^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 199,1 (2025)	30-Sep-2024

1973Ca20: E_α=7.00-10.00 MeV alpha beams were produced at the Oliver Lodge Laboratory of the University of Liverpool. Targets were 115 μg/cm^2 ^{30}Si element and also 700 μg/cm^2 SiO_2 (both 95% ^{30}Si). γ rays were detected with a Ge(Li)-NaI(Tl) escape-suppressed and pair-escape spectrometer. Measured Eγ, $\gamma(\theta)$, Doppler-shift attenuation. Deduced levels, $T_{1/2}$, J, π, γ-ray branching ratios, multipolarities, mixing ratios, transition strengths. Comparisons with shell-model calculations. Report levels up to 5282. An additional uncertainty of 25% due to stopping power is assumed in 1973Ca20 and has been added in quadrature with original uncertainty by the evaluators.

1975Bu15: E_α=6.7, 8.0 and 9.8 MeV alpha beams were produced at the Oliver Lodge Laboratory of the University of Liverpool. Targets were 1 mg/cm^2 ^{30}Si layer (>95% ^{30}Si) on Au backings. γ rays were detected with a Ge(Li)-NaI(Tl) escape-suppressed spectrometer and a three-Ge(Li) Compton polarimeter. Measured Eγ, Iγ, $\gamma(\theta)$, γ(lin pol). Deduced levels, J, π, γ-ray branching ratios, multipolarities, mixing ratios. Comparisons with shell-model calculations. Report levels up to 4866. See also 1973Bu10 for details for the polarimeter and 1973Bu05 for $\gamma(\theta$,pol) data for transitions from 2868, 4050, 4096 and 4868 levels with E_α=7.7 and 9.8 MeV.

1972Hi06: E_α=6.0-9.5 MeV alpha beams of 100-200 nA were produced from the Stanford tandem Van de Graaff accelerator. Target was a 200 μg/cm^2 SiO_2 film (95% ^{30}S) on gold backings. γ rays were detected with a 55 cm^3 Ge(Li) detector. Measured Eγ, Iγ, $\gamma(\theta)$. Deduced levels, J, π, γ-ray branching ratios, multipolarities, mixing ratios, transitions strengths. Report levels up to 4210.

Others:

1969Br28: E_α=5.50-7.76 MeV alpha beams were produced from the 5.5 MeV Van de Graaff accelerator of the Laboratori Nazionali di Legnaro, Italy. Target was a 500 μg/cm^2 SiO_2 (93.4% ^{30}S) on thick carbon backings. γ rays were detected with a 30 cm^3 Ge(Li) detector, FWHM=4.5 keV at Eγ=1.8 MeV. Measured Eγ, Doppler-shift attenuation. Deduced $T_{1/2}$ for 840, 1970, 2310, 2870, 2940 and 2970 levels. An uncertainty of 20% due to stopping power is assumed and included. See also 1969Br20 using the Doppler-shift attenuation method with E_α=8.6-9.0 MeV and 1971Br23 using the recoil-distance method with E_α=7.7 MeV at the same lab for $T_{1/2}$ of 2940 level.

1969Ra29: E_α=5.5-9.0 MeV alpha beams were produced from the Triangle Universities Nuclear Laboratory FN tandem Van de Graaff accelerator. Target was 15-150 μg/cm^2 SiO_2 (95% ^{30}S) onto 1.5 μm Ni backings. γ rays were detected with a 20 cc Ge(Li) detector, FWHM=4.5 keV at Eγ=1.33 MeV. Measured Eγ, Iγ, Doppler-shift attenuation. Deduced levels, $T_{1/2}$, γ-ray branching ratios for 842, 1968, 2313, 2869, 2937, 2970 and 3221 levels. An uncertainty of 20% due to stopping power is assumed and included. See also 1970Ra24 by the same authors for $T_{1/2}$ of 2937 level using the Recoil-distance method at E_α=8.1 and 8.7 MeV.

1970Cu05: E_α=7.52 MeV alpha beam of 40 nA was produced from the Universities of Arizona 6 MV Van de Graaff accelerator. Target was 300 μg/cm^2 SiO_2 (95% ^{30}S) on a tantalum backing. Neutrons were detected with a neutron detector and γ rays were detected with two 3-in by 3-in NaI(Tl) detectors. Measured Eγ, Iγ, n$\gamma(\theta)$. Deduced mixing ratios for 1970γ and 1470γ.

1970Ka08: E_α=6.5-7.5 MeV alpha beams were produced from the 5 MV Van de Graaff accelerator of the CRN of Strasbourg. Target was a 20 μg/cm^2 Silicon film (89% ^{30}S) on thick gold and copper backings. γ rays were detected with a 22 cm^3 Ge(Li) detector, FWHM=3.5 keV. Measured Eγ, Iγ, Doppler-shift attenuation. Deduced levels, $T_{1/2}$, γ-ray branching ratios for 842, 1968, 2313, 2869 and 2937 levels. Uncertainty from stopping power is assumed to be 10% and included.

1972To04: E_α=6.30-7.56 MeV alpha beams were produced from the 5 MV Van de Graaff accelerator of the CRN of Strasbourg. Target was a 300 μg/cm^2 Silicon film (89% ^{30}S) on a gold backing. γ rays were detected with a 55 cm^3 Ge(Li) detector, FWHM=3.5 keV at Eγ=1.332 MeV. Measured Eγ, $\gamma(\theta)$. Deduced levels, mixing ratios for transitions from 1970, 2310, 2870 and 2940 levels.

1977St02: E_α=7.5 and 10.2 MeV alpha beams were produced from the Utrecht 6-MV Tandem Van de Graaff accelerator. Target was 200 μg/cm^2 95% enriched $^{30}SiO_2$. γ rays were detected with five cylindrical NaI(Tl) scintillation crystals and two large Ge(Li) detectors; neutrons were detected with a NE213 liquid scintillator. Measured Eγ, Iγ, E_n, nγ-coin, n$\gamma(\theta)$, $\gamma\gamma$-coin. Deduced levels, γ-ray branching ratios, multipolarities, mixing ratios. Comparisons with available data.

1997He11: E_α=5.6-10 MeV from 88-inch cyclotron at LBNL. Measured γ-ray yields.

^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

^{33}S Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[@]	Comments
0.0	3/2$^+$[#]		
840.95 *9*	1/2$^+$[#]	1.18 ps *23*	E(level): others: 841.1 *3* (1973Ca20), 840.3 *3* (1972Hi06). T$_{1/2}$: from τ=1.70 ps *33*, weighted average of 1.66 ps *34* (1969Ra29), 1.81 ps *36* and 1.65 ps *33* (1969Br28, different stopping materials), 1.70 ps *45* (1973Ca20). Other: 1.8 ps<τ<5.4 ps (1970Ka08).
1966.42 *7*	5/2$^+$	102 fs *17*	E(level): others: 1968.0 *6* (1973Ca20), 1966.5 *3* (1972Hi06). J$^\pi$: spin=5/2 from $\gamma(\theta)$ in 1977St02; 1966γ M1+E2 to 3/2$^+$. T$_{1/2}$: from τ=147 fs *24*, unweighted average of 125 fs *37* (1969Br28), 182 fs *22* (1969Ra29), 90 fs *20* (1970Ka08), and 189 fs *50* (1973Ca20).
2312.64 *8*	3/2$^+$	117 fs *17*	E(level): others: 2313.7 *5* (1973Ca20), 2312.6 *4* (1972Hi06). J$^\pi$: from $\gamma(\theta$,pol) in 1975Bu15. T$_{1/2}$: from τ=169 fs *25*, weighted average of 178 fs *53* (1969Br28), 183 fs *25* (1969Ra29), 145 fs *25* (1970Ka08), and 198 fs *50* (1973Ca20).
2866.53 *10*	5/2$^+$	23 fs *9*	E(level): others: 2868.2 *3* (1973Ca20), 2866.2 *4* (1972Hi06). J$^\pi$: from $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. T$_{1/2}$: from τ=33 fs *13*, weighted average of 33 fs *13* (1969Br28) and 34 fs *14* (1973Ca20). Others: τ<15 fs (1970Ka08), <15 fs (1969Ra29).
2933.86 *7*	7/2$^-$	28.3 ps *14*	E(level): others: 2935.0 *5* (1973Ca20), 2934.3 *5* (1972Hi06), 2934.5 *15* (1969Br20). J$^\pi$: from $\gamma(\theta)$ in 1973Ca20 and $\gamma(\theta$,pol) in 1975Bu15. T$_{1/2}$: from τ=40.9 ps *20*, weighted average of 38 ps *11* (1969Br20), 36 ps *8* (1970Ka08), 40.5 ps *20* (1970Ra24, RDM), 44 ps *4* (1971Br23, RDM). Others: τ>5.5 ps (1973Ca20), >10 ps (1969Br28), >4 ps (1969Ra29).
2968.73 *8*	7/2$^+$	59 fs *8*	E(level): others: 2971.0 *5* (1973Ca20), 2968.7 *4* (1972Hi06). J$^\pi$: from $\gamma(\theta)$ in 1972Hi06 and 1973Ca20 and $\gamma(\theta$,pol) in 1975Bu15. T$_{1/2}$: from τ=85 fs *12*, weighted average of 90 fs *31* (1969Br28), 82 fs *12* (1969Ra29), 94 fs *24* (1973Ca20).
3220.06 *8*	3/2$^-$[#]	33 fs *13*	E(level): others: 3221.0 *5* (1973Ca20), 3219.0 *10* (1972Hi06). T$_{1/2}$: from τ=48 fs *18* (1973Ca20). Other: τ<65 fs (1969Ra29).
3831.84 *20*	5/2$^+$	30 fs *8*	E(level): others: 3833.0 *10* (1973Ca20), 3830 *2* (1972Hi06). J$^\pi$: spin=5/2 from n$\gamma(\theta)$ and $\gamma\gamma(\theta)$ in 1977St02; (3/2,5/2,7/2) from $\gamma(\theta)$ in 1973Ca20; 3/2,5/2 from $\gamma(\theta)$ in 1972Hi06; 3832γ M1+E2 to 3/2$^+$. T$_{1/2}$: from τ=44 fs *12* (1973Ca20).
3934.87 *20*	3/2$^+$	24 fs *7*	E(level): others: 3935.0 *5* (1973Ca20), 3934 *3* (1972Hi06). J$^\pi$: spin=3/2 from $\gamma(\theta)$ in 1975Bu15; (1/2,3/2,5/2) from $\gamma(\theta)$ in 1973Ca20; 3935γ M1+E2 to 3/2$^+$. T$_{1/2}$: from τ=35 fs *10* (1973Ca20).
4047.97 *9*	9/2$^+$	211 fs *53*	E(level): others: 4049.8 *5* (1973Ca20), 4047.6 *10* (1972Hi06). J$^\pi$: from $\gamma\gamma(\theta)$ in 1977St02 and $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. Other: 5/2,9/2 from $\gamma(\theta)$ in 1972Hi06 and 1973Ca20. T$_{1/2}$: from τ=305 fs *77* (1973Ca20).
4055.0 *5*	1/2$^+$[#]	12 fs *8*	Additional information 1. E(level): from 1973Ca20. Other: 4053 *3* (1972Hi06). J$^\pi$: 1972Hi06 states their $\gamma(\theta)$ is compatible with J=1/2,3/2. T$_{1/2}$: from τ=18 fs *12* (1973Ca20).
4094.48 *20*	7/2$^+$	31 fs *8*	E(level): others: 4096.0 *5* (1973Ca20), 4093.8 *10* (1972Hi06). J$^\pi$: from $\gamma\gamma(\theta)$ in 1977St02 and $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. T$_{1/2}$: from τ=45 fs *12* (1973Ca20).
4143.98 *30*	3/2,5/2	24 fs *7*	E(level): others: 4145.0 *5* (1973Ca20), 4142 *3* (1972Hi06). J$^\pi$: spin=3/2,5/2 from $\gamma(\theta)$ in 1972Hi06 and 1973Ca20; 1/2,3/2,5/2 from $\gamma\gamma(\theta)$ in 1977St02. T$_{1/2}$: from τ=34 fs *10* (1973Ca20).
4210.63 *22*	3/2$^-$[#]	32 fs *9*	E(level): others: 4212 *1* (1973Ca20), 4210 *3* (1972Hi06). T$_{1/2}$: from τ=46 fs *12* (1973Ca20).
4375.21 *30*	3/2,5/2	24 fs *10*	E(level): other: 4376 *1* (1973Ca20).

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

^{33}S Levels (continued)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[@]	Comments
			J$^\pi$: spin=3/2,5/2 from $\gamma(\theta)$ in 1975Bu15; the authors note that their $\gamma(\theta)$ data is not in agreement with L(p,d)=0 for the same level in (p,d), which gives $J^\pi=1/2^+$. T$_{1/2}$: from τ=34 fs *15* (1973Ca20).
4424.76 *22*	1/2,3/2	19 fs *10*	E(level): other: 4425 *2* (1973Ca20). J$^\pi$: spin=1/2,3/2 from $\gamma(\theta)$ in 1975Bu15. T$_{1/2}$: from τ=27 fs *14* (1973Ca20).
4729.54 *9*	9/2$^-$	57 fs *15*	E(level): other: 4732 *1* (1973Ca20). J$^\pi$: 5/2$^-$,9/2$^-$ from $\gamma(\theta$,pol) in 1975Bu15; 5/2$^-$ is ruled out since the corresponding δ(M2/E1)(1761γ)>+5.6 from 1975Bu15 is ruled out by RUL. T$_{1/2}$: from τ=82 fs *21* (1973Ca20).
4748 *1*		<7 fs	Additional information 2. E(level): from 1973Ca20. T$_{1/2}$: from τ<10 fs (1973Ca20).
4865.82 *21*	11/2$^-$	250 fs *63*	E(level): other: 4868 *1* (1973Ca20). J$^\pi$: from $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. Others: 7/2,11/2 from $\gamma(\theta)$ in 1973Ca20; 5/2,7/2,11/2 from $\gamma(\theta)$ in 1977St02. T$_{1/2}$: from τ=360 fs *90* (1973Ca20).
4918 *2*		90 fs *30*	Additional information 3. E(level): from 1973Ca20. T$_{1/2}$: from τ=130 fs *44* (1973Ca20).
4941 *2*		27 fs *11*	Additional information 4. E(level): from 1973Ca20. T$_{1/2}$: from τ=39 fs *16* (1973Ca20).
5209 *2*		<14 fs	Additional information 5. E(level): from 1973Ca20. T$_{1/2}$: from τ<20 fs (1973Ca20).
5282 *2*		21 fs *8*	Additional information 6. E(level): from 1973Ca20. T$_{1/2}$: from τ=31 fs *11* (1973Ca20).

[†] From a least-squares fit to γ-ray energies with uncertainties for levels connected with those transitions, unless otherwise noted. Values quoted from 1973Ca20 and 1972Hi06 are deduced by the authors from their measured γ-ray energies, but such Eγ values with uncertainties are not explicitly listed by the authors.

[‡] From $\gamma(\theta)$, $\gamma\gamma(\theta)$ and $\gamma(\theta$,pol) in references as noted under comments where available, unless otherwise noted.

[#] From the Adopted Levels. Those assignments are used as known assignments in all studies in this dataset.

[@] From DSAM in 1973Ca20, unless otherwise noted. An additional uncertainty of 25% due to stopping power as assumed in 1973Ca20 and has been added in quadrature with original uncertainty by the evaluators. For values from DSAM reported in other papers, uncertainties due to stopping power are already included.

$\gamma(^{33}S)$

Transitions with Iγ values given as upper limits are considered questionable by the evaluators, since they are not observed in measured γ spectra and the limits of their intensities are simply from authors' estimate. Those transitions are not considered in Adopted Gammas.

B(EL)(W.u.) and B(M+L)(W.u.) are from authors' values.

E$_i$(level)	J$_i^\pi$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^\pi$	Comments
840.95	1/2$^+$	840.1 *3*	100	0.0	3/2$^+$	Mult.,δ: 1969Ra29 report δ(E2/M1)=0.18 deduced their measured T$_{1/2}$ and measured B(E2)↑ by 1960Le07 in Coulomb excitation. B(M1)(W.u.)=3.1×10^{-2}; B(E2)(W.u.)=6.0 (1969Ra29). B(M1)(W.u.)=1.4×10^{-2} (1970Ka08).

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								B(M1)(W.u.)=3.1×10^{-2} *5*; B(E2)(W.u.)=5.8 *11* (1972Hi06).
								B(M1)(W.u.)=0.026 *4*; B(E2)(W.u.)=5.9 *16* (1975Bu15).
1966.42	5/2$^+$	1125.4 *2*	7 *1*	840.95	1/2$^+$	[E2]		I_γ: others: <1.5 (1969Ra29), <5 (1972Hi06), <0.9 (1977St02). Note that this branching ratio 7% *1* is largely greater than those measured in other studies of different reactions. See more comments in Adopted Gammas.
								B(E2)(W.u.)<2.6 (1972Hi06).
		1966.3 *1*	93 *1*	0.0	3/2$^+$	M1+E2	−0.55 *3*	A_2=−0.91 *14*; A_4=+0.15 *19* (1970Cu05)
								A_2=−1.05 *6*; A_4=+0.12 *3* (1972To04)
								A_2=−0.860 *5*; A_4=+0.066 *6*; pol=+0.07 *3* (1975Bu15)
								A_2=−1.12 *2*; A_4=+0.12 *3* (1977St02)
								I_γ: others: 100 (1969Ra29, 1970Ka08, 1972Hi06, 1973Ca20).
								Mult.: D+Q from $\gamma(\theta)$ in 1969Ra29, 1970Ka08, 1972Hi06, 1973Ca20 and 1975Bu15; E1+M2 ruled out by RUL.
								δ: weighted average of −0.36 *+17−12* (1970Cu05), −0.56 *18* (1972To04), −0.67 *13* (1972Hi06), and −0.55 *3* (1977St02). Other: −0.93 *3* in 1975Bu15 is discrepant.
								B(M1)(W.u.)=1.4×10^{-2}; B(E2)(W.u.)=9.3 (1969Ra29).
								B(M1)(W.u.)=2.9×10^{-2}; E2=18 (1970Ka08).
								B(M1)(W.u.)=2.3×10^{-2} *5*; B(E2)(W.u.)=8.0 *35* (1972Hi06).
								B(M1)(W.u.)=0.0098 *13*; B(E2)(W.u.)=10.0 *13* (1975Bu15).
2312.64	3/2$^+$	346.22[@]	<4	1966.42	5/2$^+$	[M1]		I_γ: other: <6 (1969Ra29).
								B(M1)(W.u.)<0.14 (1972Hi06).
		1471.6 *1*	69 *2*	840.95	1/2$^+$	M1+E2	−0.32 *4*	A_2=−0.63 *10* (1970Cu05); A_2=−0.61 *4* (1972To04); A_2=−0.93 *3* (1977St02)
								A_2=−0.48 *2*; A_4=−0.03 *3*; pol=−0.14 *2* (1975Bu15)
								I_γ: weighted average of 66 *5* (1969Ra29), 70 *3* (1972To04), 72 *2* (1972Hi06), 70 *4* (1973Ca20), and 65 *2* (1977St02).
								Mult.: from $\gamma(\theta$,pol) in 1975Bu15.
								δ: while $\gamma(\theta)$ of 1472γ in other work cannot yield a unique δ, parallel fitting of $\gamma(\theta)$ and γ(lin pol) of 1472γ and 2313γ in 1975Bu15 yield a unique δ=−0.34 *3* for 1472γ (excluding the higher values reported in other work) and δ=−28 *+16−80* for 2313γ. Others: −0.11 *+11−8* or −1.34 *26* (1970Cu05), −0.12 *12* or −1.3 *3* (1972To04), −0.37 *5* or −0.83 *7* (1977St02), −1.4<δ<−0.10 (1972Hi06). The weighted average of all lower-values is −0.32 *4* and is adopted by the evaluators.
								B(M1)(W.u.)=2.9×10^{-2}; B(E2)(W.u.)=11.9 (1969Ra29).
								B(M1)(W.u.)=3.0×10^{-2} *15*; B(E2)(W.u.)<60 (1972Hi06).

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								The weighted average of all lower-values is −0.32 *4* and is adopted by the evaluators. B(M1)(W.u.)=2.9×10^{-2}; B(E2)(W.u.)=11.9 (1969Ra29). B(M1)(W.u.)=3.0×10^{-2} *15*; B(E2)(W.u.)<60 (1972Hi06). B(M1)(W.u.)=0.035 *10*; B(E2)(W.u.)<3.6 or. B(M1)(W.u.)=0.013 *5*; B(E2)(W.u.)=42 *14* (1973Ca20). B(M1)(W.u.)=0.031 *+11−7*; B(E2)(W.u.)=7 *+4−2* (1975Bu15).
2312.64	3/2$^+$	2312.6 *1*	31 *2*	0.0	3/2$^+$	M1+E2	−28 *+16−80*	A_2=−0.55 *29* (1970Cu05); A_2=−0.02 *3* (1972To04); A_2=+0.04 *6* (1977St02) A_2=−0.023 *14*; A_4=+0.002 *15*; pol=+0.01 *6* (1975Bu15) I_γ: weighted average of 34 *5* (1969Ra29), 30 *3* (1972To04), 28 *2* (1972Hi06), 30 *4* (1973Ca20), and 35 *2* (1977St02). Mult.: D+Q from $\gamma(\theta)$ in 1969Ra29, 1972Hi06, 1973Ca20 and 1975Bu15; E1+M2 ruled out by RUL. δ: values of −28 *+16−80* (1975Bu15), −0.27 *7* or <−12 or >+20 (1972Hi06), and −0.28 *8* or <−11.4 (1972To04) combined would agree with δ from 1975Bu15. Other: −5.5<δ<−0.45 (1970Cu05) is in disagreement with all values from other work above. See also comments for δ(1472γ). B(M1)(W.u.)=4.9×10^{-3}; B(E2)(W.u.)=3.7 (1969Ra29). B(M1)(W.u.)=6.2×10^{-3} (1970Ka08). B(M1)(W.u.)=4.2×10^{-3} *8*; B(E2)(W.u.)=0.23 *13* or B(M1)(W.u.)<3×10^{-5}; B(E2)(W.u.)=3.4 *6* (1972Hi06). B(M1)(W.u.)=0.0036 *10*; B(E2)(W.u.)=0.2 *1* or. B(M1)(W.u.)<0.03; B(E2)(W.u.)=3 *1* (1973Ca20). B(M1)(W.u.)=3×10^{-6} *+7−2*; B(E2)(W.u.)=2.9 *+10−6* (1975Bu15).
2866.53	5/2$^+$	553.89[@]	<5	2312.64	3/2$^+$	[M1,E2]		I_γ: others: <4 (1969Ra29), <2 (1977St02).
		900.10[@]	<10	1966.42	5/2$^+$	[M1,E2]		I_γ: others: <3 (1969Ra29), <5 (1977St02). B(M1)(W.u.)<7.8×10^{-2} (1972Hi06).
		2025.51[@]	<6	840.95	1/2$^+$	[E2]		I_γ: others: <3 (1969Ra29), <12 (1977St02). B(M1)(W.u.)<7.8×10^{-2} (1972Hi06). B(E2)(W.u.)<6.8 (1972Hi06).
		2866.4 *1*	100	0.0	3/2$^+$	M1+E2	+0.116 *9*	A_2=−0.12 *5*; A_4=0.00 *6* (1972To04); A_2=−0.19 *5*; A_4=+0.02 *5* (1973Ca20) A_2=−0.09 *1*; A_4=0.00 *1* (1973Bu05); A_2=+0.02 *9* (1977St02) A_2=−0.127 *9*; A_4=+0.006 *11*; pol=−0.44 *4* (1975Bu15) pol=−0.65 *17* (1973Bu05) I_γ: from 1972Hi06, 1973Ca20, 1977St02. Mult.: from $\gamma(\theta$,pol) (1973Bu05, 1975Bu15). δ: weighted average of +0.21 *8* (1977St02), +0.114 *9* (1975Bu15), +0.09 *4* (1973Ca20), +0.17 *5* (1972To04), +0.09 *+4−23*

^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								(1972Hi06). Others: −0.14 *2* (1973Bu05) with sign in disagreement, but it is likely superseded by 1975Bu15 of the same authors; the higher values of −6.4 *17* (1972To04) and −4.6 *8* (1972Hi06) also for J=5/2 are

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								excluded based on comparisons with the unique values from 1977St02, 1975Bu15, and 1973Ca20. Additional information 7. B(M1)(W.u.)>0.1 (1970Ka08). B(M1)(W.u.)=8×10^{-2} *7*; B(E2)(W.u.)<0.8 or B(M1)(W.u.)=0.4 *3*; B(E2)(W.u.)=39 *32* (1972Hi06). B(M1)(W.u.)=0.039 *16*; B(E2)(W.u.)=0.16 *15* for J=5/2; B(M1)(W.u.)=0.033 *13*; B(E2)(W.u.)=3.6 *22* or. B(M1)(W.u.)<0.011; B(E2)(W.u.)=19 *6* for J=3/2 (1973Ca20). B(M1)(W.u.)=0.039 *+30−11*; B(E2)(W.u.)=0.27 *+30−14* (1975Bu15). B(M1)(W.u.)=0.039 *+16−12*; B(E2)(W.u.)=0.4 *+4−2* for J=5/2 (1973Bu05).
2933.86	7/2$^-$	621.21[@] 967.4 *1*	<2 58 *3*	2312.64 1966.42	3/2$^+$ 5/2$^+$	[M2] E1(+M2)	−0.012 *19*	I_γ: also from 1977St02, 1969Ra29. A_2=−0.41 *3*; A_4=+0.01 *3* (1973Ca20); A_2=−0.349 *7*; A_4=+0.011 *7* (1973Bu10) A_2=−0.313 *6*; A_4=−0.021 *7*; pol=+0.43 *3* (1975Bu15) A_2=+0.08 *7*; A_4=+0.25 *11* (1977St02) I_γ: unweighted average of 61 *2* (1972Hi06), 52 *2* (1977St02), and 61 *5* (1973Ca20). Mult.: from $\gamma(\theta$,pol) in 1975Bu15. δ: weighted average of −0.03 *7* (1973Ca20), −0.002 *12* (1975Bu15), −0.01 *+3−16* (1972Hi06), and −0.12 *4* (1977St02). B(E1)(W.u.)=1.5×10^{-5} (1970Ka08). B(E1)(W.u.)=1.4×10^{-5} *2*; B(M2)(W.u.)<0.07 (1973Ca20).
		2092.84[@] 2933.7 *1*	<2 42 *3*	840.95 0.0	1/2$^+$ 3/2$^+$	[E3] M2+E3	−0.15 *2*	I_γ: others: <2 (1969Ra29), <6 (1977St02). A_2=+0.43 *6*; A_4=−0.46 *9* (1972To04); A_2=+0.30 *5*; A_4=−0.56 *6* (1973Ca20) A_2=+0.318 *11*; A_4=−0.416 *12*; pol=−0.70 *14* (1975Bu15) A_2=+0.44 *14*; A_4=−0.8 *2* (1977St02) I_γ: unweighted average of 39 *2* (1972Hi06), 39 *5* (1973Ca20), and 48 *2* (1977St02). Mult.: from $\gamma(\theta$,pol) in 1975Bu15. δ: weighted average of −0.07 *7* (1972To04), −0.15 *4* (1972Hi06), −0.18 *12* (1973Ca20), and −0.15 *2* (1975Bu15). Others: the higher value of −5.3 *18* also for J=7/2 from 1972To04 is excluded. 1×10^{-3}<B(M2)(W.u.)<2.5; 0.7<B(E3)(W.u.)<2E3 (1969Ra29). B(M2)(W.u.)=0.019 *2* (1973Ca20).
2968.73	7/2$^+$	656.08[@] 1002.3 *2*	<2 9 *2*	2312.64 1966.42	3/2$^+$ 5/2$^+$	[E2] M1(+E2)	−0.005 *16*	I_γ: others: <2 (1969Ra29), <1 (1977St02). A_2=−0.30 *9*; A_4=+0.16 *11* (1973Ca20); A_2=−0.30 *10* (1977St02) A_2=−0.31 *3*; A_4=−0.04 *3*; pol=−0.32 *12* (1975Bu15)

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								I_γ: weighted average of 10 *5* (1969Ra29), 10 *2* (1972Hi06), 10 *2* (1973Ca20), and 7 *2* (1977St02). Mult.: from $\gamma(\theta)$ in 1972Hi06 and 1973Ca20 and $\gamma(\theta$,pol) in 1975Bu15. δ: weighted average of −0.04 *8* (1972Hi06), −0.04 *21* (1973Ca20), and −0.003 *16* (1975Bu15). Other: +0.03 *5* (1977St02) with sign in disagreement. B(M1)(W.u.)=3.7×10^{-2} *11*; B(E2)(W.u.)<3.5 (1972Hi06). B(M1)(W.u.)=0.034 *11*; B(E2)(W.u.)<5.7 (1973Ca20).
2968.73	7/2$^+$	2127.71[@]	<15	840.95	1/2$^+$	[M3]		I_γ: others: <3 (1969Ra29), <2 (1977St02).
		2968.6 *1*	91 *2*	0.0	3/2$^+$	E2(+M3)	−0.009 *10*	A_2=+0.27 *12*; A_4=−0.34 *14* (1972To04); A_2=+0.39 *3*; A_4=−0.24 *3* (1973Ca20) A_2=+0.46 *1*; A_4=−0.29 *1* (1973Bu10); A_2=+0.53 *4*; A_4=−0.44 *6* (1977St02) A_2=+0.444 *8*; A_4=−0.296 *9*; pol=+0.88 *10* (1975Bu15) I_γ: weighted average of 90 *5* (1969Ra29), 90 *2* (1972Hi06), 90 *2* (1973Ca20), and 93 *2* (1977St02). Mult.: from $\gamma(\theta)$ in 1972Hi06, 1973Ca20, and $\gamma(\theta$,pol) in 1975Bu15. δ: weighted average of −0.00 *3* (1972Hi06), −0.00 *7* (1973Ca20), and −0.010 *10* (1975Bu15). B(E2)(W.u.)=5.9 *14* (1972Hi06). B(E2)(W.u.)=5.4 *14* (1973Ca20). B(E2)(W.u.)=5.4 *+18−11* (1975Bu15).
3220.06	3/2$^-$	251.33[@]	<3	2968.73	7/2$^+$	[M2]		I_γ: other: <2 (1969Ra29).
		286.20[@]	<2	2933.86	7/2$^-$	[E2]		I_γ: from 1969Ra29.
		353.53[@]	<2	2866.53	5/2$^+$	[E1]		I_γ: other: <7 (1969Ra29).
		907.41[@]	<3	2312.64	3/2$^+$	[E1]		I_γ: other: <5 (1969Ra29).
		1253.61[@]	<2	1966.42	5/2$^+$	[E1]		I_γ: also from 1969Ra29.
		2379.0 *1*	63 *2*	840.95	1/2$^+$	E1(+M2)	+0.02 *+36−9*	A_2=−0.30 *3*; A_4=−0.03 *3*; pol=+0.5 *2* (1975Bu15) I_γ: weighted average of 62 *5* (1969Ra29), 63 *2* (1972Hi06), and 63 *5* (1973Ca20). Mult.,δ: from $\gamma(\theta$,pol) (1975Bu15). B(M2)(W.u.)>6.5×10^{-4} (1969Ra29).
		3219.9 *1*	37 *2*	0.0	3/2$^+$	(E1(+M2))	−0.00 *9*	A_2=+0.21 *4*; A_4=+0.01 *4*; pol=+0.1 *4* (1975Bu15) I_γ: weighted average of 38 *5* (1969Ra29), 37 *2* (1972Hi06), and 37 *5* (1973Ca20). Mult.,δ: D(+Q) from $\gamma(\theta)$ in 1975Bu15; $\Delta\pi$=yes from level scheme. B(M2)(W.u.)>1.7×10^{-4} (1969Ra29).
3831.84	5/2$^+$	611.77[@]	<9[#]	3220.06	3/2$^-$	[E1]		I_γ: other: <9 (1972Hi06).
		863.10	8[#] *1*	2968.73	7/2$^+$	M1+E2	+0.26 *15*	A_2=−0.3 *2* (1977St02) Mult.,δ: D+Q from n$\gamma(\theta)$ in 1977St02; E1+M2 ruled out by RUL. I_γ: other: 16 *6* (1972Hi06).
		897.97[@]	<3[#]	2933.86	7/2$^-$	[E1]		I_γ: other: <13 (1972Hi06).

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
3831.84	5/2$^+$	1519.16	20[#] *2*	2312.64	3/2$^+$	M1+E2	−0.23 *10*	A_2=−0.94 *2* (1977St02) E_γ: not seen in 1972Hi06. Mult.,δ: D+Q from n$\gamma(\theta)$ in 1977St02; E1+M2 ruled out by RUL.
		1865.36[@]	<4[#]	1966.42	5/2$^+$	[M1,E2]		
		2990.75[@]	<5[#]	840.95	1/2$^+$	[E2]		I_γ: other: <7 (1972Hi06).
		3831.6 *2*	72[#] *2*	0.0	3/2$^+$	M1+E2	+0.41 *6*	A_2=+0.39 *3*; A_4=−0.10 *4* (1973Ca20) A_2=+0.40 *8*; A_4=−0.09 *9* (1973Ca20) A_2=+0.25 *3*; A_4=+0.05 *3*; pol=0.0 *3* (1975Bu15) A_2=+0.68 *10*; A_4=+0.30 *15* (1977St02) I_γ: others: 84 *6* (1972Hi06), 100 (1973Ca20). Mult.: D+Q from $\gamma(\theta)$ in 1973Ca20 and 1975Bu15; E1+M2 ruled out by RUL. δ: $\gamma(\theta)$ in 1973Ca20 give a unique δ=+0.41 *17* for J=5/2, which is consistent with the lower value of +0.38 *4* in 1975Bu15 and +0.62 *10* in 1977St02. The weighted average is +0.41 *6* and is adopted here. Others: −0.13<δ<+8.14 for J=3/2 and −0.03 *11* for J=7/2$^+$ in 1973Ca20; +10 *3* also for J=5/2 and +0.0<δ<+5.7 for J=3/2 in 1975Bu15; +2.5 *8* also for J=5/2 in 1977St02; −0.03≤δ≤4.4 or −3.8≤δ≤+0.56 for J=3/2 and +0.41≤δ≤+6.3 for J=5/2 in 1972Hi06. B(M1)(W.u.)=0.011 *3*; B(E2)(W.u.)=0.5 *4* (J=5/2) or B(M1)(W.u.)=0.013 *4*; B(E2)(W.u.)<0.09 (J=7/2) (1973Ca20).
3934.87	3/2$^+$	714.80[@]	<10	3220.06	3/2$^-$	[E1]		
		1068.32[@]	<10	2866.53	5/2$^+$	[M1,E2]		
		1622.19[@]	<15	2312.64	3/2$^+$	[M1,E2]		
		3093.7 *2*	24 *6*	840.95	1/2$^+$	D+Q		A_2=−0.49 *6*; A_4=+0.09 *7* (1975Bu15) I_γ: weighted average of 30 *10* (1972Hi06) and 22 *6* (1973Ca20). Mult.,δ: −1.7<δ(Q/D)<−0.0 (1975Bu15).
		3935.0 *5*	76 *6*	0.0	3/2$^+$	M1+E2	−0.23 *7*	A_2=0.00 *5*; A_4=+0.05 *7* (1973Ca20) I_γ: weighted average of 70 *10* (1972Hi06) and 78 *6* (1973Ca20). Mult.: D+Q from $\gamma(\theta)$ in 1973Ca20; E1+M2 ruled out by RUL. δ: from 1973Ca20 for J=3/2. Other: +0.21 *9* for J=5/2 (1973Ca20). B(M1)(W.u.)=0.011 *3*; B(E2)(W.u.)<0.4 (J=3/2) or B(M1)(W.u.)=0.011 *3*; B(E2)(W.u.)<0.2 (J=5/2) (1973Ca20).
4047.97	9/2$^+$	216.13[@]	<2	3831.84	5/2$^+$	[E2]		
		827.90[@]	<2	3220.06	3/2$^-$	[E3]		I_γ: other: <6 (1977St02).
		1079.2 *1*	10 *1*	2968.73	7/2$^+$	M1+E2	−0.33 *4*	A_2=−0.92 *4*; A_4=+0.01 *6*; pol=+0.03 *10* (1975Bu15) I_γ: from 1973Ca20. Others: 12 *4* (1972Hi06), 9 *2* (1977St02). Mult.: D+Q from $\gamma(\theta)$ in 1975Bu15; E1+M2

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								ruled out by RUL. δ: weighted average of −0.27 *8* in 1972Hi06 and −0.34 *4* in 1975Bu15 (J^π=9/2$^+$). Others: +0.45<δ<+3.1 (J^π=5/2$^+$) (1972Hi06). B(M1)(W.u.)=0.007 *2*; B(E2)(W.u.)=3.0 *18* (1975Bu15).
4047.97	9/2$^+$	1114.09	3 *1*	2933.86	7/2$^-$	[E1]		I_γ: from 1973Ca20. Others: <2 (1972Hi06), 3 (1975Bu15), <8 (1977St02).
		1181.42[@]	<2	2866.53	5/2$^+$	[E2]		I_γ: other: <8 (1977St02).
		1735.28[@]	<3	2312.64	3/2$^+$	[M3]		I_γ: other: <11 (1977St02).
		2081.5 *1*	87 *1*	1966.42	5/2$^+$	E2+M3	−0.02 *3*	A_2=+0.34 *6*; A_4=−0.29 *6* (1973Ca20) A_2=+0.36 *7*; A_4=−0.41 *8* (1973Ca20) A_2=+0.32 *3*; A_4=−0.22 *3*; pol=+0.78 *13* (1973Bu05,1975Bu15) A_2=−0.52 *7*; A_4=−0.26 *10* (1977St02) I_γ: from 1973Ca20. Others: 88 *4* (1972Hi06), 91 *2* (1977St02). Mult.: from $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. δ: weighted average of −0.00 *4* (1972Hi06), −0.03 *3* (1975Bu15), and −0.08 *9* (1973Ca20). Others: +1.5 *3* (1972Hi06), +2.2 *+9−6* (1973Ca20), +2.2 *8* (1973Bu05), for J=5/2. First set of $\gamma(\theta)$ data for J^π=5/2$^+$, second for 9/2$^+$ (1973Ca20). $\gamma(\theta)$ from 1977St02 is inconsistent with data from other works. B(M1)(W.u.)=0.018 *11*; B(E2)(W.u.)=8 *2* (J=5/2$^+$) or B(E2)(W.u.)=9.5 *24* (J=9/2$^+$) (1973Ca20). B(E2)(W.u.)=9 *2* (1975Bu15). B(E2)(W.u.)=9 *3* (1973Bu05).
		3206.85[@]	<6	840.95	1/2$^+$	[E4]		I_γ: other: <15 (1977St02).
		4047.70[@]	<4	0.0	3/2$^+$	[M3]		
4055.0	1/2$^+$	1086.3[@]	<25	2968.73	7/2$^+$	[M3]		
		1188.5[@]	<25	2866.53	5/2$^+$	[E2]		
		1742.3[@]	<30	2312.64	3/2$^+$	[M1,E2]		
		4054.7	100	0.0	3/2$^+$			A_2=+0.06 *14* (1977St02)
4094.48	7/2$^+$	262.64[@]	<3	3831.84	5/2$^+$	[M1]		
		874.41[@]	<2	3220.06	3/2$^-$	[M2]		I_γ: other: <5 (1977St02).
		1125.73[@]	<30	2968.73	7/2$^+$	[M1,E2]		I_γ: other: <7 (1977St02).
		1160.60[@]	<3	2933.86	7/2$^-$	[E1]		I_γ: other: <7 (1977St02).
		1227.93	7 *2*	2866.53	5/2$^+$	[M1,E2]		I_γ: from 1975Bu15. Others: <20 (1972Hi06), <7 (1977St02).
		1781.79[@]	<30	2312.64	3/2$^+$	[E2]		I_γ: other: <10 (1977St02).
		2127.7 *2*	88 *1*	1966.42	5/2$^+$	M1+E2	+0.20 *3*	A_2=+0.033 *11*; A_4=+0.030 *12*; pol=−0.73 *11* (1973Bu05,1975Bu15) A_2=+0.23 *6* (1977St02) I_γ: from 1975Bu15. Others: 95 *2* (1972Hi06), 91 *1* (1973Ca20), 100 (1977St02). Mult.: from $\gamma(\theta$,pol) in 1973Bu05. δ: weighted average of +0.19 *2* (1973Bu05), +0.19 *7* (1975Bu15), and +0.30 *5* (1977St02) Others:

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								-0.32 *3* for J=5/2, −0.16 *4* or −2.5 *5* for J=3/2 (1973Bu05). B(M1)(W.u.)=0.07 *2*; B(E2)(W.u.)=2.5 *11* (1973Bu05). B(E2)(W.u.)=2.1 *8* (1975Bu15).
4094.48	7/2$^+$	3253.36[@]	<3	840.95	1/2$^+$	[M3]		I_γ: other: <15 (1977St02).
		4096.0 *5*	5 *1*	0.0	3/2$^+$	[E2]		I_γ: from 1975Bu15. Others: 5 *2* (1972Hi06), 9 *1* (1973Ca20).
4143.98	3/2,5/2	312.1[@]	<9	3831.84	5/2$^+$			
		923.91[@]	<8	3220.06	3/2$^-$			I_γ: other: <6 (1977St02).
		1175.23[@]	<9	2968.73	7/2$^+$			I_γ: other: <8 (1977St02).
		1210.10[@]	<9	2933.86	7/2$^-$			I_γ: other: <9 (1977St02).
		1277.42[@]	<10	2866.53	5/2$^+$			I_γ: other: <8 (1977St02).
		1831.29[@]	<11	2312.64	3/2$^+$			I_γ: other: <15 (1977St02).
		2177.48[@]	<9	1966.42	5/2$^+$			I_γ: other: <8 (1977St02).
		3302.85[@]	<8	840.95	1/2$^+$			I_γ: other: <13 (1977St02).
		4143.7 *3*	100	0.0	3/2$^+$	D+Q		A_2=−0.45 *5*; A_4=−0.13 *6* (1973Ca20) A_2=−0.27 *5*; A_4=−0.02 *5* (1973Ca20) A_2=−0.43 *2*; A_4=+0.06 *2* (1975Bu15); A_2=−0.21 *7* (1977St02) δ: for J=5/2: −2.6 *8* or −0.31 *+36−26* (1972Hi06), −2.47 *13* or −0.05 *5* (1975Bu15), +0.05 *8* (1973Ca20); for J=3/2: −0.07<δ<+5.5 or −4.9<δ<−0.48 (1972Hi06), −1.2 *+6−17* (1975Bu15), −0.55 *19* and −4.0 *+15−55* (1973Ca20).
4210.63	3/2$^-$	378.79[@]	<12	3831.84	5/2$^+$	[E1]		
		990.55[@]	<10	3220.06	3/2$^-$	[M1,E2]		
		1241.88[@]	<12	2968.73	7/2$^+$	[M2]		
		1276.74[@]	<12	2933.86	7/2$^-$	[E2]		
		1344.07[@]	<14	2866.53	5/2$^+$	[E1]		
		1897.93[@]	<10	2312.64	3/2$^+$	[E1]		
		3369.5 *2*	100	840.95	1/2$^+$	D+Q	−0.05 *18*	A_2=−0.32 *2*; A_4=+0.03 *2*; pol=+0.3 *3* (1975Bu15) Mult.,δ: from $\gamma(\theta)$ in 1975Bu15.
		4210.34[@]	<6	0.0	3/2$^+$	[E1]		
4375.21	3/2,5/2	4374.9 *3*	100	0.0	3/2$^+$	D+Q		A_2=−0.14 *3*; A_4=+0.04 *4* (1975Bu15) I_γ: from 1973Ca20. δ: −5.1 *10* or +0.12 *3* for J=5/2, −0.04<δ<+7, −0.40 *+8−20* or −7 *+4−7* for J=3/2
4424.76	1/2,3/2	2458.24	44 *6*	1966.42	5/2$^+$			I_γ: from 1973Ca20.
		3583.6 *2*	56 *6*	840.95	1/2$^+$	D+Q		A_2=−0.05 *7*; A_4=+0.03 *7* (1975Bu15) I_γ: from 1973Ca20. δ: −3.3 *6* or +0.23 *5* for J=3/2, −0.00 for J=1/2 (1975Bu15).
		4424.44[@]		0.0	3/2$^+$			E_γ: 1973Ca20 state that this transition was obscured by a contamination γ ray from ^{12}C.
4729.54	9/2$^-$	635.05[@]	<2[#]	4094.48	7/2$^+$	[E1]		
		681.56[@]	<2[#]	4047.97	9/2$^+$	[E1]		
		794.66[@]	<3[#]	3934.87	3/2$^+$	[E3]		

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^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
4729.54	9/2$^-$	897.69[@]	<3[#]	3831.84	5/2$^+$	[M2]		
		1509.44[@]	<4[#]	3220.06	3/2$^-$	[M3]		
		1760.8 *1*	82 *1*	2968.73	7/2$^+$	E1(+M2)	−0.03 *3*	A_2=−0.41 *4*; A_4=−0.06 *4*; pol=+0.49 *10* (1975Bu15); A_2=−0.20 *5* (1977St02) I_γ: from 1975Bu15. Other: 100 (1973Ca20), 82 *2* (1977St02). Mult.: from $\gamma(\theta$,pol) in 1975Bu15. δ: weighted average of −0.02 *3* (1975Bu15) and −0.06 *4* (1977St02) for J=9/2. Other: δ(M2/E1)>+5.6 for J=5/2$^-$ from 1975Bu15 is excluded by RUL.
		1795.6 *1*	18 *1*	2933.86	7/2$^-$	M1+E2	+1.2 *5*	A_2=+0.87 *5*; A_4=+0.07 *8* (1975Bu15); A_2=+0.39 *13*; A_4=+0.4 *2* (1977St02) I_γ: from 1975Bu15. Other: 18 *2* (1977St02). Mult.: D+Q from $\gamma(\theta)$ in 1975Bu15 and 1977St02; E1+M2 ruled out by RUL. δ: weighted average of +1.0 *3* (1975Bu15) and +2.5 *8* (1977St02).
		1862.95[@]	<4[#]	2866.53	5/2$^+$	[M2]		
		2416.81[@]	<5[#]	2312.64	3/2$^+$	[E3]		
		2763.00[@]	<10[#]	1966.42	5/2$^+$	[M2]		
		3888.34[@]	<12[#]	840.95	1/2$^+$	[M4]		
4748		3907	10 *3*	840.95	1/2$^+$			I_γ: from 1973Ca20.
		4748	90 *3*	0.0	3/2$^+$			A_2=+0.68 *11*; A_4=−0.38 *17* (1977St02) I_γ: from 1973Ca20.
4865.82	11/2$^-$	771.33[@]	<3[#]	4094.48	7/2$^+$	[M2]		
		817.84[@]	<3[#]	4047.97	9/2$^+$	[E1]		
		930.94[@]	<4[#]	3934.87	3/2$^+$	[M4]		
		1033.96[@]	<5[#]	3831.84	5/2$^+$	[E3]		
		1645.72[@]	<10[#]	3220.06	3/2$^-$	[E4]		
		1897.03[@]	<8[#]	2968.73	7/2$^+$	[M2]		
		1931.9 *2*	100	2933.86	7/2$^-$	E2(+M3)	−0.010 *10*	A_2=+0.49 *4*; A_4=−0.24 *4* (1973Ca20); A_2=+0.43 *8*; A_4=−0.34 *13* (1977St02) A_2=+0.41 *2*; A_4=−0.27 *2*; pol=+0.56 *15* (1973Bu05,1975Bu15) Mult.: from $\gamma(\theta$,pol) in 1973Bu05 and 1975Bu15. δ: weighted average of −0.00 *7* (1973Ca20) and −0.010 *10* (1975Bu15). Others: 0 for J=11/2 and −1.28 *9* for J=7/2 (1973Bu05); +1.00 *34* for J=7/2 (1973Ca20). I_γ: from 1977St02, 1973Ca20. B(E2)(W.u.)=13.4 *34* (J=11/2), or B(M1)(W.u.)=0.0061 *26*; B(E2)(W.u.)=7 *3* (J=7/2$^-$) (1973Ca20). B(E2)(W.u.)=15 *4* (J^π=11/2$^-$) (1973Bu05).
		1999.23[@]	<7[#]	2866.53	5/2$^+$	[E3]		
		2553.07[@]	<7[#]	2312.64	3/2$^+$	[M4]		
		2899.26[@]	<5[#]	1966.42	5/2$^+$	[E3]		
		4024.61[@]	<5[#]	840.95	1/2$^+$	[E5]		
4918		1698	100	3220.06	3/2$^-$			I_γ: from 1973Ca20.

Continued on next page (footnotes at end of table)

^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Comments
4941		2007	100	2933.86	$7/2^-$	I_γ: from 1973Ca20.
5209		5209	100	0.0	$3/2^+$	I_γ: from 1973Ca20.
5282		5282	100	0.0	$3/2^+$	I_γ: from 1973Ca20.

† Eγ values with uncertainties and their intensity values are from 1975Bu15; Eγ values without uncertainty are from level-energy differences and their intensity values are from 1972Hi06, unless otherwise noted.

‡ From $\gamma(\theta)$, $\gamma\gamma(\theta)$ and $\gamma(\theta$,pol) data as given under comments with electric or magnetic nature determined based on RUL and measured $T_{1/2}$ where available, unless otherwise noted. Assignments in square brackets are assumed ones from level scheme.

From 1977St02.

@ Placement of transition in the level scheme is uncertain.

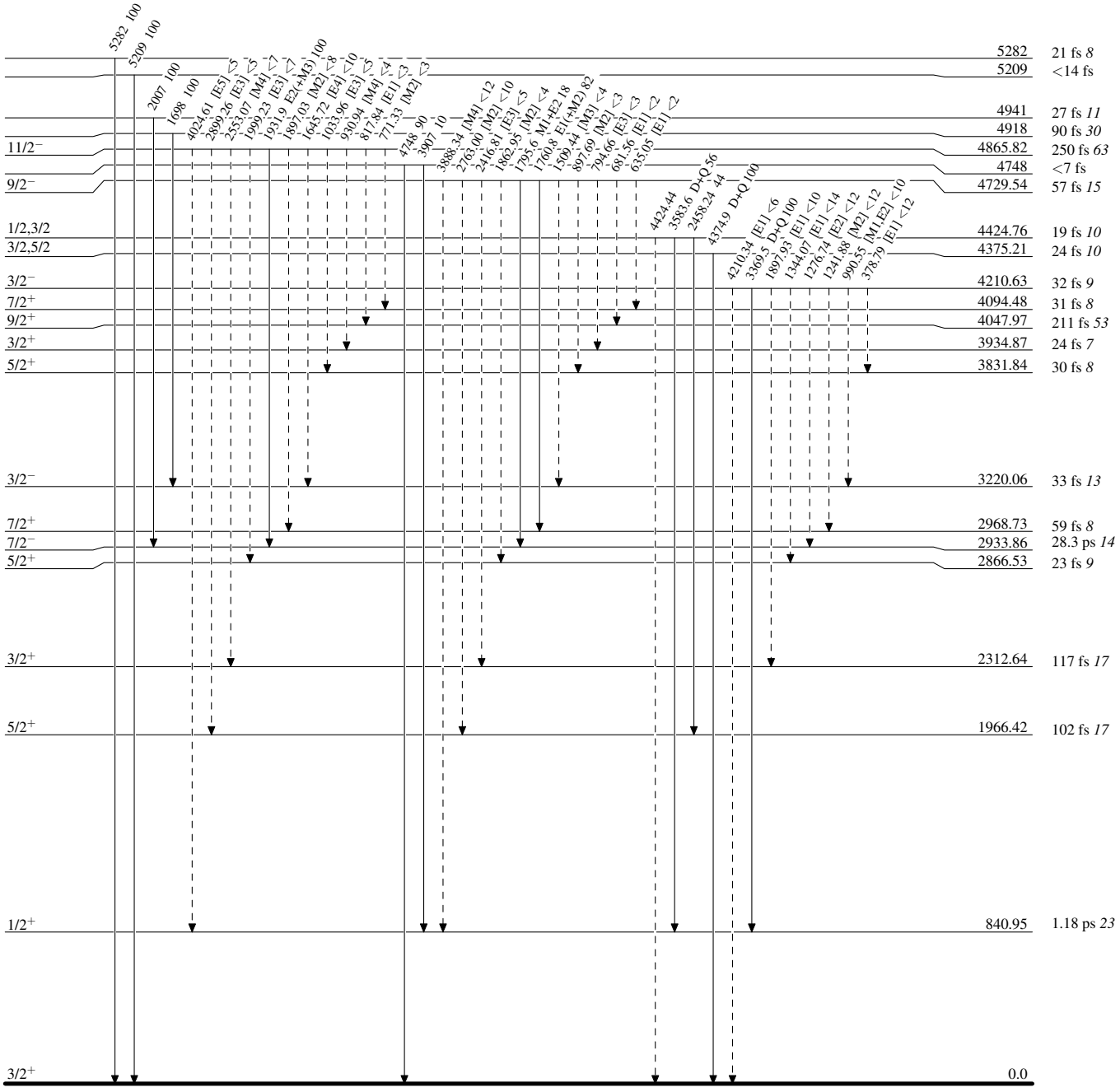
^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06

Legend

Level Scheme

Intensities: % photon branching from each level

γ Decay (Uncertain)



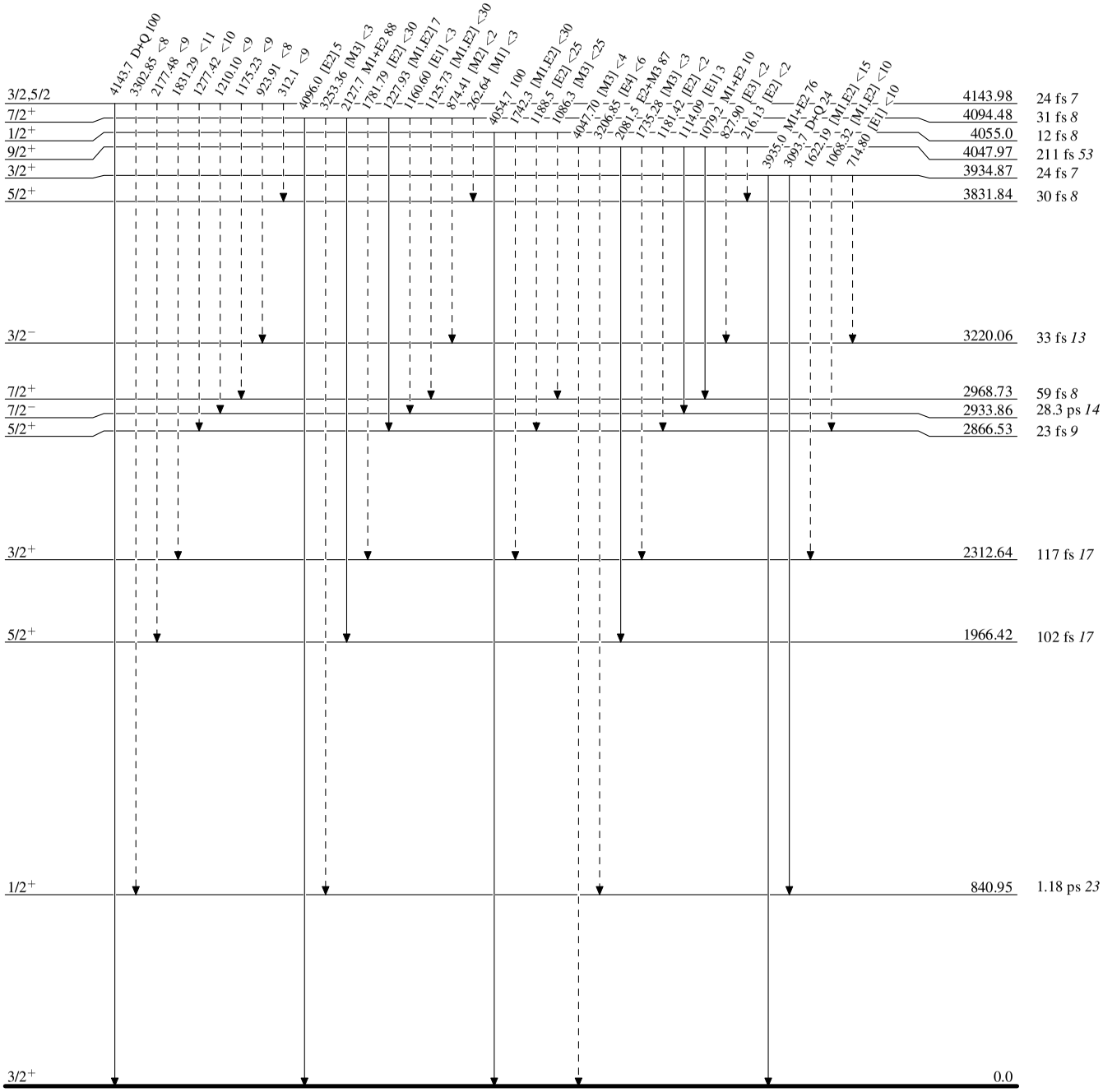
$^{33}_{16}S_{17}$

^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 Legend

Level Scheme (continued)

Intensities: % photon branching from each level

γ Decay (Uncertain)



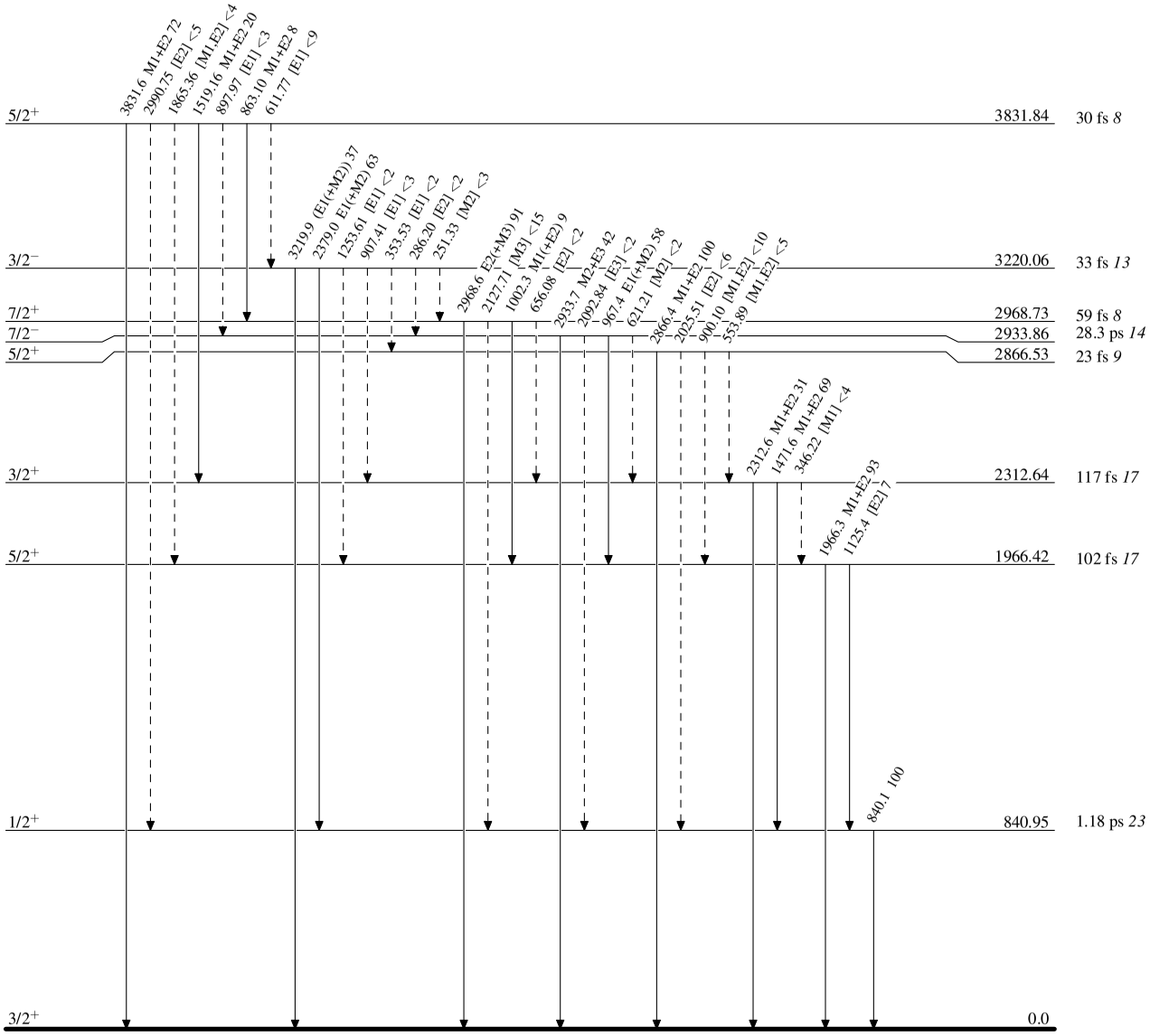
$^{33}_{16}S_{17}$

^{30}Si(α,nγ) 1973Ca20,1975Bu15,1972Hi06 Legend

Level Scheme (continued)

Intensities: % photon branching from each level

γ Decay (Uncertain)



$^{33}_{16}S_{17}$