁻)=-6426.10 10; S(n)=11480.67 6; S(p)=10276.67 15; Q(α)=-6257.34 25 2012Wa38.
 S(2n)=19843.49 15, S(2p)=18085.29 15 (2012Wa38).
 Identification of stable ⁴²Ca by F.W. Aston, Nature 133, 684 (1934) through mass spectrographic studies.
⁴²Ca(n,n): 1989Ra06: E=thermal. Measured Bragg diffraction patterns, deduced scattering lengths.
⁴²Ca(³He,³He): 1971Ra35: E=13.0 MeV; 1973Mo13: E=28 MeV. Measured σ(θ).
⁴²Ca(⁴⁸Ti,⁴⁸Ti): 1990Vo07, 1988Br02: E=240-725 MeV. Measured σ(θ), DWBA analysis.
 Hyperfine structure and isotope-shift measurements: 2000Mu17, 2015Go24.

 Population of levels in decays/reactions labeled with XREF=Y

⁴²K β⁻ (12.355 h): 0, 1525, 1837, 2424, 2752, 3447
⁴²Sc ε decay (680.79 ms): 0, 1525, 1837
⁴²Sc ε decay (61.7 s): 0, 1525, 2424, 2752, 3189
³⁸Ar(⁶Li,d): 0, 1525, 1837, 2424, 2752, 3300, 3654, 4443, 4448,5866, 6016+6020, 6313+6390, 6516, 6716+6720
⁴⁰Ar(³He,n): 0, 1525, 1837, 2424, 3300(?), 3392, 3654, 9270,10205, 14700
⁴⁰Ca(t,pγ): 0, 1520, 2420, 3890, 5850, 6020, 6520, 6700, 6820
⁴⁰Ca(α,²He): 0, 1530, 2750, 3190, 3660, 4830, 5380, 7280, 8810,9080, 9330, 9600, 9870, 10160
⁴⁰Ca(¹⁴C,¹²C),(¹²C,¹⁰C): 0, 1700, 2800, 3500, 4800
⁴⁰Ca(⁹⁶Zr,⁹⁴Zr): 0, 5866
⁴¹Ca(n,γ) E=thermal: 0, 1524.7, 2424.2, 2752.4, 3253.9, 3446.9,3954.4, 3999.7, 4690.1, 4759.7, 5017.1, 11480.7
⁴²Ca(γ,γ): 0, 1525
⁴²Ca(π⁺,π⁺'),(π⁻,π⁻): 0, 1520, 2420, 3440, 4104, 4680, 6300
⁴²Ca(d,d'): 0, 1524, 1835, 2423, 2749, 3445
⁴²Ca(¹⁶O,¹⁶O'): 0, 1525, 1837, 2424, 2752, 3254, 3447, 4100,4449, 4690, 4971
 Coulomb excitation: 0, 1525
⁴⁵Sc(p,α),(pol p,α): 0, 1525, 1837, 2424, 2752, 3190, 3254, 3954,
 4100, 4117
⁴⁶Ti(d,⁶Li): 0, 1525, 1837
⁹⁶Zr(⁴⁰Ca,⁴²Caγ): 0, 1525, 1837, 2424, 2752, 3189, 3254,
 3447, 3654, 3954, 4443, 4760, 5017, 5866

 Some recent theoretical structure references (levels, B(E2), etc.): 2016Wo02 (shape coexistence), 2012Ca13,
 2012Ca27, 2012Ha26.

⁴²Ca Levels

Cross Reference (XREF) Flags

A ²⁴ Mg(²⁴ Mg,α2pγ)	P ⁴¹ Ca(d,p),(pol d,p)	⁴⁰ Ca(t,pγ)
B ²⁷ Al(¹⁸ O,2npγ)	Q ⁴² Ca(e,e')	⁴⁰ Ca(α, ² He)
C ²⁷ Al(¹⁹ F,αγ)	R ⁴² Ca(p,p'γ)	⁴⁰ Ca(¹⁴ C, ¹² C),(¹² C, ¹⁰ C)...
D ²⁸ Si(¹⁶ O,2pγ)	S ⁴² Ca(p,p')	⁴⁰ Ca(⁹⁶ Zr, ⁹⁴ Zr)
E ³⁰ Si(¹⁸ O,α2nγ)	T ⁴² Ca(α,α')	⁴¹ Ca(n,γ) E=thermal
F ³⁸ Ar(α,γ): Resonances	U ⁴³ Ca(p,d)	⁴² Ca(γ,γ)
G ³⁹ K(α,p)	V ⁴³ Ca(d,t)	⁴² Ca(π ⁺ ,π ⁺ '),(π ⁻ ,π ⁻)
H ³⁹ K(α,pγ)	W ⁴³ Ca(³ He,α)	⁴² Ca(d,d')
I ⁴⁰ Ca(t,p)	X ⁴⁴ Ca(p,t)	⁴² Ca(¹⁶ O, ¹⁶ O')
J ⁴¹ K(p,γ)	Y Others:	Coulomb Excitation
K ⁴¹ K(p,n),(p,p): Resonances	⁴² K β ⁻ Decay (12.355 h)	⁴⁵ Sc(p,α),(pol p,α)
L ⁴¹ K(p,α): Resonances	⁴² Sc ε Decay (680.79 ms)	⁴⁶ Ti(d, ⁶ Li)
M ⁴¹ K(³ He,dγ)	⁴² Sc ε Decay (61.7 s)	⁹⁶ Zr(⁴⁰ Ca, ⁴² Caγ)
N ⁴¹ K(³ He,d)	³⁸ Ar(⁶ Li,d)	
O ⁴¹ Ca(n,α): Resonances	⁴⁰ Ar(³ He,n)	

E(level) [†]	Jπ [§]	XREF	T _{1/2} [‡]	Comments
0.0 ^a	0+	ABC E GHIJ MN PQRSTUWXYZ	stable	The rms charge radius (<r ² > ^{1/2} : 3.5081 fm 21 (2013An02 evaluation). Jπ: L(t,p)=L(p,t)=0 from 0+. Adopted (1977En02) neutron-stripping spectroscopic factor=1.6 2 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.58 6 (L=3). Adopted (1977En02) proton-stripping spectroscopic factor=3.2 4 (L=2).

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF	T _{1/2} [‡]	Comments
1524.71 ^a 3	2+	ABCDE GHIJ N PQRSTUWVXy	0.83 ps 3	<p>μ=+0.08 12 (2003Sc21,2014StZZ). Q=-0.19 8 (1973To07,2014StZZ,2013StZZ). $J\pi$: L(t,p)=L(p,t)=2 from 0+. $T_{1/2}$: weighted average of 0.62 ps 21 (α,pγ), 0.97 ps 22 (γ,γ), 1.11 ps 21 (p,p'γ) and 0.825 ps 28 (coulomb excitation). μ: from transient field integral perturbed angular correlation (2003Sc21). Q: reorientation method (1973To07). Adopted (1977En02) neutron-stripping spectroscopic factor=0.04 2 (L=1), 0.48 12 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.18 3 (L=3), small (L=1). Adopted (1977En02) proton-stripping spectroscopic factor=0.04 3 (L=2). $J\pi$: L(t,p)=L(p,t)=0 from 0+. $T_{1/2}$: from (p,p'γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.18 5 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.05 2 (L=3). Adopted (1977En02) proton-stripping spectroscopic factor=0.3 2 (L=2). $J\pi$: L(t,p)=L(p,t)=2 from 0+. $T_{1/2}$: weighted average of 114 fs 30 (α,pγ) and 210 fs 50 (p,p'γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.56 14 (L=3), small (L=1). Adopted (1977En02) neutron-pickup spectroscopic factor=0.16 7 (L=3), (0.0) (L=1). Adopted (1977En02) proton-stripping spectroscopic factor=0.05 5 (L=2). $J\pi$: L(t,p)=L(p,t)=4 from 0+. $T_{1/2}$: weighted average of 3.5 ps 3 (^{18}O,2npγ), 2.63 ps 28 (^{16}O,2pγ) and 1.6 ps 7 (α,pγ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.03 1 (L=1), 0.86 22 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.59 10 (L=3), 0.01 (L=1). μ=-2.49 9 (1975Yo02,2014StZZ). $J\pi$: L(α,^2He)=L(α,α')=6 from 0+. $T_{1/2}$: weighted average of 5.30 ns 16 (α,pγ) and 5.27 ns 14 (α,α'). μ: DPAD (1975Yo02). Adopted (1977En02) neutron-stripping spectroscopic factor=1.2 3 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.99 18 (L=3) (L=3), 0.01 (L=1).</p>
1837.31 ^b 18	0+	E GHIJ N PQRSTUWVXy	387 ps 6	
2424.15 ^b 4	2+	B E GH J MN PQRSTUWVXy	140 fs 40	
2752.40 ^a 4	4+	ABCDE GHIJ M PQRSTUWVXy	2.8 ps 4	
3189.26 ^a 10	6+	ABCDE GHIJ M P R TUVW Y	5.28 ns 15	

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF		T _{1/2} [‡]	Comments
3253.89 ^b 5	4+	B	E gHIJ P R T V XY	123 fs 21	J π : L(α, α')=L(p,t)=4 from 0+. T _{1/2} : weighted average of 118 fs 21 ($\alpha, p\gamma$) and 210 fs +100-70 (p,p' γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.22 6 (L=3), small (L=1). Adopted (1977En02) neutron-pickup spectroscopic factor=0.08 2 (L=3), 0.00 (L=1).
3300.0 4	0+	gHIJ	N RST V Xy	>0.9 ps	J π : L($^6\text{Li}, d$)=L(p,t)=0 from 0+.
3392.01 24	2+	HIJ	P RST V XY	135 fs 40	J π : L(t,p)=L(α, α')=2 from 0+. T _{1/2} : weighted average of 118 fs 21 in ($\alpha, p\gamma$) and 230 fs 50 in (p,p' γ). Adopted (1977En02) neutron-stripping spectroscopic factor=0.01 1 (L=1), 0.01 1 (L=3). Adopted (1977En02) neutron-pickup spectroscopic factor=0.01 (L=3), 0.01 1 (L=1).
3446.94 ^c 5	3-	B	E GHIJ MN PQRSTUVWXY	0.27 ps 9	B(E3) $\uparrow$ =0.0110 18 (1971He08, 1989It02). B(E3) from (e,e'). J π : L(t,p)=L(p,t)=3 from 0+. T _{1/2} : weighted average of 0.23 ps 7 ($\alpha, p\gamma$) and 0.45 ps 14 (p,p' γ). Adopted (1977En02) neutron-stripping spectroscopic factor=small (L=0 and L=2). Adopted (1977En02) neutron-pickup spectroscopic factor=0.26 17 (L=0), 0.12 3 (L=2). Adopted (1977En02) proton-stripping spectroscopic factor=0.28 4 (L=1+3).
3654.0 3	2+	GHIJ	P RSTUVWXY	49 fs 35	J π : L(t,p)=L(p,t)=2 from 0+. T _{1/2} : from ($\alpha, p\gamma$). Other: 40 fs +60-40 from (p,p' γ). J π : L(p,p')=2 or 3.
3780 10	(2+, 3-)		S		J π : $\Delta J=1$ γ to 0+ and L(α, α')=3, L($^3\text{He}, d$)=1(+3).
3885.0 4	1-	HIJ	N P RST V Y		J π : $\Delta J=1$ γ to 0+ and L(α, α')=3, L($^3\text{He}, d$)=1(+3).
3954.39 ^c 6	4-	B	E GHI MN P RS V Y	3.36 ps 21	J π : $\gamma(\theta, \text{lin pol})$ in ($^{18}\text{O}, \alpha 2n\gamma$) and ($\alpha, p\gamma$); L($^3\text{He}, d$)=3; L($^3\text{He}, \alpha$)=0(+2); $\sigma(\theta)$ and $A_y(\theta)$ in (pol p, α). T _{1/2} : from ($\alpha, p\gamma$). J π : $\gamma(\theta, \text{lin pol})$ in ($^{18}\text{O}, \alpha 2n\gamma$) and gammas to 2+ and 4+.
3999.66 9	4+	E	HIJ P RS Y		J π : L($^3\text{He}, d$)=1+3 from 3/2+, L($^3\text{He}, \alpha$)=0+2; γ to 2+.
4047.0 4	3-	GHIJ	N P RST V	0.17 ps 5	T _{1/2} : from ($\alpha, p\gamma$). J π : L(p,t)=L(p,p')=L(α, α')=5 from 0+; $\sigma(\theta)$ and $A_y(\theta)$ in (pol p, α); also $\gamma(\theta, \text{lin pol})$. T _{1/2} : from ($\alpha, p\gamma$). Adopted (1977En02) neutron-stripping spectroscopic factor=small (L=2). Adopted (1977En02) neutron-pickup spectroscopic factor=0.43 13 (L=2). Adopted (1977En02) proton-stripping spectroscopic factor=0.46 9 (L=3).
4099.65 ^c 11	5-	ABCDE	GHIJ MN pQRSTUVwXY	0.45 ps 10	J π : $\gamma(\theta, \text{lin pol})$ in (p,p' γ); $\sigma(\theta)$ and $A_y(\theta)$ in (pol p, α).
4117.1 3	3-	H J	N p R w Y		J π : $\gamma(\theta, \text{lin pol})$.
4180 2	0		W		J π : γ to 2+.
4232.0 4	1	HIJ	N P RS		
4342.3 6	(0+ to 4+)	g iJ	rs w		

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF				T _{1/2} [‡]	Comments
4354.0 5	4-	gHi	P	rs	Vw	0.47 ps 7	J π : $\gamma(\theta, \text{lin pol})$ in (α, γ); L(d,t)=2. T _{1/2} : from (α, γ).
4418.0 4	3-	GH J	MN	P	UVWX		J π : L(p,t)=3 from 0+; also L(d,p)=0+2 from 7/2-, L($^3\text{He}, d$)=1+3 from 3/2+.
4443.0 6	4+	H		QRST	v Y		XREF: S(4470). J π : L(p,p')=L(α, α')=4 from 0+.
4448.8 4	2+	HI J		p R	v Y		J π : L(t,p)=2 from 0+; gammas to 0+ and 3-.
4505.0 5	(2,3,4)+	HI		P	S		J π : L(d,p)=1+3 from 7/2-; and gammas to 2+ and 4+.
4566.9 5	(1,2+)	HI J		P	S		J π : gammas to 0+ and 2+.
4666 10	(3,4)-	i		P		y	J π : L(d,p)=0+2 from 7/2- this level was not adopted by 1990En08 since the (d,p) cross section is small.
4690.06 10	3-	GH i	N	PQ	TuVwXy		J π : L(t,p)=L(p,t)=3 from 0+.
4717.53 ^b 14	6+	A E Hi	n		y	83 fs 32	J π : $\gamma\gamma(\theta)(\text{DCO})$ and $\gamma(\text{lin pol})$ in ($^{18}\text{O}, \alpha 2n\gamma$). T _{1/2} : from (α, γ).
4717.6 4	3-	i	n	P	S	y	J π : L(p,p')=3 from 0+; L(d,p)=0+2 from 7/2-.
4759.71 16	2+	HI J		P	T	Xy	J π : L(t,p)=L(p,t)=2 from 0+.
4866.0 6	2+	HI J		P	ST	Xy	J π : L(t,p)=L(α, α')=L(p,p')=2; but L($\alpha, ^2\text{He}$)=4.
4897.0 ^c 3	5-	E GH i			uvwXy	47 fs 21	J π : $\gamma(\theta, \text{lin pol})$. T _{1/2} : from (α, γ).
4904.0 5	3-	Hi J	N	P	Tuvw	y	J π : L(α, α')=3. This requires E3 to g.s. E(level): if T _{1/2} <50 fs then E3 50% to g.s. is unlikely. In that case another level of J π =2+ is required.
4946.9 10	(1,2,3)-	Hi	N	P		y	J π : L($^3\text{He}, d$)=1(+3) from 3/2+ and γ to 2+.
4971.0 5	3-	GH i J	N	PQ	ST	Xy	J π : L(p,p')=L(p,t)=3 from 0+.
5017.14 11	4+	HI		P	T V	Xy	J π : L(t,p)=L(p,t)=4 from 0+.
5075.0 8	(1,2,3)-	GHI	N	P			J π : L($^3\text{He}, d$)=1(+3) from 3/2+ and γ to 3-.
5158.0 7	3-	GHI	N		T		J π : L(α, α')=3 from 0+.
5188.0 11	(2,3,4)+	H			Vw		J π : γ to 3-; L(d,t)=3.
5210.3 7	(2+)	Hi j	N	p	T Vwx		J π : γ to 4+. L(t,p)=L(α, α')=2. It is assumed that the level at 5200 5 in (t,p) and 5205 5 in (α, α') is the same as 5210 2 in (α, γ).
5212.98 19	6	E					J π : from $\gamma(\theta, \text{DCO})$ in ($^{18}\text{O}, \alpha 2n\gamma$).
5214.1 6	(2+)	H j		p	wx		J π : gammas to 2+ and 4+; L(p,t)=2. It is assumed that the level at 5213 in (p,t) is the same as this level. See also comment for 5210 level.
5320.0 5	(3,4)-	GHI	N	P RS	UVw Y		XREF: U(5340). J π : L(d,p)=0(+2) and L(d,t)=0+2 from 7/2-.
5345.0 10	0+	H		R	wXY		XREF: X(5332). J π : L(p,t)=0 and γ to 2+.
5358.0 6	2+	HI J		P		X	J π : γ to 0+ and L(d,p)=1 from 7/2-.
5380.0 6	5-	HI			T V	XY	J π : gammas to 4+ and 6+; L(d,t)=2 from 7/2-. Inconsistent with L($\alpha, ^2\text{He}$)=6.
5393.0 7	(3)-	GH i	N	P	t	w	J π : gammas to 2+; L($^3\text{He}, d$)=1(+3) from 3/2+ and L(d,p)=(0+2).
5407 4	3-	i	N	P	t	Vw	J π : L($^3\text{He}, d$)=1+3; L(d,p)=0.
5439.0 10	(3,4)-	Hi		P		V	J π : L(d,p)=L(d,t)=0 from 7/2-.
5466 5	(1 to 5)-	i	N				J π : L($^3\text{He}, d$)=3.
5472.0 6	(2,3,4)+	Hi		P		V X	J π : γ to 2+; L(d,p)=L(d,t)=1 from 7/2-; L(p,t)=(4) favors 4+.

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF				T _{1/2} [‡]	Comments
5490.77 ^c 13	6-	ABCDE	GH		v x	59 fs 14	J π : from $\gamma(0, \text{lin pol, DCO})$. T _{1/2} : from $(\alpha, p\gamma)$.
5491.0 8	3-		H N		T v x		J π : L(α, α')=3. But inconsistent with L(d,t)=3(+1) for a level at 5488.5.
5510.0 8	3-		Hi N Q		T Y		XREF: T(5527). J π : L(e,e')=L(α, α')=3.
5530.0 7	2+		Hi P		X		J π : L(p,t)=2 and L(d,p)=1.
5578.0 11	(0+ to 4+)		HI				J π : γ to 2+.
5593.0 5	3-	GHI	J N		T V x		J π : L($^3\text{He}, d$)=1+3 from 3/2+; L(d,t)=0+2 from 7/2-.
5601.0 8	(3-, 4-)		Hi		Wx		J π : L($^3\text{He}, \alpha$)=(0+2) from 7/2-. It is assumed that the level at 5610.20 in ($^3\text{He}, \alpha$) is the same as the level at 5601.2 in ($\alpha, p\gamma$).
5624.0 7	3-		GHI N P		T		J π : L($^3\text{He}, d$)=1(+3) from 3/2+; L(d,p)=0(+2) from 7/2-.
5665.0 6	(3-)		gHi n q		T w		J π : L(α, α')=L(p,t)=3. It is assumed that the level at 5665.2 in ($\alpha, p\gamma$) is the same as 5667.5 in (α, α') and 5664 in (p,t).
5670.0 7	(3-)		gHi P q		w		J π : gammas to 2+ and 3-; L(d,p)=0+2. It is assumed that the level at 5670.2 in ($\alpha, p\gamma$) is the same as 5669.10 in (d,p).
5691.77 17	6+	E	Hi P		T w		J π : $\gamma(0, \text{DCO})$ in ($^{18}\text{O}, \alpha 2n\gamma$); gammas to 4+ and 6+. But L(α, α')=(4,5) gives (4+, 5-).
5716.0 10	2+		Hi n		t X		J π : L(p,t)=2.
5725.0 10	(2+ to 6+)		Hi n		t		J π : γ to 4+.
5738.0 5	(2+)		J S				J π : gammas to 0+ and 2+; L(p,p')=2,3.
5744.01 ^c 11	7-	ABCDE	GHI			0.42 ps 10	J π : $\Delta J=2$ γ to 5-; γ to 6+ from $\gamma(0, \text{lin pol, DCO})$. T _{1/2} : from $(\alpha, p\gamma)$. Other: 10.5 ps 10 is reported in ($^{16}\text{O}, 2p\gamma$) using RDM. It may suggest two closely spaced levels.
5769.0 7	3-		Hi		Vwx		J π : gammas to 2+ and 4+; L(d,t)=2 from 7/2-.
5774.9 7	(4, 5)+		Hi P		wx		J π : gammas to 4+ and 6+; L(d,p)=1 from 7/2-.
5797.0 6	(1, 2)+		HI p		V Y		XREF: I(5790). J π : gammas to 0+ and 2+; L(d,t)=3 from 7/2-.
5802.0 10	3-	GH	N pQ		STUVWxY		XREF: G(5791)N(5795)T(5794)U(5790)W(5790). J π : L(α, α')=3.
5822.0 10	(1, 2, 3)-		H N		x		J π : γ to 2+; L($^3\text{He}, d$)=1 from 3/2+.
5860 10	0+		I				J π : L(t,p)=0.
5866.0 8	(1, 2, 3-)		gH		Y		J π : gammas to 0+ and 2+. If this level is the same as 5860 in (t,p) with L=0, then placement of 4028.5 γ is incorrect as it would be E0.
5875.0 7	2+		gH N		T		J π : L(α, α')=2.
5924.0 5	(3, 4)-		GHI N P		t V Y		XREF: I(5920). J π : gammas to 4+, 4- and 5-; L(d,p)=0+2 from 7/2-.
5925.5 3	(5)	E	HI		st V Y		XREF: I(5920). J π : $\Delta J=1$, γ to 6+ from DCO in ($^{18}\text{O}, \alpha 2n\gamma$); γ from 4+.
5956 10	(3, 4)-			P			J π : L(d,p)=0+2 from 7/2-.
5980 5	3-		I N		UV Y		XREF: I(5980). J π : L($^3\text{He}, d$)=1 from 3/2+; L(d,t)=0(+2) from 7/2-.

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF				T _{1/2} [‡]	Comments
5994.0 8	3-	HI	P	UV	Y		XREF: I(5980). J π : γ to 2+; L(d,p)=0+2; L(d,t)=0+(2) from 7/2-.
6003.0 10	3-, 4-	HI	p	UV	Y		XREF: I(5980). J π : L(d,p)=0+2 from 7/2-.
6016 5	0+	I	n	T	y		J π : L(t,p)=0. L(α , α')=2 is inconsistent.
6020.0 7	(4+, 5, 6-)	H	n		y		J π : gammas to 4- and 6+; 5- or 6- are supported by 11/2- transfer in (α ,p) from 3/2+.
6028.0 6	(3)-	H	P	tuvw			J π : L(d,p)=0+2 from 7/2-; γ to 2+.
6038.0 7	(1, 2, 3)-	H	N	T v	Y		XREF: Y(6020). J π : L(^3He ,d)=(1+3) from 3/2+; L(d,t)=2(+0) from 7/2-; γ to 2+.
6080	0+				X		J π : L(p,t)=0.
6093.5 8	(3- to 7-)	H	n q	v			J π : γ to 5-.
6104.0 7	(0+ to 4+)	H	n q	v			J π : γ to 2+.
6113.0 8	4+	GHI	PQ	T V	Y		XREF: G(6096)I(6105). J π : L(t,p)=4.
6140.8 6	6-	gHi	p			49 fs +21-14	J π : $\gamma(0)$ to 6- in (α ,p γ); γ to 4-, 5-.
6144.72 ^c 14	7-	ABCDE	gHI	p		<70 fs	T _{1/2} : from (α ,p γ). J π : from $\gamma(0)$, lin pol, DCO).
6158 5	3-	i	N P	T V			T _{1/2} : from (α ,p γ). J π : L(α , α')=3.
6182.0 7	(1, 2, 3-)	Hi	N	T			J π : E=6182 γ to 0+.
6212.0 10	3-	Hi	P S	Vw			J π : L(d,p)=0+2 from 7/2-; L(p,p')=2 or 3 from 0+.
6240 5	3-		N P	T V			J π : L(α , α')=3.
6247.9 6	(4+, 5, 6-)	H					J π : gammas to 4- and 6+.
6274 7	2+	I	P				J π : L(t,p)=2.
6313 7	(2 to 5)+	G I	P	T VW	y		XREF: I(6290). J π : L(d,p)=1 and Ay(0).
6390 10	(3, 4)-	I	P RST	y			XREF: I(6400)Y(6300). J π : L(d,p)=0 from 7/2-; L(π^+ , π^+)=(3).
6408.57 ^c 12	8-	ABCDE	GH		w	31.0 ps 25	J π : $\Delta J=2$ E2 γ to 6-; $\Delta J=1$ γ to 7- from $\gamma(0)$, lin pol, DCO). T _{1/2} : from (^{16}O , 2p γ). J π : L(d,p)=1 from 7/2-.
6426 10	(2 to 5)+	i	P	w			J π : L(d,p)=0+2 from 7/2-.
6462 10	(3, 4)-	i	P				J π : L(d,p)=1 from 7/2-.
6516.0 6		I	P	TU W Y			J π : L(p,d)=0+2 from 7/2- is incompatible. L(t,p)=(0) suggests (0+) and L(^3He , α)=(4) suggests (4+).
6541.8 6	5+	H	P				J π : gammas to 5-, 6+, and 6-; L(d,p)=1 from 7/2-.
6553.72 ^c 12	9-	ABCDE	GH			42 ps 3	J π : $\Delta J=2$ E2 γ to 7-; $\Delta J=1$ γ to 8- from $\gamma(0)$, lin pol, DCO).
6572 15	(2 to 5)+	i	P	w			J π : L(d,p)=1 from 7/2-.
6584.7 8	(5- to 8-)	GHi		w			J π : gammas to 7- and 6-.
6614 15	(3, 4)+	i	P	T			J π : L(d,p)=1 and analyzing power in (d,p).
6636.30 ^b 15	8+	E HI	P RST	W Y		36 fs 15	XREF: I(6640)P(6653)W(6660). J π : from $\gamma(0)$, DCO) in (^{18}O , α 2n γ). T _{1/2} : from (α ,p γ). XREF: P(6670)W(6660). J π : γ to 6+.
6674.8 10	(4+ to 8+)	H	P	T W Y			J π : γ to 6+; γ to (2+); L(d,p)=(1+3) from 7/2-.
6715.9 7	(4+)	H	P	y			J π : $\Delta J=1$ γ to 6+ from $\gamma(0)$, DCO) in (^{18}O , α 2n γ).
6718.14 17	7	E					XREF: Y(?). J π : L(t,p)=0.
6720 8	0+	I		y			

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF				T _{1/2} [‡]	Comments	
6746.5 8	4+	GHI	P	T	XY		XREF: P(6760). J π : L(d,p)=1 from 7/2-; J _n =1/2+3/2 in (pol d,p); γ transitions to 5- in (α , γ). But 3/2+ transfer in (α ,p) from 3/2+ favors 3+.	
6781 7		G I	P	TU	W		XREF: I(6800).	
6816.8 10	(4,5)+	HI	P		Y		J π : γ to 6+; L(d,p)=1 from 7/2-.	
6895.8 6	4+	HI	P				J π : gammas to 3- and 6+; L(d,p)=1 from 7/2-.	
6920 4	(3,4)+	I	P				J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p).	
6931 7	(2,3)+	G I	P	ST	V		XREF: I(6940). J π : 3/2+ transfer in (α ,p) from 3/2+ and L(d,p)=1+3 from 7/2-.	
6940.2 6	(5-,6,7-)	Hi			t		J π : gammas to 5- and 7-.	
6961 15	(3,4)+		P				J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p).	
6975.5 5	(5+)	GH	P				J π : gammas to 5-, 6+, and 6-; 13/2+ transfer in (α ,p) from 3/2+.	
7020 12	4+	G I	PQ	s	w	Y	XREF: I(7010). J π : 11/2+ transfer in (α ,p) from 3/2+; L(d,p)=1+3 from 7/2-; J _n =1/2+5/2 in (pol d,p).	
7041 15	(3-,4-)		P	s	w		J π : L(d,p)=(0+2) from 7/2-.	
7103 7	(1 to 4)-	G I	Q		Y		XREF: I(7110). J π : 5/2- transfer in (α ,p) from 3/2+.	
7129.9 10	4+	Hi	P				J π : L(d,p)=1 from 7/2-; J _n =1/2+3/2 in (pol d,p); γ to 6+.	
7153 7	(3,4)+	G i	P				J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p); 11/2+ transfer in (α ,p) favors 4+.	
7180 20	2+	I					J π : L(t,p)=2.	
7197.9 10		H	P				J π : γ to 6+, but L(d,p)=(0+2) from 7/2- suggests (3-,4-).	
7228 7	(3-,4-)	G	P				J π : 5/2- transfer in (α ,p) from 3/2+ gives (1 to 4)(-) and L(d,p)=(0+2) from 7/2- gives (3-,4-).	
7273 7	(3,4)+	G I	P		Y		XREF: I(7257). J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p); 3/2+ transfer in (α ,p) from 3/2+ favors 3+.	
7282.02 14	9-	A E HI		U	Y		XREF: I(7280). J π : gammas to 8- and 9-; γ (θ ,DCO) in ($^{18}\text{O},\alpha 2n\gamma$). But L(α , ^2He)=(5,6,7) suggest (7-).	
7344.7 10	(6- to 10-)	G I		R	Y		XREF: I(7320). J π : γ to 8-.	
7348 15	(3,4)+		P				J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p).	
7360.6 10	(5- to 9-)	H					J π : γ to 7-.	
7368.46 ^c 15	10-	ABCDE H				1.9 ps 8	J π : from γ (θ ,lin pol,DCO). T _{1/2} : weighted average of 2.6 ps 11 in ($^{18}\text{O},2n\gamma$) and 1.5 ps 8 in ($^{16}\text{O},2p\gamma$).	
7388.8 10	4+	HI	PQ	S	Y		XREF: P(7401). J π : γ to 6+; L(d,p)=1 from 7/2-; J _n =1/2+3/2 in (pol d,p).	
7415.87 15	8+	E H	P	S	w	Y	XREF: P(7422). J π : from γ (θ ,DCO) in ($^{18}\text{O},\alpha 2n\gamma$); γ to 6+.	
7421.2 8	(4+ to 8+)	H	P	RS	U	w	Y	XREF: P(7438). J π : γ to 6+.
7468 15	(2 to 5)(+)		P				J π : L(d,p)=(1+3) from 7/2-.	

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF		T _{1/2} [‡]	Comments
7520 15	(3,4)+		P		J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p).
7543.1 6	(4+ to 7-)	H		w	J π : gammas to 5- and 6+.
7562.5 10	(4+,5+)	H	PQ	w Y	XREF: P(7571).
7600 15	(2+ to 5+)		P		J π : γ to 6+; L(d,p)=(1) from 7/2-.
7634.03 23	(6,8+)	E H			J π : L(d,p)=(1+3) from 7/2-.
7643 15	3+,4+		P		J π : γ to 6+; $\gamma(\theta,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
7696.8 10	4+	H	P		J π : L(d,p)=1 from 7/2-; J _n =1/2+3/2 in (pol d,p).
7726.5 10	(4+ to 8+)	H			J π : L(d,p)=1 from 7/2-; J _n =1/2+3/2 in (pol d,p); γ to 6+.
7750.66 17	(11)-	CD		<2.1 ps	J π : γ to 6+.
7758.0 6	(6-,7-)	H			J π : $\Delta J=1$ γ to 10-; $\gamma(\text{lin pol})$.
7760 15	(3,4)+		P		T _{1/2} : from ($^{16}\text{O},2p\gamma$).
7793 15	(3,4)+		P		J π : gammas to 5-, 6-, 7- and 8-.
7800.7 10	(5- to 9-)	H			J π : L(d,p)=1 from 7/2-; J _n =1/2 in (pol d,p).
7838.9 12	(2+ to 6+)	H			J π : γ to 7-.
7921.2 8	(4+ to 8+)	H			J π : γ to (4+).
7939.8 8	(4+ to 8+)	H			J π : γ to 6+.
8052.6 10	(4+ to 8+)	H			J π : gammas to 6+.
8059.7 8	(6- to 9-)	H			J π : γ to 6+.
8082.7 10	(7- to 11-)	H			J π : gammas to 7- and 8-.
8103.2 8	(4+ to 8+)	H			J π : γ to 9-.
8170 20			W		J π : gammas to 6+.
8297.46 ^c 15	11-	ABCDE H	TU W Y	<1.7 ps	XREF: W(8260).
					J π : $\Delta J=1$ M1 γ to 10-; γ to 9-;
					$\gamma(\theta,\text{pol},\text{DCO})$.
8364.8 8	(6-,7,8+)	H	R U W		T _{1/2} : from ($^{18}\text{O},2np\gamma$).
					XREF: W(8330).
8449.7 6	(7,8)-	H	Q S U W		J π : gammas to 6+ and 8-.
					XREF: W(8410).
8450	0+			X	J π : gammas to 6- and 9-.
8511.7 8	(6- to 9-)		U Y		J π : L(p,t)=0 from 0+.
					XREF: Y(8520).
8517.0 11	(3 to 9)	H	U W Y		J π : gammas to 7- and 8-.
					XREF: W(8520).
8522.3 3	(10)	C	U W Y		J π : γ to (5,7).
					XREF: W(8520).
8580.9 12	(2+ to 6+)	H	TU W		J π : $\Delta J=1$ γ to (11)-; $\gamma(\theta)$ in ($^{19}\text{F},\alpha\gamma$).
					XREF: W(8600).
8611.9 12	(2+ to 6+)	H	TU W		J π : γ to (4+).
					XREF: W(8600).
8615.13 15	9	E			J π : γ to (4+).
8722.30 15	9	E			J π : from $\gamma(\theta,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
8744.9 11	(8- to 12-)	H			J π : from $\gamma(\theta,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
8773.7 8	(5,6,7)	H	Q U Y		J π : γ to 10-.
					XREF: Y(8810).
8847.97 ^b 20	(10+)	E H	Q U W Y		J π : gammas to 6- and 6+.
					XREF: Y(8810).
					J π : gammas to 8+; $\gamma(\theta,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
8951.3 11	(6+ to 10+)	H			J π : γ to 8+.
9015.01 14	10+	A E			J π : from $\gamma(\theta,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$);
					gammas to 8+, 9- and 11-.
9036.9 11	(8- to 12-)	H	UV Y		XREF: Y(9080).
					J π : γ to 10-.
9115 5		F			
9191 5		F			

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF			Comments
9205.9 8	(7- to 9-)	H	UV	Y	XREF: Y(9080). J π : gammas to 7- and 9-.
9241.9? 9		E		Y	J π : from $\gamma(0,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
9270					
9280 5	1-#	F			
9311.08 16	(8, 10+)	E			J π : $\Delta J=(0,2)$ γ to (6,8+); γ to 8+; $\gamma(0,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$).
9330 50				Y	
9367 5		F			
9377.7 10	(5- to 9-)	H			J π : γ to 7-.
9426 5		F			
9470 5		F			
9561 5		F			
9600 50	(5-, 6+)			Y	J π : L($\alpha,^2\text{He}$)=(5,6).
9635 5		F			
9672 5		F			
9699 5		F			
9723 5		F			
9750 10	(2-)		M Q S UVW	Y	XREF: W(9740). T=2. J π : M2 excitation in (e,e'); g.s. analog of ^{42}Ca .
9757 5		F			
9759.7 10	(7- to 11-)	H			J π : γ to 9-.
9770	(2+)		Q		J π : E2 excitation in (e,e').
9784 5		F			
9786.29 14	(9-, 11)	A E			J π : from $\gamma(0,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$); gammas to 9, 10+, 10- and 11-.
9841.6 10	(5, 6)-	H		UVW Y	XREF: Y(9870). J π : γ to 7-; L(p,d)=L($^3\text{He},\alpha$)=2 from 7/2-.
9850 10	(3-)		M	X	T=2. J π : possible IAS of ^{42}Ca at 107 keV.
9947 5		F			
10000 10	(4)-		M	u w	T=2. J π : possible IAS of ^{42}Ca at 258 keV; L($^3\text{He},d$)=3 from 3/2+.
10035.6 10	(5- to 9-)	H		u w	J π : γ to 7-.
10038 5		F			
10160 50				Y	
10168.69 16	(10, 12+)	A E			J π : from $\gamma(0,\text{DCO})$ in ($^{18}\text{O},\alpha 2n\gamma$); gammas to 10+ and 11-.
10205 5		F		Y	
10231 5		F			
10282 5	1-#	F			
10314 5		F			
10358 5	1-#	F			
10389 5		F			
10450.0 10	(5)-		M QRS U W		XREF: U(10430)W(10430). T=2. J π : possible IAS of ^{42}Ca at 699. L($^3\text{He},d$)=3 from 3/2+.
10453 5		F			
10500 5	1-#	F			
10510 20				W	T=2.
10527 5		F			
10561 5		F			
10588 5		F			
10610 20				W	T=2.
10612 5		F			
10633 5		F			
10652 5		F			
10673 5	1-#	F			
10700 5	#	F			
10726 5	1-#	F			
10783 5	1-#	F			
10805 5	1-#	F			

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	$J\pi^{\S}$	XREF		Comments
10842 5	1-#	F		
10884 5	1-#	F		
10905 5	1-#	F		
10916 5	1-#	F		
10968 5		F		
10970 20	3-		U WX	T=2. J π : L(p,t)=3 from 0+ and L(p,d)=0 from 7/2-.
10985 5		F		
11013 5	1-#	F		
11048 5		F		
11076 5	1-#	F		
11108 5	1-#	F		
11149 5	1-#	F		
11165.7 9	(10, 12)	E		J π : $\gamma(\theta, \text{DCO})$ in ($^{18}\text{O}, \alpha 2n\gamma$).
11185 5	1-#	F		
11223 5	1-#	F		
11235 5	(1+)		Q	T=2. J π : M1 excitation in (e,e').
11279 5		F		
11303.7 10		F J		
11309.5 10		J		
11319.3 10		J		
11326.1 10		J		
11331.0 10		J		
11335.9 10	1-#	F J		
11343.7 10		J		
11361.3 7	(1, 2+)	J		J π : $\gamma(\theta)$ in (p, γ).
11363.2 10		J		
11380.8 10	1-#	F J		
11398.4 10		J		
11401.3 10		F J		
11405.1 ^b 11	(12+)	E		J π : $\gamma(\theta, \text{DCO})$ in ($^{18}\text{O}, \alpha 2n\gamma$).
11409.1 10		J		
11412.0 10		J		
11416.9 10		J		
11426.0 10		J L		
11429.6 15	(0+, 1-, 2+) [@]	L		
11432.3 10		J L		
11436.1 10	(1-, 2+) [@]	J L		
11439.7 10	1-#	F J L		
11440 20	3-, 4-		U WX	T=2. J π : L(p,d)=L($^3\text{He}, \alpha$)=0 from 7/2-.
11445.6 10		J L		
11447.7 15	(0+, 1-, 2+) [@]	L		
11449.0 15		L		
11450.5 15		L		
11453.1 15		L		
11464.7 15		L		
11468.1 15		L		
11469.3 15	(1-, 2+) [@]	L		
11473.5 15	(1-, 2+) [@]	L		
11475.8 15		L		
11477.7 15		L		
(11480.64 7)	3-, 4-		Y	J π : s-wave capture in ^{41}Ca g.s. (J π =7/2-).
11481.77 9		O		
11485.20 6	(2+) [@]	L O		
11486.86 6		O		
11488.7 15	1-#	F L		
11490.40 9		L O		
11493.6 15		L		
11495.41 6		O		
11499.0 1		L O		
11500.20 6		L O		

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
11503.70 11		L O	
11507.10 15	(0+, 1-, 2+) @	L O	
11508.8 15		L	
11510.34 16	(1-) @	L O	
11512.5 15		L	
11514.36 15		O	
11516.6 15	(1-) @	L	
11519.5 3		F L O	
11523.3 15	(1-, 2+) @	L O	
11525.4 15		L	
11527.4 15	(1-, 2+) @	L	
11529.3 15	(0+, 1-, 2+) @	L	
11530.7 3		L O	
11532.6 15		L	
11537.12 25		O	
11540.0 15	(1-) @	L	
11542.3 15	(0+, 1-, 2+) @	L	
11543.6 15		L	
11544.4 15	1- #	F L	
11550.0 15	(0+, 1-, 2+) @	L	
11551.5 15		L	
11555.4 15	(1-) @	L	
11556.3 15		L	
11558.1 15		L	
11562.8 15		L	
11569.2 15	1- @	L	
11571.7 15	(0+, 1-, 2+) @	L	
11572.8 15	(1-, 3-, 4+) @	L	
11575.2 15	(3-, 4+) @	L	
11576.2 15		L	
11589.8 15	(1-) @	L	
11591.1 15		L	
11592.6 15		L	
11594.6 15		L	
11596.7 15	1- @	L	
11599.4 15	(1-, 2+) @	L	
11601.8 15	1- @	L	
11603.5 15		L	
11612.5 15	1- @	F KL	
11614.0 15		L	
11616.0 15	1- @	L	
11621.0 15	(1-, 2+) @	L	
11632.8 15		L	
11634.5 15	(1-, 2+) @	L	
11636.1 15	(1-, 2+) @	L	
11637.4 15	(1-, 2+) @	L	
11639.4 15	1- @	KL	
11641.1 15		L	E(level): possible analog of 1927 level in ^{42}Ca .
11643.5 15		L	
11644.1 4	(1-, 2+) @	JKL	
11646.2 15	(4+) @	L	
11651.2 15	(1-, 2+) @	J L	
11653.4 15		JKL	
11654.2 15	(1-) @	L	
11656.8 15	(1-) @	L	
11658		JK	
11662.2 15	(1-, 2+) @	F JKL	
11664.9 15		L	
11670.9 4	2+ @	JKL	
11674.0 5	(1-, 2+) &	JK	
11680		J	
11685		JK	
11689.2 15	(1-, 2+) @	L	

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
11693.0 4	(1-, 2+)&	JK	
11695.0 15	(3-)@	L	
11697.3 15		J L	
11699.7 15		J L	
11707.5 4	2+@	J L	
11709.2 15	(1-, 2+)@	JKL	
11710.1 15		JKL	
11718.3 15		JKL	
11725.7 9	(8- to 11)	E	J π : γ to 9 and 10-.
11727.1 3	2+@	JKL	
11728.2 15		L	
11729.3 15		L	
11733.0 15		JKL	
11737.4 15	(0+, 1-, 2+)@	L	
11738.4 4	1-@	JKL	
11743.4 5	(1-, 2+)&	JKL	
11748.0 15		L	
11752.3 15		JKL	
11756.6 15	(1-)@	JKL	
11758		J	
11760		JK	
11763		JK	
11768		JK	
11772.7 15	(1-, 2+)@	J L	
11775.0 4	(1-, 2+)&	JK	
11777.2 15		L	
11778.5 15	(0+, 1-, 2+)@	JKL	
11783.0 15	(1-, 2+)@	L	
11784.7 15	(1-), 2+@	L	
11786.1 15		JKL	
11787.5 15		L	
11789.8 15		L	
11792		J	
11795.2 4	(1-, 2+)&	J L	
11798.3 15	(1-, 2+)@	JKL	
11805.4 4	(1-, 2+)@	JKL	
11809.7 15	(1-, 2+)@	JKL	
11811.1 15	(1-, 2+)@	L	
11814		JK	
11818.0 15		L	
11821.1 4		E	
11822.4 4	(1-)@	JKL	
11824.0 15	(1-, 2+)@	L	
11829.0 15	(1-, 2+)@	JKL	
11830.2 15	(2+)@	L	
11831.8 15		JKL	
11836.4 15	(4+)@	JKL	
11843.3 5	(1-, 2+)@	JKL	
11844.9 15	(1-, 2+)@	L	
11846.8 15		L	
11850		JK	
11852.6 15	1-@	JKL	
11856.4 15		JKL	
11865.6 15	(0+, 1-, 2+)@	KL	
11868.0 4	(1-, 2+)&	JK	
11871.5 4	(1-, 2+)&	JKL	
11872.8 15		L	
11873.7 4	(1-, 2+)&	JKL	
11881		JK	
11885.2 15	(1-, 2+, 3-)@	JKL	
11887		JK	
11895.3 15	(1-, 2+)@	JKL	
11902.0 15	(1-, 2+)@	JKL	

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Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
11906.3 15	(1-, 3-) [@]	JKL	
11910.6 15	(1-, 2+) [@]	JKL	
11916		JK	
11921		JK	
11923.3 15	(1-, 2+) [@]	L	
11925.6 5	(1-, 2+) ^{&}	JKL	
11929		K	
11933.1 15	(1-, 2+) [@]	KL	
11937		JK	
11941.9 15	2+ [@]	L	
11944.4 15	1- [@]	J L	
11950.1 15		JKL	
11953		JK	
11959.2 5	(1-)	J L	
11962.8 15	(1-, 2+) [@]	JKL	
11967		JK	
11970.2 15	1- [@]	KL	
11976.8 15	(2+) [@]	L	
11980.3 4	1- [@]	JKL	
11989.0 15	(2+, 3-) [@]	L	
11992.1 15	(1-, 2+) [@]	L	
12000.2 15	2+ [@]	L	
12005.0 15	(1-, 2+) [@]	L	
12006.3 15		L	
12012.0 15	(2+) [@]	L	
12013.6 15		L	
12020.4 15	(1-, 2+) [@]	L	
12029.5 15	(0+, 1-, 2+) [@]	L	
12032.5 15	(3-) [@]	L	
12039.8 15	1- [@]	L	
12041.8 15		L	
12042.8 15		L	
12050.9 15	(1-, 2+) [@]	L	
12052.0 15		L	
12061.8 15		L	
12066.2 15	(1-, 2+) [@]	L	
12070.1 15	(2+) [@]	L	
12071.4 15		L	
12082.8 15		L	
12085.2 15		L	
12091.9 15		L	
12099		L	
12101.3 15	1- [@]	JKL	E(level): possible analog of 2356 level in ^{42}Ca .
12105.1 15		J L	
12109		JK	
12112.2 15	1- [@]	JKL	
12116.5 15	(2+) [@]	KL	
12123.8 15	(1-, 2+) [@]	JKL	
12127.6 15		JKL	
12130		J	
12135.2 15		JKL	
12137.9 15		L	
12142		JK	
12144.7 15		JKL	
12146.8 15		L	
12148.5 15		J L	
12153.7 15	2+ [@]	JKL	
12156		J	
12158.6 15	1- [@]	KL	
12160		JK	
12163.1 15	1- [@]	JKL	
12168.3	(1-) [@]	JKL	
12172.0 5	(1, 2+) ^{&}	JK	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
12175.7 15	1-@	KL	
12180		JK	
12182.8 15	1-@	KL	
12185		JK	
12187.7 15		JKL	
12198		JK	
12198.1 11		E	
12203.0 15	(1-, 3-)@	JKL	
12204.1 15		JKL	
12207.9 15	(0+, 1-, 2+)@	JKL	
12210.4 15		L	
12212.2 15		JKL	
12216		JK	
12221.0 15		L	
12222.7 15		J L	
12226.3 15		JKL	
12230.5 15	(1-, 2+, 3-)@	JKL	
12236		JK	
12238.4 15	(1-, 3-)@	JKL	
12239.4 15		J L	
12246.4 15	(1-, 2+)@	L	
12247.6 15		L	
12251.8 15	(1-)@	L	
12255		JK	
12260.2 15	(2+, 3-)@	L	
12263		JK	
12265.2 15	1-@	L	
12268.1 15	3-@	L	
12270		JK	
12271.8 15	(1-, 2+)@	L	
12277.2 15	(0+, 1-, 2+, 3-, 4+)@	JKL	
12278.7 15		JKL	
12280	0+	J	X J π : L(p,t)=0 from 0+.
12285.7 15	(1-, 2+)@	J L	
12287.7 15		JKL	
12291.3 15		JKL	
12294.9 15		L	
12298.6 15	(1-, 2+, 3-)@	JKL	
12300.6 15		JKL	
12304.9 15		JKL	
12308.2 15		KL	
12310.9 15		JKL	
12314		JK	
12316		J	
12320.6 15	(0+, 1-, 2+)@	L	
12323.2 15	(1-, 2+)@	JKL	
12327.0 15		JKL	
12330		JK	
12336		JKL	
12340		KL	
12344		JK	
12348		JKL	
12351		JKL	
12358		J L	
12362		JKL	
12369		JKL	
12374		JKL	
12377		L	
12381		JKL	
12383		L	
12386		JKL	
12390		J	
12397		J L	

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Adopted Levels, Gammas (continued)
⁴²Ca Levels (continued)

E(level) [†]	Jπ [§]	XREF	Comments
12701.4 4		E	
12814.7 8		E	
13712.8 11		E	
13762.8 13		E	
14700 50	0+	Y	Jπ: L(³ He,n)=0.
15251.7 13		E	
17.4×10 ³ 1	1-	J	Γ=3.3 MeV 5 (1973Di03).
			Jπ: GDR, T=1 (p,γ).
20.4×10 ³ 1	1-	J	Γ=4.4 MeV 1 (1973Di03).
			Jπ: GDR, T=2 (p,γ).

[†] From least-squares adjustment to measured E_γ data when such data are available. Otherwise weighted averages of available level energies from different reactions are taken.

[‡] Primarily from (α,pγ) and (p,p'γ) by Doppler Shift Attenuation Method (DSAM) or Recoil Distance Method (RDM), unless otherwise noted.

[§] When L-transfer arguments are used, the target spin-parity is Jπ=3/2+ for ⁴¹K; Jπ=0+ for ⁴⁰Ca, ⁴²Ca and ⁴⁴Ca; Jπ=7/2- for ⁴³Ca. When assigning Jπ to a level based on γ transitions from this level to a level of known Jπ, evaluators use the following rules: if E_γ<4 MeV, transitions are considered to be E1, M1 or E2; if E_γ>4 MeV, M2 and E3 are also considered as possible.

From angular distributions of the ground-state γ-rays from resonant states in (α,γ).

@ From comparison of experimental data of angular distributions with theoretical predictions in (p,α):resonance.

& From γ(θ) and analysis of proton-resonance data in (p,γ).

a (A): g.s., Yrast band.

b (B): Excited 0+ band.

c (C): Negative-parity structure.

^γ(⁴²Ca)

E(level)	E _γ [†]	I _γ [†]	Mult. [‡]	δ [‡]	α	I(γ+ce)	Comments
1524.71	1524.67 3	100	E2				B(E2)(W.u.)=9.5 4.
1837.31	312.60 25	100 6	E2		0.00349		I _γ : represents 97.95% 17 decay branching for level.
	1837.3		E0			2.05 17	B(E2)(W.u.)=55 5. ρ ² (E0)=0.140 12, q _K ² (E0/E2)=0.92 8, X(E0/E2)=0.089 8 (2005Ki02 evaluation). Decay takes place by pair formation. Γ (pair production)=1.6×10 ⁻⁸ eV 2 from (e,e') (1978Gr02). I(γ+ce): from (p,p'γ).
2424.15	586.9 §	<1.5					
	899.41 4	100 2	M1+E2	-0.17 2			B(M1)(W.u.)=0.15 5; B(E2)(W.u.)=15 6.
	2424.16 7	43 2	E2				B(E2)(W.u.)=1.7 5.
2752.40	328.2	1.0 4	[E2]				B(E2)(W.u.)=60 30.
	1227.65 3	100.0 4	E2				B(E2)(W.u.)=8.3 12.
3189.26	436.84 12	100	E2				B(E2)(W.u.)=0.777 22.
3253.89	501.46 3	64 7	[M1]				B(M1)(W.u.)=0.50 11.
	829.7	18 9	[E2]				B(E2)(W.u.)=130 80.
	1729.19 5	100 7	E2(+M3)	+0.05 4			B(E2)(W.u.)=19 4.
3300.0	875.8	100 1	E2				B(E2)(W.u.)<130.
	1775.3	8 4	E2				B(E2)(W.u.)<0.31.
3392.01	967.8	45 10					
	1554.7	15 3	[E2]				B(E2)(W.u.)=3.2 +14-7.
	1867.3	100 4	M1+E2	+1.7 4			B(M1)(W.u.)=0.0026 +11-6; B(E2)(W.u.)=6.4 +27-15.
	3391.9	87 8	E2				B(E2)(W.u.)=0.43 9.
3446.94	692.0 8	6.6 18	[E1]				B(E1)(W.u.)=0.00025 11.
	1022.77 4	57 2	[E1]				B(E1)(W.u.)=0.00068 23.
	1922.18 7	100 3	E1(+M2)	+0.02 7			B(E1)(W.u.)=0.00018 6; B(M2)(W.u.)<0.7.
3654.0	1229.8	4.2 10					
	1816.7	7 4	[E2]				B(E2)(W.u.)=4 +18-3.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
3654.0	2129.2	100 3	M1 (+E2)	-0.06 17	B(M1)(W.u.)=0.035 25; B(E2)(W.u.)<0.55.
	3653.8	22.2 10	E2		B(E2)(W.u.)=0.34 25.
3885.0	1460.8	4 2			
	2047.6	93 3	E1		
	3884.8	100 4	E1		
3954.39	507.45 3	100 4	M1+E2	+0.11 5	B(M1)(W.u.)=0.042 4; B(E2)(W.u.)=6 +6-4.
	1202.0	18 4	E1		B(E1)(W.u.)=1.5×10 ⁻⁵ 4.
3999.66	1247.2	7 4			
	1575.5	49 5			
	2474.80 10	100 5			
4047.0	600.1	22 5	M1+E2	+0.21 12	B(M1)(W.u.)=0.07 3; B(E2)(W.u.)=30 +70-25.
	1294.6	29 8	[E1]		B(E1)(W.u.)=0.00024 11.
	1622.8	29 10	[E1]		B(E1)(W.u.)=0.00012 6.
	2522.2	100 11	[E1]		B(E1)(W.u.)=0.00011 4.
4099.65	652.8				
	910.37 15	100 3	E1 (+M2)	+0.04 2	B(E1)(W.u.)=0.00102 24.
	1347.26 14	61 3	E1+M2	-0.09 4	B(E1)(W.u.)=0.00019 5.
4117.1	670.1	61 11			
	1692.8	21 6			
	2592.2	100 7			
4232.0	1807.8	27 5			
	4231.8	100 5			
4342.3	1918.1	100			
4354.0	399.6	9 2	M1+E2	>0.09	δ : also, <-0.09. B(M1)(W.u.)<0.046; B(E2)(W.u.)>3.9.
	907.0	53 9			
	1100.1	20 5	[E1]		B(E1)(W.u.)=0.00010 3.
	1601.6	100 9	E1		B(E1)(W.u.)=0.00016 3.
4418.0	971.0	67 12			
	1993.8	25 8			
	2893.2	100 13			
4443.0	1189.1	10 3			
	1690.6	100 5			
	2018.8	16 4			
4448.8	794.8	34 6			
	1001.8	37 9			
	2611.4	49 11			
	2924.0	100 17			
	4448.5	66 14			
4505.0	1113.0	34 6			
	1251.1	15 4			
	1752.6	64 11			
	2980.2	100 13			
4566.9	682.0	47 9			
	2142.8	100 9			
	3042.2	100 9			$I\gamma$: $I\gamma(3043)/I\gamma(2143)=78/44$ in (p, γ). $I\gamma$: $I\gamma(4566)/I\gamma(2143)=100/44$ in (p, γ).
	4566				
4690.06	2265.8	22 6			
	3165.24 11	100 6			
4717.53	1463.7 3	95 5	[E2]		B(E2)(W.u.)=48 +30-13.
	1525.5	35 7			
	1965.2 4	100 3	[E2]		B(E2)(W.u.)=12 +7-3.
4759.71	2335.70 30	57 29			
	2922.5	43 14			
	3235.1	86 29			
	4759.6	100 29			
4866.0	2441.8	100 9			
	3341.2	22 9			
	4865.7	22 9			$I\gamma$: $I\gamma(4866)/I\gamma(3341)=100/100$ in (p, γ). $I\gamma$: branching most likely incorrect.
4897.0	779.0	8 1	[E2]		B(E2)(W.u.)=310 150.
	797.8 3	100 4	M1+E2	+0.14 8	B(M1)(W.u.)=0.7 4; B(E2)(W.u.)=70 +230-60.
	1449.0	18 4	E2		B(E2)(W.u.)=31 16.

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Adopted Levels, Gammas (continued)
 $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
4904.0	2151.5	36 9	[E3]		
	2479.8	45 9			
	4903.7	100 18			
4946.9	2522.7	100			
4971.0	1016.6	91 14			
	2546.7	100 17			E γ : (p, γ) reported 1526, 2281 and 4968 γ transitions instead of the three transition given here from (α ,p γ).
	3446.1	94 17			
5017.14	1763.12 12	100 7			
	3492.2	21 7			
5075.0	657.0	47 10			
	1628.0	100 10			
5158.0	2733.7	85 17			
	3633.1	100 17			
5188.0	770.0	100			
5210.3	1956.1	100 5			
	2457.5	14 5			
5212.98	1213.2 3	100 10			
	1959.1 4	75 9			
5214.1	1217.3	100 8			
	2789.7	25 7			
	3689.1	39 8			
	5213.7 [§]				γ reported in (p, γ) only.
5320.0	902.0	61 11			
	1220.3	61 11			
	1273.0	26 5			
	1365.6	100 13			
	2066.1	16 5			
5345.0	3820.1	100			
5358.0	2933.7	33 20			
	5357.6	100 20			
5380.0	2126.1	52 10			
	2190.5	86 12			
	2627.5	100 14			
5393.0	2968.7	33 12			
	3868.1	100 12			
5439.0	1339.3	100			
5472.0	2218.1	100 10			
	2719.5	43 8			
	3947.1	16 10			
5490.77	2301.6 2	100	E1 (+M2)	+0.10 8	B(E1)(W.u.)=0.00077 19.
5491.0	1374.0	100 13			
	3966.1	45 13			
5510.0	1463.0	47 12			
	2063.0	100 12			
5530.0	3105.7	100 13			
	4005.1	43 13			
5578.0	2185.9	100			
5593.0	1638.6	100 15			
	3168.7	56 8			
	4068.1	52 15			
	5592.6	52 15	[E3]		E γ : reported only in (p, γ).
5601.0	1096.0	49 15			
	1601.3	100 15			
5624.0	1624.3	100 15			
	5623.6	60 15	[E3]		
5665.0	1247.0	51 11			
	1710.6	100 16			
	3240.7	71 13			
5670.0	2223.0	100 16			
	4145.1	79 16			
5691.77	974.1 2	100 13			
	2437.8 3	83 13			

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult. ‡	$\delta^\ddagger$	Comments
5691.77	2502.4	30 9			
5716.0	2462.0	100			
5725.0	2972.5	100			
5738.0	3313.7	33 17			
	4213.1	33 17			
	5737.6	100 33			
5744.01	253.3 1	2.6 2			
	1026.3 2	4.0 4			
	1644.29 11	100 3	E2 (+M3)	-0.02 3	B(E2)(W.u.)=7.2 18.
	2554.75 21	73 3	E1+M2	-0.04 2	B(E1)(W.u.)=3.2×10 ⁻⁵ 8; B(M2)(W.u.)<0.12.
5769.0	3016.5	100 11			
	3344.7	59 11			
5774.9	2521.0	100 3			
	2585.5	12 3			
5797.0	3372.7	100 18			
	4272.1	72 15			
	5796.6	85 18			
5802.0	1802.3	100			
5822.0	3397.7	100			
5866.0	4028.5	122 22			
	4341.1	100 22			
5875.0	3122.5	41 11			
	3450.7	100 11			
5924.0	1419.0	27 8			
	1570.0	32 8			
	1824.2	100 14			
	1969.6	57 11			
	3171.5	54 11			
5925.5	2736.2 4	100			
5994.0	1023.0	20 6			
	3569.7	100 6			
6003.0	3250.5	100			
6020.0	2065.6	23 7			
	2830.5	100 7			
6028.0	2073.6	91 16			
	3275.5	100 16			
	4503.0	36 11			
6038.0	3613.7	33 8			
	4513.0	100 8			
6093.5	1197.0	100 8			
	1993.2	47 8			
6104.0	3679.7	100 14			
	4579.0	79 14			
6113.0	1695.0	16 5			
	2859.0	100 5			
6140.8	649.8	16 6	(M1+E2)	-0.25 +25-10	B(M1)(W.u.)=0.16 +8-10; B(E2)(W.u.)<210.
	1787.0	17 3	[E2]		B(E2)(W.u.)=8 +3-4.
	2041.2§	26 5	[M1]		Placement possibly incorrect.
	2186.5	100 9	E2 (+M3)	=0.0	B(M1)(W.u.)=0.009 +3-5.
6144.72	2955.42 20	100	E1 (+M2)	+0.02 2	B(E2)(W.u.)=13 5.
6182.0	4657.0	100 13			B(E1)(W.u.)>0.00031.
	6181.5	47 13			
6212.0	3459.4	100			
6247.9	2293.5	74 13			
	3058.4	100 15			
	3495.4	82 13			
6408.57	263.84 8	20.3 9	M1 (+E2)	0.00 2	B(M1)(W.u.)=0.0055 6.
	664.6 2	5.0 7			
	917.77 12	100 3	E2 (+M3)	+0.03 2	B(E2)(W.u.)=2.28 21.
	3219.2 3	16.3 17	M2+E3	+0.85 23	δ: weighted average of +0.8 2 in (¹⁶ O,2pγ) and +2.0 10 in (α,pγ).
					B(M2)(W.u.)=0.016 5; B(E3)(W.u.)=5.0 18.

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
6516.0	2630.9 4091.6 4991.0				$E\gamma$: from ($^{14}\text{C},^{12}\text{C}$) only. $E\gamma$: from ($^{14}\text{C},^{12}\text{C}$) only. $E\gamma$: from ($^{14}\text{C},^{12}\text{C}$) only.
6541.8	1050.8 2442.2 3352.4	43 7 29 7 100 10			
6553.72	145.12 10 409.1 2 809.73 10 3364.4 3	36.8 17 3.0 5 100 2 11 1	M1 (+E2) E2 (+M3) [E3]	0.00 2 -0.03 2	B(M1)(W.u.)=0.042 4. $E\gamma$: reported only in ($^{18}\text{O},\alpha 2n\gamma$). B(E2)(W.u.)=2.96 23. $E\gamma$: reported only in ($^{18}\text{O},\alpha 2n\gamma$). B(E3)(W.u.)=4.1 5.
6584.7	840.7 1093.8	100 11 85 11			
6636.30	1918.6 2 3447.1 4	100 4 100 3			
6674.8	3485.4	100			
6715.9	1505.0 1999.9 3525.4	100 13 83 13 68 13			
6718.14	1505.1 2 2000.4 3 3528.8 5	100 9 64 7 52 5			
6746.5	1850.0 2646.2	100 18 96 18			
6816.8	3627.4	100			
6895.8	970.5 1404.8 3706.4	32 6 8 3 100 6			
6940.2	1195.7 2043.9 2840.2	43 9 100 13 74 11			
6975.5	1483.8 2259.9 2875.2 3785.4	36 7 27 7 60 9 100 11			
7129.9	3940.4	100			
7197.9	4008.4	100			
7282.02	728.3 1 873.5 2	30 3 100 5			
7344.7	936.1	100			
7360.6	1215.9	100			
7368.46	814.70 19 959.9 2	100 3 3.5 6	M1+E2 [E2]		B(E2)(W.u.)=1.4 +10-4.
7388.8	4199.3	100			
7415.87	779.6 2 1723.9 3 2699.9 4225.3	35 3 30 5 4.0 12 100 5			
7421.2	2704.9 4230.3	33 5 100 5			
7543.1	2645.9 2826.9 4352.3	100 19 100 19 63 19			
7562.5	2844.9	100			
7634.03	1708.5 4 1942.2 3 2916.3 3 4444.3	51 9 54 9 100 14 80 11			
7696.8	4507.3	100			
7726.5	3008.9	100			
7750.66	382.20 8	100	M1 (+E2)	+0.02 7	
7758.0	1349.1 2013.6	56 9 75 13			

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
7758.0	2266.7	100 13			
	2861.9	81 13			
7800.7	1655.9	100			
7838.9	1123.0	100			
7921.2	3204.9	100 13			
	4730.3	61 13			
7939.8	2248.0	75 12			
	4750.3	100 12			
8052.6	3334.9	100			
8059.7	1651.1	100 2			
	2315.6	6 2			
8082.7	1529.0	100			
8103.2	2410.0	49 8			
	3386.9	100 8			
8297.46	928.98 10	100 4	M1+E2	-0.11 5	B(M1)(W.u.)>0.0095; B(E2)(W.u.)>0.040.
	1743.8 2	67 4	[E2]		
8364.8	1956.1	100 18			
	5175.2	75 18			
8449.7	1896.0	69 12			
	2041.0	69 12			
	2958.7	100 12			
8511.7	2103.0	89 13			
	2767.6	100 13			
8517.0	2591.4	100			
8522.3	771.61 20	100	D(+Q)	0.00 4	
8580.9	1865.0				
8611.9	1896.0	100			
8615.13	1199.3 3	34 4			
	1896.9 2	100 8			
	1978.7 3	54 7			
	2061.1	9 2			
8722.30	1306.4 2	90 9			
	1440.3 3	30 5			
	2004.0 3	86 15			
	2085.9 2	100 10			
	2168.6 3	36 6			
8744.9	1376.4				
8773.7	3282.7	100 11			
	5584.2	41 11			
8847.97	2211.6 2	100			
8951.3	2314.9	100			
9015.01	292.7 2	11 2			
	399.9 1	26 2			
	717.6 3	5 1			
	1599.1 1	100 4			
	1733.0 2	67 10			
	2378.6 3	13 2			
	2461.3 3	15 2			
9036.9	1668.4	100			
9205.9	1924.0	92 13			
	3060.8	100 13			
9241.9?	1959.9				
9311.08	1677.0 3	90 6			
	2674.7 3	100 12			
9377.7	3633.5	100			
9759.7	3205.9	100			
9786.29	475.2 1	14 1			
	771.3 1	100 3			
	938.3 2	16 1			
	1063.9 3	24.0 14			
	1171.0 2	16.0 15			
	1488.8 1	44 2			
	2417.8 2	28 2			

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
9841.6	3696.7	100			
10035.6	3890.7	100			
10168.69	382.4 1	100 3			
	1153.6 3	29 2			
	1871.2 2	11 1			
10450.0	6349.8	100			$I\gamma$: represents >60% decay branching for level.
11165.7	2868.1 8	100			
11361.3	9835.4				
	11359.6				
11405.1	2557.0	100			
(11480.64)	6462.79 17				
	6720.46 18				
	6790.05 17				
	7480.07 18				
	7525.47 10				
	8033.03 18				
	8225.86 13				
	8727.42 14				
11644.1	7194.6	6			
	7411.4	50			
	7526.4	19			
	7596.4	19			
	7758.3	19			
	7989.3	19			
	8251.2	9			
	9218.8	16			
	9805.6	12			
	10118.1	100			
	11642.4	44			
11670.9	7221.4	38			
	7553.2	34			
	8016.1	28			
	8278.0	31			
	9245.6	59			
	9832.4	100			
	10144.9	55			
11674.0	7556.3	100			
	8281.1	59			
	9248.7	48			
	9835.5	48			
	10148.0	90			
11693.0	6932.5	90			
	7460.3	62			
	7575.3	33			
	8038.2	71			
	8300.1	62			
	8392.1	14			
	9267.7	100			
	10167.0	43			
11707.5	6114.0	32			
	7364.5	20			
	7474.8	36			
	7821.7	20			
	8052.7	32			
	8314.6	24			
	8406.6	12			
	9282.2	32			
	9869.0	100			
	10181.5	56			
11725.7	2483.8				
	4357.0				
11727.1	6966.6	27	D(+Q)	+0.02 4	δ : or +3.0 10.
	7277.6	67	(D+Q)	+0.70 10	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\dagger}$	Mult. ‡	$\delta^{\ddagger}$	Comments
11727.1	7308.4	27			
	7494.4	47	(D+Q)	+0.30 15	δ : or +2.0 10.
	7609.4	47			
	8072.3	20			
	8334.2	40	D+Q	+3.7 1	
	8426.2	40			
	9301.8	93	D+Q	+0.65 5	
	9888.5	67			
	10201.1	93	D+Q	-0.20 5	
	11725.3	100			
11738.4	6523.9	45			
	6833.8	82			
	7288.9	18			
	7505.7	32			
	7620.7	100			
	7852.6	45			
	8083.6	27			
	8345.5	50			
	9899.8	9			
	10212.4	23			
11743.4	11736.6	23			
	7510.7	35			
	7625.7	29			
	8350.5	79			
	9904.8	26			
11775.0	10217.4	100			
	11741.6	24			
	7207.3	33			
	7542.3	29			
	7657.3	19			
	7774.6	76			
	7889.2	29			
	8327.2	100			
	8382.1	62			
	9349.7	76			
11795.2	10249.0	24			
	11773.2	29			
	7677.4	50			
	8347.4	25			
	8402.3	100			
	9369.9	92			
	9956.6	46			
11805.4	10269.2	33			
	11793.4	71			
	6211.9	86			
	7355.9	38			
	7386.7	52			
	7462.4	100			
	7757.6	71			
	8357.6	24			
	8412.5	52			
	9380.1	14			
11821.1	10279.3	19			
	11803.6	19			
	1652.3 4	83 11			
11822.4	2034.6 8	100 7			
	7589.7	100			
	8167.5	56			
	8429.5	52			
	9397.1	48			
	9983.8	36			
	10296.3	92			
	11820.6	16			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$
11843.3	6871.7	68	11871.5	9446.2	100	11959.2	11957.4	100
	6976.7	100		10032.9	29	11980.3	7530.8	23
	8188.4	39		10345.4	47		8325.4	18
	8542.4	26		11869.7	55		8532.4	5
	9418.0	29	11873.7	7641.0	100		8587.4	8
	10317.2	61		7755.9	28		8679.3	21
11868.0	6963.4	87		7825.9	28		9555.0	21
	7750.2	87		7987.9	34		10454.2	100
	7820.2	87		8480.8	19		11978.5	62
	8213.1	73		9448.4	25	12172.0	8779.0	72
	8475.1	87		10035.1	16		9746.6	83
	9442.7	100		10347.6	56		10645.8	60
	10029.4	33		11871.9	6		12170.1	100
	10341.9	53	11925.6	8270.7	42	12198.1	3350.0	
	11866.2	60		8477.7	53	12701.4	880.3	2
11871.5	6133.0	59		9500.3	40		2533.1	
	6513.0	59		10399.5	63	12814.7	2646.0	
	7753.7	82		11923.8	100		4517.0	
	7823.7	47	11959.2	8511.3	25		5415.0	
	7985.7	71		9533.9			13712.8	
	8478.6	29		10433.1	50		13762.8	
							2037.0	
						15251.7	2436.9	

[†] Primarily from ($\alpha, p\gamma$), (p, γ), ($p, p'\gamma$) and ($^{18}\text{O}, \alpha 2n\gamma$). Weighted averages are taken of all available values with uncertainties. Values of γ -energies without uncertainties are deduced from level-energy difference.

[‡] From $\gamma(\theta, \text{pol})$ in ($\alpha, p\gamma$), ($p, p'\gamma$) and ($^{19}\text{F}, \alpha\gamma$). If $T_{1/2}$ is unknown and parity is determined not by polarization measurements, evaluators use D and Q, instead of M1 and E2, or, E1 and M2.

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

(A) g.s., Yrast band

(B) Excited 0+ band

(C) Negative-parity structure

^{42}K β^- Decay (12.355 h) 1970Ka17

Parent ^{42}K : E=0; $J\pi=2^-$; $T_{1/2}=12.355$ h 7; $Q(g.s.)=3525.22$ 18; % β^- decay=100.

$^{42}\text{K}-J, T_{1/2}$: From Adopted Levels of ^{42}K .

$^{42}\text{K}-Q(\beta^-)$: From 2012Wa38.

γ , $\gamma\gamma$: 1970Ka17. Others: 1966He11, 1965Mi09, 1964Ma05, 1962Pe19, 1961Mc03, 1960Ga06, 1959Mo17, 1959Ma27, 1956Po07, 1955Em04, 1954Ca64, 1953Ka26, 1947Si08.

%I γ : 1990Mi05, 2004HaZW. Others: 1959Ma27, 1955Em04, 1953Ka26.

$\gamma\gamma(t)$: 1963Bl09, 1961Si01.

$\gamma\gamma(0)$: 1966Az04, 1959As65 (also 1960As03), 1959Mo17, Arkiv Fysik 15, 303 (1959).

β : 1989He11 (also 1986HeZY), 1987Na28, 1976Ra30, 1975Ra09, 1968Va06, 1968Da12, 1965Ch30, 1964Da16, 1956Po07, 1954Ko55, 1949Sh26, 1947Si08.

$\beta\gamma$: 2001Si09, 1961Si01, 1953Ka26, 1947Bl33.

Pair conversion, E0 strength: 1971Be76.

$\beta\gamma(0)$: 1975Ve06, 1961St12, 1953Ha40, 1951St68, 1950Be60.

$\beta\gamma(\text{circ pol}, 0)$: 1968He06, 1968Da12, 1964He10, 1964De09, 1961Da02.

$\beta\gamma(\text{lin pol}, 0)$: 1953Ha40.

$T_{1/2}(^{42}\text{K isotope})$: 2005Li66, 2004Un01, 2001Ko07, 1994Mi03, 1967Go21, 1962Me06. Others: 1984Ke14, 1982RuZV, 1963Ho17, 1962Mo21, 1959Ma27, 1957Wr37, 1953Bu58, 1953Ka26, 1947Si08.

Isotopic assignment: 1954An25, 1937Hu01.

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
0.0	0+		
1524.6 3	2+		
1837.2 4	0+	0.33 ns 2	$J\pi$: from $\gamma\gamma(0)$. $T_{1/2}$: $\gamma\gamma(t)$ (1961Si01). Other: 0.42 ns 11 (1963Bl09). I $\gamma(\gamma$ to 1587 level)<0.002 (1970Ka17).
2424.3 4	2+		
2753.2 9	4+		
3445.4 7	3-		

[†] From least-squares fit to E γ data.

[‡] From Adopted Levels, unless otherwise noted.

 β^- radiations

E β^-	E(level)	I β^- [†]	Log ft	Comments
(79.8 8)	3445.4	0.07 1	4.98 7	
(1100.9 5)	2424.3	0.05 1	9.05 9	
(1688.0 5)	1837.2	0.34 3	9.92 ^{1u} 4	
(2000.6 4)	1524.6	17.64 9	7.5501 23	E β^- : 1985 10 (1956Po07), 1970 (1954Ko55). I β^- : 18 (1954Ko55).
(3525.22 18)	0.0	81.90 9	9.4768 ^{1u} 6	F-K plot first-forbidden unique shape (1956Po07, 1954Ko55). E β^- : 3524 6 (1975Ra09), 3519 4 (1968Va06). Others: 1956Po07, 1954Ko55. I β^- : 82 (1954Ko55).

[†] Absolute intensity per 100 decays.

 $\gamma(^{42}\text{Ca})$

I γ normalization: %I $\gamma(1524.7\gamma)=18.08$ 9 (1990Mi05). Others: 17.9 5 (1962Pe19), 18.4 5 (1959Ma27), 17.8 9 (1955Em04).

E $\gamma^{\dagger}$	E(level)	I $\gamma^{\ddagger}$	Mult.	α	Comments
312.60 25	1837.2	1.86 11	[E2]	0.00349	(313 γ)(1525 γ)(0): $A_2=+0.33$ 4, $A_4=+1.07$ 5 (1959As65).
692.0 8	3445.4	0.018 4			
899.7 4	2424.3	0.285 14			
1021.2 9	3445.4	0.111 8			
1228.0 15	2753.2	0.013 6			
1524.6 3	1524.6	100			
1920.8 10	3445.4	0.228 22			
2424.3 7	2424.3	0.110 16			

[†] From 1970Ka17.

[‡] For absolute intensity per 100 decays, multiply by 0.1808 9.

^{42}K β^- Decay (12.355 h) 1970Ka17 (continued) **^{42}Sc ϵ Decay (680.79 ms) 1985Da04,1997Ko65,1976Wi08**

Parent ^{42}Sc : $E=0$; $J\pi=0+$; $T_{1/2}=680.79$ ms 28; $Q(g.s.)=6426.10$ 10; $\epsilon+\beta^+$ decay=100.

$^{42}\text{Sc}-J, T_{1/2}$: From Adopted Levels of ^{42}Sc . 2015Ha07 review gives $T_{1/2}=680.72$ ms 26.

$^{42}\text{Sc}-Q(\epsilon)$: From 2012Wa38. 2015Ha07 review gives 6426.28 30.

^{42}Sc decays mainly (>99%) through β^+ decay.

γ : 1985Da04, 1980Sa32, 1977In04, 1971Ke14, 1971Ga17, 1957Cl40.

β^+ : 1961Ja22, 1957Cl40, 1955Mo83.

$\beta\gamma(0)$: 1974HaYC, 1973KeZl.

$T_{1/2}(^{42}\text{Sc g.s.})$: 1997Ko65, 1976Wi08 (also 1972Ha82), 1965Fr08, 1965Ne02, 1962Ja05, 1961Ja22, 1960Ja12, 1957Cl40, 1955Mo83.

Other: 2010StZY: deduced GT strength distributions for β -decay.

2015Ha07: review of superallowed decays; evaluated Q value, $T_{1/2}$ branching ratios, ft value, isospin-symmetry-breaking corrections.

 ^{42}Ca Levels

E(level) [†]	$J\pi$ [†]
0.0	0+
1525	2+
1837	0+

[†] From Adopted Levels, energies are rounded values.

 β^+, ϵ Data

$E\epsilon$	E(level)	$I\beta^{+\dagger}$	$I\epsilon^{\dagger}$	Log ft	$I(\epsilon+\beta^+)^{\dagger}$	Comments
(4589.10 10)	1837	0.0074 11	2.5×10^{-5} 4	6.79 7	0.0074 11	
(6426.10 10)	0.0	99.8953 15	0.0972 10	3.4845 2	99.9925 11	$E\epsilon$: measured $E(\beta^+)=4.8 \times 10^3$ 9 (1957Cl40). 0+ to 0+ superallowed β transition. $I(\epsilon+\beta^+)$: 2015Ha07 review gives 99.9941 14.

[†] Absolute intensity per 100 decays.

 $\gamma(^{42}\text{Ca})$

$E\gamma$	E(level)	$I\gamma^{\dagger}$	α	Comments
313	1837	0.0075 12	0.00349	$I\gamma$: assumed the same as for 1524.7 γ .
1524	1525	0.0075 12		$I\gamma$: weighted average of 0.0070 12 (1985Da04), 0.0103 31 (1980Sa32), 0.0079 20 (1977In04). Others: 0.0022 17 (1978De08, same laboratory as 1985Da04), 1971Ke14.

[†] Absolute intensity per 100 decays.

^{42}Sc ϵ Decay (680.79 ms) 1985Da04,1997Ko65,1976Wi08 (continued)

^{42}Sc ϵ Decay (61.7 s) 1978Be61,1974Wi14,1969Ga27

 Parent ^{42}Sc : E=616.28 6; $J\pi=7+$; $T_{1/2}=61.7$ s 4; $Q(\text{g.s.})=6426.10$ 10; % ϵ +% β^+ decay=100.

 ^{42}Sc -E,J, $T_{1/2}$: From Adopted Levels of ^{42}Sc .

 ^{42}Sc -Q(ϵ): From 2012Wa38.

 ^{42}Sc decays mainly (>99%) through β^+ decay.

 γ : 1969Ga27, 1965Ne02, 1963Ro10.

 β^+ : 1965Ne02, 1963Ro10.

 $\beta^+\gamma$: 1969Me12, 1965Ne02.

 $\beta\gamma(\text{t})$: 1969Me12.

 $T_{1/2}(^{42}\text{Sc isomer})$: 1978Be61, 1974Wi14, 1965Ne02, 1963Ro10.

 ^{42}Sc isomer beam production in $^{12}\text{C}(^{40}\text{Ca},^{42}\text{Sc})^{10}\text{B}$: 1994Uz01, 1994Ke07.

 ^{42}Ca Levels

E(level)	$J\pi^\dagger$
0.0	0+
1524.73 3	2+
2424.17 4	2+
2752.41 4	4+
3189.33 14	6+

 † From Adopted Levels.

 β^+, ϵ Data

E ϵ	E(level)	$I\beta^+^\dagger$	$I\epsilon^\dagger$	Log ft	$I(\epsilon+\beta^+)^\dagger$	Comments
(3853.05 19)	3189.33	99.336 7	0.664 7	4.163 10	100	E ϵ : 2870 100 (1963Ro10).

 † Absolute intensity per 100 decays.

 $\gamma(^{42}\text{Ca})$
 $I\gamma$ normalization: $I(\gamma+\text{ce})(1524.7\gamma+2424.1\gamma)=100$.

E γ	E(level)	$I\gamma^\ddagger$
328	2752.41	1.0 4
437.5 † 5	3189.33	100
899	2424.17	0.70 30
1227.0 † 5	2752.41	99.0 4
1524.5 † 5	1524.73	99.70 12
2424	2424.17	0.30 12

 † From 1969Ga27.

 ‡ From level scheme using Adopted Branching and assuming $I\gamma(437\gamma)=100$.

 § Absolute intensity per 100 decays.

Decay Scheme

 Intensities: $I(\gamma+\text{ce})$ per
100 parent decays

$^{24}\text{Mg}(^{24}\text{Mg}, \alpha 2p\gamma)$ 2008Sa04

2008Sa04 (also 2008Sa44): E=91.72 MeV (for ON resonance), 92.62 MeV (for OFF resonance) beam provided by Legnaro XTU Tandem accelerator. Target of a 40 $\mu\text{g}/\text{cm}^2$ ^{24}Mg film on a 15 $\mu\text{g}/\text{cm}^2$ carbon backing. Charged particles were detected with the EUCLIDES detector composed of 40 silicon detectors $\Delta E-E$ and γ -rays were detected with the GASP array of 40 HPGe detectors. Measured $E\gamma$, $\gamma\gamma$ -coin, particle- γ coin. Deduced levels from the decay of a narrow 36+ resonance in $^{24}\text{Mg}(^{24}\text{Mg}, X)$ system at 45.7 MeV (c.m.) with $\Gamma=170$ keV.

Placement of γ rays from 2008Sa04 is based on Adopted Levels and Gammas of ^{42}Ca . 2008Sa04 reported 24 γ rays from the decay of a $J\pi=36+$ resonance in $^{24}\text{Mg}+^{24}\text{Mg}$ system.

 ^{42}Ca Levels

E(level)	$J\pi^\dagger$	E(level)	$J\pi^\dagger$	E(level)	$J\pi^\dagger$
0.0	0+	5491	6-	7368	10-
1525	2+	5744	7-	8297	11-
2752	4+	6145	7-	9015	10+
3189	6+	6409	8-	9786	(9-, 11)
4100	5-	6554	9-	10169	(10, 12+)
4718	6+	7282	9-		

† From Adopted Levels.

 $\gamma(^{42}\text{Ca})$

$E\gamma$	E(level)	$E\gamma$	E(level)	$E\gamma$	E(level)
145	6554	810	6554	1525	1525
253	5744	815	7368	1644	5744
264	6409	874	7282	1733	9015
382	10169	910	4100	1965	4718
437	3189	918	6409	2301	5491
665	6409	929	8297	2555	5744
728	7282	1228	2752	2955	6145
772	9786	1347	4100	3220	6409

 $^{27}\text{Al}(^{18}\text{O}, 2np\gamma)$ 1975Wa04

Includes $^{26}\text{Mg}(^{18}\text{O}, 2n\gamma)$ E=40 MeV and $^{28}\text{Si}(^{19}\text{F}, \alpha p\gamma)$ E=45 MeV from 1975O101, measured intensities.

1975Wa04 (also 1975O101), 1974Po10: E=40 MeV ^{18}O beam was produced from the Brookhaven National Laboratory MP tandem Van de Graaff facility. a target of 250 $\mu\text{g}/\text{cm}^2$ isotopically enriched ^{27}Al evaporated onto a thick W backing.

γ -rays were detected with two true coaxial Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma(\theta)$, $\gamma(\text{lin pol})$, $T_{1/2}$ by recoil-distance method (RDM). Deduced levels, $J\pi$, mixing ratios.

 ^{42}Ca Levels

E(level) †	$J\pi^\ddagger$	$T_{1/2}^\S$	E(level) †	$J\pi^\ddagger$	$T_{1/2}^\S$	E(level) †	$J\pi^\ddagger$	$T_{1/2}^\S$
0.0	0+		3446.5? 6	3-		6145.11 25	7-	
1524.61 8	2+		3571.59? 17			6408.87 24	8-	
2423.62 21	2+		3953.5 12	4-		6554.07 25	9-	42 ps 3
2752.29 12	4+	3.5 ps 3	4099.67 17	5-		7368.8 3	10-	2.6 ps 11
3189.32 14	6+		5491.00 24	6-	<1.7 ps	8297.9 4	11-	<1.7 ps
3254.3 10	4+		5744.19 22	7-				

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

‡ From Adopted Levels.

§ From recoil-distance method (1975O101).

$^{27}\text{Al}(^{18}\text{O},2\text{npy})$ 1975Wa04 (continued) $\gamma(^{42}\text{Ca})$

A_2 , A_4 and Pol values are from 1975OL01.

$E\gamma$	E(level)	$I\gamma$	Mult. [†]	Comments
145	6554.07			$I\gamma(145)/I\gamma(810)=24\ 4/76\ 4$.
263.74 15	6408.87	4.7	D+Q	$A_2=-0.18\ 2$; $A_4=-0.14\ 3$.
382.24 [‡] 10	3571.59?	2.8		Placement considered uncertain (by the evaluators) since the level population is tentative.
				$A_2=-0.42\ 12$; $A_4=0$.
				Pol=-0.52 15.
437.04 8	3189.32	118.4	E2	$A_2=+0.23\ 2$; $A_4=-0.15\ 2$.
				Pol=+0.32 5.
502	3254.3			
507	3953.5			
694	3446.5?			
809.88 12	6554.07	32.3 5	E2	$A_2=+0.30\ 3$; $A_4=-0.19\ 3$.
				Pol=+0.37 8.
814.75 15	7368.8	19.5	M1	$A_2=-0.30\ 6$; $A_4=-0.02\ 4$.
				Pol=-0.41 9.
898.99 20	2423.62	4.99	D	$A_2=+0.13\ 10$; $A_4=+0.11\ 15$.
910.45 15	4099.67	19.2	E1	$A_2=-0.20\ 2$; $A_4=-0.07\ 3$.
				Pol=+0.19 9.
917.87 12	6408.87	24.1	E2	$A_2=+0.31\ 5$; $A_4=-0.17\ 5$.
				Pol=+0.41 12.
929.10 25	8297.9	6.9	M1	$A_2=-0.25\ 7$; $A_4=0$.
				Pol=-0.67 27.
1023	3446.5?			
1227.66 8	2752.29		E2	$A_2=+0.23\ 1$; $A_4=-0.11\ 1$.
				Pol=+0.29 6.
1347.24 20	4099.67	10.2	(E1)	$A_2=-0.23\ 2$; $A_4=0$.
				Pol=+0.05 25.
				$I\gamma(910)/I\gamma(1347)=61\ 2/33\ 2$.
1524.58 8	1524.61	222.5	E2	$A_2=+0.22\ 1$; $A_4=-0.10\ 1$.
				Pol=+0.37 9.
1644.54 20	5744.19	22.2	(E2)	$A_2=+0.26\ 2$; $A_4=-0.17\ 3$.
				Pol=+0.25 29.
1921.8 8	3446.5?	2.2	D	$A_2=-0.55\ 14$; $A_4=0$.
2301.68 25	5491.00	32.3	E1	$A_2=+0.32\ 3$; $A_4=-0.10\ 4$.
				Pol=-0.30 25.
2424	2423.62			
2554.70 25	5744.19	17.4	(E1)	$A_2=-0.26\ 16$; $A_4=0$.
				Pol=-0.17 30.
				$I\gamma(1644)/I\gamma(2556)=51\ 2/49\ 2$.
2955.6 3	6145.11	4.8	D	$A_2=-0.30\ 8$; $A_4=0$.
3219.3 6	6408.87	4.5	[M2+E3]	$A_2=+0.72\ 5$; $A_4=0$.
				$I\gamma(264)/I\gamma(918)/I\gamma(3219)=17\ 3/70\ 2/13\ 2$.

[†] From $\gamma(\text{lin pol})$ and $T_{1/2}$ in 1975OL01.

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

$^{27}\text{Al}(^{19}\text{F},\alpha\gamma) \quad ^{1981}\text{He20}$

$^{1981}\text{He20}$ (also $^{1981}\text{He17}$): $E=47-108$ MeV ^{19}F beam produced at the MP-Tandem at the MPI in Heidelberg. Main experiment for ^{42}Ca at $E=72$ MEV. Targets of 1 mg/cm^2 Al on Au backings of 100 mg/cm^2 . γ -rays were detected with two Ge(Li) of 26% relative efficiency, FWHM=1.9 keV and 2.1 keV. Measured E_γ , I_γ , γ_γ , $\gamma(\theta)$. Deduced levels, $J\pi$, γ -ray mixing ratios.

Others: $^{1976}\text{Po03}$, $^{1975}\text{O101}$: $E=40$ MeV. Measured cross sections.

 ^{42}Ca Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	Comments
0.0	0+	
1524.61 8	2+	
2752.29 12	4+	
3189.37 19	6+	
4099.6 7	5-	
5491.1 8	6-	
5744.3 6	7-	
6145.1 8	7-	
6408.8 6	8-	
6553.8 6	9-	
7368.3 6	(10)-	
7750.5 6	(11)-	
8297.1 6	(9)-	$J\pi$: (11)- in Adopted Levels.
8522.1 7	(10)	

† Deduced by the evaluators from E_γ values.

‡ From $\gamma(\theta)$ in $^{1981}\text{He20}$.

 $\gamma(^{42}\text{Ca})$

E_γ	$E(\text{level})$	Mult.	δ	Comments
145.03 † 10	6553.8	D(+Q)	+0.03 2	$A_2=-0.24$ 3; $A_4=0$.
264	6408.8			
382.20 † 8	7750.5	D(+Q)	+0.02 7	$A_2=-0.24$ 4; $A_4=0$.
437.09 † 15	3189.37	Q		$A_2=+0.21$ 3; $A_4=-0.07$ 3.
771.61 20	8522.1	D(+Q)	0.00 4	$A_2=-0.15$ 5; $A_4=0$.
809.54 † 15	6553.8			$A_2=+0.29$ 5; $A_4=-0.05$ 5.
814.44 † 15	7368.3	D(+Q)	0.00 2	$A_2=-0.18$ 5; $A_4=0$.
910	4099.6			
918	6408.8			
928.84 † 19	8297.1	D+Q	-0.11 5	$A_2=-0.27$ 4; $A_4=0$.
1227.66 † 8	2752.29	Q		$A_2=+0.24$ 3; $A_4=-0.05$ 3.
1347	4099.6			
1524.58 † 8	1524.61	Q		$A_2=+0.34$ 4; $A_4=-0.12$ 4.
1644	5744.3			
2302	5491.1			
2555	5744.3			
2956	6145.1			
3219	6408.8			

† $^{1981}\text{He20}$ take value from $^{1978}\text{Eg02}$. In their level-scheme figure, $^{1981}\text{He20}$ give E_γ values rounded to nearest keV.

$^{28}\text{Si}(^{16}\text{O},2p\gamma)$ 1978Eg02,1976Ro06

Includes $^{12}\text{C}(^{32}\text{S},2p\gamma)$ from 1987TaZY.

1978Eg02: E=45 MeV ^{16}O beam was produced at the Utrecht EN tandem accelerator. A target of $250\text{ }\mu\text{g}/\text{cm}^2$ ^{28}Si enriched to 99.91% on a $20\text{ }\mu\text{m}$ Au backing. γ -rays were detected with a NaI(Tl) Compton suppression spectrometer (CSS) and an array of three Ge(Li) detectors of about 25% efficiency. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma(\theta)$, $\gamma(\text{lin pol})$. Deduced levels, $J\pi$, mixing ratios.

1976Ro06: E=36–42 MeV ^{16}O beam was produced from the Oak Ridge tandem Van de Graaff accelerator. A natural target of $0.7\text{ mg}/\text{cm}^2$ Si on a thick Pt backing. γ -rays were detected with Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(\theta)$, $\gamma(\theta)$. Deduced levels, $J\pi$, mixing ratios, γ -branchings, transition probabilities.

1975Wu01 (also 1974Li06): E=36.5–50 MeV ^{16}O beam was produced from the Van de Graaff tandem accelerator of the University of Cologne. A natural target of $150\text{--}200\text{ }\mu\text{g}/\text{cm}^2$ Si layer evaporated onto stretched target foils of $1\text{ }\mu\text{m}$ Au or Ni. γ -rays were detected with $55\text{--}85\text{ cm}^3$ Ge(Li) detectors, FWHM=3 keV at 1.33 MeV. Measured $E\gamma$, lifetimes by recoil-distance method.

1975Uh02: E=32.5 MeV. Measured γ by $\gamma(\theta, \text{H}, \text{t})$.

1980Da22 (also 1983Da12): E=40 MeV. Measured average γ multiplicity.

1987TaZY: $^{12}\text{C}(^{32}\text{S},2p\gamma)$ E=75 MeV. Measured g factor of high-spin states.

 ^{42}Ca Levels

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$T_{1/2}^\S$	Comments
0.0	0+		
1524.61 8	2+		
2752.29 12	4+	2.63 ps [#] 28	
3189.37 17	6+		
4099.58 17	5-	<0.7 ps	
5491.19 23	6-	<0.14 ps [@]	$J\pi$: 5+ in 1976Ro06.
5744.29 22	7-	10.5 ps 10	$J\pi$: 5- in 1976Ro06.
6144.96 23	7-		$J\pi$: 6+ in 1976Ro06.
6408.79 22	8-	31.0 ps 25	$J\pi$: 7+ in 1976Ro06.
6553.82 22	9-	44 ps 7	$J\pi$: 7- in 1976Ro06.
7368.3 3	(8,10)-	1.5 ps 8	$J\pi$: 6-,8- in 1976Ro06; 10- in Adopted Levels.
7750.5 3	(7,9,11)-	<2.1 ps ^{&}	$J\pi$: 5- to 9- in 1976Ro06; (11)- in Adopted Levels.
8297.1 4	(7 to 11)-		$J\pi$: 11- in Adopted Levels.

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

[‡] From $\gamma(\text{lin pol})$ and $\gamma(\theta)$ in 1978Eg02.

[§] From recoil-distance method (1975Wu01), unless otherwise stated.

[#] From recoil-distance method (1974Li06).

[@] From DSA analysis (1975Wu01).

[&] From line shape analysis (1978Eg02).

 $\gamma(^{42}\text{Ca})$

$E\gamma^\dagger$	$E(\text{level})$	$I\gamma^\ddagger$	Mult. [§]	$\delta^\#$	Comments
145.03 10	6553.82	6.9 3	D(+Q)	0.00 2	$A_2=-0.264$ 16; $A_4=0$ (1978Eg02). $I\gamma$: $I\gamma(145.0)/I\gamma(809.5)=28$ 1/72 1.
263.83 8	6408.79	2.4 1	M1		$A_2=-0.21$ 3; $A_4=0$ (1978Eg02). $A_2=-0.09$ 3; $A_4=-0.01$ 3 (1976Ro06). $\text{Pol}=-0.42$ 11 (1978Eg02), -0.09 4 (1976Ro06). $I\gamma$: $I\gamma(263.8)/I\gamma(917.6)/I\gamma(3219.2)=15$ 1/73 2/12 2.
382.20 8	7750.5	6.0 4	M1		$A_2=-0.23$ 3; $A_4=0$ (1978Eg02). $\text{Pol}=-0.41$ 5 (1978Eg02).
437.09 15	3189.37	76 3	E2		$A_2=+0.23$ 3; $A_4=-0.08$ 3 (1978Eg02). $A_2=+0.264$ 9; $A_4=-0.089$ 9 (1976Ro06). $\text{Pol}=+0.39$ 3 (1978Eg02), $+0.32$ 5 (1976Ro06).
809.54 15	6553.82	18.1 4	E2		$A_2=+0.374$ 17; $A_4=-0.147$ 17 (1978Eg02). $A_2=+0.38$ 3; $A_4=-0.17$ 5 (1976Ro06). $\text{Pol}=+0.69$ 4 (1978Eg02), $+0.37$ 8 (1976Ro06).
814.44 15	7368.3	11.8 4	M1+E2		$A_2=-0.150$ 15; $A_4=0$ (1978Eg02). $A_2=-0.38$ 5; $A_4=+0.24$ 5 (1976Ro06). $\text{Pol}=-0.37$ 3 (1978Eg02), -0.41 9 (1976Ro06).
910.21 15	4099.58	8.2 3	E1(+M2)	+0.04 [@] 2	$A_2=-0.152$ 15; $A_4=0$ (1978Eg02). $A_2=-0.18$ 3; $A_4=-0.01$ 3 (1976Ro06). $\text{Pol}=+0.21$ 3 (1978Eg02), $+0.19$ 9 (1976Ro06).

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$^{28}\text{Si}(^{16}\text{O},2\text{p}\gamma)$ 1978Eg02,1976Ro06 (continued) **$\gamma(^{42}\text{Ca})$ (continued)**

$E\gamma^\dagger$	E(level)	$I\gamma^\dagger$	Mult.§	$\delta^\#$	Comments
917.59 15	6408.79	11.5 3	E2		$A_2=+0.336$ 13; $A_4=-0.115$ 14 (1978Eg02). $A_2=+0.365$ 19; $A_4=-0.12$ 3 (1976Ro06). Pol=+0.63 4 (1978Eg02), +0.41 12 (1976Ro06).
928.84 19	8297.1	3.8 2	M1+E2		$A_2=+0.01$ 5; $A_4=0$ (1978Eg02). $A_2=-0.67$ 14; $A_4=+0.41$ 15 (1976Ro06). Pol=-0.48 9 (1978Eg02), -0.67 27 (1976Ro06).
1227.66 ‡ 8	2752.29	91.0 20	E2		$A_2=+0.280$ 10; $A_4=-0.085$ 10 (1978Eg02). $A_2=+0.262$ 11; $A_4=-0.061$ 13 (1976Ro06). Pol=+0.42 2 (1978Eg02), +0.29 6 (1976Ro06).
1347.26 14	4099.58	4.9 3	E1+M2	-0.09@ 4	$A_2=-0.25$ 3; $A_4=0$ (1978Eg02). $A_2=-0.42$ 7; $A_4=+0.10$ 8 (1976Ro06). Pol=+0.27 5 (1978Eg02), +0.05 25 (1976Ro06).
1524.58 ‡ 8	1524.61	100 3	E2		$A_2=+0.277$ 10; $A_4=-0.093$ 10 (1978Eg02). $A_2=+0.285$ 11; $A_4=-0.082$ 17 (1976Ro06). Pol=+0.44 2 (1978Eg02), +0.37 9 (1976Ro06).
1644.7 4	5744.29		E2		$E\gamma$: from $\gamma\gamma$. $I\gamma$: $I\gamma(1644.7)/I\gamma(2554.85)=57$ 8/43 8. $A_2=+0.29$ 4; $A_4=-0.09$ 4 (1976Ro06). Pol=+0.25 29 (1976Ro06).
2301.75 21	5491.19	11.9 4	E1		$A_2=+0.470$ 20; $A_4=0$ (1978Eg02). $A_2=+0.325$ 16; $A_4=+0.055$ 18 (1976Ro06). Pol=-0.30 25 (1976Ro06).
2554.85 21	5744.29	8.1 3	E1(+M2)	0.00 +8-2	$A_2=-0.290$ 20; $A_4=0$ (1978Eg02). $A_2=-0.33$ 4; $A_4=+0.01$ 4 (1976Ro06). Pol=+0.40 10 (1978Eg02), -0.17 30 (1976Ro06).
2955.5 3	6144.96	2.4 1	E1		$A_2=-0.25$ 3; $A_4=0$ (1978Eg02). $A_2=-0.36$ 8; $A_4=-0.01$ 9 (1976Ro06). Pol=+0.40 20 (1978Eg02).
3219.2 3	6408.79	1.8 2	M2+E3	+0.8 2	$A_2=+0.92$ 3; $A_4=+0.36$ 4 (1978Eg02). $A_2=+0.76$ 14; $A_4=+0.29$ 15 (1976Ro06). Pol=-1.1 6 (1978Eg02).

† From 1978Eg02. Values of $I\gamma$ for most γ rays are also available in 1976Ro06 and agree with those from 1978Eg02, but are somewhat less precise.

‡ From 1975Wa04 in ($^{18}\text{O},2\text{n}\gamma$). This energy used as a calibration line by 1978Eg02.

§ Assigned by the evaluators based on $\gamma(\theta)$ and $\gamma(\text{lin pol})$ data.

$^\#$ From 1978Eg02, unless otherwise stated. 1976Ro06 give δ values for almost all the transitions, but their $J\pi$ values differ from the values in Adopted Levels for all the levels above 4100 keV.

@ From 1976Ro06.

 $^{30}\text{Si}(^{18}\text{O},\alpha 2\text{n}\gamma)$ 2003La04

2003La04: E=68 MeV ^{18}O beam was produced from the VIVITRON accelerator at IReS Strasbourg. Target of a 800 $\mu\text{g}/\text{cm}^2$ ^{30}Si . γ -rays were detected with the high-efficiency EUROBALL IV germanium detector array in coincidence with the Recoil Filter Detector (RFD). Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(\theta)(\text{DCO})$, $\gamma\gamma(\text{recoil})$ coin, $\gamma(\text{lin pol})$. Deduced levels, branchings.,

 ^{42}Ca Levels

E(level) †	$J\pi^\ddagger$	Comments
0.0 §	0+	
1524.73 § 20	2+	
1837 $^\#$	0+	
2424.3 $^\#$ 3	2+	
2752.5 § 3	4+	
3189.2 § 3	6+	
3254.0 $^\#$ 3	4+	
3446.8@ 3	3-	
3954.5@ 4	4-	

Continued on next page (footnotes at end of table)

$^{30}\text{Si}(^{18}\text{O}, \alpha 2n\gamma)$ 2003La04 (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [‡]	Comments
3999.9 3	4	
4099.7@ 3	5-	
4717.7# 3	6+	
4897.5@ 4	5-	
5213.1 3	6	
5490.7@ 3	6-	
5691.9 3	6	
5744.0@ 3	7-	
5925.5 4	5, 7	J π : (5) in Adopted Levels from γ from a 6896, 4+ level.
6144.6@ 3	7-	
6408.5@ 3	8-	
6553.7@ 3	9-	
6636.3# 3	8+	
6718.2 3	7	
7282.0 3	9-	
7368.5@ 3	10-	
7415.9 3	8	
7634.1 4	6, 8	
8297.5@ 3	11-	
8615.2 3	9	
8722.3 3	9	
8848.0# 3	10+	J π : 8, 10+ in Table supplied with the priv. comm.; 10+ in figure 1 of 2003La04.
9015.0 3	10	
9241.9? 9		Ordering of 1960-2484 cascade from 11725.3 level is not established.
9311.1 3	8, 10	
9786.3 3	9, 11	
10168.7 3	10, 12	
11165.7 9	10, 12	
11405.1# 11	(12+)	
11725.8 9		
11821.1 5		
12198.1 11		
12701.4 5		
12814.8 8		
13712.9 11		
13762.9 14		
15251.8 13		

[†] From least-squares fit to E γ data.[‡] From $\gamma\gamma(\theta)(\text{DCO})$ and $\gamma(\text{lin pol})$.

§ (A): g.s., Yrast band.

(B): Excited 0+ band.

@ (C): Negative-parity structure.

 $\gamma(^{42}\text{Ca})$

E(level)	E γ [†]	I γ [†]	Mult.	Comments
1524.73	1524.7 2	100		DCO=0.98 8.
2424.3	899.5 3			DCO=1.00 18.
	2424.2 [‡]			
2752.5	1227.7 2	100		DCO=0.99 8.
3189.2	436.7 1	100		DCO=1.09 11.
3254.0	501.5 2	40 4		DCO=1.02 16.
	829.7 [‡]	5 1		
	1729.2 3	100 7		DCO=0.96 16.
3446.8	694.4 [‡]			
	1022.5 3	80 10		
	1922.0 3	100 10		
3954.5	507.7 2			DCO=2.2 5.
	1202.0 [‡]			
3999.9	1575.6 3	58 8		

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$^{30}\text{Si}(^{18}\text{O}, \alpha 2n\gamma)$ 2003La04 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult.	Comments
3999.9	2475.1 3	100 12		DCO=1.04 29.
4099.7	145.2 $\frac{1}{2}$	2 1		
	910.5 2	100 3	\$	DCO=1.61 15.
	1347.3 2	60 3	\$	DCO=1.57 13.
4717.7	1463.7 3	95 5	\$	DCO=1.08 14.
	1528.5 $\frac{1}{2}$	32 7		
	1965.2 4	100 3	\$	DCO=1.01 15.
4897.5	797.8 3	100.0		DCO=0.94 22.
5213.1	1213.2 3	100 10		
	1959.1 4	75 9		
5490.7	1536.1 $\frac{1}{2}$	1.0 3		
	2301.4 2	100 3		DCO=1.00 7.
				Mult.: possible magnetic character from $\gamma(\text{lin pol})$; but 6- to 6+ requires E1(+M2).
5691.9	974.1 2			DCO=1.00 26.
	2437.8 3			DCO=1.4 4 (?).
5744.0	253.3 1	2.6 2		DCO=1.72 22.
	1026.3 2	4.0 4		DCO=1.69 28.
	1644.2 1	100 3	\$	DCO=1.02 8.
	2554.7 2	72 3	\$	DCO=1.60 20.
5925.5	2736.2 4	100.0		DCO=2.1 4.
6144.6	2955.3 2	100.0	\$	DCO=1.76 25.
6408.5	263.9 1	20.0 13		DCO=1.92 18.
	664.6 2	5.0 7		DCO=1.84 26.
	917.8 2	100 3	\$	DCO=0.97 10.
	3219.2 3	16 2	#	DCO=1.07 15.
6553.7	145.2 1	35 2		DCO=2.07 19.
	409.1 2	3.0 5		
	809.7 1	100 4	\$	DCO=1.06 9.
	3364.4 3	11 1	[E3]	DCO=0.80 12.
				Mult.: possible magnetic character from $\gamma(\text{lin pol})$; but 9- to 6- requires E3.
6636.3	1918.6 2	100 5	\$	DCO=1.03 18.
	3447.1 4	16 2		DCO=1.03 23.
6718.2	1505.1 2	100 9		DCO=1.52 20.
	2000.4 3	64 7		
	3528.8 5	52 5		Mult.: $\Delta J=1$ transition.
7282.0	728.3 1	30 3		DCO=1.06 16.
	873.5 2	100 8	#	DCO=1.80 26.
7368.5	814.8 1	100 3	#	DCO=1.85 18.
	959.9 2	3.5 6		DCO=0.95 15.
7415.9	779.6 2	35 3		DCO=0.99 12.
	1723.9 3	30 5		
	2698.1 $\frac{1}{2}$	4.0 12		
	4226.6 $\frac{1}{2}$	100 5		Mult.: possible magnetic character.
7634.1	1708.5 4			
	1942.2 3			
	2916.3 3			DCO=1.1 3.
	4444.8 $\frac{1}{2}$			
8297.5	929.0 1	100 4	#	DCO=1.52 16.
	1743.8 2	65 4	\$	DCO=0.99 10.
8615.2	1199.3 3	34 4		
	1896.9 2	100 8		DCO=0.99 15.
	1978.7 3	54 7		DCO=2.3 4.
	2061.4 $\frac{1}{2}$	9 2		
8722.3	1306.4 2	90 9		DCO=1.68 26.
	1440.3 3	30 5		
	2004.0 3	86 15		
	2085.9 2	100 10		DCO=1.57 20.
	2168.6 3	36 6		
8848.0	2211.6 2	100.0	\$	DCO=0.97 15.
9015.0	292.7 2	11 2		DCO=2.20 30.
	399.9 1	26 2		DCO=1.76 15.
	717.6 3	5 1		
	1599.1 1	100 4		DCO=1.04 15.

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$^{30}\text{Si}(^{18}\text{O},\alpha 2n\gamma)$ 2003La04 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	Mult.	Comments
9015.0	1733.0 2	67 10		DCO=1.50 22.
	2378.6 3	13 2		DCO=0.98 29.
	2461.3 3	15 2		DCO=0.96 18 (?).
9241.9?	1960			
9311.1	1677.0 3	90 6		Mult.: $\Delta J=0,2$ transition.
	2674.7 3	100 12		DCO=1.05 20.
9786.3	475.2 1	14 1		DCO=1.91 22.
	771.3 1	100 3	#	DCO=1.61 12.
	938.3 2	16 1	#	DCO=1.57 16.
	1063.9 3	24.0 14		DCO=1.01 14.
	1171.0 2	16.0 15		DCO=1.00 16.
	1488.8 1	44 2	#	DCO=0.99 10.
	2417.8 2	28 2		DCO=1.08 16.
10168.7	382.4 1	100 3		DCO=1.84 18.
	1153.6 3	29 2		DCO=1.02 14.
	1871.2 2	11 1		DCO=2.06 23.
11165.7	2868.1 8	100.0		DCO=2.18 33.
11405.1	2557	100.0		
11725.8	2484			
	4357			
11821.1	1652.3 4	83 11		DCO=1.87 27.
	2034.6 8	100 7		
12198.1	3350			
12701.4	880.3 2			
	2533 1			
12814.8	2646			
	4517			
13712.9	5415			
13762.9	2037			
15251.8	2437			

$\dagger$ From private communication received from first author (M. Lach) on March 19, 2003, as an e-mail reply.

$\ddagger$ From level-energy difference.

$\S$ Electric character from $\gamma(\text{lin pol})$.

Magnetic character from $\gamma(\text{lin pol})$.

 $^{38}\text{Ar}(\alpha,\gamma)$: Resonances 1967Na10

1967Na10: E=3–6 MeV alpha beam was produced from the Pennsylvania State University 6 MV Van de Graaff accelerator.

Enriched ^{38}Ar target. γ -rays were detected with a NaI anti-coincidence spectrometer. Measured $\sigma(\theta)$. Deduced

levels, $J\pi$, Γ_{γ} .

Others:

1976Fo04,1974Fo04: E=6–15 MeV. Measured $\sigma(\theta)$ for the giant dipole resonances.

 ^{42}Ca Levels

All data are from 1967Na10.

E(level) $\ddagger$	$J\pi^{\dagger}$	$(2J+1)\Gamma_{\alpha}\Gamma_{\gamma}/\Gamma$	Measured E_{α} (lab)	E(level) $\ddagger$	$J\pi^{\dagger}$	$(2J+1)\Gamma_{\alpha}\Gamma_{\gamma}/\Gamma$	Measured E_{α} (lab)
9115 5		0.43 eV	3158 5	9757 5		2.05 eV	3867 5
9191 5		0.42 eV	3242 5	9784 5		0.75 eV	3897 5
9280 5	1–	1.49 eV	3340 5	9870 5		1.44 eV	3992 5
9367 5		0.78 eV	3436 5	9947 5		1.74 eV	4077 5
9426 5		1.48 eV	3501 5	10038 5		0.62 eV	4178 5
9470 5		0.83 eV	3551 5	10205 5		0.85 eV	4362 5
9561 5		0.76 eV	3651 5	10231 5		0.57 eV	4391 5
9635 5		0.53 eV	3732 5	10282 5	1–	2.81 eV	4448 5
9672 5		0.47 eV	3773 5	10314 5		1.23 eV	4483 5
9699 5		0.75 eV	3803 5	10358 5	1–	2.23 eV	4532 5
9723 5		0.75 eV	3830 5	10389 5		0.99 eV	4566 5

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$^{38}\text{Ar}(\alpha,\gamma)$: Resonances 1967Na10 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^{\ddagger}$	$J\pi^{\dagger}$	$(2J+1)\Gamma_{\alpha}\Gamma_{\gamma}/\Gamma$	Measured E_{α} (lab)	$E(\text{level})^{\ddagger}$	$J\pi^{\dagger}$	$(2J+1)\Gamma_{\alpha}\Gamma_{\gamma}/\Gamma$	Measured E_{α} (lab)
10453 5		1.68 eV	4637 5	11013 5	1-	3.46 eV	5255 5
10500 5	1-	2.13 eV	4688 5	11048 5		1.28 eV	5294 5
10527 5		0.50 eV	4718 5	11076 5	1-	1.91 eV	5325 5
10561 5		0.53 eV	4756 5	11108 5	1-	1.68 eV	5361 5
10588 5		1.16 eV	4786 5	11149 5	1-	2.51 eV	5406 5
10612 5		0.83 eV	4812 5	11185 5	1-	0.99 eV	5446 5
10633 5		3.65 eV	4835 5	11223 5	1-	2.63 eV	5488 5
10652 5		0.45 eV	4857 5	11279 5		1.05 eV	5550 5
10673 5	1-	1.32 eV	4880 5	11301 5		1.21 eV	5574 5
10700 5		0.98 eV	4910 5	11336 5	1-	8.10 eV	5613 5
10726 5	1-	1.74 eV	4938 5	11378 5	1-	2.43 eV	5659 5
10783 5	1-	2.54 eV	5001 5	11399 5		0.62 eV	5682 5
10805 5	1-	4.29 eV	5026 5	11441 5	1-	1.65 eV	5729 5
10842 5	1-	5.37 eV	5067 5	11489 5	1-	2.84 eV	5782 5
10884 5	1-	2.89 eV	5113 5	11519 5		0.66 eV	5815 5
10905 5	1-	2.69 eV	5136 5	11545 5	1-	1.59 eV	5843 5
10916 5	1-	2.69 eV	5148 5	11612 5		2.00 eV	5918 5
10968 5		0.85 eV	5206 5	11661 5		0.59 eV	5972 5
10985 5		0.90 eV	5225 5				

† From angular distributions of the ground-state γ -rays from resonant states (1967Na10).

‡ Excitation energy of resonance= $S(\alpha)+E_{\alpha}(\text{c.m.})$ with $E_{\alpha}(\text{c.m.})$ deduced from $E_{\alpha}(\text{lab})$. $S(\alpha)=6257.34 \pm 25$ (2012Wa38).

 $^{38}\text{Ar}(^6\text{Li},\text{d})$ 1978Fo02

Target ^{38}Ar g.s. $J\pi=0+$.

1978Fo02: $E=17.0$ MeV ^6Li beam. 95% enriched ^{38}Ar gas target. Reaction particles were momentum analyzed with a multi-range magnetic spectrograph. Measured $\sigma(\theta)$. Deduced levels, relative α -strengths and major configurations for $0+$ states from DWBA calculations.

 ^{42}Ca Levels

All data are from 1978Fo02.

$E(\text{level})$	L	Relative strength	$E(\text{level})$	L	Relative strength	$E(\text{level})$	Relative strength
0.0 §	0	1.00	3300	0	0.81	6020 $^{\#}$	
1520			3650			6350	
1840	0	0.22	4440 †			6520 ‡	0.13 $^{\@}$
2420			4450 †			6700 ‡	0.26 $^{\@}$
2750			5860		0.31		

† Unresolved doublet.

‡ α -unbound level.

§ $d\sigma/d\Omega(7.5^{\circ})=3.8$ $\mu\text{b}/\text{sr}$.

$^{\#}$ Very weakly populated.

$^{\@}$ DWBA cross section obtained by extrapolation.

$^{39}\text{K}(\alpha, p)$ 1995Th06

$J\pi(^{39}\text{K g.s.})=3/2+$.

1995Th06: E=25 MeV alpha beam was produced from the Niels Bohr Institute Tandem Van de Graaff Accelerator. A target of natural KCl enriched to 93.1% and 20 $\mu\text{g}/\text{cm}^2$ in ^{39}K . Reaction products were momentum analyzed in a multigap magnetic spectrograph of the Elbek type and detected in nuclear emulsions, FWHM=30 keV. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$ from DWBA analysis.

1971Pe04: E=10 MeV. Measured $\sigma(\theta)$. Hauser-Feshbach calculations.

1955Sc82: E=8.2 MeV. Eight groups reported up to 4100 keV.

Integrated cross section (mb) (1971Pe04)

Energy	cross section	
0	4.5	7
1520	14.8	22
1840	2.9	4
2430	11.0	16
2760	19.4	29
3200	18.5	37
3260	18.0	36
3390+3440	14.8	22
3680	9.6	14
3910	3.8	8
4260	4.7	7
4400	9.97	20
4810		
5010		

^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	$d\sigma/d\Omega$ $\mu\text{b}/\text{sr}^\#$	E(level) [†]	$J\pi^{\ddagger}$	$d\sigma/d\Omega$ $\mu\text{b}/\text{sr}^\#$
0.0	0+ ^f	47	5618 7	3-b	286
1524 4	2+h	57	5669 7	3-c	229
1836 4	0+f	27	5741 7	7-e	287
2420 4	2+h	29	5791 7	3-b	351
2753 3	4+i	102	5866 7	0+, 2+f	103
3188 4	6+i	123	5922 7	3-, 4-c	131
3260 § 40			6026 5	1- to 6-d	329
3446 ^k 4	3-c	152	6096 7	4+ ^g	260
3680 § 40			6144 5	6- and 7-e	641
3953 ^l 3	4-c	339	6321 7	c	217
4044 5	3-&	97	6410 7	8-e	219@
4101 3	5-c	384	6549 7	9-e	242
4260 § 40			6587 7	j	339
4425 4	3-c	162	6737 7	f	174
4691 4	3-c	132	6779 7		254@
4894 ^m 3	5-c	393	6931 7	f	190
4960 5	3-b	148	6975 7	j	218
5073 5	≤3-b	323	7031 7	i	251@
5156 5	3-c	131	7103 7	b	206
5316 5	3-, 4-a	101	7153 7	i	209
5387 5	1-, 2-, 3-b	419	7228 7	b	
5488 5	6-d	589	7274 7	f	
5587 7	3-c	70			

[†] Uncertainty of 3 to 7 keV assigned (evaluators) based on a general statement by 1995Th06.

[‡] From comparisons of experimental $\sigma(\theta)$ data with DWBA calculations with a cluster form factor for a single particle transfer, as stated in comments for individual levels (1995Th06).

§ From 1971Pe04 only.

At 17.5°, unless otherwise stated.

@ At 22.5°.

& For $p_{1/2}$ transfer.

a For $p_{3/2}$ transfer.

$^{39}\text{K}(\alpha, p)$ 1995Th06 (continued) **^{42}Ca Levels (continued)**

- b For $f_{5/2}$ transfer.
 c For $f_{7/2}$ transfer.
 d For $h_{11/2}$ transfer.
 e For $j_{15/2}$ transfer.
 f For $d_{3/2}$ transfer.
 g For $d_{5/2}$ transfer.
 h For $g_{7/2}$ transfer.
 i For $i_{11/2}$ transfer.
 j For $i_{13/2}$ transfer.
 k 3390+3440 (doublet) in 1971Pe04.
 l 3910 (1971Pe04).
 m 4810 (1971Pe04).

 $^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01

Includes g-factor and $T_{1/2}$ measurements in $^{40}\text{Ca}(\alpha, 2p\gamma)$.
 1980Ke01 (also 1976Bi15, 1976Be13): E=15.14 MeV alpha beam was produced from the 7 MV Van de Graaff accelerator of the University of Freiburg. A target of 140 $\mu\text{g}/\text{cm}^2$ ^{39}K evaporated onto a 10 $\mu\text{g}/\text{cm}^2$ carbon backing. Charged particles were detected with an ΔE -E telescope of two annular surface barrier detectors and γ -rays were detected with two Ge(Li) detectors of 22% efficiency. Measured $E\gamma$, $I\gamma$, p- γ coin. Lifetime measurement by DSA technique in 1976Bi15 and 1976Be13; $\gamma(\theta)$ in 1976Be13. Deduced levels, branchings, mixing ratios.
 1978Pr02 (also 1976Pr15): E=9.5, 16.0 MeV. Measured $\gamma(\text{lin pol})$, lifetimes by Doppler shift method. Also 1976Pr15 at E=9.5, 11.5 MeV. Deduced levels, $J\pi$, branchings, mixing ratios.
 1973Mc16: E=9 MeV. Measured p- γ coin, lifetime of 2750 level by DSA method.
 1971Ha12: E=7.5 MeV. Measured $p\gamma(\theta)$, lifetimes by DSA method.
 1971AlZF: E=15 MeV. Measured $\gamma\gamma$ coin, $\gamma(\theta)$.
 1970Ma39: E=10 MeV. Measured $p\gamma(\theta, H, t)$, deduced g factor for 3190 level.
 1970Co32: E=8.3 MeV. Measured lifetime by recoil-distance method.
 1969Ha02: E=7.5, 9.0, 10.6 MeV. Measured $p\gamma(t)$ and Doppler-shift attenuation.
 g-factor measurements of 3190, 6+ level using $^{40}\text{Ca}(\alpha, 2p\gamma)$: 1975Yo02 (E=23 MeV), 1971No06 (also 1972No09, 1970No04) (E=25 MeV).

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
0.0	0+		
1524 2	2+	0.62 ps 21	$T_{1/2}$: from 1969Ha02, 1971Ha12. Other: 0.69 ps 21 (quoted by 1971Ha12 from Carlsson (priv comm)).
1837 2	0+		
2423 3	2+	0.114 ps 30	$T_{1/2}$: average of 0.11 ps 3 (1969Ha02), 0.118 ps 28 (1971Ha12). Other: 0.125 ps 21 (quoted by 1971Ha12 from Carlsson (priv comm)).
2751 2	4+	1.6 ps 7	$T_{1/2}$: from 1973Mc16. Others: 24 ps 7 (1969Ha02), 1.3 ps +14-7 (1971Ha12), 2.0 ps +14-7 (quoted by 1971Ha12 from Carlsson (priv comm)), 8.0 ps 17 (1970Co32).
3190 2	6+	5.30 ns 16	$T_{1/2}$: from 1970Ma39. Others: 3.7 ns 5 (1969Ha02), 5.3 ns 3 (quoted by 1971Ha12 from Carlsson (priv comm)), 5.52 ns 15 (1970No04) in $^{40}\text{Ca}(\alpha, 2p\gamma)$. g=-0.42 3 (1970Ma39), -0.50 +2-3 (1971No06, 1972No09), -0.415 15 (1975Yo02).
3253 2	4+	0.118 ps 21	$T_{1/2}$: average of 0.10 ps 3 (1969Ha02), 0.125 ps 21 (1971Ha12). Other: 0.17 ps 3 (quoted by 1971Ha12 from Carlsson (priv comm)).
3300 2	0+		
3393 2	2+	0.118 ps 21	$T_{1/2}$: from 1971Ha12. Other: 0.18 ps 4 (quoted by 1971Ha12 from Carlsson (priv comm)).
3446 6	3-	0.23 ps 7	$T_{1/2}$: average of 0.25 ps 7 (1969Ha02), 0.20 ps 7 (1971Ha12). Other: 0.28 ps 7 (quoted by 1971Ha12 from Carlsson (priv comm)).
3654 2	2+	49 fs 35	$T_{1/2}$: from 1971Ha12. Other: 62 fs 28 (quoted by 1971Ha12 from Carlsson (priv comm)).
3884 2	1-		
3953 2	4-	3.26 ps 21	$T_{1/2}$: from 1976Pr15.
3998 2	4+		
4048 2	3-	0.17 ps 5	$T_{1/2}$: average of 0.17 ps 5 (1976Pr15), 0.17 ps 6 (1976Bi15).
4099 2	5-	0.45 ps 10	$T_{1/2}$: average of 0.40 ps 10 (1976Pr15), 0.51 ps +10-8 (1976Bi15).
4117 2	3-		
4232 2	1		
4355 2	4-	0.47 ps 7	$T_{1/2}$: average of 0.53 ps 7 (1976Pr15), 0.38 ps 10 (1976Bi15).
4420 2	3-		

Continued on next page (footnotes at end of table)

$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
4443 2	4+		
4452 2	2+		
4505 2	(2, 3, 4)+		
4566 2	(1, 2+)		
4691 2	3-		
4715 2	6+	83 fs 32	$T_{1/2}$: from 1976Be13.
4761 2	2+		
4865 2	2+		
4896 2	5-	47 fs 21	$T_{1/2}$: average of 55 fs 35 (1976Pr15), 44 fs 21 (1976Bi15).
4904 2	3-		
4948 2	(1, 2, 3)-		
4972 2	3-		
5016 2	4+		
5075 2	(1, 2, 3)-		
5159 2	3-		
5188 2	(2, 3, 4)+		
5210 2	(2+)		$J\pi$: other: 3+ (1980Ke01).
5215 2	(2+)		
5320 2	(3, 4)-		
5345 2	0+		
5357 2	2+		
5380 2	5-		
5393 2	(3)-		
5439 2	(3, 4)-		
5472 2	(2, 3, 4)+		
5491 2	3-		
5492 2	6-	59 fs 14	$T_{1/2}$: from 1978Pr02.
5510 2	3-		
5530 2	2+		
5578 2	(0+ to 4+)		
5594 2	3-		
5601 2	(3-, 4-)		
5624 2	3-		
5665 2	(3-)		
5670 2	(3-)		
5690 2	6+		
5716 2	2+		
5726 2	(2+ to 6+)		
5743 3	7-	0.42 ps 10	$T_{1/2}$: from 1978Pr02.
5769 2	3-		
5775 2	(4, 5)+		
5797 2	(1, 2)+		
5806 2	3-		
5820 2	(1, 2, 3)-		
5866 2	(1, 2, 3-)		E(level): If this level is the same as 5860 in (t,p) with L=0, then placement of 4029 γ is incorrect as it would be E0.
5875 2	2+		
5925 2	(3, 4)-		
5927 2	(5)		
5993 2	3-		
6003 2	3-, 4-		
6020 2	(4+, 5, 6-)		
6028 2	(3)-		
6038 2	(1, 2, 3)-		
6093 2	(3- to 7-)		
6104 2	(0+ to 4+)		
6113 2	4+		
6141 2	6-		$T_{1/2}$: 49 fs +21-14 (1976Bi15).
6145 2	7-	<0.07 ps	$T_{1/2}$: from 1978Pr02.
6180 2	(1, 2, 3-)		
6213 2	3-		
6248 2	(4+, 5, 6-)		
6408 2	8-		

Continued on next page (footnotes at end of table)

$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
6542 2	5+		
6553 2	9-		
6585 2	(5- to 8-)		
6635 2	8+	36 fs 15	$T_{1/2}$: from 1976Be13.
6675 2	(4+ to 8+)		
6715 2	(4+)		
6746 2	4+		
6817 2	(4, 5)+		
6896 2	4+		
6940 2	(5-, 6, 7-)		
6975 2	(5+)		
7130 2	4+		
7198 2			
7282 2	9-		
7345 2	(6- to 10-)		
7361 2	(5- to 9-)		
7368 2	10-		
7390 2	4+		
7415 2	8+		
7420 2	(4+ to 8+)		
7542 2	(4+ to 7-)		
7560 2	(4+, 5+)		
7634 2	(6, 8+)		
7697 2	4+		
7724 2	(4+ to 8+)		
7758 2	(6-, 7-)		
7801 2	(5- to 9-)		
7838 2	(2+ to 6+)		
7920 2	(4+ to 8+)		
7940 2	(4+ to 8+)		
8050 2	(4+ to 8+)		
8060 2	(6- to 9-)		
8083 2	(7- to 11-)		
8102 2	(4+ to 8+)		
8296 2	11-		
8365 2	(6-, 7, 8+)		
8450 2	(7, 8)-		
8512 2	(6- to 9-)		
8517 2	(3 to 9)		
8580 2	(2+ to 6+)		
8611 2	(2+ to 6+)		
8745 2	(8- to 12+)		
8774 2	(4- to 8-)		
8847 2	(10+)		
8950 2	(6+ to 10+)		
9037 2	(8- to 12-)		
9206 2	(7- to 9-)		
9378 2	(5- to 9-)		
9760 2	(7- to 11-)		
9842 2	(5, 6)-		
10036 2	(5- to 9-)		

[†] From 1980Ke01, unless otherwise noted.[‡] From Adopted Levels. $\gamma(^{42}\text{Ca})$

E(level)	$E\gamma^{\ddagger}$	$I\gamma^{\ddagger}$	Mult.§	$\delta\%$	Comments
	^x 4029	100	18		Placed from 5866 level to 1837 level in 1980Ke01, but both levels are 0+. This γ may have been misplaced.
1524	1524	100			

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$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued)

 $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Mult. §	$\delta^{\S}$	Comments
1837	313	100			
2423	899	100 7			
	2423	33 7			
2751	1227	100			
3190	439	100			$A_2=+0.39$ 3; $A_4=-0.17$ 2 (1970Ma39).
3253	502	43 6			
	1729	100 6			
3300	877	100			
3393	1556	12 4			
	1869	100 12			
	3393	84 12			
3446	695	8 2			
	1023	58 8			
	1922	100 8			$A_2=-0.2$ (1976Be13).
3654	2130	100 9	M1 (+E2)	-0.06 17	Mult., δ : from 1971Ha12.
	3654	32 9			
3884	2047	92 3			I_{γ} : $\Delta(I_{\gamma})=23$ in 1980Ke01 seems a type error.
	3884	100 4			
3953	507	100 4	M1+E2	+0.11 5	A_2 =negative, Pol=-0.28 (1976Pr15).
					Mult., δ : from 1976Bi15. +0.09 from 1976Pr15.
	1202	18 4	E1		$A_2=+0.35$ 2; $A_4=-0.02$ 2 (1976Pr15).
					Pol=-0.66 14 (1976Pr15).
3998	1575	89 13			
	2474	100 13			
4048	602	56 13	M1+E2	+0.21 12	I_{γ} : branching seems wrong in 1980Ke01. Branching=9% 3 (1976Bi15).
					$A_2=+0.29$ 3; $A_4=-0.02$ 3 (1976Pr15).
					Pol=+0.30 10 (1976Pr15).
	1625	30 9			
	2524	100 11			
4099	909	100 8			
	1348	61 8	E1		$A_2=-0.25$ 3; $A_4=+0.01$ 3 (1976Pr15).
					Pol=+0.44 10 (1976Pr15).
4117	671	61 11			
	2593	100 11			
4232	1809	23 7			
	4232	100 7			
4355	402	9 2	M1+E2	>0.09	$A_2=+0.48$ 3; $A_4=-0.07$ 3 (1976Pr15).
					Pol=+0.58 40 (1976Pr15).
	909	53 9			
	1102	20 5			
	1604	100 9	E1		$A_2=+0.39$ 2; $A_4=-0.02$ 2 (1976Pr15).
					Pol=-0.68 15 (1976Pr15).
4420	974	67 12			
	1997	25 8			
	2896	100 13			
4443	1190	10 3			
	1692	100 5			
	2020	16 4			
4452	798	34 6			
	1006	37 9			
	2615	49 11			
	2928	100 17			
	4452	66 14			
4505	1112	34 6			
	1252	15 4			
	1754	64 11			
	2981	100 13			
4566	682	47 9			
	2143	100 9			
4691	2268	22 6			
	3167	100 6			

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$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Mult. [§]	$\delta^{\S}$	Comments
4715	1462	100 11			$I_{\gamma}(1462)/I_{\gamma}(1525)/I_{\gamma}(1964)=48\ 3/44\ 3/7.5\ 20$ (1976Be13). $\delta(Q/D)=-0.96\ 10$ for $J(4715)=4$ (1976Be13). $A_2=+0.46\ 5$; $A_4=-0.30\ 6$ (1976Be13).
	1525	39 9			
	1964	78 11			$\delta(Q/D)=-1.1\ +15-5$ for $J(4715)=4$ (1976Be13). $A_2=+0.47\ 6$; $A_4=-0.30\ 7$ (1976Be13).
4761	2338	96 16			
	3237	100 16			
4865	2442	100 9			
	3341	22 9			
4896	779	8 1			
	797	100 4	M1+E2	+0.14 +6-10	δ : other: $-0.14\ +7-14$ (1976Bi15). $A_2=+0.43\ 1$; $A_4=-0.02\ 1$ (1976Pr15). Pol=+0.78 9 (1976Pr15).
	1450	18 4	E2		$A_2=+0.42\ 2$; $A_4=-0.13\ 2$ (1976Pr15). Pol=+0.77 16 (1976Pr15).
4904	2481	33 13			
	4904	100 18	[E3]		
4948	2525	100			
4972	1019	91 14			
	2549	100 17			
	3448	94 17			
5016	1763	100 7			
	3492	21 7			
5075	655	47 10			
	1629	100 10			
5159	2736	85 17			
	3635	100 17			
5188	768	100			
5210	1957	100 5			
	2459	14 5			
5215	1217	100 8			
	2792	25 7			
	3691	39 8			
5320	900	61 11			
	1221	61 11			
	1272	26 5			
	1367	100 13			
	2067	16 5			
5345	3821	100			
5357	5357	100			
5380	2127	52 10			
	2190	86 12			
	2629	100 14			
5393	2970	33 12			
	3869	100 12			
5439	1340	100			
5472	2219	100 5			
	2721	43 8			
	3948	16 10			
5491	1374	100 13			
	3967	45 13			
5492	2302	100	E1 (+M2)	+0.10 8	$A_2=+0.46\ 3$; $A_4=-0.05\ 3$ (1978Pr02). Pol=-0.74 11 (1978Pr02).
5510	1462	47 12			
	2064	100 12			
5530	3107	100 13			
	4006	43 13			
5578	2185	100			
5594	1641	100 15			
	3171	56 8			
	4070	52 15			
5601	1096	49 15			

Continued on next page (footnotes at end of table)

$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Mult. §	$\delta^{\S}$	Comments
5601	1603	100 15			
5624	1625	100 15			
	5624	60 15	[E3]		
5665	1245	51 11			
	1712	100 16			
	3242	71 13			
5670	2224	100 16			
	4146	79 16			
5690	975	100 13			
	2437	83 13			
	2500	30 9			
5716	2463	100			
5726	2975	100			
5743	1644	100 9	E2		$\delta(\text{M3/E2})=-0.02$ 3 (1978Pr02). $A_2=+0.40$ 2; $A_4=-0.16$ 2 (1978Pr02). $\text{Pol}=+0.67$ 20 (1978Pr02). $A_2=-0.37$ 3; $A_4=-0.02$ 3 (1978Pr02). $\text{Pol}=+0.42$ 25 (1978Pr02). $I_{\gamma}(2553)/I_{\gamma}(1644)=40$ 5/60 5 (1978Pr02).
	2553	80 9	E1+M2	-0.04 2	
5769	3018	100 11			
	3346	59 11			
5775	2522	100 3			
	2585	12 3			
5797	3374	100 18			
	4273	72 15			
	5797	85 18			
5806	1808	100			
5820	3397	100			
5866	4029	100 18			
	4342	82 18			
5875	3124	41 11			
	3452	100 11			
5925	1420	27 8			
	1570	32 8			
	1826	100 14			
	1972	57 11			
	3174	54 11			
5927	2737	100			
5993	1021	20 6			
	3570	100 6			
6003	3252	100			
6020	2067	23 7			
	2830	100 7			
6028	2075	91 16			
	3277	100 16			
	4504	36 11			
6038	3615	33 8			
	4514	100 8			
6093	1197	100 7			
	1994	47 7			
6104	3681	100 14			
	4580	79 14			
6113	1693	16 5			
	2860	100 5			
6141	650	16 6	(M1+E2)	-0.25 +10-25	I_{γ} : 52 12 (1976Bi15).
	1786	17 3			
	2042	26 5			
	2188	100 9			
6145	2955	100	(E1)		$\delta(\text{Q/D})=+0.02$ 2 (1978Pr02). $A_2=-0.21$ 3; $A_4=-0.01$ 3 (1978Pr02).
6180	4656	100 13			
	6180	47 13	[E3]		
6213	3462	100			

Continued on next page (footnotes at end of table)

$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Mult. §	$\delta^{\S}$	Comments
6248	2295	74 13			
	3058	100 15			
	3497	82 13			
6408	263	16 3	D		$\delta(Q/D)=0.00$ 2 (1978Pr02).
	916	100 6	E2		$A_2=-0.24$ 2; $A_4=-0.04$ 3 (1978Pr02).
	3218	33 6	M2+E3	+2.0 10	$A_2=+0.35$ 2; $A_4=-0.16$ 2 (1978Pr02).
					$\delta(Q/D)=+0.03$ 2 (1978Pr02).
					$A_2=+0.67$ 16; $A_4=+0.25$ 13 (1978Pr02).
					$I_{\gamma}(3218)/I_{\gamma}(916)/I_{\gamma}(262)=13$ 2/70 3/17 3 (1978Pr02).
6542	1050	43 7			
	2443	29 7			
	3352	100 10			
6553	145	15 2			
	810	100 2	E2		$\delta(M3/E2)=-0.03$ 2 (1978Pr02).
					$A_2=+0.32$ 2; $A_4=-0.14$ 2 (1978Pr02).
6585	842	100 11			
	1093	85 11			
6635	1920	16 3			$I_{\gamma}(1920)/I_{\gamma}(3445)=7$ 2/93 2 (1976Be13).
					$A_2=+0.47$ 7; $A_4=-0.32$ 8 (1976Be13).
					$\delta(Q/D)=+0.7$ 4 for J(6635)=6, +0.9 3 for J(6635)=4.
	3445	100 3			
6675	3485	100			
6715	1505	100 13			
	2000	83 13			
	3525	68 13			
6746	1850	100 18			
	2647	96 18			
6817	3627	100			
6896	969	32 6			
	1404	8 3			
	3706	100 6			
6940	1197	43 9			
	2044	100 13			
	2841	74 11			
6975	1483	36 7			
	2260	27 7			
	2876	60 9			
	3785	100 11			
7130	3940	100			
7198	4008	100			
7282	729	35 5			
	874	100 5			
7345	937	100			
7361	1216	100			
7368	815	100	M1+E2	-0.16 4	$A_2=-0.45$ 5; $A_4=+0.01$ 6 (1978Pr02).
7390	4200	100			
7415	780	100			
7420	2705	33 5			
	4230	100 5			
7542	2646	100 18			
	2827	100 18			
	4352	63 18			
7560	2845	100			
7634	1707	51 9			
	1944	54 9			
	2919	100 14			
	4444	80 11			
7697	4507	100			
7724	3009	100			
7758	1350	56 9			
	2015	75 13			
	2266	100 13			
	2862	81 13			
7801	1656	100			

Continued on next page (footnotes at end of table)

$^{39}\text{K}(\alpha, p\gamma)$ 1980Ke01 (continued) **$\gamma(^{42}\text{Ca})$ (continued)**

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$
7838	1123	100	8296	1743	79 11	8774	3282	100 11
7920	3205	100 13	8365	1957	100 18		5584	41 11
	4730	61 13		5175	75 18	8847	2212	100
7940	2250	75 12	8450	1897	69 12	8950	2315	100
	4750	100 12		2042	69 12	9037	1669	100
8050	3335	100		2958	100 12	9206	1924	92 13
8060	1652	100 2	8512	2104	89 13		3061	100 13
	2317	6 2		2769	100 13	9378	3635	100
8083	1530	100	8517	2590	100	9760	3207	100
8102	2412	49 7	8580	1865	100	9842	3697	100
	3387	100 7	8611	1896	100	10036	3891	100
8296	928	100 11	8745	1377	100			

† From level-energy differences (1980Ke01).

‡ From 1980Ke01, unless otherwise noted.

§ From 1976Pr15 and 1978Pr02, unless otherwise noted.

* γ ray not placed in level scheme.

 $^{40}\text{Ar}(^3\text{He}, n)$ 1977Bo16, 1974Pe03

Target ^{40}Ar g.s. $J\pi=0^+$.

1977Bo16: E=11.5 MeV ^3He beam was produced at the CN Van de Graaff accelerator at the Hahn-Meitner Institute. Target of enriched ^{40}Ar gas. Neutrons were detected with 16 liquid scintillators and energies were determined by the time-of-flight (TOF) method with a flight path of 17.5 m. FWHM=40–350 keV. Measured $\sigma(\theta)$. Deduced levels $J\pi$, L-transfers from DWBA analysis.

1974Pe03: E=18.65 MeV ^3He beam was produced at the University of Michigan. A natural argon gas target. Neutrons were measured using a time-of-flight spectrometer, FWHM=320 keV. Measured cross sections at 0° and 15° . Deduced levels. DWBA calculations.

Other:

1964Br13: E=25 MeV. Measured cross section at 0° . No levels identified.

 ^{42}Ca Levels

E(level) †	$L^\ddagger$	$d\sigma/d\Omega$ (mb/sr) §	Comments
0.0	0	0.81 17	$\sigma(\text{exp})/\sigma(\text{dw})=0.0027$ (1977Bo16) for $d_{3/2}^2$. $d\sigma/d\Omega=0.78$ mb/sr (1977Bo16).
1520		<0.020	$d\sigma/d\Omega=0.04$ mb/sr (1974Pe03) at 15° .
1840		0.04 3	$d\sigma/d\Omega<0.03$ mb/sr (1977Bo16).
2420		0.03 2	
3300?		<0.05	
3400		0.05 3	
3700		0.03 2	E(level): 1977Bo16 assign this group to ^{40}Ca g.s. from $^{38}\text{Ar}(^3\text{He}, n)$.
9270 ‡			
10200 ‡			
14700 ‡ 50	0	0.12 $^\#$	$\sigma(\text{exp})/\sigma(\text{dw})=0.00017$ (1977Bo16) for $f_{7/2}^2$.

† From 1974Pe03, unless otherwise stated.

‡ From 1977Bo16.

§ From 1974Pe03 at 0° .

$^\#$ From 1977Bo16 at 0° .

$^{40}\text{Ca}(t,p)$ 1967Bj06,1967Wi15

Target ^{40}Ca g.s. $J\pi=0+$.

1967Bj06: E=10–12 MeV triton beam was produced at the Aldermaston Tandem generator. A target of CaCO_3 (97% in ^{40}Ca) evaporated onto a carbon film. Reaction products were momentum analyzed with a multi-angle, broad-range magnetic spectrograph and detected in nuclear emulsions, FWHM=15–20 keV. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1967Wi15: E=7.5 MeV tritons were produced at the Los Alamos Vertical Van de Graaff Accelerator. A natural calcium target. Protons were detected by a ΔE -E solid-state detector telescope, FWHM=50 keV. Measured $\sigma(\theta)$. A total 28 levels reported, with L values for 19 groups.

1973Ca13: E=20 MeV. FWHM=20 keV. Measured $\sigma(\theta)$. Six L=0 levels reported.

1964Mi06: E=7.2 MeV. Energies and L values of first five levels reported.

Others:

1977Is03: E=12 MeV. Measured form factor.

1997Be45: E=28, 33, 37.3 MeV. Measured $\sigma(\theta)$, deduced model parameters.

^{42}Ca Levels

d σ /d Ω (max) in mb/sr (1967Wi15)			
Level	energy	cross section	angle
	0	1.45	10.3°
	1523	0.426	28°
	1836	0.135	10.3°
	2423	0.159	28°
	2751	0.201	48°
	3186	0.082	72°
	3253		
	3437	0.056	40°
	3651	0.118	28°
	4090	0.02	
	4448	0.305	29°
	4757	0.498	27°
	4869	0.345	27°
	5011	0.133	48°
	5201	0.055	35°
	5366		
	5471	0.133	48°
	5779	0.08	
	5863	1.85	10.3°
	6015	0.573	10.3°
	6106	0.056	46°
	6273		
	6518	0.30	15.5°
	6723		
	6920	0.437	30°
	7134		
	7259	0.08	
	7385	0.637	28°

E(level) [†]	L [†]	$\Sigma(d\sigma/d\Omega)^{\S}$	Comments
0.0	0	100.5	
1520.20	2	45.3	E(level): 1523 (1967Wi15).
1840.20	0	14.1	E(level): 1836 (1967Wi15).
2420.20	2	18.1	E(level): 2423 (1967Wi15).
2751 $\frac{1}{2}$.4	4	32.2	
3186 $\frac{1}{2}$.6		15.1	L: 6 assigned by 1967Wi15, but none assigned by 1967Bj06 in their $\sigma(\theta)$ distribution.
3253 $\frac{1}{2}$.5		6.7.4	
3300.20		1.3.2	
3390.20	2	3.2.2	
3438 $\frac{1}{2}$.9	3	7.1.4	
3651 $\frac{1}{2}$.6	2	9.3.5	
3880.20		2.2.1	
3950.20		1.6.2	
4000.20		0.8.1	
4050.20		1.2.2	
4091 $\frac{1}{2}$.8		5.8.3	
4230.20		0.8.1	

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(\text{t,p})$ 1967Bj06,1967Wi15 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	L [†]	$\Sigma(\text{d}\sigma/\text{d}\Omega)^{\S}$	Comments
4350 20		1.3 2	
4448 $\frac{1}{2}$ 11	2	32 2	
4500 20		0.8 1	
4560 20		0.9 1	
4680 20	3	7.0 4	
4710 20		1.0 3	
4756 $\frac{1}{2}$ 9	2	43 2	
4868 $\frac{1}{2}$ 7	2	28 1	
4900 20		4.8 7	
4960 20	2, 3	2.7 2	
5011 $\frac{1}{2}$ 7	4	20 1	
5070 20			
5150 20			
5200 $\frac{1}{2}$ 5	2	10 1	
5320 20			
5363 $\frac{1}{2}$ 9		9# 2	
5370 20		9# 2	
5410 20			
5469 $\frac{1}{2}$ 9		21 3	L: 4 assigned by 1967Wi15, but none assigned by 1967Bj06 in their $\sigma(\theta)$ distribution.
5520 20			
5580 20			
5610 20		8 1	
5660 20			
5700 20			
5775 $\frac{1}{2}$ 11		28@ 2	
5790 20		28@ 2	
5860 $\frac{1}{2}$ 10	0	97 5	
5920 20			
5980 20			
6014 $\frac{1}{2}$ 9	0	25 1	
6105 $\frac{1}{2}$ 7	4	12 1	
6150 20			
6170 20			
6200 20			
6273 $\frac{1}{2}$ 7	2	17 2	
6290 20			
6400 20			
6450 20		9.5 1	
6517 $\frac{1}{2}$ 8	(0)	30 2	
6600 20			
6640 20			
6720 $\frac{1}{2}$ 8	0	28 2	
6730 20			
6800 20			
6820 20		23 12	
6880 20		52& 3	
6920 $\frac{1}{2}$ 4		52& 3	L: 2 assigned by 1967Wi15 for a 6920 group, but none assigned by 1967Bj06 in their $\sigma(\theta)$ distribution for 6880+6910+6940.
6940 20		52& 3	
7010 20		11 1	
7110 20		40 ^a 2	E(level): 7134 8 (1967Wi15).
7130 20		40 ^a 2	
7180 20	2	11 2	
7257 $\frac{1}{2}$ 7		18 1	
7280 20			
7320 20			
7384 $\frac{1}{2}$ 5		78 4	L: 2 assigned by 1967Wi15, but none assigned by 1967Bj06 in their $\sigma(\theta)$ distribution.

[†] From 1967Bj06. Level energies are adopted from 1967Bj06 due to better resolution (15–20 keV) than in 1967Wi15 (50 keV), unless otherwise noted.

$\frac{1}{2}$ Weighted average from 1967Bj06 and 1967Wi15.

$\S$ Summed over 24 angles. Values are in arbitrary units (1967Bj06).

For 5350+5370.

$^{40}\text{Ca}(\text{t},\text{p})$ 1967Bj06,1967Wi15 (continued) **^{42}Ca Levels (continued)**

@ For 5760+5790.
 & For 6880+6910+6940.
 a For 7110+7130.

 $^{40}\text{Ca}(\text{t},\text{p}\gamma)$ 1977LiZI

1977LiZI: E=10 MeV. Measured $\gamma(\theta)$ in coincidence with protons at 0° .

 ^{42}Ca Levels

E(level)	$J\pi$
0.0	
1520	
2420	
3890	
5850	
6020	
6520	
6700	
6820 [†]	(0) [‡]

[†] Strongly excited state.
[‡] From isotropic $\gamma(\theta)$.

 $\gamma(^{42}\text{Ca})$

$E\gamma^\dagger$	E(level)	$E\gamma^\dagger$	E(level)	$E\gamma^\dagger$	E(level)
900	2420	2930 [‡]	6820	4400 [‡]	6820
1520	1520	3430	5850	4500	6020
1960	5850	3600	6020	5000	6520
2130	6020	3890	3890	5180	6700
2420	2420	4100	6520	5300 [‡]	6820
2630	6520	4280	6700		
2810	6700	4330	5850		

[†] From level-energy differences.
[‡] It is assumed that the 6820 decays in the same manner as other levels reported by 1977LiZI.

 $^{40}\text{Ca}(\alpha,^2\text{He})$ 1990Fi07,1980Va17

1990Fi07: E=55.7 MeV α beam was produced at the Bonn isochronous cyclotron. A target of ^{40}Ca enriched to 99.8%. ^2He is detected by measuring the two breakup protons in coincidence with a pair of vertically arranged ΔE -E detector telescopes, FWHM=200–300 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1980Va17: E=65 MeV α beam was produced at the AVF cyclotron of the KVI. A solid and self-supporting target of ^{40}Ca . Break-up protons from the outgoing ^2He were detected with two ΔE -E solid-state counter telescopes. Measured $\sigma(\theta)$. Deduced level, $J\pi$, L from DWBA analysis.

1978Ja10 (also 1978Ja22, 1980StZO): E=55 MeV. Measured pp coin, $\sigma(\theta)$. Deduced reaction mechanism. 6^+ state at 3190 is the most intensely populated state, whereas 0, 1530, 2750, 7400 and 9040 are very weak in the spectrum shown by 1978Ja10.

 ^{42}Ca Levels

E(level) [†]	$L^\dagger$	Normalization constant $N^\dagger$	Comments
0.0 [§]	0	260 20	N=410 200 (1980Va17).
1530 [§] 50	2	260 20	
2750 [§] 50	4	180 15	N=160 40 (1980Va17).

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(\alpha, ^2\text{He})$ 1990Fi07,1980Va17 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	L [‡]	Normalization constant N [‡]	Comments
3190 § 50	6	120 5	N=140 40 (1980Va17).
3660 70	2		E(level), L: from 1980Va17.
			N=350 200 for $\nu f_{7/2}^2$, 43 20 for $\nu f_{7/2} p_{3/2}$, 60 30 for $\nu p_{3/2}^2$ (1980Va17).
4830 @ 50	4	30 4	E(level): 5010 70 (1980Va17).
			N=190 70 for $\nu f_{7/2}^2$, 28 8 for $\nu f_{7/2} p_{3/2}$, 190 70 for $\nu f_{7/2} \nu f_{5/2}$ (1980Va17).
5380 # 50	6	9 1	
7280 # 50	6	6 1	E(level): 7400 (1978Ja10), 7510 50 (1980Va17).
			L: in 1980Va17, L=6 fits well, but L=5 and 7 cannot be discarded.
			N(for L=6)=70 20 for $\nu f_{7/2}^2$, 17 6 for $\nu f_{7/2} \nu f_{5/2}$ (1980Va17).
8810 50	‡		
9080 50	6, 7, 8 ‡		E(level): 9040 (1978Ja10), 9111 50 (1980Va17).
			L: from 1980Va17, L=6 is less probable.
			N(for L=6)=80 30 for $\nu f_{7/2}^2$, 18 5 for $\nu f_{7/2} \nu f_{5/2}$. N(for L=7)=34 7 for $\nu f_{7/2} g_{9/2}$. N(for L=8)=6 2 for $\nu g_{9/2}^2$ (1980Va17).
9330 50	‡		
9600 50	5, 6 ‡		E(level): 9510 50 (1980Va17).
			L: from 1980Va17, L=5 fits slightly better than L=6.
			N(for L=5)=18 4 for $\nu f_{7/2} \nu g_{9/2}$, 65 10 for $\nu p_{3/2} \nu g_{9/2}$. N(for L=6)=30 6 for $\nu f_{7/2} \nu f_{5/2}$ (1980Va17).
9870 50	6, 7, 8 ‡		E(level): 9990 50 (1980Va17).
			L: from 1980Va17, L=6 is less probable.
			N(for L=6)=18 4 for $\nu f_{7/2} \nu f_{5/2}$. N(for L=7)=32 6 for $\nu f_{7/2} g_{9/2}$. N(for L=8)=6 2 for $\nu g_{9/2}^2$ (1980Va17).
10160 50	‡		

[†] From 1990Fi07, unless otherwise stated. N=[dσ/dΩ](exp)/[dσ/dΩ](DWBA).

[‡] L≥5 (1990Fi07).

§ Member of $\nu f_{7/2}^2$ multiplet.

Member of $\nu f_{7/2} \otimes \nu f_{5/2}$ multiplet.

@ Configuration= $\nu f_{7/2} \otimes \nu p_{3/2}$.

 $^{40}\text{Ca}(^{14}\text{C}, ^{12}\text{C}), (^{12}\text{C}, ^{10}\text{C}), (^{10}\text{B}, ^8\text{B})$ 1985Vi01,1972Sc21,1979KuZQ

Target ^{40}Ca g.s. Jπ=0+.

1985Vi01: ($^{14}\text{C}, ^{12}\text{C}$) E=64 MeV ^{14}C beam was produced from the Los Alamos three-state electrostatic accelerator. Target of ^{40}Ca on a carbon backing. Scattered particles were momentum analyzed with the Q3D spectrometer and detected in a 50 cm long gridded ionization counter, FWHM=250 keV. Measured σ(θ). Levels observed as multiplets up to 4800. DWBA analysis.

1972Sc21,1974An36: ($^{12}\text{C}, ^{10}\text{C}$) E=114 MeV. 3190, 6+ level reported.

1977NaZS: ($^{12}\text{C}, ^{10}\text{C}$) E=108 MeV. Measured σ(θ).

1979KuZQ: ($^{10}\text{B}, ^8\text{B}$) E=70 MeV, levels 1520, 2750 and 3190 reported.

 ^{42}Ca Levels

E(level) [†]	L	dσ/dΩ (max) mb/sr [†]	Comments
0.0	0	0.3	
1700		0.3	E(level): 1525+1837.
2800		0.4	E(level): 2424+2752.
3500			E(level): multiplet of 7 levels from 3189 to 3886.
4800	2.0		E(level): multiplet of 10 levels from 4666 to 5015.

[†] From ($^{14}\text{C}, ^{12}\text{C}$) (1985Vi01).

$^{40}\text{Ca}(^{96}\text{Zr}, ^{94}\text{Zr})$ 2011Co14

Two-neutron transfer channel in inverse kinematics.

2011Co14: E(^{96}Zr)=275–330 MeV from XTU–Tandem + ALPI at LNL, Legnaro. This energy is at or up to 25% below the Coulomb barrier, thus only the neutron transfer channels are relevant. Target= CaF_2 , 50 $\mu\text{g}/\text{cm}^2$ strip supported on a 15 $\mu\text{g}/\text{cm}^2$ carbon backing. The Ca-like recoils were detected by PRISMA magnetic spectrometer. Mass identification was made from event-by-event reconstruction of the ion trajectory in the magnetic elements. Measured excitation functions. Deduced total kinetic energy loss (TKEL) distributions, differential cross sections and transfer probabilities. Comparison with semi-classical microscopic calculations.

 ^{42}Ca Levels

E(level)	$J\pi$	Comments
0.0	0+	
5760	0+	Transition to 5.76 MeV, 0+ state is much stronger than for g.s. The 5.76 MeV state is dominated by two neutrons in the $2p_{3/2}$ shell.

 $^{41}\text{K}(p,\gamma)$ 1971Vi14,1967An10,1963Si13

1971Vi14: E=1.4–1.75 MeV. Measured γ , $\gamma(\theta)$, γ branching, resonances.

1967An10: E=1.86–2.17 MeV. A large number of resonances reported.

1963Si13: E=1060–1200 keV. Measured yield of γ rays, $\gamma\gamma$ coin.

1986Se02: E=0.6 to 4 MeV. Measured yields. Statistical-model analysis.

1973Di03 (also 1971DiZV): E=4–13 MeV. Measured γ , $\gamma(\theta)$. Deduced GDR structure and cross sections.

1967Lu08: E=1.4–1.75 MeV. A total of 74 resonances reported. Measured primary and secondary γ .

1966En04: E=0.3–2.1 MeV. Measured resonance strengths. Resonance at E(p)(lab)=1111 measured.

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	(2J+1) $\Gamma_p\Gamma_\gamma/\Gamma$ eV [§]	E(p)(lab)	Comments
0.0	0+			
1522.9 5	2+			
1836.4 7	0+			
2422.1 5	2+			
2749.9 7	4+			
3190.2 8	6+			
3250.4 8	4+			
3297.2 8	0+			$J\pi$: 1- and 2+ quoted by 1969Fl03 are not supported by $\gamma(\theta)$ data of 1971Vi14.
3388.2 9	2+			
3442.4 7	3-			
3649.8 8	2+			
3883.6 10	1-			
3997.6 14	4+			
4044.4 12	3-			
4104.4 16	5-			Measured upper limit of branching to 1523, 2+ level is <1.
4113.4 16	3-			
4228.4 14	1			
4342.3 14				
4413.7 14	3-			
4448.8 17	2+			
4566 3	(1, 2+)			
4758 3	2+			
4869 3	2+			
4904 3	3-			
4968 2	3-			
5213 2	(2+)			$J\pi$: 2+ assigned by 1971Vi14 cannot be justified.
5359 2	2+			
5594 2	3-			
5738 2	(2+)			
11303.7 10		1.0 eV 5	1052 1	
11309.5 10		1.0 eV 5	1058 1	
11319.3 10		1.0 eV 5	1068 1	
11326.1 10		3.0 eV 15	1075 1	

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$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$(2J+1)\Gamma_p\Gamma_\gamma/\Gamma$ eV §	$E(\text{p})(\text{lab})$	Comments
11331.0 10		0.50 eV 25	1080 1	
11335.9 10		1.0 eV 5	1085 1	
11343.7 10		3.0 eV 15	1093 1	
11361.3 10	(1-, 2+)	8.5 eV 43	1111 1	$J\pi$: from 1963Si13.
11363.2 10		7.0 eV 35	1113 1	
11380.8 10		4.5 eV 23	1131 1	
11398.4 10		1.5 eV 8	1149 1	
11401.3 10		2.0 eV 10	1152 1	
11409.1 10		7.0 eV 35	1160 1	
11412.0 10		8.0 eV 40	1163 1	
11416.9 10		5.0 eV 25	1168 1	
11425.7 10		6.0 eV 30	1177 1	
11432.5 10		0.50 eV 25	1184 1	
11436.4 10		1.0 eV 5	1188 1	
11439.4 10		8.5 eV 43	1191 1	
11446.2 10		4.0 eV 20	1198 1	
11645	(1-, 2+)		1402	
11650			1407	
11654			1411	
11656#			1413	
11658			1415	
11662			1419	
11668	(1-, 2+)		1425	
11674	(1-, 2+)		1431	
11680#			1438	
11685			1443	
11693	(1-, 2+)		1451	$J\pi$: the (p, α) resonance at excitation=11694 keV has $J\pi=3-$.
11698			1456	
11701			1459	
11706	(1-, 2+)		1464	
11709? #			1467	
11714?			1472	
11719#			1477	
11727	2+		1486	
11732#			1491	
11740	(1-, 2+)		1499	
11743	(1-, 2+)		1502	
11751#			1510	
11755#			1514	
11758#			1517	
11760			1519	
11763			1523	
11768			1528	
11772#			1532	
11775	(1-, 2+)		1535	
11779#			1539	
11783#			1543	
11787#			1547	
11792			1552	
11797	(1-, 2+)		1557	
11798			1558	
11805	(1-, 2+)		1566	
11809#			1570	
11814			1575	
11823	(1-, 2+)		1584	
11829#			1590	
11833#			1594	
11836			1597	
11840	(1-, 2+)		1601	
11850			1612	
11853			1615	
11858#			1620	
11868	(1-, 2+)		1630	

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued) ^{42}Ca Levels (continued)

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$E(\text{p})(\text{lab})$	Comments
11871	(1-, 2+)	1633	
11878	(1-, 2+)	1640	
11881#		1643	
11885		1648	
11887		1650	
11895#		1658	
11901		1664	
11907		1670	
11911?#		1674	
11916?#		1679	
11921		1684	
11925	(1-, 2+)	1689	
11937		1701	
11944#		1708	
11949#		1713	
11953#		1717	
11960		1724	
11964		1728	
11967#		1732	
11979	(1-, 2+)	1744	
12099@		1867	
12102#		1870	
12105@		1873	
12109@		1877	
12113#		1881	
12122#		1890	
12126#		1894	
12130@		1898	
12131#		1900	
12142#		1911	
12144#		1913	
12150#		1919	
12152@		1921	
12156#		1925	
12160#		1929	
12165@		1934	
12168@		1937	
12172#&	(1, 2+)	1942	
12180#		1950	
12185#		1955	
12189#		1959	
12198@		1968	
12201@		1971	
12205#		1975	
12208#		1978	
12214#		1985	
12216#		1987	
12223@		1994	
12226#		1997	
12230@		2001	
12236#		2007	
12238#		2009	
12242@		2013	
12249#		2020	
12255#		2027	
12263#		2035	
12270#		2042	
12278#		2050	
12279#		2051	
12280@		2052	
12283@		2055	
12288#		2060	
12293#		2065	

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued) ^{42}Ca Levels (continued)

E(level) [†]	$J\pi^{\ddagger}$	E(p)(lab)	Comments
12297#		2070	
12302@		2075	
12305@		2078	
12311#		2084	
12314@		2087	
12316@		2089	
12322#		2095	
12328#		2101	
12330#		2103	
12338#		2112	
12344@		2118	
12348#		2122	
12351#		2125	
12358@		2132	
12362@		2136	
12369#		2143	
12374#		2148	
12381#		2156	
12386#		2161	
12390#		2165	
12397#		2172	
17.4×10 ³	1- 1-		$\Gamma=3.3$ MeV 5 (1973Di03). $J\pi$: GDR, T=1 (1973Di03).
20.4×10 ³	1- 1-		$\Gamma=4.4$ MeV 1 (1973Di03). $J\pi$: GDR, T=2 (1973Di03).

[†] Resonance energies are from 1963Si13 up to E(p)(lab)=1198 keV, from 1971Vi14 or 1967Lu08 for E(p)(lab)=1402 to 1744 keV, and from 1967An10 for E(p)(lab) above 1860. Excitation energy for resonances=E(p)(c.m.)+S(p) with E(p)(c.m.) deduced from E(p)(lab) and S(p)=10276.67 15 (2012Wa38).

[‡] From Adopted Levels for bound states, from 1971Vi14 for resonances.

[§] From 1963Si13.

γ to g.s. reported (1967An10,1967Lu08).

@ γ of E γ >8500 reported (1967An10).

& A multiplet of γ rays near 8100 feeds a composite of levels near 4 MeV with a total branching of 170, relative to 100 for 12173 transition.

 $\gamma(^{42}\text{Ca})$

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\ddagger}$	Mult.	$\delta^{\S}$	Comments
1522.9	1523	100			
1836.4	313.5	100			
2422.1	899	39 4			
	2422	100 4			
2749.9	328	<1			
	1227	100			
3190.2	440	100			
3250.4	500	22 6			
	1727	100 6			
3297.2	875	100 5			
	1774	11 5			
3388.2	966	45 10			
	1552	14 7			
	1865	79 10			
	3388	100 5			
3442.4	692	6 3			
	1020	52 10			
	1919	100 6			
3649.8	1228	6 3			
	1814	7 4			
	2127	100 11			
	3650	26 8			

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued)

 $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\ddagger}$	Mult.	$\delta^{\S}$	Comments
3883.6	2048	43 6			
	3884	100 6			
3997.6	1248	17 8			
	1576	50 8			
	2475	100 8			
4044.4	602	23 8			
	1294	31 8			
	2521	100 15			
4104.4	662	11 5			
	914	100 18			
	1354	71 11			
4113.4	1691	23 7			
	2590	100 7			
4228.4	1806	33 7			
	4228	100 7			
4342.3	1920	100			
4413.7	2891	85 11			
	4414	100 11	[E3]		
4448.8	2028	82 27			
	2925	100 27			
4566	2144	44 22			
	3043	78 33			
	4566	100 33			
4758	2336	57 29			
	2922	43 14			
	3235	86 29			
	4758	100 29			
4869	3346	100 40			
	4869	100 40			
4904	2154	36 9			
	2482	45 9			
	4904	100 18	[E3]		
4968	1526	40 20			
	2218	60 20			
	4968	100 20	[E3]		
5213	2791	82 27			
	5213 [#]	100 27			$E\gamma$: treated as uncertain (evaluators) since it is not reported in $(\alpha,\text{p}\gamma)$.
5359	2937	33 20			
	5359	100 20			
5594	3172	57 22			
	3758	33 11	[E3]		
	4071	33 11			
	5594	100 33	[E3]		
5738	3316	33 17			
	4215	33 17			
	5738	100 33			
11361.3	9840				
	11362				
11645	7197	6			
	7418	50			
	7533	19			
	7602	19			
	7762	19			
	7996	19			
	8258	9			
	9224	16			
	9810	12			
	10123	100			
	11646	44			
11668	7219	38			
	7555	34			
	8018	28			
	8280	31			

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\ddagger}$	Mult.	$\delta^{\S}$	Comments
11668	9246	59			
	9832	100			
	10145	55			
11674	7561	100			
	8286	59			
	9252	48			
	9838	48			
	10151	90			
11693	6935	90			
	7465	62			
	7580	33			
	8043	71			
	8305	62			
	8396	14			
	9271	100			
	10170	43			
	6112	32			
	7364	20			
11706	7478	36			
	7822	20			
	8056	32			
	8318	24			
	8409	12			
	9284	32			
	9870	100			
	10183	56			
	11706	36			
	6970	27			$A_2=-0.04$ 7; $A_4=+0.14$ 7. δ : +0.15 3 if $J_f=1$; +0.02 4 or +3.0 10 if $J_f=2$.
	7279	67			$A_2=-0.12$ 9; $A_4=-0.14$ 7. δ : +0.23 10 or +5.0 20 if $J_f=1$; +0.70 10 if $J_f=2$.
	7314	27			$A_2=-0.01$ 17; $A_4=+0.19$ 17. δ : +0.09 6 or +20 10 if $J_f=1$; -0.22 20 or >+5 if $J_f=2$.
11727	7500	47	D+Q	+0.30 15	$A_2=-0.21$ 20; $A_4=+0.16$ 22. δ : or +2.0 10 if $J_f=1$.
	7615	47			
	8078	20			
	8340	40	D+Q	+3.7 1	$A_2=+0.04$ 11; $A_4=-0.28$ 12. $A_2=-0.22$ 12; $A_4=+0.20$ 13.
	8431	40			$\delta(\text{Q/D})=+0.45$ 10 for $J(\text{final level})=1$; but adopted $J(\text{final level})=0$.
	9306	93	D+Q	+0.65 5	$A_2=-0.12$ 7; $A_4=-0.05$ 7.
	9892	67			$A_2=-0.25$ 4; $A_4=+0.10$ 4.
	10205	93	D+Q	-0.20 5	$A_2=-0.03$ 7; $A_4=-0.10$ 7. δ : or >100.
	11728	100			$A_2=-0.09$ 6; $A_4=+0.15$ 6.
11740	6527	45			
	6836	82			
	7291	18			
	7512	32			
	7627	100			
	7856	45			
	8090	27			
	8352	50			
	9904	9			
	10217	23			
11743	11740	23			
	7515	35			
	7630	29			
	8355	79			
	9907	26			
11775	10220	100			
	11743	24			
	7209	33			

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\gamma)$ 1971Vi14,1967An10,1963Si13 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$
11775	7547	29	11823	9987	36	11878	7834	28
	7662	19		10300	92		7994	34
	7777	76		11823	16		8490	19
	7891	29	11840	6872	68		9456	25
	8333	100		6971	100		10042	16
	8387	62		8190	39		10355	56
	9353	76		8543	26		11878	6
	10252	24		9418	29	11925	8276	42
	11775	29		10317	61		8484	53
11797	7684	50	11868	6964	87		9504	40
	8355	25		7755	87		10403	63
	8409	100		7824	87		11926	100
	9375	92		8218	73	11960	8518	25
	9961	46		8480	87		9538	
	10274	33		9446	100		10438	50
	11797	71		10032	33		11960	100
11805	6212	86		10345	53	11979	7530	23
	7357	38		11868	60		8329	18
	7392	52	11871	6133	59		8537	5
	7464	100		6512	59		8591	8
	7762	71		7758	82		8682	21
	8364	24		7827	47		9557	21
	8418	52		7987	71		10456	100
	9384	14		8483	29		11979	62
	10283	19		9449	100	12172	8785	72
	11806	19		10035	29		9750	83
11823	7595	100		10348	47		10650	60
	8173	56		11871	55		12173	100
	8435	52	11878	7650	100			
	9401	48		7765	28			

† Level-energy differences.

‡ Relative branching ratios from 1971Vi14.

§ From $\gamma(0)$ data of 1971Vi14.

Placement of transition in the level scheme is uncertain.

 $^{41}\text{K}(\text{p},\text{n}),(\text{p},\text{p})$: Resonances 1967An10,1967Lu08,1970De11Includes resonances in ^{42}Ca from $^{41}\text{K}(\text{p},\text{p})$ (1970De11).

1967An10: E=1.86–2.17 MeV. A large number of resonances reported.

1967Lu08: E=1.40–1.74 MeV.

1970De11: E=1.35–1.96 MeV protons from the Utrecht 3 MV Van de Graaff accelerator. 99.2% enriched ^{41}K target. A BF_3 counter and Si detectors. Measured $\sigma(E_p,0)$. Deduced resonance energies, strengths, widths for a group of 14 resonances. Also deduced alpha width, see $^{41}\text{K}(\text{p},\alpha)$ dataset. S_n and S_p are neutron and proton resonance strengths, respectively. **^{42}Ca Levels**Resonance strength $S=(2J+1)\Gamma_p\Gamma_l/\Gamma$ from 1970De11. Γ_l is Γ_n or Γ_p .

E(level)†	$J\pi^\ddagger$	E(p)(lab)	E(level)†	$J\pi^\ddagger$	E(p)(lab)	E(level)†	$J\pi^\ddagger$	E(p)(lab)
11612.5§ 15	1–	1368.4 15	11693		1451	11755		1514
11639.4# 15	1–	1395.9 15	11709		1467	11760		1519
11645		1402	11714		1472	11763		1523
11654		1411	11719		1477	11768		1528
11658		1415	11727		1486	11775		1535
11662		1419	11732		1491	11779		1539
11668		1425	11738		1497	11783		1543
11674		1431	11743		1502	11787		1547
11688		1446	11751		1510	11798.3@ 15	(1–, 2+)	1558.7 15

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\text{n}),(\text{p},\text{p})$: Resonances 1967An10,1967Lu08,1970De11 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$E(\text{p})(\text{lab})$	$E(\text{level})^\dagger$	$J\pi^\ddagger$	$E(\text{p})(\text{lab})$	$E(\text{level})^\dagger$	$E(\text{p})(\text{lab})$
11805.4 ^{&} 15	(1-, 2+)	1566.0 15	11967		1732	12236	2007
11811.1 ^a 15	(1-, 2+)	1571.8 15	11970.2 ^b 15	1-	1734.8 15	12238	2009
11814		1575	11980.3 ^c 15	1-	1745.1 15	12255	2027
11823		1584	12101.3 ^d 15	1-	1869.1 15	12263	2035
11829		1590	12109		1877	12270	2042
11833		1594	12112.2 ^e 15	1-	1880.3 15	12278	2050
11836		1597	12114		1882	12279	2051
11840		1601	12122		1890	12286	2058
11850		1612	12126		1894	12293	2065
11855		1617	12132		1901	12297	2070
11858		1620	12142		1911	12302	2075
11865		1627	12144		1913	12305	2078
11868		1630	12152		1921	12309	2082
11871		1633	12158.6 ^f 15	1-	1927.8 15	12311	2084
11878		1640	12160		1929	12314	2087
11881		1643	12163.1 ^g 15	1-	1932.4 15	12322	2095
11885		1648	12168 ^h 3	(1-)	1937 3	12328	2101
11887		1650	12172		1942	12330	2103
11895		1658	12175.7 ⁱ 15	1-	1945.3 15	12336	2110
11901		1664	12180		1950	12340	2114
11907		1670	12182.8 ^j 15	1-	1952.6 15	12344	2118
11911		1674	12185		1955	12348	2122
11916		1679	12189		1959	12351	2125
11921		1684	12198		1968	12362	2136
11925		1689	12201		1971	12369	2143
11929		1693	12205		1975	12374	2148
11933		1697	12208		1978	12381	2156
11937		1701	12214		1985	12386	2161
11948		1712	12216		1987		
11953		1717	12226		1997		
11964		1728	12230		2001		

[†] Excitation energy= $S(\text{p})+E(\text{p})(\text{c.m.})$ with $E(\text{p})(\text{c.m.})$ deduced from $E(\text{p})(\text{lab})$ and $S(\text{p})=10276.71\ 67$ (2012Wa38). $E(\text{p})(\text{lab})$ below 1.8 MeV are from 1967Lu08, and above 1.8 MeV from 1967Lu08; values with uncertainties are from 1970De11.

[‡] From fits to experimental cross-section data (1970De11).

[§] $S_n < 5$ eV, $S_p=465$ eV 240, $\Gamma_n < 3$ eV, $\Gamma_p=160$ eV 50, for $J=1$ (1970De11). No neutron emission observed.

[#] $S_n < 5$ eV, $S_p=48$ eV 30, $\Gamma_n < 4$ eV, $\Gamma_p=25$ eV 10, for $J=1$ (1970De11). No neutron emission observed.

[@] $E(\text{p})(\text{lab})=1557$ (1967Lu08). $S_n < 5$ eV, $S_p=400$ eV 200, $\Gamma_n < 4$ eV for $J=1$ or 2; $\Gamma_p=200$ eV 70 for $J=1$, 120 eV 40 for $J=2$ (1970De11).

[&] $E(\text{p})(\text{lab})=1566$ (1967Lu08). $S_n=65$ eV 33, $S_p=350$ eV 175, $\Gamma_n=26$ eV 15, $\Gamma_p=140$ eV 60 for $J=1$; $\Gamma_n=16$ eV 10, $\Gamma_p=85$ eV 40 for $J=2$ (1970De11).

^a $E(\text{p})(\text{lab})=1570$ (1967Lu08). $S_n=30$ eV 15, $S_p=250$ eV 125, $\Gamma_n=11$ eV 7, $\Gamma_p=95$ eV 50 for $J=1$; $\Gamma_n=6$ eV 4, $\Gamma_p=56$ eV 30 for $J=2$ (1970De11).

^b $S_n < 5$ eV, $S_p=100$ eV 50, $\Gamma_n < 9$, $\Gamma_p=120$ eV 30 for $J=1$ (1970De11).

^c $E(\text{p})(\text{lab})=1744$ (1967Lu08). $S_n=40$ eV 20, $S_p=380$ eV 140, $\Gamma_n=21$ eV 10, $\Gamma_p=200$ eV 50 for $J=1$ (1970De11).

^d $E(\text{p})(\text{lab})=1867$ (1967An10). $S_n=200$ eV 100, $S_p=1700$ eV 850, $\Gamma_n=78$ eV 60, $\Gamma_p=660$ eV 290 for $J=1$ (1970De11).

^e $E(\text{p})(\text{lab})=1879$ (1967An10). $S_n=150$ eV 75, $S_p=2030$ eV 400, $\Gamma_n=55$ eV 30, $\Gamma_p=740$ eV 80, for $J=1$ (1970De11).

^f $E(\text{p})(\text{lab})=1927$ (1967An10). $S_n < 5$ eV, $S_p=250$ eV 125, $\Gamma_n < 5$ eV, $\Gamma_p=130$ eV 50, for $J=1$ (1970De11).

^g $E(\text{p})(\text{lab})=1934$ (1967An10). $S_n=15$ eV 8, $S_p=500$ eV 250, $\Gamma_n=7$ eV 5, $\Gamma_p=250$ eV 90, for $J=1$ (1970De11).

^h $E(\text{p})(\text{lab})=1937$ (1967An10). $S_n=15$ eV 8, $S_p=300$ eV 150, $\Gamma_n < 10$ eV, $\Gamma_p=100$ eV 50, for $J=1$ (1970De11).

ⁱ $S_n=55$ eV 28, $S_p=1940$ eV 450, $\Gamma_n=21$ eV 10, $\Gamma_p=740$ eV 100, for $J=1$ (1970De11).

^j $S_n < 5$ eV, $S_p=1210$ eV 250, $\Gamma_n < 4$ eV, $\Gamma_p=440$ eV 50 for $J=1$ (1970De11).

⁴¹K(p,α): Resonances 1970De10

1970De10: E=1170–2100 keV proton beam was produced from the Utrecht 3 MV Van de Graaff accelerator. A 99.2% enriched ⁴¹K target on carbon backing. Emitted α-particles were detected with Si detectors. Measured σ(E_p,θ). Deduced resonance energies, Jπ.
 1970De11: ⁴¹K(p,n) and ⁴¹K(p,p) resonances, E(p)=1350–1960 keV. Measured σ(θ). Deduced IAR strengths. 14 resonances reported.
 1967An10: 51 resonances reported from E(p)(lab)=1867 to 2172.
 1967Lu08: 48 resonances reported from E(p)(lab)=1402 to 1744.
 1960Cl02: ⁴¹K(p,α) E=1–3 MeV.
 1950Ri59: ⁴¹K(p,n) E=1.3 to 3.5 MeV. Eight resonance peaks reported at E(p)(lab)=1600, 1900, 2240, 2460, 2600, 2800, 2960, 3120.

⁴²Ca Levels

A₂, A₄ and A₆ coefficients from angular distributions are from 1970De10.

E(level) [†]	Jπ [‡]	(2J+1)Γ _p Γ _α /Γ [@]	E(p)(lab)	Comments
11426.8 15		3.1 eV	1178.2 15	
11429.6 15	(0+, 1-, 2+)	2.6 eV	1181.0 15	A ₂ =+0.03 13.
11432.0 15		5.6 eV	1183.5 15	
11435.5 15	1-, 2+	2.8 eV	1187.1 15	A ₂ =-0.44 8, A ₄ =+0.05 13, A ₆ =-0.09 11.
11440.4 15		1.9 eV	1192.1 15	
11444.3 15		1.9 eV	1196.1 15	
11447.7 15	0+, 1-, 2+	6.8 eV	1199.6 15	A ₂ =-0.14 5, A ₄ =+0.05 7.
11449.0 15		10 eV	1200.9 15	
11450.5 15		9.0 eV	1202.4 15	
11453.1 15		1.9 eV	1205.1 15	
11464.7 15		0.7 eV	1217.0 15	
11468.1 15		0.7 eV	1220.5 15	
11469.3 15	1-, 2+	2.6 eV	1221.7 15	A ₂ =-0.32 5, A ₄ =+0.13 7.
11473.5 15	(1-, 2+)	6.0 eV	1226.0 15	A ₂ =-0.46 7, A ₄ =+0.14 11, A ₆ =-0.11 10.
11475.8 15		5.6 eV	1228.3 15	
11477.7 15		3.5 eV	1230.3 15	
11484.4 15	(2+)	7.4 eV	1237.2 15	A ₂ =-0.40 5, A ₄ =+0.23 8, A ₆ =-0.11 7.
11488.7 15	1-	15 eV	1241.6 15	A ₂ =-0.85 5, A ₄ =+0.11 7, A ₆ =-0.04 6.
11490.3 15		9.2 eV	1243.2 15	
11493.6 15		2.1 eV	1246.6 15	
11499.4 15		1.6 eV	1252.5 15	
11501.1 15		2.4 eV	1254.3 15	
11503.4 15		2.8 eV	1256.6 15	
11505.4 15	0+, 1-, 2+	2.7 eV	1258.7 15	A ₂ =-0.11 5, A ₄ =+0.07 8, A ₆ =-0.09 7.
11508.8 15		2.4 eV	1262.2 15	
11510.9 15	(1-)	7.1 eV	1264.3 15	A ₂ =-0.96 3, A ₄ =+0.15 5, A ₆ =-0.06 4.
11512.5 15		5.7 eV	1265.9 15	
11516.6 15	(1-)	1.9 eV	1270.1 15	A ₂ =-0.76 7, A ₄ =-0.05 11.
11518.2 15		2.9 eV	1271.8 15	
11523.3 15	(1-), 2+	1.1 eV	1277.0 15	A ₂ =+0.32 7, A ₄ =-0.21 9, A ₆ =+0.09 9.
11525.4 15		1.8 eV	1279.2 15	
11527.4 15	(1-, 2+)	3.9 eV	1281.2 15	A ₂ =+0.66 18, A ₄ =-0.14 20.
11529.3 15	(0+), 1-, 2+	10 eV	1283.2 15	A ₂ =+0.03 8.
11531.0 15		6.9 eV	1284.9 15	
11532.6 15		2.5 eV	1286.5 15	
11540.0 15	(1-)	10 eV	1294.1 15	A ₂ =-0.71 7, A ₄ =+0.07 11.
11542.3 15	0+, 1-, 2+	14 eV	1296.5 15	A ₂ =-0.05 5, A ₄ =-0.03 7, A ₆ =+0.06 6.
11543.6 15		10 eV	1297.8 15	
11544.4 15		18 eV	1298.6 15	
11550.0 15	0+, 1-, 2+	2.2 eV	1304.4 15	A ₂ =+0.65 7, A ₄ =-0.04 8, A ₆ =+0.07 8.
11551.5 15		2.7 eV	1305.9 15	
11555.4 15	(1-)	6.9 eV	1309.9 15	A ₂ =-0.83 4, A ₄ =+0.13 6, A ₆ =-0.05 5.
11556.3 15		12 eV	1310.8 15	
11558.1 15		15 eV	1312.7 15	
11562.8 15		1.0 eV	1317.5 15	
11569.2 15	1-	4.2 eV	1324.0 15	A ₂ =-0.96 3, A ₄ =+0.08 6, A ₆ =-0.03 5.
11571.7 15	0+, 1-, 2+	3.3 eV	1326.6 15	A ₂ =-0.06 9, A ₄ =-0.15 12, A ₆ =+0.08 10.
11572.8 15	(1-, 3-, 4+)	2.8 eV	1327.7 15	A ₂ =+0.95 34, A ₄ =-0.34 35, A ₆ =+0.18 30.
11575.2 15	(3-, 4+)	3.2 eV	1330.2 15	A ₂ =+2.0 4, A ₄ =-0.10 34, A ₆ =-0.39 34.
11576.2 15		2.4 eV	1331.2 15	
11589.8 15	(1-)	9.0 eV	1345.1 15	A ₂ =-1.02 3, A ₄ =+0.04 5, A ₆ =+0.04 4.

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\alpha)$: Resonances 1970De10 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^\dagger$	$J\pi^\ddagger$	$(2J+1)\Gamma_p\Gamma_\alpha/\Gamma^\oplus$	$E(\text{p})(\text{lab})$	Comments
11591.1 15		13 eV	1346.5 15	$A_2=+1.53$ 18, $A_4=-0.12$ 16, $A_6=+0.28$ 13.
11592.6 15		13 eV	1348.0 15	
11594.6 15		5.4 eV	1350.0 15	
11596.7 15	1-	13 eV	1352.2 15	$A_2=-1.01$ 4, $A_4=+0.03$ 7, $A_6=-0.04$ 6.
11599.4 15	1-, 2+	20 eV	1355.0 15	$A_2=-0.44$ 7, $A_4=-0.01$ 11, $A_6=+0.08$ 9.
11601.8 15	1-	16 eV	1357.4 15	$A_2=-1.05$ 5, $A_4=+0.08$ 9, $A_6=+0.03$ 7.
11603.5 15		9.3 eV	1359.2 15	
11612.5 15	1-	18 eV	1368.4 15	$A_2=-0.83$ 4, $A_4=+0.02$ 7, $A_6=-0.04$ 6. $\Gamma=170$ eV 50 ($\Gamma_\alpha=5$ eV 2, $\Gamma_n<3$ eV, $\Gamma_p=160$ eV 50) (1970De11). E(level): possible analog of 1913 level in ^{42}K .
11614.0 15		15 eV	1369.9 15	
11616.0 15	1-	17 eV	1372.0 15	$A_2=-0.86$ 5, $A_4=0.00$ 9, $A_6=-0.07$ 7.
11621.0 15	(1-), 2+	6.0 eV	1377.1 15	$A_2=-0.76$ 12, $A_4=+0.27$ 22.
11632.8 15		2.1 eV	1389.2 15	
11634.5 15	1-, 2+	12 eV	1390.9 15	$A_2=-0.17$ 3, $A_4=+0.01$ 4, $A_6=-0.05$ 3.
11636.1 15	1-, (2+)	3.5 eV	1392.6 15	$A_2=-0.56$ 3, $A_4=0.00$ 4, $A_6=+0.02$ 3.
11637.4 15	1-, 2+	20 eV	1393.9 15	$A_2=-0.28$ 3, $A_4=-0.03$ 4, $A_6=+0.03$ 3.
11639.4 15	1-	27 eV	1395.9 15	$A_2=-0.81$ 3, $A_4=+0.05$ 5, $A_6=-0.06$ 4. $\Gamma=40$ eV 10 ($\Gamma_\alpha=14$ eV 5, $\Gamma_n<4$ eV, $\Gamma_p=25$ eV 10) (1970De11). E(level): possible analog of 1927 level in ^{42}K .
11641.1 15		21 eV	1397.7 15	
11643.5 15		4.5 eV	1400.1 15	$A_2=+1.87$ 16, $A_4=+0.40$ 14, $A_6=-0.11$ 13.
11644.2 15	(0+), 1-, 2+	8.0 eV	1400.9 15	$A_2=-0.29$ 12, $A_4=-0.12$ 18.
11646.2 15	(4+)	10 eV	1402.9 15	$A_2=+1.5$ 10, $A_4=+0.6$ 6.
11651.2 15	(1-), 2+	4.1 eV	1408.0 15	$A_2=-0.52$ 4, $A_4=-0.14$ 6.
11653.4 15		2.4 eV	1410.3 15	$A_2=+1.12$ 22, $A_4=-0.75$ 24, $A_6=+0.20$ 20.
11654.2 15	(1-)	4.2 eV	1411.1 15	$A_2=-0.85$ 5, $A_4=-0.09$ 8, $A_6=+0.05$ 7.
11656.8 15	(1-)	20 eV	1413.8 15	$A_2=-0.60$ 5, $A_4=-0.09$ 7.
11662.2 15	(1-, 2+)	15 eV	1419.3 15	$A_2=+0.33$ 6, $A_4=+0.05$ 7.
11664.9 15		12 eV	1422.1 15	
11670.9 15	2+	1.3 eV	1428.2 15	$A_2=+0.18$ 7, $A_4=-0.46$ 9.
11689.2 15	(1-, 2+)	20 eV	1447.0 15	$A_2=+0.03$ 2, $A_4=+0.07$ 3, $A_6=+0.03$ 3.
11695.0 15	(3-)	34 eV	1452.9 15	$A_2=+0.78$ 3, $A_4=-0.03$ 4, $A_6=+0.17$ 4.
11697.3 15		31 eV	1455.3 15	
11699.7 15		8.9 eV	1457.7 15	
11707.5 15	2+	4.7 eV	1465.7 15	$A_2=-0.05$ 7, $A_4=-0.28$ 10, $A_6=+0.04$ 9.
11709.2 15	(1-, 2+)	28 eV	1467.4 15	$A_2=-0.10$ 2, $A_4=-0.04$ 3, $A_6=+0.04$ 3.
11710.1 15		40 eV	1468.4 15	
11718.3 15		2.6 eV	1476.8 15	
11727.1 15	(0+, 1-, 2+)	2.2 eV	1485.8 15	$A_2=+0.05$ 4, $A_4=-0.19$ 5, $A_6=+0.15$ 5.
11728.2 15		11 eV	1486.9 15	
11729.3 15		9.7 eV	1488.0 15	
11733.0 15		13 eV	1491.8 15	$A_2=-0.34$ 4, $A_4=+0.21$ 6, $A_6=-0.20$ 5.
11737.4 15	(0+, 1-, 2+)	12 eV	1496.3 15	$A_2=-0.02$ 7, $A_4=-0.04$ 10, $A_6=+0.05$ 9.
11738.4 15	1-	30 eV	1497.4 15	$A_2=-0.67$ 3, $A_4=+0.02$ 4, $A_6=+0.02$ 4.
11743.4 15		3.4 eV	1502.5 15	
11748.0 15		4.5 eV	1507.2 15	
11752.3 15		4.5 eV	1511.6 15	
11756.6 15	(1-)	9.2 eV	1516.0 15	$A_2=-1.11$ 2, $A_4=+0.24$ 4, $A_6=-0.03$ 4.
11772.7 15	1-, 2+	27 eV	1532.5 15	$A_2=+0.15$ 3, $A_4=+0.05$ 4, $A_6=+0.03$ 4.
11777.2 15		16 eV	1537.1 15	
11778.5 15	0+, 1-, 2+	12 eV	1538.4 15	$A_2=-0.01$ 5, $A_4=-0.14$ 6, $A_6=+0.08$ 6.
11783.0 15	(1-, 2+)	18 eV	1543.0 15	$A_2=+0.32$ 10, $A_4=+0.33$ 12, $A_6=-0.06$ 11.
11784.7 15	(1-), 2+	18 eV	1544.8 15	$A_2=+0.18$ 9, $A_4=+0.44$ 12, $A_6=-0.10$ 11.
11786.1 15		6.7 eV	1546.2 15	
11787.5 15		9.3 eV	1547.6 15	
11789.8 15		7.6 eV	1550.0 15	
11795.2 15		7.0 eV	1555.5 15	
11798.3 15	1-, 2+	210 eV	1558.7 15	$A_2=+0.04$ 3, $A_4=+0.05$ 3, $A_6=+0.02$ 4. $\Gamma=300$ eV 100 ($\Gamma_\alpha=100$ eV 70, $\Gamma_n<4$ eV, $\Gamma_p=200$ eV 7) for J=1; $\Gamma=180$ eV 60 ($\Gamma_\alpha=60$ eV 40, $\Gamma_n<4$ eV, $\Gamma_p=120$ eV 40) (1970De11). E(level): possible analog of 2061 level in ^{42}K .

Continued on next page (footnotes at end of table)

$^{41}\text{K}(\text{p},\alpha)$: Resonances 1970De10 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	$(2J+1)\Gamma_p\Gamma_\alpha/\Gamma^{\oplus}$	E(p)(lab)	Comments
11805.4 15	1-, 2+ [§]	12 eV	1566.0 15	$\Gamma=170$ eV 70 ($\Gamma_\alpha=5$ eV 3, $\Gamma_n=26$ eV 15, $\Gamma_p=140$ eV 60) for J=1; $\Gamma=100$ eV 50 ($\Gamma_\alpha=3$ eV 2, $\Gamma_n=16$ eV 10, $\Gamma_p=85$ eV 40) (1970De11).
11808.2 15	0+, 1-, 2+	11 eV	1568.9 15	$A_2=-0.09$ 5, $A_4=-0.05$ 7.
11811.1 15	1-, 2+ [§]	5.7 eV	1571.8 15	$\Gamma=110$ eV 50 ($\Gamma_\alpha<4$ eV, $\Gamma_n=11$ eV 7, $\Gamma_p=95$ eV 50) for J=1; $\Gamma=63$ eV 30 ($\Gamma_\alpha<2$ eV, $\Gamma_n=6$ eV 4, $\Gamma_p=56$ eV 30) (1970De11).
11818.0 15		6.5 eV	1578.9 15	
11822.4 15	(1-)	3.5 eV	1583.4 15	$A_2=-0.81$ 4, $A_4=+0.18$ 7, $A_6=-0.03$ 6.
11824.0 15	1-, 2+	5.5 eV	1585.0 15	$A_2=-0.69$ 5, $A_4=+0.23$ 9, $A_6=-0.10$ 7.
11829.0 15	(1-, 2+)	12 eV	1590.2 15	$A_2=+0.26$ 8, $A_4=-0.06$ 10, $A_6=+0.11$ 9.
11830.2 15	(2+)	34 eV	1591.4 15	$A_2=+0.24$ 5, $A_4=-0.08$ 7.
11831.8 15		34 eV	1593.0 15	
11836.4 15	(4+)	8.7 eV	1597.7 15	$A_2=+1.61$ 16, $A_4=+0.64$ 16, $A_6=-0.17$ 16.
11843.3 15	1-, 2+	4.6 eV	1604.8 15	$A_2=+0.50$ 8, $A_4=-0.04$ 10, $A_6=+0.05$ 9.
11844.9 15	(1-), 2+	7.7 eV	1606.4 15	$A_2=-0.27$ 6, $A_4=+0.21$ 9, $A_6=+0.07$ 8.
11846.8 15		10 eV	1608.4 15	
11852.6 15	1-	11 eV	1614.3 15	$A_2=-0.78$ 7, $A_4=+0.05$ 12, $A_6=+0.04$ 8.
11856.4 15		8.8 eV	1618.2 15	$A_2=+2.1$ 3.
11865.6 15	0+, (1-), 2+	9.8 eV	1627.7 15	$A_2=-0.05$ 8, $A_4=-0.09$ 10.
11871.5 15		27 eV	1633.7 15	
11872.8 15		10 eV	1635.0 15	
11873.7 15		12 eV	1635.9 15	
11885.2 15	(1-, 2+, 3-)	43 eV	1647.7 15	$A_2=+0.60$ 7, $A_4=+0.01$ 7, $A_6=-0.14$ 7.
11895.3 15	1-, (2+)	5.7 eV	1658.1 15	$A_2=-0.63$ 7, $A_4=-0.02$ 11, $A_6=+0.04$ 10.
11902.0 15	(1-), 2+	18 eV	1664.9 15	$A_2=-0.39$ 5, $A_4=+0.02$ 7, $A_6=+0.03$ 7.
11906.3 15	1-, 3-	29 eV	1669.3 15	$A_2=+0.99$ 8.
11910.6 15	(1-, 2+)	81 eV	1673.8 15	$A_2=-0.45$ 3, $A_4=-0.08$ 5, $A_6=+0.02$ 5.
11923.3 15	(1-, 2+)	130 eV	1686.8 15	$A_2=-0.56$ 4, $A_4=-0.03$ 6, $A_6=+0.11$ 5.
11925.6 15		88 eV	1689.1 15	
11933.1 15	(1-, 2+)	19 eV	1696.8 15	$A_2=-0.26$ 7, $A_4=+0.01$ 11, $A_6=+0.04$ 9.
11941.9 15	2+	9.0 eV	1705.8 15	$A_2=+0.03$ 7, $A_4=-0.54$ 10, $A_6=-0.06$ 11.
11944.4 15	1-	62 eV	1708.4 15	$A_2=-0.70$ 3, $A_4=-0.02$ 5, $A_6=+0.02$ 5.
11950.1 15		83 eV	1714.2 15	
11959.2 15	(1-)	81 eV	1723.5 15	$A_2=-1.04$ 4, $A_4=+0.03$ 7.
11962.8 15	1-, 2+	35 eV	1727.2 15	$A_2=-0.25$ 5, $A_4=+0.09$ 8.
11970.2 15	1-	260 eV	1734.8 15	$A_2=-1.00$ 3. $\Gamma=430$ eV 360 ($\Gamma_\alpha=310$ eV 350, $\Gamma_n<9$ eV, $\Gamma_p=120$ eV 30) (1970De11).
11976.8 15	(2+)	22 eV	1741.6 15	$A_2=+0.30$ 10, $A_4=-0.77$ 13, $A_6=+0.16$ 11.
11980.3 15	1-	180 eV	1745.1 15	$A_2=-0.69$ 4, $A_4=-0.06$ 7, $A_6=+0.07$ 7. $\Gamma=320$ eV 80 ($\Gamma_\alpha=95$ eV 50, $\Gamma_n=21$ eV 10, $\Gamma_p=200$ eV 50) (1970De11).
11989.0 15	(2+, 3-)	8.9 eV	1754.1 15	E(level): possible analog of 2227 level in ^{42}K . $A_2=+0.40$ 16, $A_4=-0.77$ 22, $A_6=+0.07$ 19.
11992.1 15	1-, 2+	120 eV	1757.2 15	$A_2=-0.37$ 4, $A_4=+0.03$ 5.
12000.2 15	2+	59 eV	1765.5 15	$A_2=-0.04$ 3, $A_4=+0.12$ 4.
12005.0 15	(1-, 2+)	38 eV	1770.5 15	$A_2=+0.25$ 7, $A_4=-0.08$ 9, $A_6=+0.06$ 9.
12006.3 15		53 eV	1771.8 15	$A_2=+0.30$ 19.
12012.0 15	(2+)	11 eV	1777.6 15	$A_2=+0.26$ 5, $A_4=-0.11$ 6, $A_6=+0.06$ 6.
12013.6 15		110 eV	1779.3 15	
12020.4 15	1-, 2+	130 eV	1786.2 15	$A_2=+0.36$ 3, $A_4=+0.03$ 3, $A_6=+0.03$ 3.
12029.5 15	0+, 1-, 2+	34 eV	1795.5 15	$A_2=-0.14$ 9, $A_4=+0.20$ 12, $A_6=+0.05$ 12.
12032.5 15	(3-)	29 eV	1798.6 15	$A_2=+1.19$ 12, $A_4=-0.04$ 12, $A_6=+0.24$ 12.
12039.8 15	1-	9.4 eV	1806.1 15	$A_2=-1.06$ 6, $A_4=+0.09$ 10, $A_6=+0.06$ 9.
12041.8 15		8.2 eV	1808.2 15	
12042.8 15		16 eV	1809.2 15	
12050.9 15	1-, 2+	23 eV	1817.5 15	$A_2=+0.31$ 7, $A_4=+0.05$ 9, $A_6=+0.06$ 10.
12052.0 15		43 eV	1818.6 15	
12061.8 15		17 eV	1828.6 15	
12066.2 15	(1-, 2+)	7.7 eV	1833.1 15	$A_2=+0.21$ 7, $A_4=-0.08$ 9.
12070.1 15	(2+)	39 eV	1837.1 15	$A_2=-0.20$ 6, $A_4=+0.03$ 9, $A_6=+0.06$ 7.
12071.4 15		25 eV	1838.5 15	
12082.8 15		34 eV	1850.2 15	$A_2=+0.11$ 4, $A_4=-0.09$ 5, $A_6=+0.12$ 5.
12085.2 15		18 eV	1852.6 15	

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$^{41}\text{K}(\text{p},\alpha)$: Resonances 1970De10 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	$J\pi^{\ddagger}$	$(2J+1)\Gamma_p\Gamma_\alpha/\Gamma^{\oplus}$	E(p)(lab)	Comments
12091.9 15		41 eV	1859.5 15	$A_2=-0.09$ 8, $A_4=-0.17$ 11, $A_6=+0.22$ 11.
12101.3 15	1-§	70 eV	1869.1 15	$A_2=-0.09$ 4, $A_4=0.00$ 6, $A_6=-0.03$ 5. $\Gamma=770$ eV 300 ($\Gamma_\alpha=27$ eV 20, $\Gamma_n=78$ eV 60, $\Gamma_p=660$ eV 290) (1970De11). E(level): possible analog of 2356 level in ^{42}K .
12105.1 15		19 eV	1873.0 15	
12112.2 15	1-§	39 eV	1880.3 15	$\Gamma=810$ eV 90 ($\Gamma_\alpha=14$ eV 5, $\Gamma_n=55$ eV 30, $\Gamma_p=740$ eV 80) (1970De11). E(level): possible analog of 2389 level in ^{42}K .
12116.5 15	(2+)	240 eV	1884.7 15	$A_2=+0.10$ 4, $A_4=+0.09$ 5, $A_6=+0.03$ 5.
12123.8 15	(1-), 2+	24 eV	1892.1 15	$A_2=-0.47$ 7, $A_4=+0.14$ 10, $A_6=-0.03$ 10.
12127.6 15		200 eV	1896.0 15	$A_2=-0.61$ 5, $A_4=-0.33$ 7, $A_6=+0.07$ 6.
12135.2 15		130 eV	1903.8 15	$A_2=+1.07$ 10, $A_4=+0.16$ 10, $A_6=+0.35$ 10.
12137.9 15		110 eV	1906.6 15	
12144.7 15		36 eV	1913.6 15	
12146.8 15		87 eV	1915.7 15	
12148.5 15		66 eV	1917.5 15	
12153.7 15	2+	53 eV	1922.8 15	$A_2=-0.07$ 5, $A_4=-0.23$ 8, $A_6=-0.02$ 7.
12158.6 15	1-§	150 eV	1927.8 15	$A_2=-0.19$ 3, $A_4=-0.09$ 4, $A_6=+0.05$ 4. $\Gamma=210$ eV 70 ($\Gamma_\alpha=80$ eV 50, $\Gamma_n<5$ eV, $\Gamma_p=130$ eV 50) (1970De11). $\Gamma=380$ eV 120 ($\Gamma_\alpha=120$ eV 80, $\Gamma_n=7$ eV 5, $\Gamma_p=250$ eV 90) (1970De11).
12163.1 15	1-§	240 eV	1932.4 15	E(level), $J\pi$: from $^{41}\text{K}(\text{p},\text{n})$ (1970De11). $\Gamma=105$ eV 50 ($\Gamma_\alpha<5$ eV, $\Gamma_n<10$ eV, $\Gamma_p=100$ eV 50) (1970De11).
12168.3	(1-)	<5 eV	1937.3	$A_2=-0.71$ 2, $A_4=-0.02$ 4, $A_6=+0.05$ 4. $\Gamma=850$ eV 110 ($\Gamma_\alpha=84$ eV 30, $\Gamma_n=21$ eV 10, $\Gamma_p=740$ eV 100) (1970De11).
12175.7 15	1-§	220 eV	1945.3 15	$A_2=-0.40$ 4, $A_4=+0.04$ 6. $\Gamma=480$ eV 60 ($\Gamma_\alpha=40$ eV 20, $\Gamma_n<4$ eV, $\Gamma_p=440$ eV 50) (1970De11). E(level): possible analog of 2470 level in ^{42}K .
12182.8 15	1-§	110 eV	1952.6 15	
12187.7 15		32 eV	1957.6 15	
12203.0 15	(1-, 3-)	13 eV	1973.3 15	$A_2=+0.85$ 6, $A_4=-0.21$ 6, $A_6=+0.04$ 6.
12204.1 15		19 eV	1974.4 15	
12207.9 15	(0+), 1-, 2+	19 eV	1978.3 15	$A_2=+0.23$ 6, $A_4=-0.02$ 7, $A_6=-0.09$ 7.
12210.4 15		26 eV	1980.9 15	
12212.2 15		25 eV	1982.7 15	
12221.0 15		5.1 eV	1991.7 15	
12222.7 15		5.1 eV	1993.5 15	
12226.3 15		230 eV	1997.1 15	$A_2=+0.01$ 2, $A_4=-0.27$ 3, $A_6=+0.11$ 3.
12230.5 15	(1-, 2+), 3-	250 eV	2001.5 15	$A_2=+0.61$ 9, $A_4=+0.26$ 11.
12238.4 15	(1-), 3-	14 eV	2009.5 15	$A_2=+0.83$ 11, $A_4=+0.11$ 12, $A_6=+0.11$ 11.
12239.4 15		20 eV	2010.6 15	
12246.4 15	(1-), 2+	20 eV	2017.7 15	$A_2=-0.37$ 3, $A_4=+0.11$ 4.
12247.6 15		24 eV	2019.0 15	
12251.8 15	(1-)	130 eV	2023.3 15	$A_2=-0.52$ 5, $A_4=+0.04$ 7.
12260.2 15	2+, (3-)	23 eV	2031.9 15	$A_2=-0.54$ 11, $A_4=-0.86$ 13.
12265.2 15	1-	31 eV	2037.0 15	$A_2=-0.89$ 6, $A_4=-0.18$ 10, $A_6=+0.07$ 9.
12268.1 15	3-	120 eV	2040.0 15	$A_2=+0.62$ 8, $A_4=-0.21$ 10, $A_6=+0.27$ 9.
12271.8 15	1-, 2+	180 eV	2043.8 15	$A_2=-0.26$ 7, $A_4=0.00$ 10, $A_6=+0.05$ 9.
12277.2 15	(0+), 1-, 2+, 3-, 4+	50 eV	2049.3 15	$A_2=+0.56$ 33.
12278.7 15		70 eV	2050.8 15	
12285.7 15	(1-), 2+	270 eV	2058.0 15	$A_2=-0.40$ 3, $A_4=+0.12$ 4.
12287.7 15		110 eV	2060.0 15	
12291.3 15		78 eV	2063.7 15	
12294.9 15		57 eV	2067.4 15	
12298.6 15	(1-, 2+, 3-)	78 eV	2071.2 15	$A_2=+0.51$ 7, $A_4=+0.10$ 9, $A_6=+0.21$ 8.
12300.6 15		58 eV	2073.3 15	
12304.9 15		250 eV	2077.7 15	$A_2=+0.92$ 4, $A_4=-0.11$ 5, $A_6=+0.17$ 5.
12308.2 15		74 eV	2081.0 15	
12310.9 15		79 eV	2083.8 15	
12320.6 15	(0+, 1-), 2+	200 eV	2093.8 15	$A_2=-0.23$ 4, $A_4=+0.17$ 6, $A_6=+0.21$ 5.
12323.2 15	1-, 2+	210 eV	2096.4 15	$A_2=-0.48$ 7.
12327.0 15		160 eV	2100.3 15	
12336#			2110	

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$^{41}\text{K}(\text{p},\alpha)$: Resonances 1970De10 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^\dagger$	$E(\text{p})(\text{lab})$	$E(\text{level})^\dagger$	$E(\text{p})(\text{lab})$	$E(\text{level})^\dagger$	$E(\text{p})(\text{lab})$
12340#	2114	12362#	2136	12381#	2156
12348#	2122	12366#	2140	12383#	2158
12351#	2125	12372#	2146	12386#	2161
12355#	2129	12377#	2152	12397#	2172

† $E(\text{p})(\text{c.m.})+S(\text{p})$ with $S(\text{p})=10276.67$ 15 (2012Wa38) and $E(\text{p})(\text{c.m.})$ deduced from $E(\text{p})(\text{lab})$. From 1970De10, unless otherwise noted.

‡ From comparisons of experimental data of angular distributions with theoretical predictions (1970De10), unless otherwise noted.

§ From fits to experimental cross-section data (1970De11).

From 1967An10.

@ From 1970De10. Uncertainty is 30%.

 $^{41}\text{K}(^3\text{He},\text{d})$ 1973Ja17,1971Pe04,1970Fo04

Target ^{41}K g.s. $J\pi=3/2+$.

1973Ja17: $E=23$ MeV ^3He beam was produced at the Nuclear Structure Research Laboratory at the University of Rochester. Targets of KI (99% enriched in ^{41}K) evaporated onto carbon backings. Deuterons were momentum analyzed with an Enge broad-range spectrograph and detected in nuclear emulsions, FWHM=9–14 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L-transfer, spectroscopic factors from DWBA analysis.

1971Pe04: $E=10$ MeV ^3He beam was produced from the CN Van de Graaff accelerator of Legnaro, Padova. Targets of KI (natural and 99.16% enriched in ^{41}K) evaporated onto carbon backings. Reaction products were detected with a $\Delta E-E$ telescope of surface-barrier detectors. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L-transfer, spectroscopic factors from DWBA analysis.

1970Fo04 (also 1968Fo05): $E=11.0$ MeV beam was produced from the Liverpool University Tandem accelerator. Target of 300 $\mu\text{g}/\text{cm}^2$ KI (95.35% enriched in ^{41}K) evaporated onto a thin carbon backing. Deuterons were measured with a magnetic spectrograph (14' to 40') and a surface barrier detector telescope (35' to 85'). Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L-transfer, spectroscopic factors from DWBA analysis.

Other: 1968Ly02.

 ^{42}Ca Levels

Following $J\pi$ values are implied by L-transfers: 0- to 3- for $L=1$; 0+ to 4+ for $L=2$; 1- to 5- for $L=3$; 1-, 2-, 3- for $L=1+3$.

Spectroscopic factor C^2S : $N \cdot g \cdot C^2S = \sigma(\theta)^{\text{exp}}/\sigma(\theta)^{\text{DWBA}}$, where N is the normalization factor and $g=(2J_f+1)/(2J_i+1)$.

$E(\text{level})^\dagger$	L	$(2J_f+1)C^2S^\ddagger$	Comments
0 5	2	2.22 21	$(2J_f+1)C^2S$: 2.90 (1970Fo04), 2.50 (1971Pe04).
1522 5	2	0.25 6	$(2J_f+1)C^2S$: <0.20 (1971Pe04).
1832 5	2	0.39 7	$(2J_f+1)C^2S$: <0.39 (1971Pe04).
2418 5	2	0.37 6	$(2J_f+1)C^2S$: <0.24 (1971Pe04).
3297?			Very weakly excited.
3444 5	1+3 §	0.06, 1.06	$(2J_f+1)C^2S$: 2.11 (1970Fo04), 2.31 (1971Pe04) for $L=3$.
3880 5	1(+3)	0.02, 0.06	
3949 5	3	2.8 3	$(2J_f+1)C^2S$: 4.17 (1970Fo04), 4.59 (1971Pe04).
4044 5	1+3	0.03, 0.27	
4093 5	3	3.0 3	$(2J_f+1)C^2S$: 5.91 (1970Fo04), 6.05 (1971Pe04).
4116 5	(1)	0.18	
4225 5	(1)	0.02	
4420 5	1+3 §	0.03, 0.71	$(2J_f+1)C^2S$: 1.78 (1970Fo04), 1.40 (1971Pe04) for $L=3$.
4685 5	1(+3)#	0.14, 0.11	$(2J_f+1)C^2S$: 0.43 (1970Fo04), 0.42 (1971Pe04) for $L=1$.
4710 5			
4896 5	1+3#	0.18, 0.40	$(2J_f+1)C^2S$: 0.61 (1970Fo04), 0.48 (1971Pe04) for $L=1$.
4944 5	1(+3)	0.06, 0.07	
4969 5	1+3#	0.09, 0.23	$(2J_f+1)C^2S$: 0.12 (1970Fo04) for $L=1$.
5075 5	1(+3)#	0.26, 0.32	$(2J_f+1)C^2S$: 0.60 (1970Fo04), 0.48 (1971Pe04) for $L=1$.
5156 5	1+3#	0.07, 0.12	$(2J_f+1)C^2S$: 0.17 (1970Fo04) for $L=1$.
5205 5			
5322 5	3	0.32 5	
5389 5	1(+3)#	0.10, 0.12	$(2J_f+1)C^2S$: 0.35 (1971Pe04) for $L=1$.
5410 5	1+3#	0.06, 0.15	$(2J_f+1)C^2S$: 0.33 (1970Fo04) for $L=1$.
5466 5	3	0.34 7	

Continued on next page (footnotes at end of table)

$^{41}\text{K}(^3\text{He},\text{d})$ 1973Ja17,1971Pe04,1970Fo04 (continued) ^{42}Ca Levels (continued)

E(level) [†]	L	(2J _f +1)C ² S [‡]	Comments
5488 5	1+3 [#]	0.11, 0.49	(2J _f +1)C ² S: 0.78 (1971Pe04) for L=1.
5509 5	1+3 [#]	0.07, 0.37	(2J _f +1)C ² S: 0.65 (1970Fo04) for L=1.
5587 5	1+3	0.06, 0.27	
5622 5	1(+3) [#]	0.16, 0.16	(2J _f +1)C ² S: 0.50 (1970Fo04), 0.44 (1971Pe04) for L=1.
5665 5	1+3 [#]	0.07, 0.30	(2J _f +1)C ² S: 0.29 (1970Fo04) for L=1.
5720 5	(2, 1+3)		
5795 5	1	0.12 1	(2J _f +1)C ² S: 0.36 (1970Fo04,1971Pe04).
5826 5	1	0.04 1	
5877 5	(2, 1+3)		
5918 5	(1+3)	0.02, 0.07	
5975 5	1	0.02 1	
6023 5	2	0.27 4	
6039 5	(1+3)	0.03, 0.13	
6100 5	(1+3)	0.01, 0.24	
6158 5	1+3	0.07, 0.23	
6191 5			
6242 5	(1+3)	0.05, 0.19	

[†] From 1973Ja17. Values from 1971Pe04 and 1970Fo04 are in general agreement, but less accurate.

[‡] From 1973Ja17. Values quoted by 1978En02 are adjusted upwards by ≈37%, based on standard normalization factors in 1977En02.

[§] Pure L=3 in 1970Fo04 and/or 1971Pe04.

[#] Pure L=1 in 1970Fo04 and/or 1971Pe04.

 $^{41}\text{K}(^3\text{He},\text{d}\gamma)$ 1969Te05

Target ^{41}K g.s. J π =3/2+.

1969Te05: E=18 MeV ^3He beam. Deuterons were detected with ΔE -E counter telescopes and γ -rays were detected with a NaI crystal. Measured γ , particle- γ coin, particle- γ (θ). Deduced decay of isobaric-analog states.

 ^{42}Ca Levels

E(level)	J π [†]	L	Comments
0.0	0+		
1510	2+		
2420			
2750			
3190			
3440 [‡]	3-		
3950 [‡]	(4-)		
4100 [‡] 5	5-		E(level): doublet: 4095 and 4113 in (p,p' γ) (1969Te05).
4420 [‡] 5	(2-)		E(level): triplet: 4417, 4442 and 4450 in (p,p' γ) (1969Te05).
9750 10	(2-) [§]	3	
9850 10	(3-) [§]	3	
10000 10	(4-) [§]	3	
10450 10	(5-) [§]	3	

[†] From 1969Te05.

[‡] Possible T=1 state.

[§] Possible T=2, $f_{7/2}d_{3/2}^{-1}$ multiplet, in analogy with low-lying states in ^{42}K .

 $\gamma(^{42}\text{Ca})$

E(level)	E γ [†]	I γ [‡]	Comments
3440	690	17 3	
	1020	50 8	
	1930	100 15	
3950	510	100	

Continued on next page (footnotes at end of table)

$^{41}\text{K}(^3\text{He},\text{d}\gamma)$ 1969Te05 (continued) **$\gamma(^{42}\text{Ca})$ (continued)**

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	Comments
3950	1200	<70	
4100	660	100 15	
	910	30 4	
	1350	14 2	
4420	980	43 6	
	2910	100 15	
10450	6350		$I\gamma$: >60% branch.

† From level-energy differences.

‡ From 1969Te05.

 $^{41}\text{Ca}(\text{n},\gamma)$ E=thermal 1989Ki11

1989Ki11: thermal neutrons were produced from the Los Alamos Omega Reactor. Target of a 12 mg CaCO_3 enriched to 81.7% in ^{41}Ca . γ -rays were detected with a 26 cm^3 Ge(Li) detector with a NaI(Tl) annulus operated in either a Compton-suppression mode or in a pair spectrometer mode. Measured $E\gamma$, $I\gamma$. Deduced neutron-separation energy. The authors report observing more than 250 γ rays in the range of 100 keV to 10 MeV. But only selected cascades, relevant to the determination of the neutron-separation energy, are reported in the paper.

 ^{42}Ca Levels

E(level) †	$J\pi^\ddagger$	E(level) †	$J\pi^\ddagger$	E(level) †	$J\pi^\ddagger$
0.0	0+	3253.90 4	4+	4690.07 10	3-
1524.73 3	2+	3446.96 4	3-	4759.71 16	2+
2424.18 4	2+	3954.42 5	4-	5017.15 11	4+
2752.42 4	4+	3999.67 9	4+	(11480.65 7)	3-, 4-§

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

‡ From Adopted Levels unless otherwise noted.

§ s-wave capture in ^{41}Ca g.s. ($J\pi=7/2^-$).

 $\gamma(^{42}\text{Ca})$

$E\gamma$	E(level)	$E\gamma$	E(level)	$E\gamma$	E(level)
501.46 3	3253.90	1763.12 12	5017.15	6720.46 18	(11480.65)
507.45 3	3954.42	1922.20 7	3446.96	6790.05 17	(11480.65)
899.42 3	2424.18	2335.70 30	4759.71	7480.07 18	(11480.65)
1022.77 3	3446.96	2424.17 6	2424.18	7525.47 10	(11480.65)
1227.65 3	2752.42	2474.80 10	3999.67	8033.03 18	(11480.65)
1524.68 3	1524.73	3165.24 11	4690.07	8225.86 13	(11480.65)
1729.19 5	3253.90	6462.79 17	(11480.65)	8727.42 14	(11480.65)

$^{41}\text{Ca}(\text{n},\alpha)$: Resonances 2012Ve01

2012Ve01: E=1 to 80 keV neutrons were produced via (γ,n) and (γ,F) at the gelina neutron time-of-flight facility of the Institute for Reference Materials and Measurement (rimm) in Geel (Belgium). Two flight paths for two different measurements: 8.5-m and 30-m. α particles were detected with a Frisch gridded ionization chamber. Measured $\sigma(E_{\text{n}})$, α yields. Deduced resonance energies, widths, strengths from R-Matrix analysis.

$J\pi(^{41}\text{Ca})$ g.s.)=7/2-.

 ^{42}Ca Levels

For $\Gamma_{\text{n}}/\Gamma_{\text{p}}$, ω_{p} values were used from literature (reference 20 in 2012Ve01).
 ω_{α} =resonance strength.

E(level) [§]	Γ	$E_{\text{res}}(\text{keV})$	Comments
11481.77 9		1.09 7	
11485.18 6	0.036 keV [‡] 4	4.500 2	ω_{α} =3.93 eV 18. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =8.5 4.
11486.86 6	0.245 keV [‡] 13	6.183 5	ω_{α} =17.7 eV 6.
11490.43 9	0.13 keV [†] 10	9.75 7	ω_{α} =0.4 eV 3. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =0.7 5.
11495.41 6	0.18 keV [†] 14	14.730 14	ω_{α} =10.4 eV 12.
11499.04 10	[†]	18.36 7	ω_{α} =2.4 eV 11.
11500.15 6	0.42 keV [†] 10	19.467 15	ω_{α} =28.1 eV 19. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =281 18.
11503.69 11	0.60 keV [†] 20	23.01 9	ω_{α} =1.3 eV 7. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =7 4.
11507.09 13	[†]	26.41 12	ω_{α} =1.2 eV 7.
11510.34 16	1.25 keV [†] 10	29.66 14	ω_{α} =1.3 eV 7. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =3.0 16.
11514.36 15	1.0 keV [†] 6	33.68 14	ω_{α} =5.5 eV 22. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =15 6.
11519.6 3	2.0 keV [†] 12	38.9 3	ω_{α} =12 eV 5. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =64 26.
11523.28 24	[†]	42.60 24	ω_{α} =2.7 eV 16. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =40 23.
11530.7 3	[†]	50.0 3	ω_{α} =3.7 eV 19. Deduced $\Gamma_{\text{n}}/\Gamma_{\text{p}}$ =8 4.
11537.12 25	[†]	56.44 24	ω_{α} =16 eV 5.

[†] From the measurement with the flight path=8.5 m and using Voigt fit method.

[‡] From R-matrix analysis using SAMMY code.

[§] S(n)(^{42}Ca)=11480.67 keV 6 (2012Wa38). The E(res) values listed in tables II and III are assumed to be in c.m. system.

 $^{41}\text{Ca}(\text{d},\text{p}),(\text{pol d},\text{p})$ 1975Ha14,1978Vo04

$J\pi(^{41}\text{Ca})$ g.s.)=7/2-.

1975Ha14 (also 1972El12): (d,p) E=12 MeV deuteron beam was produced at the tandem accelerator of the Niels Bohr Institute. A 20 $\mu\text{g}/\text{cm}^2$ target with a carbon backing (81.8% in ^{41}Ca). Protons were momentum analyzed with a broad-range magnetic spectrograph, FWHM=15 keV. Measured $\sigma(E_{\text{p}},\theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

1978Vo04 (also 1978Vo01): (pol d,p) E=11 MeV polarized deuteron beam was produced at the McMaster University FN tandem Van de Graaff accelerator. A 25 $\mu\text{g}/\text{cm}^2$ thick target (81.8% in ^{41}Ca) evaporated onto a carbon backing. Protons were momentum analyzed with a magnetic spectrograph and detected in nuclear emulsions, FWHM=15 keV. Measured $\sigma(E_{\text{p}},\theta)$, $\text{Ay}(\theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

Level energy	Cross section data				
	$\sigma(\text{max})$	$\mu\text{b}/\text{sr}$	$\theta(\text{lab})$	$\sigma(\text{max})$	$\mu\text{b}/\text{sr}$
	(1975Ha14)			(1978Vo04)	
0	105	35		98	35
1525	396	15		448	15
1836	22	30		21	35
2423	344	35		346	30
2752	1060	35		1054	35
3187	2050	35		2243	35
3251	266	35		267	40
3295	8	30		12	35

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	$^{41}\text{Ca}(\text{d,p}),(\text{pol d,p})$		1975Ha14,1978Vo04 (continued)	
3389	69	10	60	10
3441	11			
3650	399	15		
3888	4	25		
3949	27	5		
3999	23	15		
4052	40	5		
4103	14	30		
4228	14	30		
4356	67	25		
4423	103	5		
4448	3270	15	2525	15
4505	125	15	158	15
4566	13	20		
4666	54	5		
4691	116	5		
4720	72	5		
4760	1650	15	1650	10
4869	1220	15	1277	10
4899	95	5		
4947	36	15		
4977	83	5		
5020	3950	15	4210	15
5084	160	15		
5210	6200	15	6042	10
5325	210	5		
5356	140	15		
5384	58	10		
5412	210	5		
5442	100	5		
5474	2660	15	2804	15
5533	150	5	158	15
5626	100	5		
5669	87	5		
5696	80	10		
5778	14140	15	14530	15
5801	110	15		
5926	160	5		
5956	200	5		
5988	160	5		
6004	170	5		
6021	110	5		
6112	1010	10	1381	15
6138				
6157	160	5		
6184	100	10		
6213	460	5		
6250	94	5		
6276	190	10	181	15
6304	590	10	617	15
6390	130	5		
6426	340	10	360	15
6462	220	5		
6495	450	10	408	10
6557	320	10	282	10
6572	300	5	232	10
6614	510	15	471	20
6653	40	20		
6670	10	30		
6717	160	10		
6760	350	15	794	15
6785	39	10		
6814	2000	15	2853	15
6884	330	10	518	15
6909	960	10	1072	15
6937	160	10		
6961	1920	10	2247	10
6987	200	10		

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$^{41}\text{Ca}(\text{d,p}),(\text{pol d,p})$ 1975Ha14,1978Vo04 (continued)

7025	390	15	572	15
7041	150	10		
7123	650	10	702	15
7160	740	10	823	15
7203	130	5		
7221	160	5		
7270	1940	10	2184	15
7348	1470	10	1579	10
7401	1540	15	1534	15
7422	52	30		
7438	41	25		
7468	110	10		
7520	2110	10	2649	15
7571	400	5		
7600	160	15		
7643	830	10	1272	10
7709	1570	10	1589	15
7760	980	10	1309	15
7793	3100	10	4628	15

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	$L^{\S}$	(2J+1)S [#]	Comments
0.0		3@&	0.91@	(2J+1)S: 1.0 (1975Ha14).
1525 5		1+3@	0.24, 2.7@	Spin of transferred neutron=3/2+7/2 (1978Vo04). (2J+1)S: 0.25, 3.1 (1975Ha14).
1836 5		3@&	0.21@	(2J+1)S: 0.23 (1975Ha14).
2423 5		3@&	3.14@	(2J+1)S: 3.4 (1975Ha14).
2752 5		1+3@	0.32, 8.25@	Spin of transferred neutron=3/2+7/2 (1978Vo04). (2J+1)S: 0.35, 9.5 (1975Ha14).
3187 5		3@&	17.1@	(2J+1)S: 20.0 (1975Ha14).
3251 5		3@&	2.36@	L: 3 (1978Vo04). (2J+1)S: 2.4 (L=3), 0.014 (L=1)) (1975Ha14).
3295 10		3@	0.10@	(2J+1)S: 0.08 (1975Ha14).
3389		1@a	0.04@	L: 1+3 (1975Ha14). (2J+1)S: 0.06 (L=1), 0.05 (L=3) (1975Ha14).
3441 10				
3650 10		1+3@	0.25, 0.42@	Spin of transferred neutron=3/2+7/2 (1978Vo04). (2J+1)S: 0.26, 0.72 (1975Ha14).
3888 10				
3949 10		(0+2)	0.006, 0.13	
3999 10				
4052 10		(0+2)	0.011, 0.10	
4103 10				
4228 10				
4356 10		2(+0)	0.35, 0.001	
4423 10		0+2	0.024, 0.32	
4448 10		1@a	1.54@	E(level): doublet. (2J+1)S: 1.7 (1975Ha14).
4505 10		1+3@	0.07, 0.08@	Spin of transferred neutron=(3/2+7/2) (1978Vo04). (2J+1)S: 0.083, 0.09 (1975Ha14).
4566 10				
4666 10		0+2	0.017, 0.021	
4691 10		0+2	0.033, 0.20	
4720 10		0+2	0.022, 0.05	
4760 10		1@a	1.03@	(2J+1)S: 1.1 (1975Ha14).
4869 10		1@a	0.72@	L: 1(+3) (1975Ha14). (2J+1)S: 0.83 (L=1), 0.51 (L=3) (1975Ha14).
4899 10		0+2	0.023, 0.29	
4947 10		(1)	0.025	
4977 10		0	0.026	
5020 10		1@a	2.43@	L: 1(+3) (1975Ha14). (2J+1)S: 2.6 (L=1), 1.4 (L=3) (1975Ha14).
5084 10				
5210 10		1@a	3.78@	(2J+1)S: 4.2 (1975Ha14).

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$^{41}\text{Ca}(\text{d,p}),(\text{pol d,p})$ 1975Ha14,1978Vo04 (continued) ^{42}Ca Levels (continued)

E(level) [†]	$J\pi^{\ddagger}$	$L^{\S}$	(2J+1)S [#]	Comments
5325 10		0(+2)	0.025, 0.016	
5356 10		1	0.083	
5384 10		(0+2)	0.005, 0.04	
5412 10		0	0.022	
5442 10		0	0.013	
5474 10		1@a	1.48@	L: 1(+3) (1975Ha14). (2J+1)S: 1.6 (L=1), 1.0 (L=3) (1975Ha14). (2J+1)S: 0.09 (1975Ha14).
5533 10		1@a	0.09@	
5626 10		0(+2)	0.011, 0.021	
5669 10		0+2	0.010, 0.017	
5696 10				
5778 10		1@a	6.88@	(2J+1)S: 9.1 (1975Ha14).
5801 10				
5926 10		0+2	0.021, 0.022	
5956 10		0+2	0.023, 0.021	
5988 10		0+2	0.019, 0.028	
6004 10		0+2	0.015, 0.071	
6021 10		0+2	0.011, 0.042	
6112 10		1@a	0.70@	L: 1+3 (1975Ha14). (2J+1)S: 0.59 (L=1), 0.57 (L=3) (1975Ha14).
6138 10				
6157 10		0+2	0.019, 0.040	
6184 10		(0+2)	0.012, 0.036	$J\pi$: adopted $J\pi=(1,2+)$.
6213 10		0+2	0.05, 0.18	
6250 10		0+2	0.010, 0.030	
6276 10		1@a	0.14@	(2J+1)S: 0.11 (1975Ha14).
6304 10	(2 to 5)+	1@	0.33@	Spin of transferred neutron=(3/2) (1978Vo04). (2J+1)S: 0.33 (1975Ha14).
6390 10		0(+2)	0.014, 0.006	
6426 10	(2 to 5)+	1@a	0.17@	(2J+1)S: 0.17 (1975Ha14).
6462 10		0+2	0.023, 0.071	
6495 10	(2 to 5)+	1@a	0.26@	(2J+1)S: 0.22 (1975Ha14).
6557 15	(2 to 5)+	1@a	0.17@	(2J+1)S: 0.15 (1975Ha14).
6572 15	(2 to 5)+	1@a	0.15@	(2J+1)S: 0.16 (1975Ha14).
6614 15	3+, 4+	1@b	0.34@	L: 1(+3) (1975Ha14). (2J+1)S: 0.30 (L=1), 0.18 (L=3) (1975Ha14).
6653 15				
6670 15				
6717 15		(1+3)	0.070, 0.35	
6760 15	3+, 4+	1@	0.32@	Spin of transferred neutron=1/2+3/2 (1978Vo04). L: 1(+3) (1975Ha14). (2J+1)S: 0.18 (L=1), 0.26 (L=3) (1975Ha14).
6785 15				
6814 15	(2 to 5)+	1@a	1.17@	L: 1+3 (1975Ha14). (2J+1)S: 1.0 (L=1), 0.97 (L=3) (1975Ha14).
6884 15	(2 to 5)+	1@a	0.20@	(2J+1)S: 0.15 (1975Ha14).
6909 15	3+, 4+	1@b	0.52@	(2J+1)S: 0.48 (1975Ha14).
6937 15		1+3	0.058, 0.14	
6961 15	3+, 4+	1@b	1.06@	(2J+1)S: 0.97 (1975Ha14).
6987 15		(1)	0.075	
7025 15	3+, 4+	1+3@	0.19, 0.37@	Spin of transferred neutron=1/2+5/2 (1978Vo04). (2J+1)S: 0.20, 0.33 (1975Ha14).
7041 15		(0+2)	0.015, 0.057	
7123 15	3+, 4+	1@	0.36@	Spin of transferred neutron=1/2+3/2 (1978Vo04). (2J+1)S: 0.31 (1975Ha14).
7160 15	3+, 4+	1@b	0.38@	(2J+1)S: 0.35 (1975Ha14).
7203 15		(0+2)	0.016, 0.028	
7221 15		(0+2)	0.019, 0.026	
7270 15	3+, 4+	1@b	0.91@	(2J+1)S: 0.98 (1975Ha14).
7348 15	3+, 4+	1@b	0.69@	(2J+1)S: 0.74 (1975Ha14).
7401 15	3+, 4+	1@b	0.72@	(2J+1)S: 0.96 (1975Ha14).
7422 15				
7438 15				

Continued on next page (footnotes at end of table)

$^{41}\text{Ca}(\text{d,p}),(\text{pol d,p})$ 1975Ha14,1978Vo04 (continued) **^{42}Ca Levels (continued)**

E(level) [†]	J π [‡]	L [§]	(2J+1)S [#]	Comments
7468 15		(1+3)	0.056, 0.15	
7520 15	3+, 4+	1@b	1.06@	L: 1+3 (1975Ha14). (2J+1)S: 1.1 (L=1), 0.85 (L=3) (1975Ha14).
7571 15		(1)	0.016	
7600 15		(1+3)	0.072, 0.24	
7643 15	3+, 4+	1@	0.62@	Pure p _{1/2} neutron transfer is indicated by observation of the 7643 group at three most forward angles only (1978Vo04). L: 1+3 (1975Ha14). (2J+1)S: 0.45 (L=1), 0.39 (L=3) (1975Ha14). (2J+1)S: 0.74 (1975Ha14).
7709 15	3+, 4+	1@b	0.75@	Spin of transferred neutron=(1/2) (1978Vo04). L: 1+3 (1975Ha14). (2J+1)S: 0.47 (L=1), 0.94 (L=3) (1975Ha14).
7760 15	(3, 4)+	1@	0.54@	L: 1+3 (1975Ha14). (2J+1)S: 1.6 (L=1), 1.4 (L=3) (1975Ha14).
7793 15	3+, 4+	1@b	1.78@	

[†] From 1975Ha14. Almost all the levels are also reported by 1978Vo04. Reported (1978Vo04) energies of 43 groups agree with the values of 1975Ha14 within about 5 keV.

[‡] From 1978Vo04, based on the analyzing power data.

[§] From 1975Ha14 (DWBA analysis), unless otherwise stated.

[#] From 1975Ha14, unless otherwise stated. The values quoted here are from non-zero finite-range potential. 1975Ha14 provide corresponding values for local zero-range potential also. The values from 1978Vo04 correspond to the former choice of potential.

@ From 1978Vo04. Values from 1975Ha14 are given under comments.

& Spin of transferred neutron=7/2 from vector analyzing power (1978Vo04).

a Spin of transferred neutron=3/2 from vector analyzing power (1978Vo04).

b Spin of transferred neutron=1/2 from vector analyzing power (1978Vo04).

 $^{42}\text{Ca}(\gamma,\gamma)$ 1966Me11

1966Me11: E=1520 keV γ -rays from ^{42}K radioactive source. Targets of natural and enriched CaCO_3 (94.42% in ^{42}Ca).

Scattered γ -rays were detected with a 3 by 3 in. NaI(Tl) detector. Measured cross section for resonant scattering.

Deduced T_{1/2} from measured resonance width for the 1.52 MeV level.

Other: 1972KaXR.

 ^{42}Ca Levels

E(level)	J π [†]	T _{1/2}	Comments
0.0	0+		
1520	2+	0.97 ps 22	T _{1/2} : from $\Gamma=0.00048$ eV 11 (1966Me11). Other: 0.520 ps 35 (1972KaXR).

[†] From Adopted Levels.

 $\gamma(^{42}\text{Ca})$

E γ	E(level)	Comments
1520	1520	B(E2) $\downarrow$ =0.0074 17.

$^{42}\text{Ca}(\text{e},\text{e}')$ 1989It02

Target ^{42}Ca g.s. $J\pi=0+$.

1989It02 (also 1983It02,1981It02): E=62.5–250 MeV electron beams were produced from the linear accelerators both at the Laboratory of Nuclear Science, Tohoku University and at the Accelerator Laboratory, University of Saskatchewan. Target of a 48.9 mg/cm² 94.4% enriched ^{42}Ca metallic foil. Scattered electrons were measured by a hodoscope-type array of solid-state detectors or plastic scintillators mounted at the focal plane in a magnetic spectrometers. Measured $\sigma(\theta)$. Deduced levels, form factors, $J\pi$, $\beta(\lambda)$. Overall resolution is 0.15% for one experiment and 0.10% for the other. Comparisons of measured form factors with DWBA calculations.

1984Ra04: E=30–57.5 MeV. Measured cross sections, deduced isovector M2 transition strengths. FWHM=25–45 keV.

1980St17: E=39 MeV. Measured cross sections. Deduced M1 strength.

1978Gr02: E=31–67 MeV. Measured cross sections, deduced monopole (E0) excitation. FWHM=30 keV.

1971He08: E=198, 250, 300 MeV. Measured $\sigma(\theta)$.

1968Fr11: E=250 MeV. Measured cross section for elastic scattering.

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\ddagger}$	$L^{\ddagger}$	B(EL) [†]	Comments
0.0	0+			
1520	2+	2	0.0418 15	Other B(E2)=0.0320 20 (1971He08).
1837				E(level): from 1978Gr02, E0 excitation. E0 matrix element=5.24 fm ² 39 (1978Gr02).
2420	2+	2	0.0118 12	
2750	4+			
3440	3–	3	0.0136 6	Other B(E3)=0.0091 4 (1971He08).
4100	5–	5	0.00011 9	Other B(E5)=0.000066 6 (1971He08).
4450	4+			
4690	3–	3	0.00215 21	
4980	3–	3	0.0010 1	
5520	3–			
5680	3–			
6100	(1–)	(1)		Assignment as isoscalar E1 transition is based on similarity of q-dependence of form factor with isoscalar E1 transitions of 5900 and 6950 in ^{40}Ca .
9750	(2–)			E(level), $J\pi$: from 1984Ra04, M2 excitation. B(M2)=30 $\mu^2_{\text{nfm}^2}$ 10 (1984Ra04).
9770	(2+)		0.00032 12	E(level), $J\pi$, B(EL): from 1984Ra04, E2 excitation.
11235	(1+)			E(level), $J\pi$, B(EL): from 1980St17, M1 excitation. B(M1)=0.59 5 (1980St17).

[†] From 1989It02, except as noted.

[‡] From comparisons of measured form factors with DWBA calculations (1989It02), unless otherwise noted.

⁴²Ca(π^+, π^+), (π^-, π^-) 1984Bo02

1984Bo02, 1981Bo26: E=116.0, 180.0, 292.5 MeV pions were produced at the Clinton P. Anderson Meson Physics Facility (LAMPF). Scattered particles were analyzed with the epics spectrometer and detected by position-sensitive, delay-line read-out drift chambers, FWHM=300 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from Distorted Wave Impulse Approximation (DWIA) and optical-model analysis.
1984KaZY: E=130, 180, 235, 292 MeV. Measured $\sigma(\theta)$, deduced core-excitation role.
1999Ha66: E=164-292 MeV.

⁴²Ca Levels

All data are from 1984Bo02, unless otherwise noted.

E(level)	$J\pi^{\S}$	L
0.0	0+	0
1520 [†]	2+	2
2420	2+	2
3440 [‡]	3-	3
4104	5-	5
4680	3-	3
6300	(3-)	(3)

[†] E2 matrix elements (from microscopic model, in s.p.u.): 3.22 22 (for neutron), 2.80 21 (for proton) (1981Bo26).

[‡] E3 matrix elements (from microscopic model, in s.p.u.): 3.59 27 (for neutron), 4.06 28 (for proton) (1981Bo26).

[§] From L-transfer.

⁴²Ca(p,p') 1968Ba28,1971Ma53,1970La22

See also ⁴²Ca(p,p' γ) dataset.

Inelastic and elastic scattering experiments:

1968Ba28: E=22.9 MeV proton beam was produced at the University of Colorado 132 fixed-field alternating-gradient cyclotron. A self-supporting target of ⁴²Ca enriched to 93.7%. Scattered protons were detected with a 3 mm lithium-drifted silicon detector, FWHM=100 100 keV. Measured $\sigma(E_p, \theta)$. Deduced levels, L, deformation parameters from DWBA analysis.

1971Ma53: E=49.75 MeV proton beam was produced at the proton linear accelerator at the Rutherford High Energy Laboratory, Chilton, Berkshire. A self-supporting target of 90% enriched ⁴²Ca, 2mg/cm² thick. Scattered protons were detected with an n=1/2 double-focusing magnetic spectrometer with an acoustic spark-chamber assembly, FWHM=65 keV. Measured $\sigma(E_p, \theta)$. Deduced levels, L, deformation parameters from DWBA analysis.

1970La22: (p,p' γ) E=7.03 MeV proton from the University of Liverpool E(n) tandem accelerator. A 200 μ g/cm² thick enriched ⁴²Ca target. Scattered protons were detected with an annular silicon surface barrier detected and γ -rays were detected with NaI crystals. Measured scattered proton energies, E_γ , I_γ , $p\gamma(\theta)$. Deduced levels, $J\pi$, γ -branchings, mixing ratios.

1969Ko03: E=7.8 MeV. Measured scattered proton energies, lifetimes by Doppler-shift attenuation of γ rays. FWHM (for proton spectra)=120 keV.

1956Br08: E=6.5, 7.0, 7.4 MeV. A total of 14 groups reported up to 4043 keV.

1961Be19: E=3.6-6.3 MeV. E0 transition observed.

1976Al19: E=1.044 GeV. Measured $\sigma(\theta)$.

1976Ul01 (also 1976UlZ): E=4.40 MeV. Measured pair spectra, deduced E0 strength.

1983Mi25, 1982Be32: (pol p,p') E=650 MeV. Measured $\sigma(\theta)$, DWIA analysis.

Elastic scattering experiments:

1986Mc05 (also 1980NaZU): E=21-48.4 MeV. Measured $\sigma(\theta)$, deduced nuclear matter radii.

1981Ra02: (pol p,p) E=800 MeV. Measured $\sigma(\theta)$, analyzing powers.

1981No07: (pol p,p) E=65 MeV. Measured $\sigma(\theta)$, polarization.

1980Fa07: E=35.2 MeV. Measured $\sigma(\theta)$.

1979Ig01: (pol p,p) E=0.8 GeV. Measured $\sigma(\theta)$, $A_y(\theta)$.

1971Ma17: E=49.3 MeV. Measured $\sigma(\theta)$.

1969Sm02: E=26.5 MeV.

⁴²Ca Levels

E(level) [†]	L [†]	$\beta_L^{\#}$	Comments
0.0			
1520 10	2	0.21	B(E2)(W.u.)=3.8 6 (1971Ma53), 6.4 10 (1968Ba28).
1850 10	0		
2430 10	2	0.07	B(E2)(W.u.)=0.59 10 (1971Ma53), 0.87 10 (1968Ba28).

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$^{42}\text{Ca}(\text{p},\text{p}')$ 1968Ba28,1971Ma53,1970La22 (continued) ^{42}Ca Levels (continued)

E(level) [†]	L [†]	$\beta_{\text{L}}^{\#}$	Comments
2760 10	4	0.105	B(E4)(W.u.)=3.6 5 (1971Ma53), 3.9 6 (1968Ba28).
3330 [‡] 25	2+6 [‡]		E(level): doublet. Others: 3250+3300 (1970La22), 3260 (1968Ba28); 3250+3297 (1956Br08), 3191+3250+3297 in 1969Ko03.
			B(E2)(W.u.)=0.35 5, B(E6)(W.u.)=0.32 5 (1971Ma53).
3390 [§]			
3460 10	3	0.26	B(E3)(W.u.)=16.5 25 (1971Ma53), 15.9 24 (1968Ba28).
3600 25			E(level): from 1971Ma53. E=3651 (1969Ko03).
3780 10	2, 3	0.08, 0.09	
3890 [‡] 25	3, 4 [‡]		B(E3)(W.u.)=0.65 8, B(E4)(W.u.)=1.4 2 (1971Ma53).
3949			E(level): from 1956Br08 and 1969Ko03.
4000 [§]			
4040 [§]			
4120 10	5	0.14	B(E5)(W.u.)=10.8 16 (1971Ma53), 11.8 18 (1968Ba28).
4230 [§]			
4350 [§]			
4470 10	4	0.09	B(E4)(W.u.)=2.8 4 (1971Ma53), 3.0 4 (1968Ba28).
4500 [§]			
4560 [§]			
4730 10	3	0.12	E(level): 4690 25 (1971Ma53).
			B(E2)(W.u.)=3.5 4 (1971Ma53), 3.4 4 (1968Ba28).
4850 [‡] 25	2 [‡]		B(E2)(W.u.)=0.42 6 (1971Ma53).
4970 10	3	0.09	L: from 1971Ma53. L=2,3 in 1968Ba28.
			B(E2)(W.u.)=1.2 2 (1971Ma53), 1.5 5 (1968Ba28).
5740 10	2, 3	0.09, 0.10	
6220 10	2, 3	0.08, 0.10	
7030 10			

[†] From 1968Ba28, unless otherwise stated.[‡] From 1971Ma53.[§] From 1970La22.[#] From 1968Ba28. **$^{42}\text{Ca}(\text{p},\text{p}'\gamma)$ 1970La22,1969Ko03**See also $^{42}\text{Ca}(\text{p},\text{p}')$.

1970La22: E=7.03 MeV proton beam was produced at the University of Liverpool EN tandem accelerator. A target of 200 $\mu\text{g}/\text{cm}^2$ thick enriched ^{42}Ca . Protons were detected in an annular silicon surface barrier detector and γ -rays were detected in NaI crystals. Measured $E\gamma$, $I\gamma$, $E(\text{p})$, $p\gamma(\theta)$. Deduced levels, $J\pi$, branching ratios, mixing ratios.

1969Ko03: E=7.8 MeV proton beam was produced at the MIT cyclotron. A target of 1.19 mg/cm^2 enriched ^{42}Ca (93.7%). Scattered protons were detected by a solid state detector and γ -rays were detected with a Ge(Li) detector.

Measured $E\gamma$, $I\gamma$, lifetimes by Doppler-shift attenuation method. Deduced levels, branching ratios, transition strengths.

1969Sc31: E=6.5 to 6.9 MeV. Measured $p\gamma(\theta)$ for γ rays from 2420 and 3666 levels.

1969Te05: E=12 MeV. Measured branching ratios from 3440, 3950, 4100 and 4420 levels.

1985Le17: E=5 MeV. Measured $p\gamma$ coin, lifetime of 1836 level by electronic timing.

1976Ul01, 1961Be19 (also 1960Be07): E=4.4 MeV. Measured E0 electron-positron pairs and internal-conversion electrons corresponding to the g.s. E0 transition from 1840, 0+ state.

1971RoYQ: measured γ rays.

1969Ho33: E=6.7, 7.7 MeV. Measured B(E1) ratios in decay of 3447, 3- level.

Others: 1985Ki07, 1984Pa15, 1984Pa16, 1982Mi06.

 ^{42}Ca Levels

E(level) [†]	$J\pi^{\S}$	$T_{1/2}^{\#}$	Comments
0.0	0+		
1523	2+	1.11 ps 21	
1836	0+	387 ps [@] 6	
2422	2+	0.21 ps 5	
2750	4+	2.4 ps +76-2	

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$^{42}\text{Ca}(\text{p,p}'\gamma)$ 1970La22,1969Ko03 (continued) ^{42}Ca Levels (continued)

E(level) [†]	J π [§]	T _{1/2} [#]	Comments
3191	6+	>0.5 ps	
3250	4+	0.21 ps +10-7	
3297	0+	>1 ps	Measured upper limit of branching <1% for γ to g.s. and <2% for γ to 1836, 0+ level.
3389	2+	0.23 ps 5	
3442	3-	0.45 ps 14	
3651	2+	0.04 ps +6-4	
3883	1-		
3950 [‡]	4-		
4000&	4+		
4043	3-		
4090	5-		
4113	3-		
4230	1		
4350			
4417 [‡]	3-		
4442 [‡]	4+		
4450 [‡]	2+		

[†] From 1969Ko03, unless otherwise stated.[‡] From 1969Te05.[§] From Adopted Levels.[#] From Doppler-shift attenuation method (1969Ko03), except where noted.@ From p γ (t) (1985Le17).

& From 1970La22.

 $\gamma(^{42}\text{Ca})$ A_2 and A_4 are from 1970La22.

E(level)	E γ [†]	I γ [‡]	Mult. [§]	δ [§]	I(γ +ce)	Comments
1523	1523	100				
1836	313	100				(1840p)(1523 γ)(θ): A_2 =+0.02 4, A_4 =-0.03 4. ρ =0.34 3 (1976U101). Other: 0.41 4 (1961Be19). I(γ +ce): from 1976U101.
	1836		E0		2.05 17	Mult.: from the shape of the positron spectrum and the ratio I(e ⁺)/I(ce(K))=9.0 18 (1961Be19).
2422	585	≤ 1.5				
	899	100 2	M1+E2	-0.17 2		A_2 =+0.21 3; A_4 =+0.01 3. δ : weighted average of -0.09 8 (1970La22) and -0.18 2 (1969Sc31). A_2 =+0.48 6; A_4 =+0.01 8. (2420p)(1523 γ)(θ): A_2 =+0.29 2, A_4 =+0.06 3.
	2422	44 2	E2			
2750	328	2.6@ 16				
	1227	100.0 4	E2			A_2 =+0.55 8; A_4 =-0.28 11. (2750p)(1523 γ)(θ): A_2 =+0.46 3, A_4 =-0.23 4.
3191	440	100				
3250	500	64 7				δ : -0.3 to +2.0. A_2 =+0.50 3; A_4 =-0.20 4.
	828	18@ 9				
	1727	100 7				$\delta(\text{O/Q})$ =+0.05 14. A_2 =+0.38 1; A_4 =0.00 2. (3250p)(1227 γ)(θ): A_2 =+0.40 18, A_4 =-0.14 22.
3297	875	100 1				
	1774	8@ 4				(3300p)(899 γ)(θ): A_2 =-0.04 4, A_4 =-0.12 8. (3300p)(1523 γ)(θ): A_2 =-0.02 6, A_4 =+0.03 9. (3300p)(2422 γ)(θ): A_2 =+0.05 9, A_4 =-0.10 11. I γ : from 1969Ko03. I γ =45 4 in 1970La22.
3389	968	5 4				
	1553	16 3				
	1866	100 4	M1+E2	+1.7 -3+5		A_2 =+0.60 4; A_4 =-0.28 6. A_2 =+0.55 7; A_4 =-0.95 9. (3390p)(1523 γ)(θ): A_2 =+0.20 2, A_4 =-0.08 3. I γ : 17 (1969Te05).
	3389	89 8				
3442	693	4 ^c 2				

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$^{42}\text{Ca}(\text{p,p}'\gamma)$ 1970La22,1969Ko03 (continued) $\gamma(^{42}\text{Ca})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	Mult.§	$\delta^\S$	Comments
3442	1021	59 ^c 2			
	1920	100 ^c 3	D(+Q)	+0.02 7	$A_2=-0.26$ 4; $A_4=-0.02$ 4.
	3443 ^d	$\leq 3^c$	[E3]		(3440p)(1523 γ)(θ): $A_2=+0.23$ 2, $A_4=-0.07$ 2.
					(3440p)(2422 γ)(θ): $A_2=+0.55$ 10, $A_4=-0.40$ 13.
3651	1230	4 1			
	1815	<2.5			$I\gamma$: from 1970La22. Other: 12 5 (1969Ko03).
	2128	100 3	D(+Q)	0.00 10	$A_2=+0.29$ 3; $A_4=+0.02$ 3.
					δ : other: -0.08 -3+10 or +2.7 +3-7 (1969Sc31).
	3651	22 1			$A_2=+0.41$ 9; $A_4=+0.60$ 10.
					(3650p)(1523 γ)(θ): $A_2=+0.20$ 2, $A_4=-0.49$ 2.
3883	1461	4 2			
	2046	96 4			$A_2=-0.65$ 6; $A_4=+0.04$ 6.
	3883	100 4			$A_2=-0.51$ 1; $A_4=-0.06$ 3.
					(3880p)(1523 γ)(θ): $A_2=+0.02$ 9, $A_4=+0.02$ 10.
3950	510	<67&			
	1200	100&			
4000	1248	6 ^a 3			
	1577	45 ^a 5			
	2475	100 ^a 5			$A_2=+0.05$ 3; $A_4=+0.43$ 4.
					(4000p)(1523 γ)(θ): $A_2=+0.20$ 5, $A_4=+0.35$ 6.
					(4000p)(899 γ)(θ): $A_2=+0.03$ 10, $A_4=+0.12$ 12.
4043	600	22 [#] 5			
	1293	21 [#] 16			
	1621	29 [#] 10			
	2520	100 [#] 14			
					$A_2=-0.03$ 7; $A_4=+0.07$ 8.
4090	650	14& 2			
	903	100& 15			
	1343	29& 4			
4113	1687	19 ^b 6			
	2585	100 ^b 9			$A_2=+0.22$ 3; $A_4=-0.04$ 3.
					(4110p)(1523 γ)(θ): $A_2=+0.12$ 1, $A_4=-0.04$ 1.
4230	1809	25 ^a 5			
	4231	100 ^a 5			$A_2=-0.05$ 10; $A_4=-0.03$ 12.
					(4230p)(1523 γ)(θ): $A_2=+0.30$ 7, $A_4=-0.09$ 9.
4350	1100	<60 [#]			
	1160	<100 [#]			
	1600	100 [#] 50			
	2827	<40 [#]			
4417	977	43& 6			
	2897	100& 15			
4442	1692	100&			
4450	4450	100&			

† Level-energy differences.

‡ Weighted averages from 1970La22 and 1969Ko03, except when noted.

§ From $p\gamma(\theta)$ data of 1970La22, except when noted.

From 1969Ko03.

@ Unweighted average of 1970La22 and 1969Ko03.

& From 1969Te05.

^a From 1970La22.^b Unweighted average of 1969Ko03 and 1969Te05.^c From 1969Ho33.^d Placement of transition in the level scheme is uncertain.

$^{42}\text{Ca}(\text{d},\text{d}') \quad 1968\text{Ha}31$

1968Ha31: E=7.50 MeV deuteron beam was produced from the ONR electrostatic generator. Target of 90.9% enriched ^{42}Ca on a carbon backing. Scattered particles were momentum analyzed with the MIT multi-range spectrograph and detected in nuclear emulsions. Measured $\sigma(E_d, \theta)$. Deduced levels, $J\pi$, L from the optical model analysis and distorted-wave (DW) analysis.

1968Be36: (d,d) E=7.0, 7.2 MeV. Measured $\sigma(\theta)$.

1970Br27: (d,d) E=12 MeV. Measured $\sigma(\theta)$. Deduced optical-model parameters.

1970Fi01: (d,d) E=11.8 MeV. Measured $\sigma(\theta)$. Deduced optical-model parameters.

 ^{42}Ca Levels

All data are from 1968Ha31.

E(level)	L	$d\sigma/d\Omega$ (max) (mb/sr)	Comments
0.0	0		
1524 4	2	1.30	$\beta_2=0.23$.
1835 5	(0)	0.31	
2423 6		0.20	
2749 6		0.10	
3445 8	(3)	0.25	$\beta_3=0.17$.

 $^{42}\text{Ca}(\alpha, \alpha') \quad 1973\text{Ja}17, 1967\text{Li}13$

Includes $(\alpha, \alpha'\gamma)$ from 1976Br15.

Inelastic and elastic experiments: measured $\sigma(\theta)$:

1973Ja17 (also 1973JaYN): E=28.5 MeV alpha beam. A target of CaCO_3 (94% in ^{42}Ca , 90 $\mu\text{g}/\text{cm}^2$) evaporated on a carbon foil. Scattered alpha particles were momentum analyzed with an Engel broad-range spectrograph and detected in nuclear emulsions, FWHM=25 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1967Li13: E=31 MeV alpha beam from the MIT cyclotron. A 1.19 mg/cm^2 thick target of ^{42}Ca enriched to 93.7%.

Scattered alpha particles were detected by a 500- μm silicon surface barrier detector, FWHM=70 keV. Measured $\sigma(\theta)$.

Deduced levels, $J\pi$, L from DWBA analysis.

1966Pe16: E=42 MeV. Ten levels reported up to 5700 with L values for most of these levels which are in agreement with those from 1973Ja17 and 1967Li13.

1966Gr09: E=30.5 MeV.

1969Mo28: E=18-44 MeV.

1972Oe01: E=24, 29 MeV.

1975Tr01: E=24-29 MeV.

1976Br15: $(\alpha, \alpha'\gamma)$ E=31 MeV. Measured lifetime of 3190, 6+ state by pulsed-beam electronic timing.

1979Ba14, 1977Al07: E=1.37 GeV.

1989Ai02: E=29.3-50.5 MeV.

Elastic scattering experiments: optical-model parameters deduced from $\sigma(\theta)$ measurements:

1980Gi02: (α, α) E=104 MeV.

1972St28: (α, α) E=40.7-72.3 MeV.

1971FuZT: (α, α) E=72, 24 MeV.

1970Fe02: (α, α) E=42 MeV.

1969Ga22: (α, α) E=18, 22, 24, 29 MeV.

 ^{42}Ca Levels

E(level) [†]	$T_{1/2}$	$L^\dagger$	$\beta_L^\S$	Comments
0.0 $\frac{1}{2}^+$		0 $\frac{1}{2}^+$		
1520 $\frac{3}{2}^+$		2 $\frac{3}{2}^+$	0.19	$\beta_2=0.19$ (1975Tr01), 0.16 (1969Mo28), 0.10 3 (1966Gr09). B(E2)(W.u.)=10.0 15 (1967Li13).
1840 $\frac{3}{2}^+$		0 $\frac{3}{2}^+$		
2420 $\frac{3}{2}^+$		2 $\frac{3}{2}^+$	0.072	$\beta_2=0.092$ (1975Tr01). B(E2)(W.u.)=1.5 2 (1967Li13).
2750 5		4	0.067	$\beta_4=0.107$ (1975Tr01), 0.049 (1969Mo28). B(E4)(W.u.)=1.4 2 (1967Li13).
3188 5	5.27 ns 14	6		$T_{1/2}$: from pulsed-beam electronic timing (1976Br15).
3250 5		4		
3299 5		(0)		
3390 5		2		
3446 5		3	0.30	β_3 from 1975Tr01.
3653 5		2	0.051	B(E2)(W.u.)=0.75 11 (1967Li13).

Continued on next page (footnotes at end of table)

$^{42}\text{Ca}(\alpha, \alpha')$ 1973Ja17, 1967Li13 (continued) ^{42}Ca Levels (continued)

$E(\text{level})^\dagger$	$L^\dagger$	$\beta_L^\S$	Comments
3891 5	3		
4046 5			
4100 5	5		
4446 5	4	0.077	B(E4)(W.u.)=1.8 4 (1967Li13).
4686 5	3		
4760 5	(2)		
4865 5	2		
4902 5	3		
4972 5	3		
5017 5	(3, 4)		
5156 5	3		
5205 5	2		
5375 5			
5400 $\frac{1}{2}$	(4) $\frac{1}{2}$	0.036	B(E4)(W.u.)=0.4 1 (1967Li13).
5494 5	3		
5527 5	3		L: from 1967Li13.
5591 5	(3)		
5623 5	(3)		
5667 5	3		
5693 5	(4, 5)		
5720 5	(4)		
5794 5	3		
5866 5	2		
5924 5			
6017 5	2		
6050 $\frac{1}{2}$	(3) $\frac{1}{2}$		
6106 5	(4)		
6154 5	3		
6192 5			
6239 5	3		
6510 $\frac{1}{2}$	(4) $\frac{1}{2}$	0.053	B(E4)(W.u.)=0.9 2 (1967Li13).
6630 $\frac{1}{2}$	(4) $\frac{1}{2}$	0.048	B(E4)(W.u.)=0.7 2 (1967Li13).
6950			E(level): from 1967Li13.

 † From 1973Ja17, unless otherwise stated. $\frac{1}{2}$ From 1967Li13. § From 1967Li13.

$^{42}\text{Ca}(^{16}\text{O}, ^{16}\text{O}')$ 1982Re03

Target ^{42}Ca g.s. $J\pi=0+$.

1982Re03: E=60 MeV ^{16}O beam was produced at the Argonne FN tandem. Target of 93.7% enriched ^{42}Ca . Outgoing particles were momentum analyzed with the Argonne split-pole magnetic spectrograph and detected in a position-sensitive ionization chamber in the focal plane. Measured $\sigma(\text{E}(^{16}\text{O},\theta))$. Deduced levels, $J\pi$, L, deformation lengths, $B(\lambda)$ from DWBA analysis and coupled-channels analysis.

 ^{42}Ca Levels

E(level) [†]	L [‡]	Comments
0.0		
1525	2	
1837		
2424	2	
2752	4	$B(\text{E}4)\uparrow=1.18\times 10^{-4}$.
3254		
3447	3	
4100	5	
4449	2	$B(\text{E}2)\uparrow=6.07\times 10^{-3}$.
4690	3	$B(\text{E}3)\uparrow=1.68\times 10^{-3}$.
4971	3	$B(\text{E}3)\uparrow=1.13\times 10^{-3}$.

[†] Rounded values from Adopted Levels.

[‡] From comparison of experimental data with DWBA and coupled-channels calculations.

Coulomb Excitation 2013Ha06,1973To07

2013Ha06: ($^{42}\text{Ca}, ^{42}\text{Ca}'\gamma$) E=170 MeV ^{42}Ca beam was produced at the Laboratori Nazionali di Legnaro. A 1 mg/cm² ^{208}Pb target. γ -rays were detected with the γ -ray spectrometer AGATA and charged particles were detected with the DANTE array. Measured $\text{E}\gamma$, $\text{I}\gamma$, $\gamma\gamma$ -coin. Deduced levels, deformation parameters.

1973To07 (also 1972To01): ($^{32}\text{S}, ^{32}\text{S}'\gamma$) E=60 MeV. Measured static quadrupole moment by reorientation method, $\gamma(^{32}\text{S})(\theta)$.

 ^{42}Ca Levels

E(level) [†]	$J\pi$ [‡]	$T_{1/2}$	Comments
0.0	0+		
1525	2+	0.825 ps 28	$Q=-0.14$ 7 (1973To07). $B(\text{E}2)\uparrow=0.0412$ 15. $T_{1/2}$: from $B(\text{E}2)$ (1973To07).
1837	0+		
2424	2+		
2752	4+		
3254	4+		

[†] From 2013Ha06.

[‡] From Adopted Levels.

 $\gamma(^{42}\text{Ca})$

In 2013Ha06, two strong γ -rays at E=376 and 2048 were observed. From a dedicated experiment to study the low energy part of ^{42}Ca by the $^{12}\text{C}(^{32}\text{S}, 2\text{p})$ reaction, it is suggested that the two γ -rays could originate from the sub-barrier one neutron transfer reaction $^{208}\text{Pb}(^{42}\text{Ca}, ^{43}\text{Ca})$.

$\text{E}\gamma$ [†]	E(level)
312	1837
899	2424
1227	2752
1525	1525
1729	3254
2424	2424

[†] From 2013Ha06.

$^{43}\text{Ca}(\text{p,d})$ 1973Du02

Target ^{43}Ca g.s. $J\pi=7/2^-$.

1973Du02: E=40 MeV proton beam was produced at the Grenoble variable-energy cyclotron. Target of 1 mg/cm² self-supported calcium. Reaction products were detected in a ΔE -E silicon counter telescope and a anti-coincidence counter, FWHM=80–100 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

 ^{42}Ca Levels

E(level)	L	C ² _S	E(level)	L	C ² _S	E(level)	L	C ² _S
0.0	3	0.5	4100	2	0.24	9750	2	0.045 [§] 15
1520	3	0.15	4400	2	0.29	9850	2	0.10
1840	3	0.04	4700	0+2	0.06, 0.045	10010	2	0.17
2420	3	0.11	4900	2	0.33	10430	2	0.23
2750	3	0.42	5340	2	0.10	10970	0	0.10
3200	3	0.66 [‡]	5790	0+2	0.057, 0.07	11440	0	0.07
3440	0+2	0.18, 0.20	6030	(0+2)	0.09, 0.11			
3650 [†]	(1)		6500	0+2	0.12, 0.07			

[†] Obscured by ^{41}Ca (g.s.).

[‡] Corrected for ^{43}Ca contamination.

[§] Quoted (1973Du02) as >0.03, <0.06.

 $^{43}\text{Ca}(\text{d,t})$ 1973Ja17

$J\pi(^{43}\text{Ca}$ g.s.=7/2-).

1973Ja17 (also 1973JaYN): E=20 MeV deuteron beam. A target of CaCO_3 evaporated on a carbon foil, 81% enriched to ^{43}Ca , 60 $\mu\text{g}/\text{cm}^2$ thick. Reaction products were momentum analyzed with an Enge broad-range spectrograph and detected in nuclear emulsions, FWHM=10–14 keV. Measured $\sigma(E_t, \theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

1969Yn01: E=22.6 MeV. FWHM=70 keV. Measured $\sigma(\theta)$, DWBA analysis. A total of 20 groups observed. All groups were assigned pure L transfers.

1964Bj02: E=8.522 MeV. FWHM=15 keV. Measured $\sigma(\theta)$, DWBA analysis. Five groups reported at 0, 1532, 2435, 2764 and 3195.

The following groups reported by 1969Yn01 cannot be reconciled with those from 1973Ja17: 3580 (L=0), 3780 (L=1), 3920 (L=2), 4230 (L=2), 4310 (L=2), 4560 (L=3), 5670 (L=0), 5870 (L=0)).

 ^{42}Ca Levels

E(level) [†]	L [†]	C ² S [†]	Comments
0.0	3	0.46 1	C ² S: 0.50 (1969Yn01), 0.75 (1964Bj02).
1523 5	3	0.19 1	C ² S: 0.16 (1969Yn01), 0.21 (1964Bj02).
1836 5	3	0.04	C ² S: 0.05 (1969Yn01).
2425 5	3(+1)	0.16 1	C ² S: for L=3. C ² S=0.004 for L=1.
			C ² S: 0.11 (1969Yn01) for L=3, 0.21 (1964Bj02).
2750 5	3(+1)	0.59 2	C ² S: for L=3. C ² S=0.01 for L=1.
			C ² S: 0.47 (1969Yn01) for L=3, 0.75 (1964Bj02).
3188 5	3	0.87 3	C ² S: 20% of the observed strength due to ^{43}Ca g.s. from $^{44}\text{Ca}(\text{d,t})$ has been subtracted.
			C ² S: 1.0 (1969Yn01), 1.08 (1964Bj02).
3253 5	3(+1)	0.08 1	C ² S: for L=3. C ² S=0.001 for L=1.
3297?			Very weakly excited.
3393 5	1(+3)	0.003	C ² S: for L=1. C ² S=0.01 1 for L=3.
3446 5	0+2	0.09 1	C ² S: for L=0. C ² S=0.14 2 for L=2.
			C ² S: 0.09 (1969Yn01) for L=0.
3656 5	3	0.06 1	
3890 5	2(+0)	0.02, 0.002	
3956 5	0(+2)	0.002, 0.01	
4043 5	0+2	0.01, 0.01	
4099 5	2	0.30 1	C ² S: 0.25 (1969Yn01) for L=2, 4020 group.
4355 5	2	0.29 2	
4421 5	2	0.09 1	C ² S: 0.23 (1969Yn01) for L=2, 4430 group.
4447 5	1+3	0.02	C ² S: for L=1. C ² S=0.04 1 for L=3.
4690 5	0+2	0.04	C ² S: for L=0. C ² S=0.06 1 for L=2.
			C ² S: 0.04 (1969Yn01) for L=0, 4720 group.

Continued on next page (footnotes at end of table)

$^{43}\text{Ca}(\text{d},\text{t})$ 1973Ja17 (continued) **^{42}Ca Levels (continued)**

$E(\text{level})^\dagger$	$L^\dagger$	$C^2S^\dagger$	Comments
4895 5	2 (+0)	0.16 3	C^2S : for $L=2$. $C^2S=0.02$ <i>I</i> for $L=0$.
4966 5	(2)	0.18 1	$E(\text{level})$: observed only at backward angles. C^2S : 0.29 (1969Yn01) for $L=2$, 4970 group.
5012 5	(1+3)	0.08 2	C^2S : for $L=3$. $C^2S=0.003$ for $L=1$.
5189 5	3	0.13 1	
5204 5	1+3	0.08 2	C^2S : for $L=3$. $C^2S=0.01$ for $L=1$.
5321 5	0+2	0.12 2	C^2S : for $L=2$. $C^2S=0.02$ for $L=0$.
5377 5	2	0.05 1	C^2S : 0.17 (1969Yn01) for $L=2$, 5370 group.
5403 5	2 (+0)	0.05 1	C^2S : for $L=2$. $C^2S=0.004$ for $L=0$.
5436 5	0 (+2)	0.01	C^2S : for $L=0$. $C^2S=0.02$ <i>I</i> for $L=2$.
5467 5	1+3	0.01, 0.04	
5488 5	3 (+1)	0.03, 0.001	
5590 5	0+2	0.08 1	C^2S : for $L=0$. $C^2S=0.08$ <i>I</i> for $L=2$.
5767 5	2	0.17 2	
5790 5	3	0.16 2	
5923 5	2	0.06 1	
5985 5	0 (+2)	0.02	C^2S : for $L=0$. $C^2S=0.03$ <i>I</i> for $L=2$.
5997 5	0 (+2)	0.03	C^2S : for $L=0$. $C^2S=0.02$ <i>I</i> for $L=2$.
6034 5	2 (+0)	0.04 1	C^2S : for $L=2$. $C^2S=0.004$ for $L=0$.
6098 5	2	0.06 1	
6162 5	(0+2)	0.02 1	C^2S : for $L=2$. $C^2S=0.01$ for $L=0$.
6207 5	0 (+2)	0.05	C^2S : for $L=0$. $C^2S=0.04$ <i>I</i> for $L=2$.
6235 5	0+2	0.05 1	C^2S : for $L=2$. $C^2S=0.002$ for $L=0$.

† From 1973Ja17, unless otherwise noted.

$^{43}\text{Ca}(^3\text{He},\alpha)$ 1969Ly02

$J\pi(^{43}\text{Ca g.s.})=7/2^-$.

1969Ly02 (also 1967LyZY,1968Ly02): E=18 MeV ^3He beam was produced at the Heidelberg tandem. Targets made by evaporating CaCO_3 onto a carbon backing. Reaction products were momentum analyzed with a broad-range magnetic spectrograph. Measured $\sigma(E_\alpha,\theta)$. Deduced levels, $J\pi$, L and spectroscopic factors from DWBA analysis.

Cross section data	
Energy	$d\sigma/d\Omega$ (max)
	(mb/sr)
0	1.27 5
1530	1.30 5
1840	0.21 5
2430	0.57 5
2777	2.04 5
3210	4.56 5
3460	0.38 5
3650	0.15 5
4100	0.49 10
4180	0.18 5
4360	0.45 7
4440	0.29 5
4700	0.07 5
4920	0.81 5
5200	0.25 7
5340	0.52 5
5410	0.14 5
5610	0.56 5
5680	0.11 12
5790	0.48 5
6030	0.35 5
6220	0.67 5
6330	0.18 10
6420	0.17 5
6510	0.46 5
6570	0.11 7
6660	0.32 12
6790	0.17 5
7040	0.22 5
7430	0.39 5
7560	0.27 10
8170	0.14 12
8260	0.14 10
8330	0.08 10
8410	0.21 5
8520	0.21 5
8600	0.14 5
8850	0.14 15
9740	0.45 15
9850	0.66 15
10010	0.53 20
10430	1.68 5
10510	0.38 5
10610	0.29 5
10970	1.19 20
11440	1.96 5

^{42}Ca Levels

Spectroscopic factor $C^2S=(1/N)[\sigma(\theta)^{\text{exp}}/\sigma(\theta)^{\text{DWBA}}]$, where n is the normalization factor.

$J\pi$ values implied by L-transfers are: 3-, 4- for L=0 or L=0+2; 2+ to 5+ for L=1; 1- to 6- for L=2; 0+ to 7+ for L=3.

E(level)	L	C^2S
0.0	3	0.57
1530 20	3	0.17
1840 20	3	0.05
2430 20	3	0.18
2770 20	3	0.59

Continued on next page (footnotes at end of table)

$^{43}\text{Ca}(^3\text{He},\alpha)$ 1969Ly02 (continued) **^{42}Ca Levels (continued)**

E(level)	L	C ² S	E(level)	L	C ² S	E(level)	L	C ² S
3210 20	3	0.94	5790 20	(0+2)		8330 20		
3460 20	(0+2)	0.48, 0.05	6030 20			8410 20		
3650 20	(1)	0.01	6220 20	(0+2)		8520 20		
4100 20	(2)	0.43	6330 20			8600 20		
4180 20	(3)	0.05	6420 20			8850 20		
4360 20	(3)	0.12	6510 20			9740 20	2	0.32
4440 20	(0+2)	0.38, 0.04	6570 20			9850 20	2	0.43
4700 20			6660 20			10010 20	2	0.50
4920 20	(3)		6790 20			10430 20	2	0.61
5200 20	(3)		7040 20			10510 20		
5340 20	(0+2)		7430 20			10610 20		
5410 20	(0+2)		7560 20			10970 20		
5610 20	(0+2)		8170 20			11440 20	0	0.23
5680 20			8260 20					

$^{44}\text{Ca}(\text{p},\text{t})$ 1977SaZF,1973Du02

1977SaZF: E=40 MeV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1973Du02: E=40 MeV proton beam was produced at the Grenoble variable-energy cyclotron. Target of 1 mg/cm² self-supported calcium. Reaction products were detected in a ΔE -E silicon counter telescope and a anti-coincidence counter, FWHM=80–100 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L, spectroscopic factors from DWBA analysis.

1973Se01: E=52 MeV proton beam was produced at the Synchro-cyclotron at the Institute for Nuclear Studies in Japan. Targets of calcium carbonate on Mylar backings. Reaction products were momentum analyzed with a broad-range magnetic spectrograph and detected with 200 proportional counters in the focal plane, FWHM=70 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1970He23: E=20 MeV proton beam was produced at the Heidelberg Emperor Tandem. Target of enriched CaCO_3 on a carbon backing. Reaction products were detected in a ΔE -E surface barrier counter telescope, FWHM=50–55 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis. Levels reported up to 4960 keV.

1969Sm02: E=26.5 MeV proton beam was produced at the University of Colorado cyclotron. Scattered particles were detected in a ΔE -E semiconductor detector telescope, FWHM=110 keV. Measured $\sigma(\theta)$. Deduced levels, $J\pi$, L from DWBA analysis. Levels reported up to 4700 keV.

Others:

1985Mi06: E=51.9 MeV. Measured ground-state transition strength.

1983Sa01: E=40 MeV. Measured ground-state transition strength.

 ^{42}Ca Levels

Levels up to E=5809 are from 1977SaZF and from 1973Du02 after that, unless otherwise noted.

E(level)	L	$d\sigma/d\Omega$ (max) mb/sr [†]	E(level)	L
0.0	0 [#]	1.82	5332	0
1520	2 [#]	0.124	5354	
1840	0 [#]	0.027	5379	
2420	2 [#]	0.011	5464	(4)
2750	4 [#]	0.026	5500	(3)
3250	4	0.010 [‡]	5530	2
3300	0		5591	(4)
3390	2	0.046	5664	3
3450	3 [#]	0.102	5713	2
3650	2 [#]	0.001	5775	b
4100 [@]	5 [@]	0.023	5809	b
4420	3 ^{&}	0.028	6080	0
4685	3 [#]	0.091 [§]	6220	
4757	2		6750	
4863	(2)		8450	0
4896	5 ^a		9850	
4968	3	0.001	10970	3
5014	4		11440	
5213	2		12280	0

[†] From 1970He23. Values are also available from 1969Sm02.

[‡] For a multiplet. 1973Se01 report L=6 for a 3190 group.

[§] From 1969Sm02.

[#] Similar L-transfer deduced by 1969Sm02, 1970He23 and 1973Se01 from $\sigma(\theta)$.

[@] From 1973Se01 and 1973Du02. 1977SaZF report L=3 for a 4050 group.

[&] L=4 from 1969Sm02 and 1973Du02 (E=4450).

^a From 1973Du02.

^b 1973Du02 report L=3 for a 5790 group.

$^{45}\text{Sc}(\text{p},\alpha),(\text{pol p},\alpha)$ 1966Ri11,2005GuZW

1966Ri11: (p, α): E=8.5–9.4 MeV. Measured excitation functions and $\sigma(\theta)$. Lowest six excited states identified in the α spectrum. Estimated (by evaluators) FWHM=60 keV.

2005GuZW: (pol p, α), E=24.6 MeV; measured $\sigma(\theta)$, $A_y(\theta)$. Deduced configurations. Negative-parity 3–, 4– and 5– states (homologous to 3/2+ g.s. in ^{41}K) identified. No 2– state seen.

Others:

1977Sc24: E=2.5–3.8 MeV. Measured $\sigma(\theta)$.

1962Sh29: E=17–18 MeV. Measured $\sigma(\theta)$.

 ^{42}Ca Levels

<u>E(level)[†]</u>	<u>Jπ[†]</u>
0.0 [‡]	0+
1525 [‡]	2+
1837 [‡]	0+
2424 [‡]	2+
2752 [‡]	4+
3190 [‡]	6+
3254 [‡]	4+
3954 [§]	4– [§]
4100 [§]	5– [§]
4117 [§]	3– [§]

[†] From Adopted Levels, energies are rounded values.

[‡] Level population from 1966Ri11.

[§] Level population from 2005GuZW; J π value consistent with $\sigma(\theta)$ and analyzing powers.

 $^{46}\text{Ti}(\text{d},^6\text{Li})$ 1975Me01

Target ^{46}Ti g.s. J π =0+.

1975Me01: E=28 MeV deuteron beam was produced at the Princeton AVF cyclotron. Target of 82.4% enriched ^{46}Ti on carbon backing. ^6Li particles were detected in a three-detector telescope of ΔE (35 μm), E (500 μm), and anti-coincidence detectors, FWHM=100 keV. Measured $\sigma(\theta)$. Deduced levels, L, spectroscopic factors from DWBA analysis.

 ^{42}Ca Levels

<u>E(level)[†]</u>	<u>L</u>	<u>$\sigma(\text{exp})/\sigma(\text{DWBA})^{\ddagger}$</u>
0.0	0	0.015
1524	2	0.0023
1837	0	0.0028

[†] Rounded values from Adopted Levels.

[‡] Uncertainty is less than 30%.

$^{96}\text{Zr}(^{40}\text{Ca}, ^{42}\text{Ca}\gamma)$ 2007Sz05, 2011Co14

Includes $^{208}\text{Pb}(^{40}\text{Ca}, ^{42}\text{Ca})$ from 2007Co21 (also 2005Co25, 2004Sz05).

Levels in ^{42}Ca populated by 2n transfer channel.

2007Sz05: E=152 MeV ^{40}Ca beam was produced at the LNL Tandem. Target of 99.9% enriched ^{96}Zr in oxide form with a thickness of 150 $\mu\text{g}/\text{cm}^2$ on a 20 $\mu\text{g}/\text{cm}^2$ carbon backing. Projectile-like products were selected with the magnetic spectrometer PRISMA and γ -rays were detected with the CLARA array of 24 HPGe clover-type detectors.

2011Co14: the level scheme is further analyzed and discussed.

2007Co21 (also 2005Co25, 2004Sz05): $^{208}\text{Pb}(^{40}\text{Ca}, ^{42}\text{Ca})$, E=225, 236, 250 MeV using similar experimental arrangement as in 2007Sz05. Deduced 0+ excitation near 5.8 MeV.

All data listed here are from figure 8 in 2011Co14.

 ^{42}Ca Levels

E(level)	J π [†]	Comments
0.0	0+	
1525	2+	
1837	0+	
2424	2+	
2752	4+	
3189	6+	
3254	4+	
3447	3-	
3654	2+	
3954	4-	
4443	4+	
4760	2+	
5017	4+	
5866	0+	This state also excited in $^{208}\text{Pb}(^{40}\text{Ca}, ^{42}\text{Ca})$ reaction (2007Co21).

[†] From Adopted Levels.

 $\gamma(^{42}\text{Ca})$

$E\gamma$ [†]	E(level)	$I\gamma$ [‡]	$E\gamma$ [†]	E(level)	$I\gamma$ [‡]	$E\gamma$ [†]	E(level)	$I\gamma$ [‡]
313	1837	24	1227	2752	189	2129	3654	14
437	3189	30	1525	1525	620	2424	2424	29
502	3254	38	1691	4443	14	3235	4760	10
507	3954	40	1729	3254	38	4340	5866	2
899	2424	74	1763	5017	20			
1023	3447	25	1922	3447	27			

[†] Level-energy differences.

[‡] Reported intensities are based on branching ratios in Adopted Gammas.

Adopted Levels, Gammas

Q(β⁻)=-7016.48 22; S(n)=11550.05 16; S(p)=4272.23 10; Q(α)=-5745.30 26 2012Wa38.

S(2n)=27740.4 28, S(2p)=13163.59 18 (2012Wa38).

Identification and production of ms activity of ⁴²Sc by 1955Mo83 in ³⁹K(α,n) reaction at 18 MeV. The 62-s isomer was identified much later by 1963Ro10.

Mass measurements: 2009Ku19, 2006Er08.

⁴²Sc Levels

In (³He,t) reaction total experimental B(GT) strength=2.7 4 (2015Fu08) out of which ≈80% is concentrated in the 611, 1+ state.

All the isospin (T) assignments are from 1990En08 evaluation, see the arguments there for such assignments.

Cross Reference (XREF) Flags

A ⁴²Ti ε Decay (208.65 ms)
B ²⁴Mg(²⁴Mg,αpnγ)..
C ³⁹K(α,n),(α,nγ)
D ⁴⁰Ca(³He,p)
E ⁴⁰Ca(³He,pγ)

F ⁴⁰Ca(α,d)
G ⁴⁰Ca(¹²C,¹⁰B)
H ⁴¹Ca(p,γ)
I ⁴¹Ca(³He,d)
J ⁴²Ca(p,n)

K ⁴²Ca(³He,t)
L ⁴²Ca(⁶Li,⁶He)
M Pb(¹⁶O,Xγ)

E(level) [†]	Jπ [§]	XREF	T _{1/2} [#]	Comments
0.0&	0+	ABCDEF HIJKLM	680.79 ms 28	%ε+%β ⁺ =100. T=1. IAS of ⁴² Ca g.s. The rms charge radius (<r ² >) ^{1/2} : 3.570 fm 24 (2013An02 evaluation). Other: 3.539 fm 4 (2006Ga47). δ<r ² >(⁴⁵ Sc, ⁴² Sc)=+0.172 fm ² 31(stat) 136(syst) (2011Av01). Jπ: superallowed β decay to ⁴² Ca g.s. and from ⁴² Ti g.s.; L(³ He,t)=0. T _{1/2} : weighted average of 680.67 ms 28 (1997Ko65), 683.0 ms 15 (1965Fr08) and 681.0 ms 6 (1976Wi08). Others: 684.5 ms 12 (1972Ha82), 650 ms 10 (1965Ne02), 720 ms 30 (1960Mi09), 690 ms 20 (1961Ja22), 680 ms 10 (1957Cl40), 620 ms 50 (1955Mo83). In 2015Ha07 evaluation, T _{1/2} =680.72 ms 26.
611.051& 6	1+	ABCdEF HIJKLM	28 fs 12	XREF: K(615). T=0. Jπ: L(³ He,p)=0+2 and γ(θ); L(⁶ Li, ⁶ He)=0 and J(⁶ Li)=1+; L(³ He,t)=0.
616.28 ^a 6	7+	BCdEFGHI K M	61.7 s 4	XREF: K(624). T=0. %ε+%β ⁺ =100. Jπ: log ft=4.16 to 6+; J=7 from pγ(θ) in (³ He,pγ). 7+ is most likely from level systematics and shell model expectations. T _{1/2} : weighted average of 62.0 s 4 (1963Ro10), 60.6 s 4 (1965Ne02), 62.0 s 3 (1974Wi14), and 62.2 s 9 (1978Be61). Other: 68 s 8 (1994Uz01),.
1490.97& 10	3+	BCdEF HI K M	31 ps 5	T=0. Jπ: L(³ He,d)=1+3; ΔJ=2 γ to 1+ in (³ He,pγ).
1510.36 11	5+	BCdEF HI K M	44 ps 8	T=0. Jπ: L(α,d)=4; γ to 7+; ΔJ=2 γ to 7+ in (³ He,pγ).
1586.32@ 3	2+	B DE HI K M	54 fs 12	T=1. Jπ: L(³ He,p)=2; ΔJ=1 γ to 1+.
1704? 15		D		E(level): level seen weakly in (³ He,p) only.
1844.84@ 11	3(+)	B DEF HI K M	<3.5 ns	T=0. Jπ: ΔJ=1 γ to 2+; ΔJ=2 γ to 1+; weak γ from 4+; RUL. T _{1/2} : 0.7 ps to 3.5 ns.
1873.7 7	0+	E HI	<70 fs	T=1. Jπ: L(³ He,d)=3; isotropic γ(θ) to 1+ allows (0,1,2)+. This level is the only candidate as isobaric analog of ⁴² Ca (1837,0+).
1888.4 2	1+	A cDEF HI K	<42 fs	T=0. Jπ: L(³ He,p)=L(³ He,t)=0; ΔJ=1 γ to 0+.
2187.42 11	3+	BcDEF HI K	0.54 ps 24	T _{1/2} : other: 42 fs 21. T=0. Jπ: L(α,d)=2; L(³ He,d)=1+3; ΔJ=1 γ to 2+.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{42}Sc Levels (continued)

E(level) [†]	J π [§]	XREF	T _{1/2} [#]	Comments
2222.8 4	1+	cdef i Kl	87 fs 35	T=0. J π : L($^3\text{He},t$)=0, GT state. $\gamma(0)$ to 0+ favors 1 but 2 is not completely ruled out.
2223.16 4	3+	Bcdef Hi l	0.63 ps 35	T _{1/2} : from DSAM on 2222.6 γ (1971Ro30). T=0. J π : L($^3\text{He},d$)=1+3; $\Delta J=1$ γ to 2+ and RUL.
2269.14 4	2+	B EF HI K	>70 fs	T _{1/2} : from DSAM on 636 γ (1971Ro30). Assume contribution of 636.4 γ from 2222.7 level is small (evaluators). T=0.
2295.73 21	(1,2)	B DE I		J π : γ to 0+; $\Delta J=1$ γ to 1+. T=0.
2388.66 19	3+	B D F HI K M		J π : $\Delta J=0$ or 1 γ to 2+.
2433.62& 18	4+	B EF HI M	>0.14 ps	J π : L(α,d)=2; gammas to 3+ and 5+. T=0.
2455.2	1+	DEF I K	0.18 ps 11	J π : L($^3\text{He},d$)=1; $\Delta J=1$ gammas to 3+ and 5+; RUL.
2486.59‡ 12	2+	dE HI K	<50 fs	J π : L($^3\text{He},t$)=0, GT state. T=1.
2507.5	(1,2,3)+	d K		J π : γ to 1+ and $\Delta J=1$ γ to 3+; E2 to 3+ excluded by RUL. XREF: K(?).
2535.1 20	(1,2+)	DEF I	0.66 ps 28	J π : L($^3\text{He},p$)=2. J π : γ to 0+.
2586.7 16	(2,4)	DEF H		T=0.
2606.93@ 14	4(+)	B M		J π : D+Q γ to 3+.
2651.64 19	(2+)	B DEF HI K	35 fs 21	J π : $\Delta J=1$ γ to 3(+). T=0.
2669.5		K		J π : gammas to 1+ and 2+; γ from (p, γ) resonance (3,4)+ and RUL.
2726.6		D F		
2795.3‡ 3	(5+,6+)	d F HI		J π : γ to 7+; γ from (3+,4+); L($^3\text{He},d$)=(1+3).
2815.56 20	4+	B dE HI K	35 fs 14	T=1.
2833.2 11	(2+,3,4+)	EF	0.21 ps 11	J π : L($^3\text{He},d$)=3(+1) from 7/2-; $\Delta J=1$ γ gammas to 3+ and 5+; RUL.
2847.7 7	3+	DEF HI K	0.20 ps 13	J π : γ to 2+.
2883.6		F		E(level): from 1989Ki11. E=2853.47 18 adopted by 1990En08 apparently from 1989Ki11 seems to be a misprint.
2910.3 7	4+	DEF HI K	>0.8 ps	T=0. J π : L($^3\text{He},p$)=4 and L(α,d)=2.
2966.4	1+	CD F K		J π : L(α,d)=4 and $\Delta J=1$ γ to 3+.
2995.53‡ 7	4+	BC F HI M	>0.14 ps	J π : L($^3\text{He},t$)=0, GT state.
3022.80‡ 15	4-	DEF HI		J π : L(α,d)=4; $\Delta J=1$ γ to 3+.
3089.1‡ 3	5+	DEF HI K	0.21 ps 4	J π : parity from L($^3\text{He},d$)=0 and decay to (5)+; $\Delta J=1$ γ to 5+. XREF: K(?).
3146.5		d I		J π : L($^3\text{He},p$)=L(α,d)=4 and γ to 7+.
3166.5		d I		
3174.66 15	(5)+	B F		J π : L(α,d)=4; $\Delta J=(2)$ γ to 3(+); population in heavy-ion reaction favors higher spin.
3224.01 20	(5+)	B H	>0.21 ps	J π : gammas to 3+ and 5+.
3238.5	(5,6,7)+	D I K		T=1.
3285.35 14	7+	B I K		J π : L($^3\text{He},p$)=6.
3321.36 10	(1+,2,3+)	d Hi k	>0.14 ps	J π : L($^3\text{He},d$)=3; γ to 5+; $\Delta J=1$ γ to 7+.
3323.8 3	(3+,4,5+)	B d Hi k	<35 fs	J π : gammas to 1+ and 3+.
3348.4	1+	I K		T=1.
3366.5		K		J π : gammas to 3+ and 5+.
3391.4 7	3+	DEF I K	62 fs 49	J π : L($^3\text{He},t$)=0, GT state.
3446.5	(2 to 5)(+)	I		J π : L($^3\text{He},p$)=L(α,d)=2, L($^3\text{He},d$)=1+3 and $\Delta J=1$ γ to 2+.
3468.5		d I		J π : L($^3\text{He},d$)=(1).
3493.5		d I		
3512.5		d I		
3529.5		cd I		

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Adopted Levels, Gammas (continued) ^{42}Sc Levels (continued)

E(level) [†]	J π [§]	XREF	T _{1/2} [#]	Comments
3546.0 6	(5+)	B		J π : γ to 3+.
3580 5		c I K		
3602 5	(5, 6, 7)+	cD F I		J π : L(α ,d)=6.
3603.23 ^b 10	(8-)	B		J π : $\Delta J=1$ γ to 7+; bandhead.
3668.7 $\frac{1}{2}$ 3		H		
3687.6 8	1+	DE I K	<28 fs	T=0. J π : L(^3He ,p)=0+2; L(^3He ,t)=0, GT state.
3701 10		F		
3710.3 3	(5+)	B		J π : $\Delta J=1$ γ to 4+.
3718.6 5	(5+)	B HI	>70 fs	J π : L(^3He ,d)=3; gammas to 3+ and 7+.
3752.06 13	(7+)	B I		J π : $\Delta J=(2)$ γ to 5+.
3775 5		d K		
3797.3 3	3+	B d F I K		XREF: K(3807). J π : L(^3He ,p)=2; L(α ,d)=4. L(^3He ,t)=3,1+3 is inconsistent as it suggests negative parity.
3855 5		d I		J π : L(^3He ,d)=(1) from 7/2- suggests (2 to 5)(+).
3866 5	1+	d I		J π : L(^3He ,p)=0+2.
3880 5		K		
3884.04 [@] 17	6(+)	B		J π : $\Delta J=2$ γ to 4(+).
3896 5	(3, 4, 5)+	F I		J π : L(α ,d)=4.
3915 5		K		
3933.5 13	3+	DE I K	<52 fs	T=0. J π : L(^3He ,p)=2 and $\Delta J=1$ γ to 2+.
4022 5		I		
4047.72 $\frac{1}{2}$ 6	(2, 3, 4)	HI	<14 fs	T=1. J π : γ to 3+ and RUL.
4062.0 ^{&} 4	(6+)	B		J π : γ to 4+.
4070 4	(3, 4, 5)+	F K		J π : L(α ,d)=4.
4117.30 ^b 12	(10-)	B	≈ 0.5 ns	J π : $\Delta J=(2)$ γ to (8-); $\Delta J=(3)$ γ to 7+. T _{1/2} : a crude estimate by 2007Ch40 from transition rates and angular distributions, the value is within an order of magnitude.
4176 4	(3, 4, 5)+	I K		J π : L(^3He ,d)=1.
4204 5	(2 to 5)+	I		J π : L(^3He ,d)=1+3.
4245.79 10	9(-)	B		J π : $\Delta J=2$ γ to 7+; $\Delta J=1$ γ to (8-).
4246 5		F I		
4262 5		I		
4274 4		I K		
4289 5	(2 to 5)+	I		J π : L(^3He ,d)=1.
4370 4		I K		
4391 10	(1, 2, 3)+	F		J π : L(α ,d)=2.
4410 5	(2 to 5)+	I		J π : L(^3He ,d)=1.
4468.8 $\frac{1}{2}$ 4	(2, 3)+	F HI		J π : L(^3He ,d)=1 and L(α ,d)=2.
4548 5	(2 to 5)+	I K		J π : L(^3He ,d)=1.
4582 5	(2 to 5)+	I K		XREF: K(4590). J π : L(^3He ,d)=1.
4604 5	(2 to 5)(+)	I K		XREF: K(4619). J π : L(^3He ,d)=(1).
4665 5	(2 to 5)+	I		J π : L(^3He ,d)=1.
4704 5		I		
4725 5	(2 to 5)+	D I		J π : L(^3He ,d)=1.
4755 5	(3, 4, 5)+	F I		J π : L(α ,d)=4.
4786 5		f I		
4808 5		f I		
4828 5	(2 to 5)+	D I K		J π : L(^3He ,d)=1.
4875 6	(1, 2, 3)+	F I K		J π : L(α ,d)=2.
4883.31 14	(8+)	B		J π : $\Delta J=1$ to 7+.
4928 10	1+	K		J π : L(^3He ,t)=0, GT state.
4971 5		I		
4992.12 ^a 11	9(+)	B		J π : $\Delta J=2$ gammas to 7+.
5001 5	(1, 2, 3)+	F I		J π : L(α ,d)=2.
5028 5		I		
5048 5	(3, 4, 5)+	F I		J π : L(α ,d)=4.

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Adopted Levels, Gammas (continued) ^{42}Sc Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
5084 5		I K	
5120 5	(1, 2, 3)+	F I	J π : L(α ,d)=2.
5140 5	1+	I K	J π : L(^3He ,t)=0, GT state.
5305 5		F I	
5326 5		I	
5352 5		I	
5370 5		I	
5380 5		I	
5402.2 14	(7+)	B	J π : γ to (5+).
5436 5		D I	
5451.38 ^b 13	11(-)	B	J π : ΔJ =(2) to 9(-); ΔJ =1 γ to (10-).
5475 5		D I	
5507.26 [@] 19	8(+)	B	J π : ΔJ =2 γ to 6(+).
5520 5		I	
5572 5		I	
5635 5	(2 to 5)+	D F I	J π : L(^3He ,d)=1.
5651 5	(2 to 5)+	I	J π : L(^3He ,d)=1.
5686 20	(1+)	K	J π : L(^3He ,t)=(0), possible GT state.
5716 20	1+	K	J π : L(^3He ,t)=0, GT state.
5771 5		I	
5810 10		D K	
5865 5	(2 to 5)(+)	I	J π : L(^3He ,d)=(1).
5962.60 21	(9+)	B	J π : ΔJ =(2) γ to 7+.
5966 5	(2 to 5)(+)	D I K	XREF: K(5958). J π : L(^3He ,d)=(1).
5995.8 $\frac{1}{2}$ 3	(3, 4)+	H	J π : gammas to 2+ and 5+.
6011 13		F	XREF: F(6050).
6076.41 $\frac{1}{2}$ 8	(2+, 3, 4+)	H k	J π : gammas to 2+ and 4+.
6090 10		D k	
6117.7 $\frac{1}{2}$ 8	(8+)	B	J π : γ to (6+).
6174.2 $\frac{1}{2}$ 3	(3+, 4+)	D H K	XREF: D(6180)K(6167). J π : gammas to 5+ and 2+.
6253.4 $\frac{1}{2}$ 2	(3+, 4)	H	J π : gammas to 3+, 5+ and (1+, 2).
6327 10	1+	K	J π : L(^3He ,t)=0, GT state.
6364 10		K	
6737 10		K	
6823.95 14	(10+)	B	J π : ΔJ =(2) γ to (8+); γ to 9(+).
6921.36 ^a 13	11(+)	B	J π : ΔJ =2 γ to 9(+).
7068 10		K	
7129 10		F K	
7183.9 [@] 3	10(+)	B	J π : ΔJ =2 γ to 8(+).
7261 10		K	
7295 10		K	
7306.90 15	(11+)	B	J π : ΔJ =(2) γ to 9(+); γ to (10-).
7418 10		K	
7491 10		K	
7586 10		K	
7676.19 17	11(+)	B	J π : ΔJ =2 γ to 9(+).
7678 10		K	
7776 10		K	
7884 10		K	
7923 10		F K	
7974 10		K	
8094.12 13	(10-)	B	J π : ΔJ =1 γ to 11(-); ΔJ =(0) γ to (10+).
8105 10	(1+)	K	J π : L(^3He ,t)=(0), possible GT state.
8182 10		K	
8204.5 6		B	J π : γ to (10-) suggests (10, 11, 12-).
8251 10		K	
8292 10		K	
8338 10		K	
8373 10		K	
8400 10		K	
8492 10		K	

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Adopted Levels, Gammas (continued)
 ^{42}Sc Levels (continued)

E(level) [†]	Jπ [§]	XREF	Comments
8540 20		F K	
8732 10	(1+)	K	Jπ: L(³ He,t)=(0), possible GT state.
8797.97 15	(13+)	B	Jπ: ΔJ=(2) γ to 11(+).
8810 10		K	
8854 10		K	
8886.5 6		B	Jπ: γ to 9(-) suggests (9,10,11-).
8887 10		K	
8920.31 23		B	Jπ: gammas to (10+) suggests (10,11,12+).
8929 10		K	
8981 10	(1+)	K	Jπ: L(³ He,t)=(0), possible GT state.
9004.1 6		B	Jπ: γ to (10+) suggests (10,11,12+).
9068 20		K	
9088 20		K	
9113 20		K	
9156 10		K	
9203 10		K	
9236 10		K	
9280 20		K	
9312 20		K	
9406 10		K	
9510.77 ^a 16	(13+)	B	Jπ: ΔJ=(2) gammas to 11(+).
9565 10		K	
9611 10		K	
9620.29 23	(12)	B	Jπ: ΔJ=2 γ to (10-).
9793 20		K	
9826 20		K	
9874 10		K	
9901 10		K	
9947 20		K	
9978 20		K	
10011 10	1+	K	Jπ: L(³ He,t)=0, GT state.
10012.9 10	(13+)	B	Jπ: ΔJ=(2) γ to 11(+).
10118 20		K	
10142 20		K	
10165 20		K	
10195 20		K	
10250 20	1+	K	Jπ: L(³ He,t)=0, GT state.
10271 20		K	
10338 10	1+	K	Jπ: L(³ He,t)=0, GT state.
10395 10		K	
10437 10	1+	K	Jπ: L(³ He,t)=0, GT state.
10450.6 4	(13+)	B	Jπ: ΔJ=(2) γ to 11(+).
10536.19 17	(12-)	B	Jπ: ΔJ=2 γ to (10-).
10561 10	(1+)	K	Jπ: L(³ He,t)=(0), possible GT state.
10582.51 ^b 24	13	B	Jπ: ΔJ=2 γ to 11(-).
10695 10		K	
10735 10		K	
10809 10		K	
10938.8 8		B	Jπ: γ to 11(+) suggests (11,12,13+).
11070 20		K	
11180 20		K	
11220 20		K	
11260 20		K	
11400 20		K	
11620 20		K	
11810 20		K	
11830 20	(1+)	K	Jπ: L(³ He,t)=(0), possible GT state.
11853.33 ^a 18	(15+)	B	Jπ: ΔJ=2 γ to (13+).
11931.2 3		B	Jπ: γ to (12) suggests (12,13,14).
12000 20	(1+)	K	Jπ: L(³ He,t)=(0), possible GT state.
12400.9 7		B	
12420 20		K	
12449.4 6		B	Jπ: γ to (13+) suggests (13,14,15+).

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Adopted Levels, Gammas (continued) ^{42}Sc Levels (continued)

E(level) [†]	J π [§]	XREF	Comments
12700 20		K	
13021.8 5		B	J π : γ to (13+) suggests (13,14,15+).
13025.7 7		B	J π : γ to (13+) suggests (13,14,15+).
13093.6 3	(15)	B	J π : $\Delta J=(2)$ γ to 13.
13418.5 6		B	J π : γ to (13+) suggests (13,14,15+).
13619.9 ^b 8		B	J π : γ to (13) suggests (13,14,15).
15966.3 5	(17)	B	J π : $\Delta J=(2)$ γ to (15).

[†] From least-squares adjustment to measured E γ data when such data are available. Otherwise weighted averages of available level energies are taken.

[‡] From (p, γ).

[§] When L-transfer arguments are used, the target is J $\pi=0+$, except for $^{41}\text{Ca}(^3\text{He},d)$, where target J $\pi=7/2-$.

From DSAM in ($^3\text{He},p\gamma$) and (p, γ), weighted average taken when available, unless otherwise noted.

@ (A): γ sequence based on 2+.

& (B): γ sequence based on 0+.

^a (C): γ sequence based on 7+.

^b (D): γ sequence based on (8-).

 $\gamma(^{42}\text{Sc})$

E(level)	E γ [†]	I γ [‡]	Mult. [§]	δ [§]	Comments
611.051	611.046 6	100	(M1)		B(M1)(W.u.)=3.4 15.
1490.97	880.0 1	100	E2		B(E2)(W.u.)=4.0 7.
1510.36	893.9 1	100	E2		B(E2)(W.u.)=2.6 5.
1586.32	975.26 3	100 3	(M1+E2)	+0.05 3	B(M1)(W.u.)=0.40 10; B(E2)(W.u.)<7.
	1586.8 7	8.7 9	E2		B(E2)(W.u.)=9.6 24.
1844.84	258.5 1	100	D		
	1235		Q(+0)	-0.12 15	
1873.7	1262.5 7	100	(M1)		B(M1)(W.u.)>0.16.
1888.4	1888.4 2	100	(M1)		B(M1)(W.u.)>0.078.
2187.42	601.1 1	100 2	M1+E2	-0.23 4	B(M1)(W.u.)=0.17 8; B(E2)(W.u.)=70 40.
	1575	5.3 21	E2		B(E2)(W.u.)=0.6 4.
2222.8	636.2 5	$\approx$ 100	[M1+E2]		
	2222.6 13	$\approx$ 100	[M1]		
2223.16	636.833 9	100 2	(M1)		B(M1)(W.u.)=0.13 8.
	733	5.3 21			
2269.14	379	12 6			
	682.808 23	100 70	(D)		
	1658	42 6	D(+Q)	-0.06 6	
	2269	38 8			
2295.73	709.4 2	100	D+Q	-2.7 8	
2388.66	878.1 2	100 5			
	898.6	14 5			
2433.62	922.7 3	100 9	(M1+E2)	+0.40 9	B(M1)(W.u.)<0.096; B(E2)(W.u.)<70.
	942.9 2	92 8	(M1+E2)	-0.48 11	B(M1)(W.u.)<0.079; B(E2)(W.u.)<77.
2455	2455 [#] 2	100	[M1]		B(M1)(W.u.)=0.008 +13-3.
2486.59	996.15	30 7	(M1(+E2))	-0.02 4	B(M1)(W.u.)>0.10.
	1875.49	100 7	[M1]		B(M1)(W.u.)>0.051.
2535.1	2535 [#] 2	100			
2586.7	1095.7 16		D+Q	-0.10 6	
2606.93	762.1 1	100	D		
2651.64	760.97	11 3			
	1065.4 2	100 3	(M1)		B(M1)(W.u.)=0.5 3.
2795.3	2179.0	100			
2815.56	969.36	8 5	(M1)		B(M1)(W.u.)=0.029 22.
	1305.6 3	80 7	(M1(+E2))	-0.06 4	B(M1)(W.u.)=0.12 5; B(E2)(W.u.)<1.9.
	1325.2	100 7	(M1)		B(M1)(W.u.)=0.14 6.
2833.2	1246.6 [#] 9	100			
2847.7	1261.2 11	100			
2910.3	1419.0 12		D+Q	-0.14 7	
2995.53	606.47	25 13			

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Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Sc})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\ddagger}$	Mult. §	$\delta^{\S}$	Comments
2995.53	772.6 1	100 5	(M1)		B(M1)(W.u.)<0.27.
3022.80	1512.67	100	D(+Q)	-0.03 8	
3089.1	2472.7	100	[E2]		B(E2)(W.u.)=3.4 7.
3174.66	1329.8 1	100	(Q)		
3224.01	408.6 2	100 9	[M1]		B(M1)(W.u.)<0.50.
	834.9 4	83 9	[E2]		B(E2)(W.u.)<210.
	1000.8 3	67 6	[E2]		B(E2)(W.u.)<68.
	1713	55 6			
3285.35	1775.2 4	41 4			
	2668.4 2	100 12	D+Q		
3321.36	1830.9	100 20			
	2710.22	100 20			
3323.8	1813.9 6	100 9			
	1832.6 4	82 9			
3391.4	575.9 12				
	904.5 5	100	D+Q	-0.11 5	
3546.0	1358.6 6	100			
3603.23	2986.4 1	100	D		
3668.7	1235.4				
	1445.5				
3687.6	1813.5 11	≈ 20	[M1]		$E\gamma$: level-energy difference=1814.2.
					B(M1)(W.u.)>0.020.
	2101.2 10	≈ 100	(M1+E2)	-0.07 4	B(M1)(W.u.)>0.063.
	3689 2	≈ 13	[M1]		$E\gamma$: level-energy difference=3687.6.
					B(M1)(W.u.)>0.0015.
3710.3	894.7 2	100	D		
3718.6	723.0 3				$E\gamma, I\gamma$: only seen in ($^{24}\text{Mg}, \alpha p n \gamma$) and ($^{24}\text{Ne}, \alpha p n \gamma$).
	3102.9				$E\gamma, I\gamma$: only seen in (p, γ).
3752.06	2241.5 1	100	(Q)		
3797.3	473.5 2	100 9			
	1145.7 4	51 5			
3884.04	1277.1 1	100	Q		
3933.5	2347.1 13	100	(M1+E2)	1.2 5	B(M1)(W.u.)>0.0068; B(E2)(W.u.)>6.8.
4047.72	1658.63	100			$I\gamma$: this γ is only about 50%, other 50% branching from 4048 level is unaccounted.
4062.0	1628.3 3	100			
4117.30	514.0 1	100 3	(E2)		B(E2)(W.u.)=3.0.
	3500.7 3	20.8 11	(E3)		B(E3)(W.u.)=0.62.
4245.79	642.2 1	34.2 16	D+Q		
	3629.7 1	100 6	Q		
4468.8	1558.4	100 20			
	2882.4	100 8			
4883.31	1597.8 1	46 4			
	4267.3 2	100 9	D+Q		
4992.12	1239.8 2	4.9 3	Q		
	4375.8 1	100 8	(Q)		
5402.2	1856.1 12	100			
5451.38	1206.0 1	73.0 25	(Q)		
	1334.1 1	100 3	D+Q		
5507.26	1623.2 1	100	Q		
5962.60	2209.8 3	100 7	(Q)		
	5346.5 7	82 14			
5995.8	1948.0	38 13			
	2771.9	81 12			
	2906.6	19 6			
	2972.9	≈ 6			
	3148.1	25 6			
	3180.3	19 6			
	3344.7	25 6			
	3509.1	19 6			
	3562.3	19 6			
	3772.5	38 13			
	3808.1	12 6			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{42}\text{Sc})$ (continued)

E(level)	$E\gamma^{\dagger}$	$I\gamma^{\ddagger}$	Mult. §	E(level)	$E\gamma^{\dagger}$	$I\gamma^{\ddagger}$	Mult. §
5995.8	4409.2	50 12		7183.9	2300.2 5	100 18	
	4485.4	100 12		7306.90	2315.1 2	100 5	(Q)
	4505.1	44 13			3188.9 2	94 5	
6076.41	2028.6	14 4		7676.19	1713.3 2	47 4	
	2407.6	14 4			2684.0 2	100 7	Q
	2755.0	34 7		8094.12	1270.1 1	48.0 18	(D)
	3053.5	24 7			2642.7 1	100 3	D+Q
	3165.9	14 4		8204.5	4087.0 5	100	
	3687.2	59 7		8797.97	1491.0 1	46.9 22	
	3807.1	72 7			1876.6 1	100 4	(Q)
	3853.1	100 7		8886.5	4640.4 6	100	
6117.7	2055.7 7	100		8920.31	1736.4 6	36 9	
6174.2	1705.4	19 5			2096.3 2	100 7	
	2454.8	95 9		9004.1	2180.1 5	100	
	2851.3	38 9		9510.77	1834.3 2	28.2 17	(Q)
	2950.3	33 9			2589.4 1	100 4	(Q)
	3085.0	14 5		9620.29	5502.6 2	100	Q
	3178.5	33 9		10012.9	3091.4 10	100	(Q)
	3358.7	43 9		10450.6	3529.1 3	100	(Q)
	3378.8	14 5		10536.19	2442.0 1	100	Q
	3904.9	100 9		10582.51	5130.8 2	100	Q
6253.4	3164.2	13 3		10938.8	3262.5 7	100	
	3405.7	13 3		11853.33	2342.5 1	100 4	Q
	3437.9	10 3			3054.9 5	14.5 20	
	3602.3	50 6		11931.2	2310.8 2	100	
	3819.9	50 6		12400.9	3480.4 6	100	
	4030.0	≈ 3		12449.4	3651.3 5	100	
	4065.6	100 6		13021.8	3510.9 4	100	
	4743.0	23 6		13025.7	4227.5 6	100	
	4762.7	23 6		13093.6	2511.0 2	100	(Q)
6823.95	1830.3 5	11.3 14		13418.5	3907.5 5	100	
	1940.6 1	100 5	(Q)	13619.9	3037.3 7	100	
6921.36	1929.3 1	100	Q	15966.3	2872.6 3	100	(Q)
7183.9	1676.8 4	40 5	Q				

† Primarily from $(^3\text{He}, p\gamma)$, (p, γ) , $(^{24}\text{Mg}, \alpha p n \gamma)$, $(^{20}\text{Ne}, \alpha p n \gamma)$, weighted average taken when available; others from level-energy differences with recoil removed, unless otherwise noted.

‡ Primarily from (p, γ) , $(^{24}\text{Mg}, \alpha p n \gamma)$ and $(^{20}\text{Ne}, \alpha p n \gamma)$, weighted average taken when available, unless otherwise noted.

§ From $(^3\text{He}, p\gamma)$.

Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas (continued)

⁴²Ti ε Decay (208.65 ms) 2015Mo01,1969Ga27,1980HoZO

Parent ⁴²Ti: E=0; J π =0⁺; T_{1/2}=208.65 ms 80; Q(g.s.)=7016.48 22; %ε+%β⁺ decay=100.
⁴²Ti-T_{1/2}: From Adopted Levels of ⁴²Ti. 2015Ha07 review gives 208.09 ms 55.
⁴²Ti-Q(ε): From 2012Wa38. 2015Ha07 review gives 7016.83 25.
⁴²Ti decays mainly (>99%) through B⁺ decay.
2015Mo01: ⁴²Ti ions were produced from fragmentation of 680 MeV/nucleon ⁵⁸Ni beam with 400 mg/cm² ⁹Be target using SIS-18 synchrotron at GSI facility. Reaction fragments were separated in-flight using the fragment separator FRS. The identification of nuclei was achieved by measurement of magnetic rigidity and velocity of fragments from time-of-flight method. Separated ions were implanted in one of six double-sided silicon strip detectors (DSSSDs). The β-decay signals were detected in the same DSSSD. Surrounding the implantation setup was the RISING array of 15 Euroball cluster detectors for γ detection. Measured E γ , I γ , γγ-coin, βγ-coin, and β-decay half-life. Deduced levels, J, π , β feedings, log *ft* values, Gamow-Teller strengths. 2012Fu02 is an earlier report without any data.
1969Ga27: ⁴²Ti isotope was produced via ⁴⁰Ca(³He,n) reaction using ³He beam from the 5.5-MV Van de Graaff at Strasbourg. γ-rays were detected with Ge(Li) detectors (FWHM=4 keV at 1.22 MeV). Measured E γ , I γ , T_{1/2}. Deduced levels, branchings.
1980HoZO: measured G, limit of delayed proton decay.
2009Ku19: ⁴²Ti produced in ⁴⁰Ca(³He,nγ) E=17 MeV, beam from the Ion Guide Isotope Separator On-Line (IGISOL) facility at the Accelerator Laboratory of the University of Jyväskylä. Target of a 1.5 mg/cm² natural Ca. Measured E γ , βγ-coin, T_{1/2}, mass differences using JYFLTRAP Penning-trap spectrometer. Measured Q(ε)=7016.83 keV 25.
2015Ha07: review of superallowed decays; evaluated Q value, T_{1/2} branching ratios, *ft* value, isospin-symmetry-breaking corrections.
Others:
T^{1/2}(⁴²Ti), γ: 1972Zi02, 1969Al12, 1969Ni03.
Eβ⁺: 1962Ob03.
A 2222 2 (I γ =1.2 4) γ reported by 1969Ga27 is omitted here since it is assigned (by 1980HoZO) to ¹H(n,γ) line related to background. Thus the 2222 level proposed by 1969Ga27 is also omitted.
%εp<0.001 (1980HoZO).

⁴²Sc Levels

E(level)	J π [†]	T _{1/2} [†]
0.0	0 ⁺	680.79 ms 28
611.0 1	1 ⁺	
1888.4 2	1 ⁺	

[†] From Adopted Levels.

β⁺,ε Data

Eε	E(level)	Iβ ⁺ [†]	Iε [†]	Log <i>ft</i>	I(ε+β ⁺) [†]	Comments
(5128.1 3)	1888.4	0.41 6	0.0011 2	4.80 7	0.41 6	B(GT+)=0.059 9 (2015Mo01). Other: 0.080 2 from (³ He,t) (2007Ad27) adjusted for new T _{1/2} .
(6405.48 25)	611.0	56 4	0.065 4	3.21 3	55.9 36	B(GT+)=2.31 15 (2015Mo01). Other: 2.08 6 from (³ He,t) (2007Ad27) adjusted for new T _{1/2} .
(7016.48 22)	0.0	47.7 12	0.0405 11	3.495 11	47.7 12	I(ε+β ⁺): measured by 2009Ku19. Other: 43.7 36 (2015Mo01). Eε: measured Eβ ⁺ =6.0 MeV 6 (1962Ob03). From measured Q(ε)=7016.83 25, %β ⁺ =47.7 12, and T _{1/2} =208.14 ms 45, 2009Ku19 deduce <i>ft</i> =3114 s 79 (or log <i>ft</i> =3.493 11, corrected <i>Ft</i> =3122 s 79 for 0 ⁺ to 0 ⁺ superallowed β transition.

[†] Absolute intensity per 100 decays.

^{42}Ti ε Decay (208.65 ms) 2015Mo01,1969Ga27,1980HoZO (continued) $\gamma(^{42}\text{Sc})$

$\text{I}\gamma$ normalization: From determination of number of 937-keV γ rays emitted per ^{54}Ni decay (2015Mo01). Other: 0.56 14 (1969Al12).

$\text{E}\gamma^{\dagger}$	E(level)	$\text{I}\gamma^{\dagger\ddagger}$	Comments
611.0 1	611.0	100.0 35	$\text{E}\gamma$: others: 611.6 5 (1980HoZO) and 610.7 5 (1969Ga27). $\text{I}\gamma$: other: $\text{I}\gamma(611\gamma)/\text{I}\beta(\text{total})=0.56$ 14 (1969Al12).
1888.4 2	1888.4	0.73 10	$\text{E}\gamma, \text{I}\gamma$: others: 1888.0 8, $\text{I}\gamma=0.7$ (1980HoZO), 1885 2, $\text{I}\gamma<2$ (1969Ga27).

† From 2015Mo01.

‡ For absolute intensity per 100 decays, multiply by 0.559 36.

Decay Scheme

Intensities: $\text{I}(\gamma+\text{ce})$
per 100 parent decays

$^{24}\text{Mg}(^{24}\text{Mg}, \alpha \text{pn}\gamma), ^{28}\text{Si}(^{20}\text{Ne}, \alpha \text{pn}\gamma)$ 2007Ch40

2007Ch40: $\text{E}(^{24}\text{Mg})=94$ MeV beam was produced from Berkeley 88-Inch cyclotron at LBN facility. Target of a 0.5 mg/cm² self-supporting ^{24}Mg target. $\text{E}(^{20}\text{Ne})=84$ MeV beam produced at the ATLAS accelerator at ANL facility. The γ -rays were detected by Gammasphere array of 102 Compton-suppressed HPGe detectors and particles were detected with an array of 95 CsI(Tl) detectors with a 65% efficiency for detection α particles and 50% for protons. Measured $\text{E}\gamma$, $\text{I}\gamma$, $\gamma\gamma$, $\gamma(\theta)$, $\gamma\gamma(\theta)(\text{DCO})$. Deduced levels, $\text{J}\pi$, branching ratios. $^{28}\text{Si}(^{20}\text{Ne}, \alpha \text{pn}\gamma)$. The γ -ray energies and angular distribution/ correlation coefficients are averages from the two experiments.

 ^{42}Sc Levels

E(level) †	$\text{J}\pi^{\ddagger}$	$\text{T}_{1/2}$	Comments
0.0&	0+		
611.12& 10	1+		
616.9 ^a 3	7+	61.7 s § 4	$\% \varepsilon + \% \beta^+ = 100$.
1491.10& 14	3+		
1510.92 24	5+		
1586.57@ 14	2+		
1845.07@ 17	3(+)		
2187.67 17	3+		
2223.50 17	3+		
2269.48 25	(1+)		
2295.98 25			
2389.2 3	3+		
2433.89& 23	4+		
2607.19@ 20	4(+)		
2651.97 23	(2)		
2816.22 21	4+		
2996.11 20	(4)+		
3174.90 20	(5+)		
3224.58 23	(5+)		
3286.2 3	7+		
3324.1 3			

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²⁴Mg(²⁴Mg,αpnγ), ²⁸Si(²⁰Ne,αpnγ) 2007Ch40 (continued)

⁴²Sc Levels (continued)

E(level) [†]	Jπ [‡]	T _{1/2}	E(level) [†]	Jπ [‡]	E(level) [†]	Jπ [‡]
3546.3 7	(5+)		5963.2 4	9+	10013.5 11	(13+)
3603.9 ^b 3	8-		6118.0& 8	(8+)	10451.3 4	13+
3710.9 3	(5+)		6824.8 3	(10+)	10537.0 3	(12-)
3719.1 4	(5)+		6922.0 ^a 3	11+	10583.3 ^b 4	13
3752.6 3	7+		7184.5 [@] 4	10(+)	10939.5 8	
3797.6 4	(3+)		7307.7 3	11+	11854.0 ^a 3	15+
3884.31 [@] 22	6(+)		7676.8 3	11+	11931.8 4	
4062.2& 4	(6+)		8094.9 3	(10-)	12401.7 7	
4118.0 ^b 3	10-	=0.5 ns [#]	8205.2 6		12450.2 6	
4246.2 3	9-		8798.7 3	13+	13022.5 5	
4884.1 3	(8)+		8886.9 7		13026.4 7	
4992.7 ^a 3	9+		8921.1 4		13094.4 4	15
5402.4 14	(7+)		9004.9 6		13419.1 6	
5452.1 ^b 3	11-		9511.4 ^a 3	13+	13620.7 ^b 8	
5507.55 [@] 24	8(+)		9620.9 4	12	15967.1 5	17

[†] From least squares fit to Eγ data. The normalized $\chi^2=5.3$ for the uncertainties as quoted by 2007Ch40. This value is much larger than the critical $\chi^2=1.8$. The uncertainties of the following γ rays were increased by a factor of 2 to get an acceptable fit with normalized $\chi^2=2.7$: 642.2, 1830.3, 2668.4, 2986.4, 3188.9, 3629.7. It should be noted that the uncertainties for level energies quoted in table IV of 2007Ch40 are much larger than those given here.

[‡] As proposed by 2007Ch40, based on literature values for low-lying levels and $\gamma(\theta)$ and DCO data for higher levels. The assignments in Adopted Levels are the same, except that some are placed in parentheses there which, in the opinion of evaluators, still lack firm arguments.

[§] From Adopted Levels.

[#] A crude estimate by 2007Ch40 from transition rates and angular distributions, the value is within an order of magnitude.

[@] (A): γ cascade based on 2+.

& (B): γ cascade based on 0+.

^a (C): γ cascade based on 7+.

^b (D): γ cascade based on 8-.

$\gamma(^{42}\text{Sc})$

The DCO values in 2007Ch40 are for $\approx 90^\circ$ (range of 69.8° – 110.2°) and forward/backward angles (50.1° – 129.9° range).

The gates are on $\Delta J=1$, dipole transitions, unless otherwise stated. Expected values for $\Delta J=1$, dipole gate are: 1.6

for $\Delta J=2$, quadrupole or $\Delta J=0$, dipole; 1.0 for $\Delta J=1$, dipole; 0.5 to 1.9 for $\Delta J=1$, dipole+quadrupole; 1.1 to 1.7 for

$\Delta J=0$, dipole+quadrupole. Expected values for $\Delta J=2$, quadrupole gate are: 1.0 for $\Delta J=2$, quadrupole or $\Delta J=0$, dipole;

0.6 for $\Delta J=1$, dipole; 0.3 to 1.2 for $\Delta J=1$, dipole+quadrupole; 0.6 to 1.1 for $\Delta J=0$, dipole+quadrupole.

Values of A_2 and A_4 coefficients in $\gamma(\theta)$ and DCO ratios in $\gamma\gamma(\theta)$ are averages from the two experiments.

Eγ [†]	E(level)	I _γ (Mg+Mg) [§]	Mult. [@]	I _γ (Si+Ne) [#]	Comments
258.5 1	1845.07	18.0 6	D	15.0 5	DCO=0.93 3; $A_2=-0.11$ 4; $A_4=+0.01$ 5.
408.6 2	3224.58	2.29 24		2.09 19	
473.5 2	3797.6	3.5 3		3.20 22	
514.0 [‡] 1	4118.0	89 3	(Q)	90 3	$A_2=+0.24$ 6; $A_4=-0.07$ 8. The A_2 and A_4 values assume that the decay occurs at the target position. Fitting skewed distributions gives $A_2=+0.27$ 3, $A_4=-0.03$ 4.
601.1 1	2187.67	4.4 3	D	4.30 22	DCO=0.90 12; $A_2=-0.30$ 16; $A_4=-0.02$ 23.
611.1 1	611.12	66 5	D	55 5	DCO=1.03 2; $A_2=-0.12$ 2; $A_4=-0.02$ 3.
636.9 1	2223.50	14.3 5	D	11.5 4	DCO=0.96 4; $A_2=-0.12$ 3; $A_4=+0.03$ 4.
642.2 1	4246.2	10.9 5	D+Q	10.3 4	DCO=0.99 20; $A_2=-0.49$ 16; $A_4=+0.34$ 20.
682.9 2	2269.48	3.04 24	(D)	2.72 19	DCO=1.11 12.
709.4 2	2295.98	2.82 22		2.38 18	
723.0 3	3719.1	1.74 17		1.46 12	
762.1 1	2607.19	11.3 4	D	9.4 3	DCO=1.00 5; $A_2=-0.36$ 6; $A_4=+0.10$ 9.
772.6 1	2996.11	7.9 4	D	6.0 3	DCO=1.07 5.
834.9 4	3224.58	1.95 24		1.70 19	
878.1 2	2389.2	8.0 5		6.7 4	
880.0 1	1491.10	18.1 8		15.6 6	
893.9 1	1510.92	32 5	(Q)&	32 5	DCO=0.81 11.
894.7 2	3710.9	3.8 3	D	3.7 3	DCO=0.70 12.
922.7 3	2433.89	4.9 6	D&	3.5 3	DCO=1.27 13.

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$^{24}\text{Mg} (^{24}\text{Mg}, \alpha \text{pn} \gamma), ^{28}\text{Si} (^{20}\text{Ne}, \alpha \text{pn} \gamma)$ 2007Ch40 (continued) $\gamma(^{42}\text{Sc})$ (continued)

$E\gamma^\dagger$	E(level)	$I_\gamma(\text{Mg}+\text{Mg})^\S$	Mult.®	$I_\gamma(\text{Si}+\text{Ne})^\#$	Comments
942.9 2	2433.89	4.1 3	D	3.47 21	DCO=1.03 15.
975.4 1	1586.57	42.7 14	D	33.8 11	DCO=0.98 2; $A_2=-0.12$ 2; $A_4=0.00$ 3.
1000.8 3	3224.58	1.44 15		1.46 12	
1065.4 2	2651.97	4.1 3		3.06 20	
1145.7 4	3797.6	1.80 18		1.20 13	
1206.0 1	5452.1	35.1 12	(Q)	34.8 11	$A_2=+0.36$ 7; $A_4=+0.02$ 9.
1239.8 2	4992.7	4.4 3	Q&	3.59 21	DCO=1.24 17.
1270.1 1	8094.9	13.2 5	(D)	10.5 4	$A_2=+0.40$ 10; $A_4=-0.15$ 13. Mult.: $\Delta J=0$, dipole transition.
1277.1 1	3884.31	8.7 3	Q	7.0 3	DCO=1.61 11; $A_2=+0.29$ 11; $A_4=-0.16$ 16.
1305.6 3	2816.22	3.3 3	D&	2.58 22	DCO=0.64 10.
1325.2 2	2816.22	3.9 3		3.33 21	
1329.8 1	3174.90	5.1 3	(Q)	3.92 20	DCO=1.57 11.
1334.1 1	5452.1	48.1 15	D+Q	45.0 14	$A_2=-0.38$ 7; $A_4=+0.25$ 9.
1358.6 6	3546.3	1.00 18		0.90 13	
1491.0 1	8798.7	10.7 5		9.9 4	
1587.1 7	1586.57	2.1 4		2.7 3	
1597.8 1	4884.1	9.2 7		7.4 4	
1623.2 1	5507.55	6.4 3	Q	4.91 20	DCO=1.53 13; $A_2=+0.39$ 12; $A_4=-0.03$ 16.
1628.3 3	4062.2	3.5 4		3.2 3	
1676.8 4	7184.5	1.36 17	Q	1.57 13	DCO=1.5 3.
1713.3 2	7676.8	3.6 3		2.92 18	
1736.4 6	8921.1	1.6 4		1.95 25	
1775.2 4	3286.2	5.7 8		6.4 6	
1813.9 6	3324.1	2.1 3		1.61 21	
1830.3 5	6824.8	2.04 25		1.88 17	
1832.6 4	3324.1	1.98 24		1.98 19	
1834.3 2	9511.4	6.6 4	(Q)	6.1 3	$A_2=+0.32$ 6; $A_4=+0.02$ 9.
1856.1 12	5402.4	0.31 17		0.33 12	
1876.6 1	8798.7	22.8 8	(Q)	20.9 7	$A_2=+0.30$ 3; $A_4=0.00$ 3.
1929.3 1	6922.0	66.9 22	Q	63.5 20	$A_2=+0.34$ 2; $A_4=-0.07$ 3.
1940.6 1	6824.8	18.0 8	(Q)	15.7 6	$A_2=+0.34$ 7; $A_4=-0.10$ 10.
2055.7 7	6118.0	1.7 3		1.66 22	
2096.3 2	8921.1	4.4 3		4.06 22	
2180.1 5	9004.9	2.7 3		1.96 20	
2209.8 3	5963.2	4.4 3	(Q)	3.30 22	$A_2=+0.51$ 15; $A_4=0$.
2241.5 1	3752.6	12.9 6	(Q)	11.1 4	$A_2=+0.38$ 6; $A_4=-0.05$ 8.
2300.2 5	7184.5	3.4 6		3.9 4	
2310.8 2	11931.8	5.1 3		6.3 3	
2315.1 2	7307.7	12.3 6	(Q)	11.9 5	$A_2=+0.49$ 6; $A_4=-0.05$ 9.
2342.5 1	11854.0	15.2 6	Q	14.2 5	$A_2=+0.20$ 4; $A_4=-0.12$ 6.
2442.0 1	10537.0	20.2 8	Q	19.1 7	$A_2=+0.24$ 9; $A_4=-0.21$ 12.
2511.0 2	13094.4	7.0 4	(Q)	7.9 3	$A_2=+0.40$ 12; $A_4=-0.04$ 17.
2589.4 1	9511.4	23.4 8	(Q)	22.8 8	$A_2=+0.35$ 5; $A_4=-0.03$ 7.
2642.7 1	8094.9	27.5 9	D+Q	22.2 7	$A_2=-0.36$ 7; $A_4=+0.16$ 9.
2668.4 2	3286.2	16 3	D+Q	14.7 18	$A_2=+0.09$ 5; $A_4=-0.15$ 7. Mult.: $\Delta J=0$, dipole transition.
2684.0 2	7676.8	7.7 5	Q	7.8 4	$A_2=+0.24$ 9; $A_4=-0.22$ 12.
2872.6 3	15967.1	1.90 17	(Q)&	2.34 14	DCO=1.0 3.
2986.4 $\frac{7}{2}$ 1	3603.9	100 4	D	100 4	$A_2=-0.36$ 7; $A_4=-0.03$ 10. The A_2 and A_4 values assume that the decay occurs at the target position. Fitting skewed distributions gives $A_2=-0.32$ 3, $A_4=-0.01$ 4.
3037.3 7	13620.7	0.72 15		0.99 11	
3054.9 5	11854.0	2.2 3		2.59 19	
3091.4 10	10013.5	3.7 3	(Q)	4.17 21	$A_2=+0.39$ 19; $A_4=+0.15$ 25.
3188.9 2	7307.7	11.6 6		12.5 5	
3262.5 7	10939.5	1.18 23		1.39 4	
3480.4 6	12401.7	1.71 22		1.97 16	

Continued on next page (footnotes at end of table)

²⁴Mg(²⁴Mg,αpnγ), ²⁸Si(²⁰Ne,αpnγ) 2007Ch40 (continued)

⁴²Sc (continued)

Eγ [†]	E(level)	I _γ (Mg+Mg) [§]	Mult. [@]	I _γ (Si+Ne) [#]	Comments
3500.7 [‡] 3	4118.0	18.5 10	(O)	19.9 9	A ₂ =+0.53 6; A ₄ =+0.08 8. Mult.: 2007Ch40 assign E3. The A ₂ and A ₄ values assume that the decay occurs at the target position. Fitting skewed distributions gives A ₂ =+0.59 5, A ₄ =+0.13 7.
3510.9 4	13022.5	3.32 24		2.94 17	
3529.1 3	10451.3	4.9 3	(Q)	5.6 3	A ₂ =+0.49 15; A ₄ =-0.06 23.
3629.7 1	4246.2	31.9 18	Q&	32.8 15	DCO=1.04 14. Mult.: 2007Ch40 assign M2.
3651.3 5	12450.2	1.84 19		2.04 15	
3907.5 5	13419.1	2.36 20		2.32 14	
4087.0 5	8205.2	2.67 24		3.14 18	
4227.5 6	13026.4	2.14 22		2.33 18	
4267.3 2	4884.1	20.0 18	D+Q	15.3 11	A ₂ =-0.08 7; A ₄ =+0.24 9.
4375.8 1	4992.7	89 7	(Q)	75 6	A ₂ =+0.35 5; A ₄ =+0.03 7.
4640.4 6	8886.9	3.0 3		2.66 20	
5130.8 2	10583.3	11.2 4	Q	12.4 4	A ₂ =+0.30 6; A ₄ =-0.11 9.
5346.5 7	5963.2	3.6 6		4.0 5	
5502.6 2	9620.9	8.5 4	Q	9.4 3	DCO=1.8 3; A ₂ =+0.27 10; A ₄ =+0.04 13.

[†] The γ-ray energies averages (by 2007Ch40) from the two experiments. The quoted uncertainties are statistical. Above 3.5 MeV (maximum range of calibration curve), systematic uncertainties can be 1–2 keV.

[‡] Actual energy should be slightly higher because of the shift caused by the lifetime of the 4118 level.

[§] From ²⁴Mg(²⁴Mg,αpnγ).

[#] From ²⁸Si(²⁰Ne,αpnγ).

[@] 2007Ch40 assign multipolarities for most of the transitions, many based only on J_π assignments. The evaluators assign mult=D for ΔJ=0,1 M1 or E1 and Q for ΔJ=2, Q transitions for which supporting angular distribution/correlation data are available. Dipole transitions with expected M1 character may include E2 component. The mult=Q transitions are most likely E2 from expected short lifetimes of levels.

& DCO value corresponds to gate on ΔJ=2, quadrupole transition.

³⁹K(α,n),(α,nγ) 1965Ne02,1974Br04,1972Be50

1965Ne02: E=7.8–12 MeV alpha beam of 5–10 nA from the Florida State University Tandem Van de Graaff accelerator. Potassium targets of KI and KBr powder in disks of 2.5 cm diameter or evaporated onto tantalum backings. A 5.1 cm by 5.1 cm scintillator for detecting β activity of the residual nucleus and a 7.6 cm by 7.6 cm NaI detector for γ-rays. Measured cross sections, β+γ coin of decay of ⁴²Sc ground state and isomer activities, T_{1/2}. Levels in ⁴²Sc deduced from observed thresholds.

1974Br04: E=10.4 MeV alpha beam from the Stony Brook tandem Van de Graaff accelerator. Target of a 140 μg/cm² natural KI. Ge(Li) detector. Measured E_γ, I_γ. Deduced levels, T_{1/2} using Recoil Distance Method (RDM) for levels at 1490 and 1511 keV.

1972Be50: E=15 MeV alpha beam from the Stanford FN tandem Van de Graaff accelerator. Natural potassium target. A Ge(Li) detector for detecting γ-rays and a scintillator for neutrons. Measured E_γ, nγ-coin. Deduced levels, T_{a/2} by RDM for levels at 1490 and 1511 keV.

1961Sm05: E=8.29 MeV alpha beam from Yale cyclotron. Natural potassium target. Neutrons were detected were detected by their proton recoils in nuclear emulsions. Measured neutron spectra. Neutron group corresponding to ⁴²Sc ground state is reported.

⁴²Sc Levels

E(level) [†]	Jπ [‡]	T _{1/2}	Comments
0.0	0+	0.65 s [§] 1	
611	1+	60.6 s [§] 4	E(level): 600 30 in 1965Ne02.
616	7+		E(level): 526 20 in 1965Ne02.
1490	3+	31 ps 9	E(level): 1420 30 in 1965Ne02. T _{1/2} : Weighted average of 33 ps 9 in 1974Br04 and 31 ps 5 in 1972Be50.
1510	5+	45 ps 8	E(level): 1340 30 in 1965Ne02. T _{1/2} : Weighted average of 36 ps 10 in 1974Br04 and 51 ps 8 in 1972Be50.
2220 30			

Continued on next page (footnotes at end of table)

³⁹K(α ,n),(α ,n γ) 1965Ne02,1974Br04,1972Be50 (continued)

⁴²Sc Levels (continued)

E(level)[†]

2960 30
3570 40

[†] From Adopted Levels for the first four excited states since the level energies deduced by 1965Ne02 from their threshold data disagree with those from many other reactions. The matching of the levels between the Adopted Levels and those given by 1965Ne02 is based on decay modes as indicated by 1965Ne02.

[‡] From Adopted Levels.

[§] From β -counting in 1965Ne02.

$\gamma(^{42}\text{Sc})$

E γ E(level)

880 1490
894 1510

$^{40}\text{Ca}(^3\text{He},\text{p})$ 1968Pu04,1965Cl01,1966Zu01

Target ^{40}Ca $J\pi=0+$.

1968Pu04: E=18 MeV ^3He beam was produced at the tandem Van de Graaff accelerator at Max-Planck-Institut für Kernphysik. Targets of natural calcium evaporated onto carbon backings. Protons were momentum analyzed using a broad-range magnetic spectrograph and detected by nuclear emulsions. Measured $\sigma(E_p, \theta)$. Deduced levels, $J\pi$, L from DWBA analysis.

1965Cl01: levels up to 3.6 MeV excitation. Level energies from this work are quoted by 1971Sh16 as a private communication.

1966Zu01: E=10,12, 15 MeV. Measured $\sigma(E_p, \theta)$. 17 groups reported up to 3.5 MeV excitation energy.

1970Sc22: E=15, 18 MeV. Measured $\sigma(E_p, \theta)$, DWBA analysis. L-transfers for GS (L=0) and 1590 (L=2) group.

Cross sections from 1965Cl01 (as quoted by 1971Sh16)

Energy	relative cross section
0	17
618	75
1505	80
1589	33
1704	1.5
1847	7
1895	12
2186	9
2220	14
2297	5
2401	4
2461	11
2501	9
2544	2.5
2598	5
2655	3
2727	0.7
2807	8
2846	20
2919	6
2965	5
3021	6
3090	80
3149	8
3239	11
3325	10
3394	70
3483	10
3525	12
3605	5
3695	80
3785	15
3876	32
3934	17

^{42}Sc Levels

E(level) [†]	L [†]	Relative intensity ^{&}	E(level) [†]	L [†]	Relative intensity ^{&}
0.0	0	100 ^a	2655 $\frac{7}{2}$ 15		
615 $\frac{5}{2}$ 10	0+2	200 ^a	2727 $\frac{7}{2}$ 15		
1510 [#] 10	2+4	120	2807 $\frac{7}{2}$ 15		
1590 10	2	45	2850 10	4	
1704 $\frac{7}{2}$ 15			2919 $\frac{7}{2}$ 15		
1847 $\frac{7}{2}$ 15			2965 $\frac{7}{2}$ 15		
1890 10	0	17 ^a	3021 $\frac{7}{2}$ 15		
2186 $\frac{7}{2}$ 15			3100 10	4	
2220 $\frac{7}{2}$ @ 15	2	17	3149 $\frac{7}{2}$ 15		
2297 $\frac{7}{2}$ 15			3250 10	6	
2401 $\frac{7}{2}$ 15			3330 10		
2461 $\frac{7}{2}$ 15			3390 10	2	130
2500 10	2	18	3483 $\frac{7}{2}$ 15		
2544 $\frac{7}{2}$ 15			3525 $\frac{7}{2}$ 15		
2598 $\frac{7}{2}$ 15			3605 $\frac{7}{2}$ 15		

Continued on next page (footnotes at end of table)

⁴⁰Ca(³He,p) **1968Pu04,1965Cl01,1966Zu01 (continued)**
⁴²Sc Levels (continued)

E(level) [†]	L [‡]	Relative intensity ^{&}	E(level) [†]	Relative intensity ^{&}
3690 10	0+2	130 ^a	5480 10	
3780 10	2	30	5640 10	
3860 10	0+2	38 ^a	5810 10	65 ^a
3930 10	2	90	5970 10	30 ^a
4720 10		45	6090 10	
4830 10		35	6180 10	
5440 10				

[†] From 1968Pu04, unless otherwise stated.

[‡] From 1965Cl01, as quoted by 1971Sh16.

[§] doublet: 610+620.

[#] doublet: 1500+1520.

[@] 2200 10 (1968Pu04) is a composite of 2186+2220.

[&] From 1968Pu04. Cross section for L=2 at 15°, unless otherwise stated.

^a Cross section for L=0 at 5'.

⁴⁰Ca(³He,p γ) **1971Ro30,2007Sc26**

1971Ro30: E=8.4, 8.6 MeV ³He beam from the Utrecht MV tandem Van de Graaff accelerator. Targets of natural calcium metal on carbon foils. Protons were detected with two 1.5 mm Si surface-barrier detectors and γ -rays were detected with a Ge(Li) detector at 90°. Measured E γ , I γ , p γ -coin. Deduced levels, branching ratios, lifetimes by Doppler Shift Attenuation Method (DSAM).

2007Sc26: E=9 MeV beam from FN Tandem accelerator at Cologne university. Natural calcium target. Measured E γ , I γ , $\gamma\gamma$, $\gamma\gamma$ (θ) using HORUS array comprised of nine HPGe detectors and a Euroball cluster detector. Two HPGe detectors were at 45° to the beam axis, and two at 135°. The cluster Ge detector and five HPGe detectors were in a plane perpendicular to the beam axis.

Others:

2004Or03: E=4.2, 5.1 MeV. Measured E γ , I γ , DSA.

1973Ha10: E=10.0–11.5 MeV. Targets of natural calcium on Ta backings. Protons were detected in annular silicon surface-barrier detectors and γ -rays in a Ge(Li) detector (FWHM=10 keV at 1.33 MeV). Measured E γ , p γ -coin. Deduced levels, lifetimes by DSAM.

1969Ni03: E=8.0–9.0 MeV ³He beam from the University of Liverpool tandem accelerator. Natural calcium targets. Proton counter, Ge(Li) and NaI(Tl) detectors. Measured E γ , I γ , γ (θ), $\gamma\gamma$ -coin, p γ -coin. Deduced levels, branching ratios, mixing ratios and lifetimes by DSAM.

1974Br04: E=10.5 MeV ³He beam from the Stony Brook tandem Van de Graaff accelerator. Target of a 50 μ g/cm² natural Ca on a Au backing. Ge(Li) detector. Measured E γ , I γ . Deduced levels, T_{1/2} using Recoil Distance Method (RDM) for levels at 1490 and 1511 keV.

1970Fa09: E=10 MeV. Measured E γ , p γ (θ).

1970Ba26 (also 1970AnZZ): E=10, 15 MeV. Measured E γ , p γ (θ). Deduced levels, J π , branching ratios, mixing ratios.

1966Zu01: E=10, 12, 15 MeV. Measured p γ -coin γ (θ).

⁴²Sc Levels

E(level) [†]	J π [‡]	T _{1/2} [#]	Comments
0.0	0+		T=1.
611.21 20	1+ [§]	28 fs 12	T=0.
617.7 18	7		T _{1/2} : other: 97 fs 28 (1973Ha10). T=0.
1490.8 5	3+	30 ps +17-6	J π : from p γ (θ) (2007Sc26). T=0.
1511.5 18	5	43 ps 8	T _{1/2} : from RDM (1974Br04). T=0.
1586.4 4	2+ [§]	54 fs 12	T _{1/2} : from RDM (1974Br04). T=1.
1846.4 21	3(+)	<3.5 ns	T _{1/2} : weighted average of 69 fs 21 (1971Ro30), 62 fs 31 (1973Ha10), 48 fs 12 (2004Or03). T=0.
			T _{1/2} : 0.7 ps to 3.5 ns.

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(^3\text{He},\text{p}\gamma)$ 1971Ro30,2007Sc26 (continued) ^{42}Sc Levels (continued)

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}^{\#}$	Comments
1873.9 7	0+	<70 fs	T=1. J π : from isotropic $\gamma(\theta)$.
1888.9 8	1(+)	<42 fs	T=0. T $_{1/2}$: other: 42 fs 21 (1973Ha10). J π : spin=1 from $\text{p}\gamma(\theta)$ (1970Ba26,1970Fa09).
2188.0 6	3(+)	0.54 ps 24	T=0.
2222.6 6	(1)	87 fs 35	E(level): doublet, since T $_{1/2}$ values are different for 636 γ and 2223 γ . T $_{1/2}$: from DSA measurement on 2223 γ . T $_{1/2}$ =0.63 ps 35 from DSA on 636 γ .
2270.0 7	2		T=0.
2296.5 21	(1+, 2+)		T=0.
2433.4 15	4(+)		T=0.
2455.1 20		0.18 ps 11	
2488.4 10	2	<50 fs	T=1.
2535.1 20		0.66 ps 28	
2586.9 17	(2+, 4+)		T=0.
2650.5 12			
2817.0 16	4	<70 fs	T=1.
2833.2? 11		0.21 ps 11	
2847.8 12		0.20 ps 12	
2910.2 14	(2+, 4+)	>0.83 ps	T=0.
3023.4 19	4		T=0.
3090.2 21		0.21 ps 4	
3392.9 11	3	62 fs 49	T=0.
3687.8 8	1	<28 fs	T=0.
3933.6 14	3(+)	<52 fs	T=0.

[†] From least-squares fit to E γ data.[‡] From $\gamma\gamma(\theta)$ in 2007Sc26, unless otherwise noted.[§] Spin from $\text{p}\gamma(\theta)$ (1970Ba26) and $\gamma\gamma(\theta)$ (2007Sc26), parity from comparison of experimental population ratios with theory (1970Ba26).[#] From DSAM (1971Ro30), unless otherwise stated. $\gamma(^{42}\text{Sc})$

Detailed $\gamma\gamma(\theta)$ plots are shown by 2007Sc26 for the following cascades with best fits indicated for spin-sequence and mixing ratios of both transitions in a cascade: 601–975, 709–975, 880–611, 905–1875, 923–894, 943–880, 975–611, 996–880, 1096–880, 1235–611, 1305–894, 1325–880, 1420–880, 1513–894, 1658–611, 1875–611, 2101–975, 2347–975.

A transition from 1880 doublet (composite of 1874 and 1889 levels here) to 1586 level (shown by 1969Ni03 and 1970Ba26) has been omitted here since it is not confirmed in any other study.

A $_2$ and A $_4$ are from 1969Ni03 using NaI(Tl) detector.

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\dagger}$	Mult.@	δ°	Comments
611.21	611.2 2	100	(M1)		A $_2$ =−0.48 1; A $_4$ =−0.03 1. E γ : weighted average of 611.5 5 from 1969Ni03 and 611.2 2 from 1973Ha10. Mult.: dipole from $\gamma(\theta)$ (1969Ni03) and $\gamma\gamma(\theta)$ (2007Sc26); $\Delta\pi$ requires M1.
1490.8	879.6 4	100	E2		A $_2$ =+0.22 4; A $_4$ =−0.19 4 (1969Ni03). E γ : weighted average from 1971Ro30, 1973Ha10 and 1969Ni03. Mult.: from $\gamma(\theta)$ (1969Ni03) and RUL.
1511.5	893.8 4	100	(E2(+M3))	−0.07 5	δ : $\delta(\text{O/Q})$ =−0.01 3 (2007Sc26), −0.07 24 (1970Ba26), +0.39 7 or +0.25 7 (1969Ni03). Mult.: $\gamma\gamma(\theta)$ (2007Sc26) and RUL. δ : or −0.16 12.
1586.4	975.2 4	91 [#] 6	(M1+E2)	+0.05 3	E γ : weighted average from 1971Ro30, 1973Ha10 and 1969Ni03. E γ : weighted average from 1971Ro30, 1973Ha10 and 1969Ni03. Mult., δ : from 1970Ba26. Other: δ =0.000 21 (2007Sc26).
1846.4	1586.1 11 260 2	9 [#] 2 100			
	1235 [‡]		(Q(+O))	−0.12 15	Mult.: $\gamma\gamma(\theta)$ (2007Sc26).
1873.9	1262.5 7	100	D		A $_2$ =+0.03 3; A $_4$ =+0.04 3 (1969Ni03).

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(^3\text{He},\text{p}\gamma)$ 1971Ro30,2007Sc26 (continued) $\gamma(^{42}\text{Sc})$ (continued)

E(level)	$E\gamma^\dagger$	$I\gamma^\dagger$	Mult.@	$\delta^\oplus$	Comments
1888.9	1888.9 8	100	(M1)		$E\gamma$: weighted average from 1971Ro30 and 1973Ha10. $A_2=+0.20$ 3; $A_4=+0.08$ 4 (1969Ni03).
2188.0	601.6 4	100	(M1+E2)	-0.23 4	$E\gamma$: weighted average from 1971Ro30 and 1973Ha10.
	1576 $\ddagger$				
2222.6	636.2 5	50			$E\gamma$: weighted average from 1971Ro30 and 1969Ni03.
	2222.6 13	50			$A_2=0.00$ 5; $A_4=+0.08$ 7 (1969Ni03).
2270.0	683.5 5	24 $\S$			
	1661 3	76 $\S$	D(+Q)	-0.06 6	
2296.5	710 2		(M1+E2)	-2.7 8	
2433.4	923 $\ddagger$		(M1+E2)	+0.40 9	
	943 $\ddagger$		(M1+E2)	-0.48 11	
2455.1	2455 $\&$ 2				
2488.4	996 $\ddagger$		D(+Q)	-0.02 4	
	1877.1 9	100			
2535.1	2535 $\&$ 2				
2586.9	1095.7 16		(M1+E2)	-0.10 6	
2650.5	1064.0 $\&$ 11				
2817.0	969 $\ddagger$		D		
	1305.4 7	100	D+Q	-0.06 4	
	1325 $\ddagger$		D(+Q)	0.00 4	
2833.2?	1246.6 $\&$ 9				
2847.8	1261.2 $\&$ 11				
2910.2	1419.0 12		(M1+E2)	-0.14 7	
3023.4	1513 $\ddagger$		D(+Q)	-0.03 8	
3090.2	2472.4 10	100			
3392.9	575.9 12				
	904.5 5	100	(M1+E2)	-0.11 5	
3687.8	1813.5 11	15			
	2101.2 10	75	D+Q	-0.07 4	
	3689 2	10			
3933.6	2347.1 13		(M1+E2)	1.2 5	

 $\dagger$ From 1971Ro30, unless otherwise noted. $\ddagger$ From 2007Sc26 only. $\S$ From 1969Ni03.

From 1970Ba26.

@ From 2007Sc26, unless otherwise noted.

& Placement of transition in the level scheme is uncertain.

⁴⁰Ca(α ,d) 1973Th11,1977Na25

Target ⁴⁰Ca J π =0+.

1977Na25: E=40 MeV α beam was produced at the Michigan State University cyclotron. Target of 99.9% enriched metallic calcium onto a thin carbon backing. Deuterons were momentum analyzed with a split-pole magnetic spectrograph and detected with a position-sensitive resistive-wire proportional counter, energy resolution FWHM=50 keV. Measured $\sigma(E_d, \theta)$. Deduced levels, J π , L from DWBA analysis.

1973Th11: E=25.5 MeV α beam was produced at the University of Minnesota tandem generator. Targets of natural metallic calcium evaporated onto carbon or gold backings. Deuterons were analyzed with an Engel split-pole magnetic spectrometer and detected in an array of four position-sensitive surface-barrier counters in the focal plane, energy resolution FWHM=10-17 keV. Measured $\sigma(E_d, \theta)$. Deduced levels, J π , L from DWBA analysis.

1994Fi01: E=55.7 MeV. Measured $\sigma(E_d, \theta)$, DWBA analysis. FWHM=120 keV.

1966Ri04: E=50 MeV. Five groups reported at 600, 1430, 2250, 3000 and 3555. FWHM $\approx$ 200 keV.

1966Ki10: four strong groups at 600, 1440, 2230 and 3000.

Others: 1967Be44, 1964Ri03.

Energy	$\sigma(\text{integral})(1977\text{Na}25)$
618	294
1514	145
2182	3.8
2384	4.4
2844	2.8
2918	2.5
3001	3.8
3091	34.5
3182	4.4
3307	3.7
3395	15.5
3607	28.0
3794	4.9
3896	4.0
4067	2.3
4391	18.6
4467	6.3
4748	8.5
4868	3.6
4996	7.5
5053	4.0
5122	4.6

⁴²Sc Levels

E(level) [†]	L [‡]	Relative intensity [§]	E(level) [†]	L [‡]	Relative intensity [§]
0.0			3024@ 6		14.1
611@ 6		740&	3091 10	4	
619@ 6	6	740&	3182 10	4	
1491@ 6		90	3307 10	4	
1511@ 6	4	296	3395 10	2	
1846@ 6		3.3	3607 10	6	
1889@ 6		5.8	3701 10		
2189@ 6	2	11.3	3794 10	4	
2223@ 6		12.1	3896 10	4	
2270@ 6		9.9	4067 10	4	
2390@ 6	2	13.8	4252 10		
2439@ 6		3.5	4391 10	2	
2459@ 6		4.2	4467 10	2	
2540@ 6		3.7	4748 10	4	
2588@ 6		2.0	4800 10		
2653@ 6		5.0	4868 10	2	
2726@ 6		3.1	4996 10	2	
2795@ 6		4.8	5053 10	4	
2832@ 6		4.7	5122 10	2	
2846@ 6	2	6.8	5310# 30		
2883@ 6		1.1	5630# 30		
2914@ 6	4	20.1	6050# 30		
2964@ 6		4.6	7120# 30		
2997@ 6	4	5.2	7940# 30		

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(\alpha, d)$ 1973Th11, 1977Na25 (continued) **^{42}Sc Levels (continued)**E(level)[†]

8540# 30

[†] From 1973Th11 for levels below 3050, above this values are from 1977Na25, unless otherwise stated.[‡] From 1977Na25.[§] From 1973Th11.

From 1994Fi01, probably unresolved structures.

@ Doublet.

& 740 combined for 611+619.

 $^{40}\text{Ca}(^{12}\text{C}, ^{10}\text{B})$ 1972Sc21

1972Sc21(also 1974An36): E=114 MeV ^{12}C beam from the variable energy cyclotron of the Harwell Atomic Energy Research Establishment. Targets of 150 $\mu\text{g}/\text{cm}^2$ calcium oxide on carbon backings. Emitted particles were detected and identified by $\Delta\text{E-E}$ telescopes. Measured $\sigma(\theta)$. Energy calibration accurate to 100 keV.

1994Uz01: $^{12}\text{C}(^{40}\text{Ca}, ^{42}\text{Sc})^{10}\text{B}$, E=30 MeV/nucleon ^{40}Ca beam at GANIL. LISE3 achromatic spectrometer. Silicon and Ge detectors. Production of ^{42}Sc isomeric beam (Ex=617 keV).

Other:1966Ch14.

 ^{42}Sc Levels

E(level)

Comments

600

E(level): assumed (by 1972Sc21) to be the 7+ state (at 616).

 $^{41}\text{Ca}(p, \gamma)$ 1989Ki11

1989Ki11: E=1.7–2.1 MeV proton beam was produced at the Utrecht 3 MV Van de Graaff accelerator with currents of 20–40 μA and energy spread of 200 eV at 1 MeV. Targets of a 12 mg CaCO_3 enriched to 81.7 in ^{41}Ca . Two close-end hyperpure Ge(HPGe) detectors for γ -ray detection, FWHM=1.72 and 1.81 keV at 1.332 MeV. Measured E_γ , I_γ . Deduced levels, branching ratios, lifetimes by DSAM.

$S(p)(^{42}\text{Sc})=4272.40$ 15 deduced from E_x and $E_p(\text{lab})$ of the $E_x=S(p)+E_p(\text{c.m.})=6076.41$ keV resonance with E_p (1989Ki11).

$S(p)=4272.23$ 10 from 2012Wa38.

 ^{42}Sc Levels

Resonance strength= $(2J+1)\Gamma_p\Gamma_\gamma/\Gamma$ (1989Ki11).

E(level) [†]	$J\pi$ &	$T_{1/2}$	Comments
0.0	0+		
611.051 5	1+		
616.28 6	7+ ^a		
1490.43 4	3+		
1510.10 6	5+		
1586.31 2	2+		
1846	3(+)		
1874	0+		
1890	1+		
2187.54 5	3+		Measured upper limit of branching <2% for γ to g.s.
2223.15 3	3+	>0.21 ps	Measured upper limit of branching <2% for γ to g.s.
2269.13 3	2+	>70 fs	
2389.06 5	3+		
2433.33 8	4+	>0.14 ps	Measured upper limit of branching <2% for γ to 1890, 1+, <2% for γ to 611, 1+, and <4% to 616, 7+.
2486.59 13	2+		
2587	(2, 4)		
2650.98 8	(1+, 2)	35 fs 21	
2795.3 3	(5+, 6+) ^b		

Continued on next page (footnotes at end of table)

$^{41}\text{Ca}(\text{p},\gamma)$ 1989Ki11 (continued) **^{42}Sc Levels (continued)**

E(level) [†]	J $\pi^{\&}$	T _{1/2}	Comments
2815.37 6	4+	35 fs 14	
2847.6 4	3+		
2910.4 4	4+		
2995.53 7	4+	>0.14 ps	Measured upper limit of branching <6% for γ to 1890, 1+, and <10% to 616, 7+.
3022.80 15	4-		
3089.1 3	5+	>0.14 ps	
3223.28 6	(5+)	>0.21 ps	Measured upper limit of branching <3% for γ to 1890, 1+, and <4% to 611, 1+.
3321.36 10	(1+, 2, 3+)	>0.14 ps	
3322.8 3	(3+, 4, 5+)	<35 fs	
3668.7 3			
3719.3 4	(5)+	>70 fs	
4047.72 6	(2, 3, 4)	<14 fs	
4468.8 4	(2, 3)+		
5995.8 [‡] 3	(3, 4)+		
6076.41 [§] 8	(2+, 3, 4+)		
6174.2 [#] 3	(3, 4)+		
6253.4 [@] 2	(3+, 4)		

[†] From 1989Ki11, deduced from γ energies.[‡] E(p)(lab)=1765.8 3. Resonance strength=3.3 eV 8. 21% 5 of the decay occurs through unknown transitions.[§] E(p)(lab)=1848.41 12. Resonance strength=0.7 eV 2. 6% 2 of the decay occurs through unknown transitions.[#] E(p)(lab)=1948.6 3. Resonance strength=5.5 eV 14. 18% 5 of the decay occurs through unknown transitions.[@] E(p)(lab)=2029.8 3. Resonance strength=1.5 eV 4. 14% 5 of the decay occurs through unknown transitions.[&] From Adopted Levels. For resonances, the assignments are based based on decay modes, assuming E1, M1 or E2 transitions.^a 5+ and 6+ are not completely ruled out, but 7+ is generally accepted from theoretical predictions.^b 1989Ki11 give (5,6,7). $\gamma(^{42}\text{Sc})$

E(level)	E $\gamma^{\dagger}$	I $\gamma^{\ddagger}$	Comments
611.051	611.046 6		
1490.43	879.37	100	I γ <1 for gammas to 616 and g.s.
1510.10	893.81	100	I γ <1 for γ to g.s.; I γ <4 for γ to 611.
1586.31	975.25 3	100 11	
	1586.28	9.5 11	I γ <1 for γ to 616.
1846	260		
	1235		
1874	1263	100	I γ <8 for gammas to 616 and g.s.
1890	1890	100	
2187.54	601.23	95 2	
	677.4 [§]	<2	
	697.1 [§]	<2	
	1576.46	5 2	
2223.15	636.833 9	95 2	
	713.0 [§]	<2	
	732.71	5 2	
	1612.1 [§]	<2	
2269.13	379.13	6 3	
	682.808 23	52 5	
	778.7 [§]	<5	
	1658.04	22 6	
	2269.06	20 4	I γ <3 for γ to 1510; I γ <1 for γ to 616.
2389.06	543.1 [§]	<2	
	802.7 [§]	<2	
	878.95	88 4	
	898.62	12 4	
	1778.0 [§]	<4	I γ <3 for γ to 616; I γ <4 for γ to g.s.
2433.33	847.0 [§]	<2	
	923.22	48 3	
	942.89	52 3	
2486.59	596.6 [§]	<4	

Continued on next page (footnotes at end of table)

$^{41}\text{Ca}(\text{p},\gamma)$ 1989Ki11 (continued)

 $\gamma(^{42}\text{Sc})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	Comments
2486.59	612.6\$	<5	
	640.6\$	<5	
	900.3\$	<4	
	996.15	23 5	
	1875.49	77 5	
	2486.5\$	<10	$I_{\gamma}<5$ for γ to 616 and γ to 1510.
2587	1097		
2650.98	760.97	10 3	
	777.0\$	<3	
	805.0\$	<3	
	1064.66	90 3	
	1160.5\$	<3	
	2039.9\$	<3	
	2650.9\$	<3	$I_{\gamma}<2$ for γ to 616; $I_{\gamma}<3$ for γ to 1510.
2795.3	2179.0	100	
2815.37	592.2\$	<2	
	627.8\$	<2	
	969.36	5 3	
	1305.25	61 3	
	1324.92	34 2	$I_{\gamma}<1$ for gammas to g.s., 611 and 616; $I_{\gamma}<4$ for γ to 1874; $I_{\gamma}<2$ for γ to 1890.
2847.6	1261.3		
2910.4	1419.9		
2995.53	606.47	20 10	
	772.37	80 10	
	808.0\$	<6	
	1149.5\$	<4	
	1485.4\$	<5	$I_{\gamma}<3$ for γ to g.s.; $I_{\gamma}<7$ for γ to 1874; $I_{\gamma}<2$ for γ to 1890.
3022.80	1512.67	100	
3089.1	2472.7	100	
3223.28	834.21	41 3	
	1000.12	32 8	
	1035.7\$	<8	
	1377.3\$	<5	
	1713.14	27 3	
	1732.8\$	<6	
	2606.9\$	<2	$I_{\gamma}<4$ for γ to g.s.; $I_{\gamma}<5$ for γ to 1874.
3321.36	1098.2\$	<6	
	1133.8\$	<6	
	1431.3\$	<4	
	1447.3\$	<8	
	1475.3\$	<8	
	1811.2\$	<6	
	1830.89	50 10	
	2710.22	50 10	
	3321.2\$	<5	$I_{\gamma}<4$ for γ to 616.
3322.8	1099.6\$	<3	
	1135.2\$	<8	
	1476.8\$	<3	
	1812.7	57 5	
	1832.3	43 5	
	2706.4\$	<4	$I_{\gamma}<5$ for γ to g.s.; $I_{\gamma}<4$ for γ to 611; $I_{\gamma}<3$ for gammas to 1874 and 1890.
3668.7	1235.4		
	1445.5		
3719.3	1496.1\$	<2	
	1531.7\$	<7	
	1873.3\$	<4	
	2209.1\$	<4	
	2228.8\$	<6	
	3102.9	100	$I_{\gamma}<2$ for gammas to g.s., 611, 1590 and 1874.
4047.72	1658.63	=50	50% of the decay from 4048 level proceeds through unknown transitions.
4468.8	1558.4	25 5	
	2882.4	25 2	50% of the decay from 4048 level proceeds through unknown transitions.
5995.8	1948.0	6 2	

Continued on next page (footnotes at end of table)

$^{41}\text{Ca}(\text{p},\gamma)$ 1989Ki11 (continued) $\gamma(^{42}\text{Sc})$ (continued)

E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$	E(level)	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\ddagger}$
5995.8	2772.4	13 2	6076.41	2028.6	4 1	6174.2	3178.5	7 2
	2906.6	3 1		2407.6	4 1		3358.7	9 2
	2972.9	=1		2755.0	10 2		3378.8	3 1
	3148.1	4 1		3053.5	7 2		3904.9	21 2
	3180.3	3 1		3165.9	4 1	6253.4	3164.2	4 1
	3344.7	4 1		3687.2	17 2		3405.7	4 1
	3509.1	3 1		3807.14 8	21 2		3437.9	3 1
	3562.3	3 1		3853.06 8	29 2		3602.3	15 2
	3772.5	6 2	6174.2	1705.4	4 1		3819.9	15 2
	3808.1	2 1		2454.8	20 2		4030.0	=1
	4409.2	8 2		2851.3	8 2		4065.6	30 2
	4485.4	16 2		2950.8	7 2		4743.0	7 2
	4505.1	7 2		3085.0	3 1		4762.7	7 2

[†] Values without uncertainties are from level-energy differences.

[‡] Upper limits on branching ratio for transitions involving $\Delta J > 2$ are given under comments (1989Ki11).

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

 $^{41}\text{Ca}(^3\text{He},\text{d})$ 1979Vo04

Target ^{41}Ca $J\pi=7/2^-$.

1979Vo04: E=20 MeV ^3He beam was produced from the Rochester MP tandem accelerator. Enriched target of 81.8% ^{41}Ca and 18.1% ^{40}Ca about 25 $\mu\text{g}/\text{cm}^2$ on a carbon backing. Deuterons were momentum analyzed with a split-pole magnetic spectrometer and detected with nuclear emulsions, energy resolution FWHM=20 keV. Measured $\sigma(E_{\text{d}},\theta)$. Deduced levels, $J\pi$, L and spectroscopic factors from DWBA analysis. Includes also $^{41}\text{Ca}(^3\text{He},\text{d}\gamma)$.

Energy	$\text{d}\sigma/\text{d}\Omega$ (mb/sr)	Energy	$\text{d}\sigma/\text{d}\Omega$ (mb/sr)
0	0.17	4022	0.32
611	0.56	4044	0.13
615	2.72	4175	0.53
1490	2.33	4204	1.44
1510	5.29	4245	0.17
1585	1.19	4262	0.10
1843	0.024	4276	0.078
1872	0.046	4289	0.34
1886	0.059	4370	0.083
2185	0.51	4410	0.72
2220	0.20	4469	8.51
2265	0.058	4548	2.23
2293	0.10	4582	1.22
2388	0.27	4604	0.57
2433	0.21	4665	0.48
2452	0.045	4704	0.19
2486	0.70	4727	0.86
2533	0.017	4760	0.44
2648	0.13	4786	0.24
2793	0.66	4808	0.22
2814	3.18	4827	1.14
2846	0.070	4876	0.16
2911	0.070	4971	0.060
2994	0.31	5003	0.16
3021	0.57	5028	0.26
3088	6.48	5045	0.066
3146	0.061	5084	1.94
3166	0.36	5120	4.08
3245	4.34	5140	0.57
3281	0.27	5303	0.058
3322	0.86	5326	0.45
3350	0.19	5352	0.67
3390	4.50	5370	0.33

Continued on next page (footnotes at end of table)

$^{41}\text{Ca}(^3\text{He},\text{d})$ 1979Vo04 (continued)

3446	0.20	5380	0.69
3468	0.14	5434	0.46
3493	0.18	5473	0.18
3512	0.079	5520	0.35
3529	0.074	5572	0.76
3577	0.046	5633	1.69
3600	0.14	5651	4.18
3686	0.33	5771	0.47
3715	0.11	5865	0.82
3754	0.19	5964	0.77
3792	2.40		
3855	0.077		
3866	0.071		
3896	0.25		
3930	0.97		

 ^{42}Sc Levels

E(level)	L	(2J+1)S [†]	E(level)	L	(2J+1)S [†]	E(level)	L	(2J+1)S [†]
0.0	3	1.3	3350 5			4665 5	1	0.45
611 [‡]	3 [‡]	4.0 [‡]	3390 5	1+3	2.4, 2.9	4704 5	(1)	0.26
615 [‡] 5	3 [‡]	19 [‡]	3446 5	(1)	0.11	4727 5	1	0.80
1490 5	1+3	0.78, 6.9	3468 5			4760 5	3	1.4
1510 5	1+3	2.3, 11	3493 5	(1)	0.10	4786 5		
1585 5	1+3	0.42, 3.4	3512 5			4808 5		
1843 5			3529 5			4827 5	1	1.3
1872 5	3	0.24	3577? 5			4876 5		
1886 5	3	0.34	3600 5	(3)	0.45	4971 5		
2185 5	1+3	0.26, 0.46	3686 5	3	0.99	5003 5	(1)	0.27
2220 5	1+3	0.05, 0.51	3715 5	3	0.28	5028 5		
2265 5	(3)	0.26	3754 5	(1+3)	0.05, 0.19	5045 5		
2293 5	(1+3)	0.03, 0.30	3792 5	1+3	1.3, 1.3	5084 5	(1)	3.0
2388 [§] 5	3(+1)	1.1, 0.04	3855 5	(1)	0.06	5120 5	(1)	6.3
2433 5	1	0.11	3866 5			5140 5		
2452 5			3896 5			5303? 5		
2486 5	3	3.2	3930 5			5326 5		
2533? 5			4022 5			5352 5		
2648 5			4044 5			5370 5		
2793 5	(1+3)	0.27, 1.5	4175 5	1	0.32	5380 5		
2814 5	3(+1)	9.8, 0.67	4204 5	1+3	0.56, 2.1	5434 5		
2846 5			4245 5			5473 5		
2911 5			4262? 5			5520 5		
2994 5			4276 5			5572 5		
3021 5	0	0.29	4289 5	1	0.26	5633 5	1	3.4
3088 5	1+3	3.5, 4.2	4370 5			5651 5	1	7.7
3146? 5			4410 5	1	0.86	5771 5		
3166 5	(1+3)	0.11, 0.67	4469 5	1	7.9	5865 5	(1)	2.6
3245 5	3	17	4548 5	1	1.9	5964 5	(1)	2.4
3281 5	3	0.90	4582 5	1	0.94			
3322 5	1+3	0.13, 2.4	4604 5	(1)	0.56			

[†] 1979Vo04 quote spectroscopic strengths $g=[(2J_f+1)/(2J_i+1)]C^2S$; where $J_i=7/2-$ and $C^2=1/2$.

[‡] Doublet, spectroscopic factors isolated for two states from normalization to $d\gamma$ -coin data in ($^3\text{He},d\gamma$).

[§] Doublet.

⁴²Ca(p,n) 2002Or05

2002Or05: E=35 MeV, measured neutron spectra by TOF, σ at Cyclotron and Radioisotope Center, Tohoku University; deduced Gamow-Teller matrix elements.

⁴²Sc Levels

E(level)	J π [†]	Comments
0.0	0+	IAS of ⁴² Ca g.s. σ =1.13 mb/sr.
611	1+	σ =1.52 mb/sr. $\sigma(\text{Gamow-Teller})/\sigma(\text{IAS})=1.35$ 10. B(GT) strength=2.64 15 (2002Or05).

[†] From Adopted Levels.

⁴²Ca(³He,t) 2015Fu08,1971Sh16

2015Fu08 (also 2014Fu02): E=140 MeV/nucleon ³He beam was produced at the K=400 Ring Cyclotron at RCNP. Target was a self-supporting foil of 1.78 mg/cm² 93.7% enriched in ⁴²Ca. Reaction products were momentum analyzed with the Grand Raiden spectrometer (FWHM=29 keV) and detected with a focal-plane detector. Measured $\sigma(E_t, \theta)$ with five angle cuts ($\leq 0.5^\circ$, $0.5^\circ-0.8^\circ$, $0.8^\circ-1.2^\circ$, $1.2^\circ-1.6^\circ$, $1.6^\circ-2.0^\circ$). Deduced levels, L-transfers, Gamow-Teller β strengths. Comparisons with shell-model calculations, and with the data published earlier for ⁴⁶V, ⁵⁰Mn, and ⁵⁴Co produced from the (³He,t) reaction. In 2014Fu02 only the ground state and levels at 611, 1889 and 3688 are discussed. 2016Fu02, 2012Fu02, 2012St22, 2011St03 and 2007Ad27: conference papers which discuss the results of the same experiment as in 2015Fu08 and 2014Fu02 primary publications.

1971Sh16: E=26 MeV ³He beam was produced from the University of Rochester MP Tandem. Target of 94.4% enriched ⁴²Ca about 30 $\mu\text{g}/\text{cm}^2$ on a 10 $\mu\text{g}/\text{cm}^2$ carbon backing. Tritons were momentum analyzed with the Split Pole Magnetic Spectrograph and detected with 100 micron Kodak NTB emulsion plates, energy resolution FWHM=9 keV. Measured $\sigma(E_t, \theta)$. Deduced levels, J π , L from DWBA analysis.

Others:

1989Va09: E=73 MeV. Measured $\sigma(E_t, \theta)$. Deduced effective projectile-nucleon force parameters.

1987Ko34: E=18.86 MeV. Measured triton energy differences.

1977Vo02: measured Q-values. Measured $\sigma(E_t, \theta)$.

1974Ha35: E=33 MeV.

1971Be29: E=24.6 MeV. Deduced Q value and Coulomb-displacement energy.

⁴²Sc Levels

The B(GT) strengths and count rates for levels are from 2015Fu08. Total experimental B(GT) strength=2.7 4 (2015Fu08) out of which $\approx 80\%$ is concentrated in the 613, 1+ state.

Total counts observed (2015Fu08) within $\theta=0^\circ$ to 0.5° are given under comments.

E(level) [†]	J π ^b	L	Relative d σ /d Ω ^c	Comments
0.0	0+	0	84 ^f	T=1. E(level): IAS of ⁴² Ca g.s. L: from 1971Sh16 and 2015Fu08. Counts(0°)=34563 543.
613 [#] 4	1+	0&	170 ^d	L=0 in 2015Fu08; 2,1+3 in 1971Sh16. E(level): 612 4 (2015Fu08), 615 5 (1971Sh16). J π : from 2014Fu02, 2015Fu08, 1971Sh16. B(GT) strength=2.173 47 for 612 level, which represents about 80% of the total B(GT) strength in ⁴² Sc. Counts(0°)=241037 1069.
624 [@] 5 1494 [#] 4		2+4, 3+5 ^a	≤ 10 ⁱ 68 ^f	J π : 7+ (1971Sh16). E(level): 1491 4 (2015Fu08), 1498 5 (1971Sh16). J π : 3+ (1971Sh16). Counts(0°)=10039 156.
1518 [@] 5 1589 [#] 4		4+6, 5+7 ^a 2, 1+3 ^a	34 ^g 29 ^d	J π : 5+ (1971Sh16). E(level): 1586 4 (2015Fu08), 1593 5 (1971Sh16). J π : 2+ (1971Sh16). Counts(0°)=666 46.
1844 [@] 5			3.5 ^g	J π : (3+,4-) (1971Sh16).

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$^{42}\text{Ca}(^3\text{He},t)$ 2015Fu08,1971Sh16 (continued) ^{42}Sc Levels (continued)

E(level) [†]	J π^b	L	Relative d σ /d Ω^c	Comments
1887 $\frac{7}{2}^-$ # 4	1+	0&	15 ^e	E(level): 1887 4 (2015Fu08), 1888 5 (1971Sh16). J π : (3-), (0+ and 1+) (1971Sh16). B(GT) strength=0.097 3. E(level), J π : from 2014Fu02, 2015Fu08. Counts(0°)=10701 159.
2185 @ 5			≈ 2 ^f	J π : (3+, 4-) (1971Sh16).
2221 # 4	1+	0&	12 ^d	E(level): 2220 4 (2015Fu08), 2222 5 (1971Sh16). J π : from 2015Fu08; 1+, 2 in 1971Sh16. B(GT) strength=0.028 1. Counts(0°)=3081 110.
2268 # 5			20 ^d	E(level): 2272 4 (2015Fu08), 2262 5 (1971Sh16). J π : 1+, 2 (1971Sh16). Counts(0°)=486 42.
2387 @ 5			8 ^f	J π : 4 (1971Sh16).
2452 4	1+	0&		Level only from 2015Fu08. B(GT) strength=0.014 1. Counts(0°)=1537 73.
2484 # 4			≈ 35 ^e	J π : 1+, 2+ (1971Sh16). E(level): 2484 4 (2015Fu08), 2484 5 (1971Sh16). Counts(0°)=460 53.
2510 ? @ 5			3 ^f	
2650 @ 5			8 ^g	J π : (4+) (1971Sh16).
2669 $\frac{7}{2}^-$ @ 5			17 ^e	
2812 @ 5		4, 4+6 ^a	17 ^g	J π : 4+ (1971Sh16).
2842 $\frac{7}{2}^-$ # 4			8 ^d	E(level): 2841 4 (2015Fu08), 2844 5 (1971Sh16). Counts(0°)=457 35.
2907 $\frac{7}{2}^-$ @ 5			8 ^d	
2967 4	1+	0&		Level only from 2015Fu08. B(GT) strength=0.018 1. Counts(0°)=1946 69.
3080 ? @ 5			1. 6 ^j	
3232 # 4		6, 5+7 ^a	11 ^h	E(level): 3229 4 (2015Fu08), 3237 5 (1971Sh16). J π : 6+ (1971Sh16), (3+, 4, 5+) in 2015Fu08. Counts(0°)=6572 139.
3282 @ 5			8 ^g	J π : (4) (1971Sh16).
3312 @ 5			13 ^f	J π : 3+ (1971Sh16).
3346 $\frac{7}{2}^-$ # 4	1+	0&	5 ^e	E(level): 3349 4 (2015Fu08), 3340 5 (1971Sh16). B(GT) strength=0.040 1. Counts(0°)=4418 112.
3366 @ 5			10 ^d	J π : 1+, 2+ (1971Sh16).
3386 # 4			15 ^e	E(level): 3389 4 (2015Fu08), 3380 5 (1971Sh16). J π : 3, 4- (1971Sh16). Counts(0°)=521 64.
3583 @ 5			8 ^f	
3680 # 8	1+	0&	5 ^h	E(level): 3686 4 (2015Fu08), 3670 5 (1971Sh16). J π : from 2014Fu02, 2015Fu08. B(GT) strength=0.127 3. Counts(0°)=13768 182.
3775 @ 5			3 ^e	J π : (2+) (1971Sh16).
3807 @ 5		3, 1+3 ^a	24 ^d	J π : 2-, 3- (1971Sh16).
3880 @ 5			16 ^e	J π : 1+, 2+ (1971Sh16).
3915 @ 5			16 ^d	J π : 1+, 2+ (1971Sh16).
3934 # 4			14 ^g	E(level): 3931 4 (2015Fu08), 3938 5 (1971Sh16). J π : (3+, 4+) (1971Sh16). Counts(0°)=1499 62. Counts(0°)=334 31.
4070 4				Counts(0°)=333 34.
4177 4				Counts(0°)=904 48.
4272 4				Counts(0°)=245 27.
4370 4				Counts(0°)=345 33.
4547 10				Counts(0°)=364 46.
4590 § 20				Counts(0°)=560 52.
4619 § 20				Counts(0°)=435 33.
4821 10				

Continued on next page (footnotes at end of table)

$^{42}\text{Ca}(^3\text{He},t)$ 2015Fu08,1971Sh16 (continued) **^{42}Sc Levels (continued)**

E(level) [†]	$J\pi^b$	L	Comments
4873 10			Counts(0°)=3680 86.
4928 10	1+	0	B(GT) strength=0.020 1. Counts(0°)=2117 67.
5094 10			Counts(0°)=532 35.
5143 10	1+	0	B(GT) strength=0.021 1. Counts(0°)=2269 66.
5686§ 20	(1+)	(0)	B(GT) strength=0.005 1. Counts(0°)=483 51.
5716§ 20	1+	0	B(GT) strength=0.012 1. Counts(0°)=1221 63.
5803 10			Counts(0°)=1268 64.
5958 10			Counts(0°)=573 38.
6007 10			Counts(0°)=1804 71.
6078 10			Counts(0°)=516 40.
6167 10			Counts(0°)=1085 59.
6327 10	1+	0	B(GT) strength=0.018 1. Counts(0°)=1924 70.
6364 10			Counts(0°)=567 57.
6737 10			Counts(0°)=1100 50.
7068 10			Counts(0°)=1241 58.
7129 10			Counts(0°)=476 62.
7261 10			Counts(0°)=876 78.
7295 10			Counts(0°)=830 57.
7418 10			Counts(0°)=2988 83.
7491 10			Counts(0°)=653 57.
7586 10			Counts(0°)=430 37.
7678 10			Counts(0°)=441 38.
7776 10			Counts(0°)=2094 68.
7884 10			Counts(0°)=543 64.
7923 10			Counts(0°)=2313 76.
7974 10			Counts(0°)=1503 62.
8105 10	(1+)	(0)	B(GT) strength=0.004 1. Counts(0°)=458 42.
8182 10			Counts(0°)=835 70.
8251 10			Counts(0°)=1152 59.
8292 10			Counts(0°)=520 47.
8338 10			Counts(0°)=522 49.
8373 10			Counts(0°)=418 65.
8400 10			Counts(0°)=1239 79.
8492 10			Counts(0°)=431 57.
8540§ 20			Counts(0°)=749 216.
8732 10	(1+)	(0)	B(GT) strength=0.007 1. Counts(0°)=754 47.
8810 10			Counts(0°)=1492 60.
8854 10			Counts(0°)=1020 62.
8887 10			Counts(0°)=1710 72.
8929 10			Counts(0°)=1537 80.
8981 10	(1+)	(0)	B(GT) strength=0.008 1. Counts(0°)=801 116.
9068§ 20			Counts(0°)=549 164.
9088§ 20			Counts(0°)=792 149.
9113§ 20			Counts(0°)=491 100.
9156 10			Counts(0°)=643 48.
9203 10			Counts(0°)=1291 66.
9236 10			Counts(0°)=1044 63.
9280§ 20			Counts(0°)=551 56.
9312§ 20			Counts(0°)=1106 64.
9406 10			Counts(0°)=916 67.
9565 10			Counts(0°)=524 47.
9611 10			Counts(0°)=651 49.
9793§ 20			Counts(0°)=858 64.
9826§ 20			Counts(0°)=1124 69.
9874 10			Counts(0°)=620 75.

Continued on next page (footnotes at end of table)

$^{42}\text{Ca}(^3\text{He},t)$ 2015Fu08,1971Sh16 (continued) ^{42}Sc Levels (continued)

E(level) [†]	$J\pi^b$	L	Comments
9901 10			Counts(0°)=888 79.
9947 § 20			Counts(0°)=953 75.
9978 § 20			Counts(0°)=1436 88.
10011 10	1+	0	B(GT) strength=0.032 2. Counts(0°)=3137 156.
10118 § 20			Counts(0°)=1241 155.
10142 § 20			Counts(0°)=2324 184.
10165 § 20			Counts(0°)=1726 195.
10195 § 20			Counts(0°)=670 86.
10250 § 20	1+	0	B(GT) strength=0.017 2. Counts(0°)=1651 174.
10271 § 20			Counts(0°)=822 171.
10338 10	1+	0	B(GT) strength=0.016 1. Counts(0°)=1530 69.
10395 10			Counts(0°)=556 56.
10437 10	1+	0	B(GT) strength=0.020 1. Counts(0°)=1956 78.
10561 10	(1+)	(0)	B(GT) strength=0.006 1. Counts(0°)=604 55.
10695 10			Counts(0°)=670 59.
10735 10			Counts(0°)=466 61.
10809 10			Counts(0°)=495 70.
11070 20			Counts(0°)=1273 89.
11180 20			Counts(0°)=623 59.
11220 20			Counts(0°)=745 75.
11260 20			Counts(0°)=852 59.
11400 20			Counts(0°)=1566 76.
11620 20			Counts(0°)=617 96.
11810 20			Counts(0°)=614 207.
11830 20	(1+)	(0)	B(GT) strength=0.010 2. Counts(0°)=964 232.
12000 20	(1+)	(0)	B(GT) strength=0.010 1. Counts(0°)=963 77.
12420 20			Counts(0°)=631 82.
12700 20			Counts(0°)=640 195.

[†] From 2015Fu08 unless otherwise stated. Based on authors' general comments about uncertainties for level energies, evaluators assign 4 keV up to 4500 keV excitation, 10 keV from 4500 to about 11 MeV, and 20 keV for levels above 11 MeV and for doublets. Levels from 1971Sh16 are available up to 4 MeV.

[‡] Doublet in 1971Sh16, based on $\sigma(\theta)$ distribution.

§ Component peak of an unresolved multiplet, energy value is less accurate (2015Fu08).

Weighted average of values from 2015Fu08 and 1971Sh16.

@ From 1971Sh16, level not reported in 2015Fu08.

& From 2015Fu08, based on comparisons of measured angular distributions with that of the 612-keV state which is identified with an L=0 pattern.

^a From 1971Sh16, with first set of L-transfer value(s) more probable than the second set.

^b Above the g.s., L=0 transitions are assumed as Gamow-Teller (2015Fu08). The assignments proposed by 1971Sh16 in column 6 of their Table 2 are listed under comments.

^c Values are from 1971Sh16 for an angle where the cross section is the maximum. For absolute $d\sigma/d\Omega$ in $\mu\text{b/sr}$, multiply by a factor of ≈ 3 .

^d At 10°.

^e At 15°.

^f At 20°.

^g At 25°.

^h At 30°.

ⁱ At 35°.

^j At 40°.

$^{42}\text{Ca}(^6\text{Li}, ^6\text{He})$ 1990Mo13, 1975Wh01

1990Mo13: E=156 MeV ^6Li beam was produced at the Karlsruhe Isochronous Cyclotron KIZ. Target of a 2.7 mg/cm² self-supporting ^{42}Ca foil (enriched to 87.7%). Reaction products were momentum analyzed with the QQDS magnetic spectrograph "little John" and detected by position sensitive proportional counter, an ionization chamber and a plastic scintillator. Measured cross section at 0°, $\sigma(\theta)$. Deduced levels. DWBA analysis.

1975Wh01 (also 1974Wh07): E=34 MeV beam was produced at the Argonne National Laboratory (ANL). Reaction products were analyzed with the ANL Engel split-pole spectrograph and detected by two 4.5 cm long Si surface barrier position-sensitive detectors. Measured $\sigma(\theta)$. DWBA analysis.

 ^{42}Sc Levels

E(level)	$J\pi^{\dagger}$	L	σ (mb/sr) [†]	Comments
0.0	0+	(1)		L: implied from $\sigma(\theta)$ (1975Wh01).
610	1+	0	1.1	L: from 1990Mo13. L=90%(L=0)+10%(L=6) for 1+ and 7+ doublet (1975Wh01). d σ /d Ω =30 $\mu\text{b/sr}$ for first maximum at 10° (1975Wh01).
2220	(1)		0.11	

[†] From 1990Mo13 at 0'.

[‡] From Adopted Levels.

 $\text{Pb}(^{16}\text{O}, X\gamma)$ 2006MoZS

2006MoZS: E=60 MeV ^{16}O beam was produced at JAEA. A target of 11 mg/cm² PbS. γ -rays were detected by the GEMINI-II array. Measured E γ , I γ , $\gamma\gamma$ -coin. Deduced levels.

 ^{42}Sc Levels

E(level)	$J\pi^{\dagger}$	E(level)	$J\pi^{\dagger}$	E(level)	$J\pi^{\dagger}$
0.0	0+	1512	5+	2391?	3+
611	1+	1586	2+	2435	4+
618	7+	1845	3(+)	2606?	4(+)
1490	3+	2223	3+	2995?	4+

[†] From Adopted Levels.

 $\gamma(^{42}\text{Sc})$

E γ	E(level)	E γ	E(level)	E γ	E(level)
259	1845	761 [†]	2606?	894	1512
606 [†]	2995?	772 [†]	2995?	923	2435
611	611	879	1490	975	1586
637	2223		2391?		

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

Adopted Levels, Gammas

$Q(\beta^-) = -17490$ SY; $S(n) = 17478$ 28; $S(p) = 3751.22$ 27; $Q(\alpha) = -5471.1$ 3 2012Wa38.

Estimated uncertainty for $Q(\beta^-) = 300$ (syst, 2012Wa38).

$S(2n) = 32400$ 160, $S(2p) = 4836.20$ 28, $Q(\epsilon p) = 2744.25$ 24 (2012Wa38).

Identification and production of ^{42}Ti nuclide by 1962Ob03 using $^{40}\text{Ca}(^3\text{He}, n)$ which measured a half-life of 0.25 s 4.

2009Ku19: ^{42}Ti produced in $^{40}\text{Ca}(^3\text{He}, n\gamma)$ $E = 17$ MeV, beam from the Ion Guide Isotope Separator On-Line (IGISOL) facility at the Accelerator Laboratory of the University of Jyväskylä. Target of a 1.5 mg/cm² natural Ca. Measured $E\gamma$, $\beta\gamma$ -coin, $T_{1/2}$, mass differences using JYFLTRAP Penning-trap spectrometer.

 ^{42}Ti Levels**Cross Reference (XREF) Flags**

A ^{43}Cr ϵp Decay (21.2 ms)

B ^{45}Fe $\epsilon 3p$ Decay (2.45 ms)

C $^{40}\text{Ca}(^3\text{He}, n)$

D $^{40}\text{Ca}(^3\text{He}, n\gamma)$

E $^{40}\text{Ca}(^{12}\text{C}, ^{10}\text{Be})$

F $^{42}\text{Ca}(\pi^+, \pi^-)$

E(level) [†]	J π	XREF	$T_{1/2}$ [§]	Comments
0.0	0+	ABCD F	208.65 ms 80	% ϵ +% β^+ =100. $T_{1/2}$: weighted average of 211.7 ms 19 (2015Mo01, from analysis of β -decay and correlated implantations), 209.5 ms 52 (2015Mo01, from the analysis of γ -ray data), 208.14 ms 45 (2009Ku19, also 2011KuZY, from decay timing of positrons emitted by a pure ^{42}Ti source deposited on a mylar tape and counted by a 4 π cylindrical plastic scintillator, source production used Penning-trap system; uncertainty increased by evaluators by a factor of 2), 230 ms 50 (1972Zi02, β counting), 202 ms 5 (1969Ga27, γ counting), and 200 ms 20 (1969Ni03, γ counting), 250 ms 40 (1962Ob03). Other: 173 ms 14 (1969Al12, β counting) seems discrepant as compared to all the other values. 2015Ha07 review gives $T_{1/2} = 208.09$ ms 55.
1554.6 $\frac{3}{2}$ 3	2+	A CD F	0.44 ps 11	J π : L($^3\text{He}, n$)=2.
1854.2 12	0+	CD	>0.14 ps	J π : L($^3\text{He}, n$)=0.
2396.1 $\frac{3}{2}$ 10	(2+)	A CD	0.22 ps 13	J π : γ to 0+; RUL; systematics.
2676.6 8	4+	CD	>1.4 ps	J π : L($^3\text{He}, n$)=4.
2730? 35		C		
2945? 25		C		
3043.0 15	6+	CDE	3.12 ns 21	J π : L($^3\text{He}, n$)=6.
3130? 45		C		
3280 40		C		
3335?		D		
3440 30	1-	C		J π : L($^3\text{He}, n$)=1.
3540 30		C		
3660 25		C		
3744 3	2+	CD	<0.17 ps	J π : L($^3\text{He}, n$)=2.
3850 25		C		
3990 25		C		
4130 25		C		
4245 25	0+	C		J π : L($^3\text{He}, n$)=0.
4375 20	3-	C		J π : L($^3\text{He}, n$)=3.
4400 200		E		
4440 20	2+	C		J π : L($^3\text{He}, n$)=2.
4665 20	2+	C		J π : L($^3\text{He}, n$)=2.
4730 30		C		
4890? 45		C		
4950 25	4+	C		J π : L($^3\text{He}, n$)=4.
5160? 50		C		
5220 30	4+	C		J π : L($^3\text{He}, n$)=4.
5555 20	0+	C		J π : L($^3\text{He}, n$)=0.
6370 30	(0+)	C		J π : L($^3\text{He}, n$)=(0).
6445 40		C		
7500 200		E		

[†] From ($^3\text{He}, n\gamma$) and ($^3\text{He}, n$).

[‡] From $E\gamma$ in ^{43}Cr ϵp decay.

[§] From DSAM in ($^3\text{He}, n\gamma$), unless otherwise noted.

Adopted Levels, Gammas (continued)
 $\gamma(^{42}\text{Ti})$

E(level)	$E\gamma^\dagger$	$I\gamma^\S$	Mult.	Comments
1554.6	1554.6 $\frac{3}{2}$	100	(E2)	B(E2)(W.u.)=16 4.
1854.2	298.2	100	[E2]	
2396.1	838.4 $\frac{3}{2}$	100	[M1]	B(M1)(W.u.)=0.13 8.
	2396.0	28 10	[E2]	B(E2)(W.u.)=0.8 6.
2676.6	1120.6	100	[E2]	
3043.0	366.4	100	[E2]	B(E2)(W.u.)=3.2 2.
3335?	1779			
3744	2188	100 9	[M1]	
	3744	40 9	[E2]	

† From level-energy differences, recoil correction removed, unless otherwise noted.

$\frac{3}{2}$ From ^{43}Cr ϵcp decay.

§ From ($^3\text{He}, n\gamma$).

⁴³Cr ϵp Decay (21.2 ms) 2007Do17,2011Po01,2012Au08

Parent ⁴³Cr: E=0; J π =(3/2+); T_{1/2}=21.2 ms 7; Q(g.s.)=15520 syst; % ϵp decay=79.3 30.
⁴³Cr-Q(ϵp): 15520 400 (syst,2012Wa38).
⁴³Cr-J, T_{1/2}: From ⁴³Ar Adopted Levels in the ENSDF database (March 2015 update).
⁴³Cr-% ϵp decay: % ϵp =79.3 30, deduced by 2012Au08 from relative ϵp branching 87.1% 25 and total proton branching 91.0% 23 (weighted average of 92.5% 28 (2007Do17) and 88% 4 (2011Po01). Others: % ϵp =23 6 (1992Bo37), 28 1 (2007Do17, from proton spectrum), 81 4 (2011Po01).
2007Do17: ⁴³Cr was produced by the fragmentation of a 74.5 MeV/nucleon ⁵⁸Ni beam on a 250 mg/cm² natural nickel target at SISSE/LISE3 facility in GANIL. Fragments were selected by the ALPHA-LISE3 separator and identified by TOF and energy-loss with two micro-channel plate (MCP) detectors and a detection setup consisting of silicon and germanium detectors. Double-sided silicon-strip detectors (DSSSD) and a thick Si(Li) detector were used to detect implanted events, charged particles and β particles. The γ rays were detected by four Ge detectors. Measured Ep, Ip, E γ , I γ , p γ -coin, T_{1/2}. Deduced levels, proton decay branching ratios.
2011Po01: ⁴³Cr was produced by the fragmentation of a 161 MeV/nucleon ⁵⁸Ni beam on an 800 mg/cm² natural nickel target at NSCL. Fragments were selected using the A1900 separator and identified by time-of-flight (TOF) and energy-loss. Measured Ep, Ip, T_{1/2}. Deduced proton decay branching ratios.
2012Au08: ⁴³Cr nuclei produced in the reaction Ni(⁵⁸Ni,X) using the LISE3 separator at GANIL. ⁴³Cr ions were separated, identified and then implanted onto the time projection chamber (TPC). Decays were detected in a time-projection chamber (TPC), where signals from four gas electron multipliers (GEM) detected in a two-dimensional strip detector combined with drift-time analysis were used to reconstruct the tracks of the particles in three dimensions. Characterization of the TCP was done with the $\beta^+\text{p}$ decay of ⁵²Ni with reference to proton energies and branching ratios. Measured energy loss, decay event counts, angular correlation between two protons. Deduced branching ratio. Implantation and decay events were time correlated. Simulations were performed taking account different ratios of the decay energy shared between the two protons. 180 events were recorded for ⁴³Cr $\beta^+\text{p}$ emission. Correlations observed show that the $\beta^+\text{p}$ emission favor a sequential emission.
1992Bo37: ⁴³Cr was produced by the fragmentation of a 69 MeV/nucleon ⁵⁸Ni beam on a 150 mg/cm² natural nickel target in GANIL. Measured Ep, Ip, T_{1/2}. Deduced levels, proton decay branching ratios.
2001Gi01: ⁴³Cr was produced by the fragmentation of a 74.5 MeV/nucleon ⁵⁸Ni on a 230.6 mg/cm² natural nickel target in GANIL. Measured Ep, Ip, E γ , I γ , T_{1/2}. Deduced levels, branching ratios.

⁴²Ti Levels

E(level)	J π [†]	Comments
0.0	0+	
1554.6 3	2+	
2393.0 11	(2+)	
x		E(level): x=5.2 MeV or 6.6 MeV (2012Au08). From simulations studies and in comparison with the experimental results, 2012Au08 show that two protons do not share equally the 2p decay energy of 4363 keV 19 (2007Do17) and are emitted in sequence. A ratio of 34%–66% between the two protons is in good agreement with experimental data in 2012Au08. In addition the angular correlation measured between the two protons in 2012Au08 shows an isotropic distribution of the relative angle between the two protons which is a signature of sequential emission. 2012Au08 conclude that β^+ -delayed emission of protons proceeds in a sequential process via an intermediate state in ⁴² Ti at either 5.2 or 6.6 MeV in ⁴² Ti. As the level density is quite high in this energy region, no definite level energy can be assigned.

[†] From Adopted Levels.

Delayed protons

E(p) [‡]	I(p) ^{†@}
1014 17	0.6 1
1605 18	2.1 11
1818 15	7.1 12
2232 50	4.7 7
2765 19	1.2 4
3148 16	3.4 7
3382 § 25	1.0 4
3835 # 90	3.0 14
4680 26	4.5 8

[†] For intensity per 100 decays, multiply by 0.793 30.

[‡] Weighted average of 2007Do17 and 2001Gi01, unless otherwise noted.

§ From 2007Do17 only.

Unweighted average of 3744 27 from 2007Do17 and 3926 24 E from 2001Gi01.

@ From 2007Do17.

^{43}Cr ϵp Decay (21.2 ms) 2007Do17,2011Po01,2012Au08 (continued) $\gamma(^{42}\text{Ti})$

$E\gamma^{\dagger}$	E(level)	$I\gamma^{\ddagger}$
838.4 10	2393.0	6.2 13
1554.6 3	1554.6	35 2
^x 1936.8 6		1.8 8

[†] From 2007Do17.[‡] For absolute intensity per 100 decays, multiply by 0.793 30.^x γ ray not placed in level scheme.

Decay Scheme

Intensities: I(γ +ce)
per 100 parent decays **^{45}Fe $\epsilon 3\text{p}$ Decay (2.45 ms) 2007Mi36,2007Mi40,2009Mi29**Parent ^{45}Fe : $E=0$; $J\pi=(3/2+)$; $T_{1/2}=2.45$ ms 23; $Q(\text{g.s.})=16670$ syst; $\% \epsilon 3\text{p}$ decay=3.3 15. ^{45}Fe -J: From Adopted Levels of ^{45}Fe in the ENSDF database (Oct 2007 update).

^{45}Fe - $T_{1/2}$: Weighted average of 4.7 ms +34-14 (2002Gi09, earlier value of 6.0 ms +17-3 in 2001Gi02, GANIL); 3.2 ms +26-10 (2002Pf02, GSI); 1.6 ms +5-3 (2005Do20, GANIL); 2.6 ms 2 (2007Mi40,2007Mi36, 2009Mi29, NSCL-MSU); 3.6 ms +16-8 (2012Au08,2007Gi10, GANIL). Others: 2.5 ms 2 (2008Bl03, review paper, average of four values in literature); 2.56 ms 14 (2012Au08, average of their value with two previous values in literature).

 ^{45}Fe - $Q(\epsilon)$: Deduced by the evaluators from masses taken from 2012Wa38, estimated $\Delta Q=400$.

^{45}Fe - $\% \epsilon 3\text{p}$ decay: $\% 2\text{p}=70$ 4 (2007Mi36,2007Mi40,2009Mi29), $\% \epsilon+\% \beta^+=30$ 4, $\% \beta^+\text{p}=19$ 3, $\% \beta^+2\text{p}=7.8$ 20, $\% \beta^+3\text{p}=3.3$ 15 (2007Mi36, 2007Mi40,2009Mi29). The $\% \epsilon+\% \beta^+$ branch=30 4 assumes that all such $\epsilon+\beta^+$ decay events are followed by delayed proton decays. Others: $\% 2\text{p}=78$ +14-22 (2012Au08), 57 10 (2005Do20), 70-80 (2002Gi09), =80 (2002Pf02).

First observation of β -delayed three proton channel by 2007Mi36.

2007Mi36, 2007Mi40, 2009Mi29 (also 2008Mi03): ^{45}Fe was produced by the fragmentation of a 161 MeV/nucleon ^{58}Ni beam on a 800 mg/cm² natural nickel target at National Superconducting Cyclotron laboratory (NSCL) at MSU. Fragments were separated using the A1900 fragment separator and identified in-flight by time-of-flight (TOF) and energy-loss with a plastic scintillator and a thin silicon detector. Silicon detector was used to measured time-of-flight and δE . Identified ions stopped in a gaseous detector-the Optical Time Projection Chamber (OTPC) for measuring emitted protons. Measured decay branches, $T_{1/2}$. Out of a total of 125 observed decays of ^{45}Fe , 87 events were assigned to direct 2p decay, 38 to $\epsilon+\beta^+$ decay followed by proton emission. Out of 38 $\epsilon+\beta^+$ decay events, 24 were of $\beta^+\text{P}$ type, ten of $\beta^+2\text{p}$ and four of $\beta^+3\text{P}$ type.

2012Au08: measured half-life of ^{45}Fe decay and 2p-decay branching ratio at GANIL. ^{42}Ti Levels

E(level)	$J\pi$
0.0	0+

⁴⁰Ca(³He,n) 1977Bo16,1974Al14,1974Ev02

Target ⁴⁰Ca J π =0+.

1977Bo16: E=13 MeV ³He beam was produced from the CN Van de Graaff accelerator at the Hahn-Meitner-Institut. A 196 μ g/cm² target of natural ⁴⁰Ca layer on 0.2 mm tungsten backing. Neutrons were detected in 16 detectors between 0' and 82.5' at a flight path of 17.5 m (energy resolution FWHM=40-350 keV). Measured $\sigma(E_n, \theta)$. Deduced levels, L, J π from DWBA analysis of the data.

1974Al14: E=15 MeV ³He beam was produced from the University of Rochester pulsed beam facility. Targets were prepared by evaporating natural calcium onto gold or tantalum backings. Neutrons were detected by scintillators at a flight path of 4 m (FWHM=300 keV). Measured $\sigma(E_n, \theta)$. Deduced levels, J π , L from DWBA analysis.

1974Ev02: E=18 MeV beam was produced from the Munich MP tandem accelerator. Target of enriched ⁴⁰Ca. Neutrons were detected by scintillators. Measured $\sigma(E_n, \theta)$. Deduced levels, J π , L from DWBA analysis.

1968Sh09: E=8.5-10 MeV ³He beam was produced from the Van de Graaff accelerator at the California Institute of Technology. Natural ⁴⁰Ca target. Neutrons were detected with the ONR-CIT pulsed-beam neutron spectrometer (FWHM=70-300 keV). Measured $\sigma(E_n, \theta)$. Deduced levels, J π , L from DWBA analysis.

1968Ha09: E=6.5 MeV beam was produced from the 5.5 MeV Van de Graaff accelerator at the Hahn-Meitner-Institut. Measured $\sigma(E_n)$. Deduced levels.

1964Br13: E=24.4 MeV. Measured $\sigma(E_n)$.

1994NaZY: E=50 MeV. Measured $\sigma(E_n, \theta)$. Deduced levels, J π from DWBA analysis.

Level	d σ /d Ω ($\theta_{\max}$)(mb/sr)		
	1977Bo16	1974Al14	1974Ev02
0	2.01 (0°)	3.2 (0°)	3.2 (0°)
1555	0.51 (25°)	0.78 (20°)	0.75 (20°)
1860	0.01 (0°)	0.2 (0°)	0.12 (0°)
2355	0.08 (25°)	<0.2 (20°)	
2670	0.32 (0°)	0.28 (0°)	0.50 (0°)
2945			0.18 (10°)
3060	0.09 (55°)	0.1 (30°)	
3440	0.11 (10°)	0.1 (<15°)	
3745	0.37 (25°)	0.55 (20°)	0.42 (20°)
4245	0.14 (0°)		
4375	0.70 (30°)	0.40 (40°)	1.3 (20°)
4665	0.14 (25°)		
4950	0.12 (0°)		
5220	0.12 (0°)		
5555	1.03 (0°)	1.5 (0°)	2.2 (0°)
6445		1.4 (5°)	2.2 (5°)

⁴²Ti Levels

E(level) [†]	L	d σ (exp)/d σ (DWBA) (1974Al14)	E(level) [†]	L	d σ (exp)/d σ (DWBA) (1974Al14)
0.0	0	1	3990 25		
1555 20	2	0.85	4130 25		
1860 20	0	0.07	4245 25	0§	
2355 25			4375 20	3§	
2670 30	4#	0.42	4440 20	2@	0.66
2730 35			4665 20	2	
2945 25			4730 30		
3060 20	6	≤ 0.2	4890?‡ 45		
3130?‡ 45			4950 25	4	
3280 40			5160?‡ 50		
3440 30	1§		5220 30	4	
3540 30			5555 20	0	0.85
3660 25			6370 30	(0)	0.75
3745 20	2	0.65	6445 40		
3850 25					

[†] Weighted averages from 1968Sh09, 1974Al14, 1974Ev02 and 1977Bo16.

‡ Tentative level from 1968Sh09 only.

§ From 1977Bo16.

Other: 0+4 (1974Al14).

@ Other: 2+4 (1974Al14).

$^{40}\text{Ca}(^3\text{He},n\gamma)$ 1973Co38,1973Ha10

1973Co38: E=8.0 MeV beam was produced at the Oxford University tandem Van de Graaff accelerator. Target of about 1 mg/cm² natural Ca metal (99.7% purity) evaporated onto a 10 mg/cm² gold foil. Neutrons were detected by the Oxford high efficiency neutron detector and γ -rays were detected by a true coaxial Ge(Li) detector. Measured $\sigma(E_n)$, E_γ .

Deduced levels, $T_{1/2}$ by DSAM.

1973Ha10: E=10.0–11.5 MeV. Targets of 200–300 $\mu\text{g}/\text{cm}^2$ natural calcium evaporated on Ta backings. Neutrons were detected in a 5.1-cm-diam by 7.6-cm-long liquid scintillator and γ -rays were detected by a 55 cm³ Ge(Li) detector (FWHM=4.5 keV at 1.28 MeV). Measured $n\gamma$, $n\gamma\gamma$ -coin. Deduced levels, $T_{1/2}$ by DSAM.

1977Br20 (1971BrYK), 1975Ku17: E=10, 12 MeV. Measured $T_{1/2}$ by $\gamma(t)$.

1971Bo23: E=9–10 MeV. Measured E_γ , $\gamma\gamma$ -coin, $T_{1/2}$ by DSAM.

1971FoZV: E=6, 6.5, 10 MeV. Measured $n\gamma$ -coin, $p\gamma(\theta)$, $T_{1/2}$ by DSAM.

1969Ni03: E=8.0–9.0 MeV. Measured E_γ , $\gamma(\theta)$, $T_{1/2}$.

^{42}Ti Levels

E(level) [†]	J π [‡]	$T_{1/2}$ [†]	Comments
0.0	0+		
1556.0 5	2+	0.44 ps 11	$T_{1/2}$: from mean lifetime $\tau=0.63$ ps 16 as weighted average of $\tau=0.56$ ps 16 (1973Ha10), 0.75 ps 30 (1973Co38), 0.53 ps 24 (1971BrYK), 0.49 ps 21 (1971FoZV), 1.7 ps 4 (1971Bo23). 2001Ra27 evaluation gives $\tau=0.56$ ps 15.
1854.2 12	0+	>0.14 ps	$T_{1/2}$: from 1973Co38.
2396.1 12	(2+)	0.22 ps 13	$T_{1/2}$: weighted average of 0.31 ps 18 (1973Ha10), 0.35 ps 25 (1973Co38).
2676.6 8	4+	>1.4 ps	$T_{1/2}$: from 1973Co38. Other: >1.1 ps (1973Ha10).
3043.0 15	6+	3.12 ns 21	$T_{1/2}$: from $\gamma\gamma(t)$ (1977Br20). Others: 3.5 ns 14 (1975Ku17), 18 ns 4 (1973Co38).
3335?			E(level), J π : level and J π =(1,2) are considered as uncertain since It is reported by 1973Ha10 only.
3744 3	2+	<0.17 ps	J π : 1973Co38 proposed 6+. $T_{1/2}$: from 1973Co38.

[†] From DSAM, unless otherwise stated.

[‡] From 1973Co38, except where noted.

[§] From Adopted Levels.

$\gamma(^{42}\text{Ti})$

E(level)	E_γ ^{†§}	I_γ
1556.0	1556.0	
1854.2	298.2	
2396.1	840.1	100
	2396.0	28 [‡] 10
2676.6	1120.6	
3043.0	366.4	
3335?	1779	
3744	2188	100 9
	3744	40 [§] 9

[†] From level–energy differences.

[‡] Average of 37 (1973Co38) and 18 (1973Co38).

[§] From 1973Ha10.

⁴⁰Ca(¹²C,¹⁰Be) 1988Kr11

1988Kr11(also 1988Me10): E=480 MeV ¹²C beam at GANIL. Measured σ(E,θ). Deduced levels, Jπ from DWBA analysis.
Comparisons with shell model calculations.
1972Sc21: E=114 MeV. Measured charged-particle spectra.

⁴²Ti Levels

E(level)	Jπ [†]	Comments
3040 200	(6+)	E(level): 3050 100 (1972Sc21).
4400 200	(4+)	
7500 200	(6+)	

[†] As proposed by 1988Kr11 based on expected shell-model configurations.

⁴²Ca(π⁺,π⁻) 1992Le16,1991Wi03,1990We05

1992Le16: E=25-65 MeV. Measured σ(θ).
1991Wi03: E=300-500 MeV. Measured σ(θ).
1990We05 (also 1988We02): E=35 keV. Measured σ(θ).
1984Se04 (also 1984KaZY,1981SeZZ): E=125-300 MeV. Measured σ(θ).
1993Wa30: E<300 MeV. Analyzed σ(θ) data.

⁴²Ti Levels

E(level)
0.0
1500

Adopted Levels

Q(β^-)=-13860 SY; S(n)=15890 SY; S(p)=-790 SY; Q(α)=-5500 SY 2012Wa38.
Estimated uncertainties (syst,2012Wa38): $\Delta Q(\beta^-)$ =500, $\Delta Q(\alpha)$ =360, $\Delta S(n)$ =420, ΔSP =300 (2012Wa38).
S(2n)=35650 500, S(2p)=1670 300, Q(ϵp)=13730 300 (syst, 2012Wa38).
Identification and production by 1993BoZO in Ni(⁵⁸Ni,X) E=69 MeV/nucleon; measured fragment spectra (1992Bo37,1993BoZO).
Others: 2000BlZZ, 2001Gi02, 2001Gi01.

⁴²V Levels

E(level)	T _{1/2}	Comments
0.0?	<55 ns	%p=? T _{1/2} : upper limit estimated from the experimental collection rates of adjoining nuclides (1992Bo37). J π : 2- from syst (2012Au07).

Adopted Levels

S(n)=20340 CA; S(p)=1240 SY; Q(α)=-6850 SY 2012Wa38,1997Mo25.

Estimated uncertainties (syst,2012Wa38): $\Delta S(p)=\Delta Q(\alpha)=500$.

S(n) from 1997Mo25; S(p) and Q(α) from 2012Wa38.

S(2p)=-510 430, Q(ϵp)=14650 400 (syst,2012Wa38). Theoretical S(2n)=38750.

1996Bl21: ^{42}Cr identified from $^9\text{Be}(^{58}\text{Ni},X)$ E=600 MeV/nucleon; measured fragment charge vs mass to charge ratio at GANIL facility.

2001Gi01 (also 2001Gi02,2002Ch28,2000Bl01,1999Bl08): Ni($^{58}\text{Ni},X$) at 74 MeV/nucleon at GANIL facility. Measured cross section, half-life and particle spectra.

2007Do17: fragmentation reaction used to produce ^{42}Cr isotope at SISSE/LISE3 facility in GANIL. Primary beam: $^{58}\text{Ni}^{26+}$ at 74.5 MeV/nucleon; target=natural Ni. Fragment separator=ALPHA-LISE3. Fragment identification by energy loss, residual energy and time-of-flight measurements using two micro-channel plate (MCP) detectors and Si detectors. Double-sided silicon-strip detectors (DSSSD) and a thick Si(Li) detector were used to detect implanted events, charged particles and β particles. The γ rays were detected by four Ge detectors. Coincidences measured between charged particles and γ rays.

^{42}Cr is a possible candidate for 2p decay. Theoretical calculations of this decay mode: 2003Gr24, 2001Gr29, 1996Na03, 1991Br06, 1988Go21, 1988Go24.

 ^{42}Cr Levels

E(level)	J π	T $_{1/2}$	Comments
0.0	0+	13.3 ms 10	<p>$\% \epsilon + \% \beta^+ = 100$; $\% \epsilon p = 94.4$ 50 (2007Do17).</p> <p>T$_{1/2}$: measured by time correlation of implantation events due to ^{42}Cr and subsequent emission of protons and γ rays (2007Do17). Previous result from the same group: 13.4 ms $^{36-24}$ (2001Gi01).</p> <p>Total proton branching ratio is from time spectrum of events with energy >900 keV in the charged-particle spectrum. Possible small contributions from delayed-α and delayed-2p decays were ignored.</p> <p>No evidence was found for 2p decay (2001Gi01) where a 1.9 MeV peak in the charged-particle spectrum was ascribed to delayed proton decay.</p> <p>^{42}Cr decays by $\beta^+ + \epsilon$ to ^{42}V whose g.s. is unbound towards proton emission, thus each β decay is followed by a proton decay to ^{41}Ti.</p>

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