Coulomb excitation　　1972Sa27,1974An21

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 158, 1 (2019)	16-May-2019

1972Sa27 (also 1972SaYT): (α,α') E=2.6-4.0 MeV alpha beams were produced from the University of Oregon 4-MeV Van de Graaff accelerator. Target was 15 mg/cm^2 isotopically enriched Ge (85.6% in ^{73}Ge). γ rays were detected with a Ge(Li) detector and a NaI(Tl) detector. Measured Eγ, Iγ, γ-ray yields, $\gamma(\theta)$. Deduced levels, J, π, B(E2), mixing ratios. Comparisons with available data and theoretical calculations.

1974An21, 1974An17: $(^{12}C,^{12}C')$ E=30 MeV, (α,α') E=6.8 MeV. Measured Iγ, $\gamma\gamma$-coin. Deduced levels, J, π, γ-ray branching ratios, B(E2).

Others:

1975Th01: reanalyzed data in 1972Sa27; deduced B(E2) for 869 level.

1971Jo15: (α,α') and (p,p') measured precise energy of g.s. transition from the 68.7 level using a Si(Li) detector. Also includes measured Eγ using ^{72}Ge(n,γ) reaction.

1968Cz01: $(^{16}O,^{16}O')$ E=25 MeV. Measured Mossbauer effect in Coulomb-recoil implantation. See also ^{73}Ge(γ,γ):Mossbauer dataset.

1962Va20: $(^{14}N,^{14}N')$ E=36 MeV. Measured Eγ, γ-ray yields. Deduced B(E2) for 825.6 and 1040 levels.

1962Ri09: $(^{20}Ne,^{20}Ne')$ E=8-15 MeV. Measured Eγ, γ-ray yields. Deduced B(E2) for 68.7 level.

1961Ho05: (α,α'). Measured γ(t). Deduced T$_{1/2}$ for 68.7 level.

1956Te26: (α,α') E=1.0-3.2 MeV. Measured Eγ, γ-ray yields. Deduced B(E2) for 68.7 and 825.6 levels.

1958Ch34: (p,p') measured Eγ=67.03 1 using a bent-crystal spectrograph and assigned it to ^{73}Ge. But it is claimed and confirmed by 1971Jo15 that this γ line observed by 1958Ch34 should be from ^{73}Ge(p,nγ) reaction.

^{73}Ge Levels

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$	Comments
0.0	9/2$^+$		
13.18 25	5/2$^+$		
68.752 7	7/2$^+$	1.62 ns 14	B(E2)↑=0.073 7 (1972Sa27)
			B(E2)↑: others: 0.076 14 (1974An21), 0.046 7 (1962Ri09), 0.084 (1956Te26).
			T$_{1/2}$: from γ(t) in 1961Ho05.
499.08 15	7/2$^+$		B(E2)↑=0.0091 5 (1972Sa27)
			B(E2)↑: other: 0.010 2 (1974An21).
			J$^{\pi}$: 499$\gamma(\theta)$ allows J=7/2 or 9/2, 486$\gamma(\theta)$ rules out 9/2, π=+ from Coulomb excitation from 9/2$^+$ (1972Sa27).
			T$_{1/2}$: 2.2 ps $+38-13$ from B(E2)↑=0.0091 5 and 499.0γ branching ratio=3.4% according to εB(E2)↑ ratio with the assumption of δ(E2/M1)=+1.2 $+5-7$ for 499.0γ in 1972Sa27.
			εB(E2)↑(from g.s.)=0.00031 9 (1972Sa27), where ε is the ratio of the observed γ-ray yield to the total de-excitation of the state.
			εB(E2)↑(from 13.18 level)=0.0013 1 (1972Sa27).
			εB(E2)↑(from 68.75 level)=0.0075 4 (1972Sa27).
825.61 20	13/2$^+$	2.68 ps 14	B(E2)↑=0.077 4 (1972Sa27)
			B(E2)↑: others: 0.081 13 (1974An21), 0.035 9 (1962Va20), 0.062 (1956Te26).
			J$^{\pi}$: (7/2,13/2) from 825.6$\gamma(\theta)$ with 7/2 is favored, π=+ from Coulomb excitation from 9/2$^+$ (1972Sa27).
			T$_{1/2}$: from B(E2)=0.077 4 in 1972Sa27.
868.1 5	11/2$^+$		B(E2)↑=0.026 4 (1974An21)
			B(E2)↑: other: 0.010 5 (1975Th01).
			J$^{\pi}$: π=+ from Coulomb excitation from 9/2$^+$ (1974An21).
993.7 4	(9/2)$^+$		B(E2)↑=0.026 5 (1974An21)
			J$^{\pi}$: π=+ from Coulomb excitation from 9/2$^+$ (1974An21).
1040.0?	($^+$)		B(E2)↑=0.030 8 (1962Va20)
			E(level): from 1962Va20 only. Not adopted in Adopted Levels.
			J$^{\pi}$: π=+ from Coulomb excitation from 9/2$^+$ (1974An21).

Continued on next page (footnotes at end of table)

Coulomb excitation   **1972Sa27,1974An21 (continued)**

^{73}Ge Levels (continued)

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

‡ From Adopted Levels, unless otherwise noted. Assignments and arguments from this dataset are given under comments, with π=+ from direct population via Coulomb excitation from 9/2$^+$ ground state.

$\gamma(^{73}\text{Ge})$

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.@	δ&	Comments
68.752	7/2$^+$	68.752 7	100	0.0	9/2$^+$	M1+E2	0.074 4	E_γ: from 1971Jo15, weighted average of results from measurements using $(\alpha,\alpha'\gamma)$, $(p,p'\gamma)$ and (n,γ) reactions. Other: 68.6 *2* from 1972Sa27.
								δ: from adopted $T_{1/2}$=1.78 ns *11* and measured B(E2)↑=0.073 *7* (1972Sa27) if J(68.7)=7/2, together with theoretical α(M1) and α(E2) values from BrIcc code. Other: +0.92 +*300−77* from $\gamma(\theta)$ in 1972Sa27.
499.08	7/2$^+$	430.4 *2*	100#	68.752	7/2$^+$	M1+E2		δ: +0.59 +*4−6* or −5.0 *10* (1972Sa27).
		485.9 *2*	17.7# *14*	13.18	5/2$^+$	E2+M1	+3.7 *1*	I_γ: other: 17.3 *16* from ratio of measured εB(E2)↑ (1972Sa27).
		499.0 *2*	2.9# *5*	0.0	9/2$^+$	E2+M1		I_γ: other: 4.1 *12* from ratio of measured εB(E2)↑ (1972Sa27). δ: +1.2 +*5−7* or +0.71 +*94−24* (1972Sa27).
825.61	13/2$^+$	825.6 *2*	100	0.0	9/2$^+$			
868.1	11/2$^+$	799.4 *5*	63 *2*	68.752	7/2$^+$			
		868.0 *10*	100	0.0	9/2$^+$			
993.7	(9/2)$^+$	924.8 *4*	12 *2*	68.752	7/2$^+$			
		993.9 *5*	100	0.0	9/2$^+$			
1040.0?	($^+$)	1040.0^a		0.0	9/2$^+$			E_γ: γ reported by 1962Va20 and 1974An21.

† From 1972Sa27 up to 826 level and from 1974An21 above that, unless otherwise noted.

‡ From 1974An21 only.

From 1974An21.

@ M1 and E2 multipolarities are assigned based on direct population via Coulomb excitation from 9/2$^+$ ground state.

& From $\gamma(\theta)$ in 1972Sa27, unless otherwise noted.

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

^{x} γ ray not placed in level scheme.

Coulomb excitation   1972Sa27,1974An21

Legend

<u>Level Scheme</u>

Intensities: Relative photon branching from each level

– – – – ▶   γ Decay (Uncertain)

●   Coincidence

$_{32}^{73}$Ge$_{41}$