Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 178, 41 (2021).	12-Nov-2021

Q(β^-)=−14780 *SY*; S(n)=15470 *40*; S(p)=5057 *4*; Q(α)=−2566 *4* 2021Wa16
Estimated ΔQ(β^-)=200 (2021Wa16).
Q(ε)=4517 *4*, Q(εp)=609 *4*, S(2n)=28320 *140* (syst), S(2p)=7725 *4* (2021Wa16).
Mass measurements: 2007Cl01, 2007Sc24, 2005Cl08, 2002Li24.
Theory references: consult the NSR database at www.nndc.bnl.gov for 101 primary references, 96 dealing with nuclear structure calculations, and five for half-lives in β and cluster decays.
Additional information 1.
The decay scheme of ^{64}As to ^{64}Ge is not known.

^{64}Ge Levels

Cross Reference (XREF) Flags

- A ^{64}As ε decay (69.0 ms)
- B ^{65}Se εp decay (34.2 ms)
- C ^{12}C(^{54}Fe,2nγ),^{54}Fe(^{12}C,2nγ)
- D ^{40}Ca(^{32}S,2$\alpha\gamma$)

E(level)	J$^\pi$	T$_{1/2}$[†]	XREF	Comments
0.0[‡]	0$^+$	63.7 s *25*	BCD	%ε+%β^+=100; %εp=? T$_{1/2}$: from 1974Ro16. Other: 70 s *7* (1973Da01).
901.7[‡] *3*	2$^+$	2.29 ps *35*	BCD	J$^\pi$: E2 γ to 0$^+$. T$_{1/2}$: from recoil-distance method (2007St16) in ^{12}C(^{65}Ge,^{64}Ge); listed in ^{12}C(^{54}Fe,2nγ),^{54}Fe(^{12}C,2nγ) dataset.
1578.7[@] *3*	(2$^+$)	5.5 ps *+28−14*	CD	J$^\pi$: γ to 0$^+$; γ from (4$^+$). T$_{1/2}$: from recoil-distance method (2007St16) in ^{12}C(^{65}Ge,^{64}Ge); listed in ^{12}C(^{54}Fe,2nγ),^{54}Fe(^{12}C,2nγ) dataset.
2052.6[‡] *4*	4$^+$		CD	J$^\pi$: ΔJ=2, E2+M3 γ to 2$^+$.
2154.8[@] *4*	(4$^+$)		C	J$^\pi$: γ to (2$^+$); γ from (6$^+$).
2669.6 *5*	(4$^+$)		CD	J$^\pi$: ΔJ=1, (E1) γ from (5$^-$) (2003Fa01).
2969.7[#] *5*	(3$^-$)		CD	J$^\pi$: γ to 2$^+$; ΔJ=2 γ from (5$^-$).
3406.7[@] *5*	(6$^+$)		C	J$^\pi$: γ to 4$^+$; possible band assignment.
3465.6[‡] *6*	(6$^+$)		C	J$^\pi$: ΔJ=(2) γ to 4$^+$.
3716.9[#] *7*	(5$^-$)	16.8 ps *+24−20*	CD	E(level): only one level at this energy is proposed by 2003Fa01, the authors do not confirm two levels near this energy as in 1991En01. J$^\pi$: ΔJ=1, (E1+M2) γ to 4$^+$.
4245.7[#] *6*	(7$^-$)	29.9 ps *+20−17*	CD	J$^\pi$: ΔJ=2, E2 γ to (5$^-$).
5025.5 *8*			C	J$^\pi$: γ to 5$^-$.
5175.2[@] *7*	(8$^+$)		C	J$^\pi$: γ to (6$^+$), possible band assignment.
5180.0[‡] *8*	(8$^+$)		C	J$^\pi$: γ to (6$^+$); band assignment.
5372.9[#] *7*	(9$^-$)	≤2.8 ps	CD	J$^\pi$: ΔJ=2, E2 γ to (7$^-$).
6564.4[#] *8*	(11$^-$)		C	J$^\pi$: γ to (9$^-$); band assignment.
6606.8 *20*	(10)		D	J$^\pi$: ΔJ=1 γ, D+Q γ to (9$^-$). Positive parity proposed by 2003Fa01.
7578.9 *20*	(10)		D	J$^\pi$: ΔJ=1, D+Q γ to (9$^-$). Positive parity proposed by 2003Fa01.
8006.8[#] *10*	(13$^-$)		C	J$^\pi$: γ to (11$^-$); band assignment.
8426.9 *21*	(12)		D	E(level): 1820γ in ^{12}C(^{54}Fe,2nγ),^{54}Fe(^{12}C,2nγ) (1991En01) is placed from a 6065 level, instead.

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Adopted Levels, Gammas (continued)

^{64}Ge Levels (continued)

E(level)	J^π	XREF	Comments
			J^π: ΔJ=2 γ to (10). Positive parity proposed by 2003Fa01.
9299.9 *23*	(14)	D	J^π: ΔJ=2 γ to (12). Positive parity proposed by 2003Fa01.

† From recoil-distance Doppler-shift (RDDS) method in ^{40}Ca(^{32}S,2αγ) (2003Fa01), unless otherwise stated.
‡ Band(A): g.s. band.
# Band(B): Band based on $3^{(-)}$. The 3^- level is probably an octupole vibrational state but its collectivity is not established (1991En01). The higher states in this sequence may arise from weak coupling of quasiparticles to the g.s.
@ Band(C): Band based on (2^+).

γ(^{64}Ge)

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.‡	δ‡	Comments
901.7	2^+	901.5 *3*	100	0.0	0^+	E2		B(E2)(W.u.)=27 *+5−4*
1578.7	(2^+)	677.0 *3*	100 *5*	901.7	2^+	(M1+E2)		B(M1)(W.u.)=0.0056 *19*; B(E2)(W.u.)=21 *7* Mult.: from γ(θ) in ^{12}C(^{54}Fe,2nγ), and RUL. B(M1)(W.u.) and B(E2)(W.u.) for δ(E2/M1)=1.0.
		1579.0 *4*	16.0 *10*	0.0	0^+	[E2]		B(E2)(W.u.)=0.095 *33*
2052.6	4^+	1150.8 *4*	100	901.7	2^+	E2+M3	+0.06 *1*	
2154.8	(4^+)	576.2 *3*	100	1578.7	(2^+)			
2669.6	(4^+)	1090.9 *4*	100	1578.7	(2^+)			Mult.: ΔJ=1 γ from ^{12}C(^{54}Fe,2nγ),^{54}Fe(^{12}C,2nγ) is inconsistent with ΔJ=2 from ΔJ^π.
2969.7	(3^-)	2067.8 *5*	100 *8*	901.7	2^+			
		2970#	≤5	0.0	0^+	[E3]		
3406.7	(6^+)	1252.1 *4*	100 *5*	2154.8	(4^+)			
		1353.7 *5*	53 *3*	2052.6	4^+			
3465.6	(6^+)	1413.0 *4*	100	2052.6	4^+	(Q)		
3716.9	(5^-)	747.5 *3*	12.9 *28*	2969.7	(3^-)	(E2)		B(E2)(W.u.)=0.92 *22* I_γ: unweighted average of 10.0 *9* (^{54}Fe,2nγ) and 15.7 *11* (^{32}S,2αγ).
		1047.3 *4*	19.8 *31*	2669.6	(4^+)	(E1)		B(E1)(W.u.)=3.3×10^{-6} *6* I_γ: unweighted average of 16.7 *9* (^{54}Fe,2nγ) and 22.9 *16* (^{32}S,2αγ).
		1664.8 *4*	100.0 *32*	2052.6	4^+	(E1+M2)	−0.09 *3*	I_γ: unweighted average of 100.0 *32* (^{54}Fe,2nγ) and 100.0 *54* (^{32}S,2αγ). δ: −3.9 *+7−4* or −0.09 *3*, the latter is rejected by 2003Fa01 based on χ^2=0.54 for the former and 0.80 for the latter. In the opinion of the evaluator the difference in the two χ^2 values is not significant enough to reject one value. The study of 1991En01 preferred the lower mixing ratio. See also B(M2) values below which support the lower value of the mixing ratio. B(E1)(W.u.)=4.1×10^{-6} *6*, B(M2)(W.u.)=0.055 *+43−30* for δ(M2/E1)=−0.09 *3*. B(E1)(W.u.)=2.5×10^{-7} *+12−5*, B(M2)(W.u.)=6.4 *+8−10* for δ(M2/E1)=−3.9 *+7−4*, which gives unreasonably high B(M2)(W.u.), as RUL(M2)=1.
4245.7	(7^-)	528.4 *3*	100	3716.9	(5^-)	E2		B(E2)(W.u.)=30.2 *20* δ(M3/E2)=+0.07 *8*.

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Adopted Levels, Gammas (continued)

$\gamma(^{64}Ge)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.‡	δ‡	Comments
5025.5		1308.5 *5*	100	3716.9	(5^-)			
5175.2	(8^+)	1768.5 *5*	100	3406.7	(6^+)			
5180.0	(8^+)	1714.4 *5*	100	3465.6	(6^+)			
5372.9	(9^-)	1127.2 *4*	100	4245.7	(7^-)	E2		B(E2)(W.u.)≥7.3 δ(M3/E2)=−0.04 *4*.
6564.4	(11^-)	1191.5 *4*	100	5372.9	(9^-)			
6606.8	(10)	1234 *1*	100	5372.9	(9^-)	D+Q	−3.5 *+34−24*	
7578.9	(10)	2206 *1*	100	5372.9	(9^-)	D+Q	−6 *+6−7*	
8006.8	(13^-)	1442.4 *5*	100	6564.4	(11^-)			
8426.9	(12)	848 *1*	73 *8*	7578.9	(10)	Q(+O)	+0.08 *5*	
		1819.8 *6*	100 *10*	6606.8	(10)	Q(+O)	−0.06 *7*	
9299.9	(14)	873 *1*	100	8426.9	(12)	Q(+O)	0.00 *7*	

† From $^{12}C(^{54}Fe,2n\gamma)$,$^{54}Fe(^{12}C,2n\gamma)$, when a level is populated in this reaction as well as in $^{40}Ca(^{32}S,2\alpha\gamma)$. Otherwise, the data are from separate reactions. Exception is for 3717 level, where branching ratios from the two reactions are averaged.

‡ From $\gamma\gamma(\theta)$(DCO), $\gamma(\theta)$ and γ(lin pol) data in $^{40}Ca(^{32}S,2\alpha\gamma)$.

Placement of transition in the level scheme is uncertain.

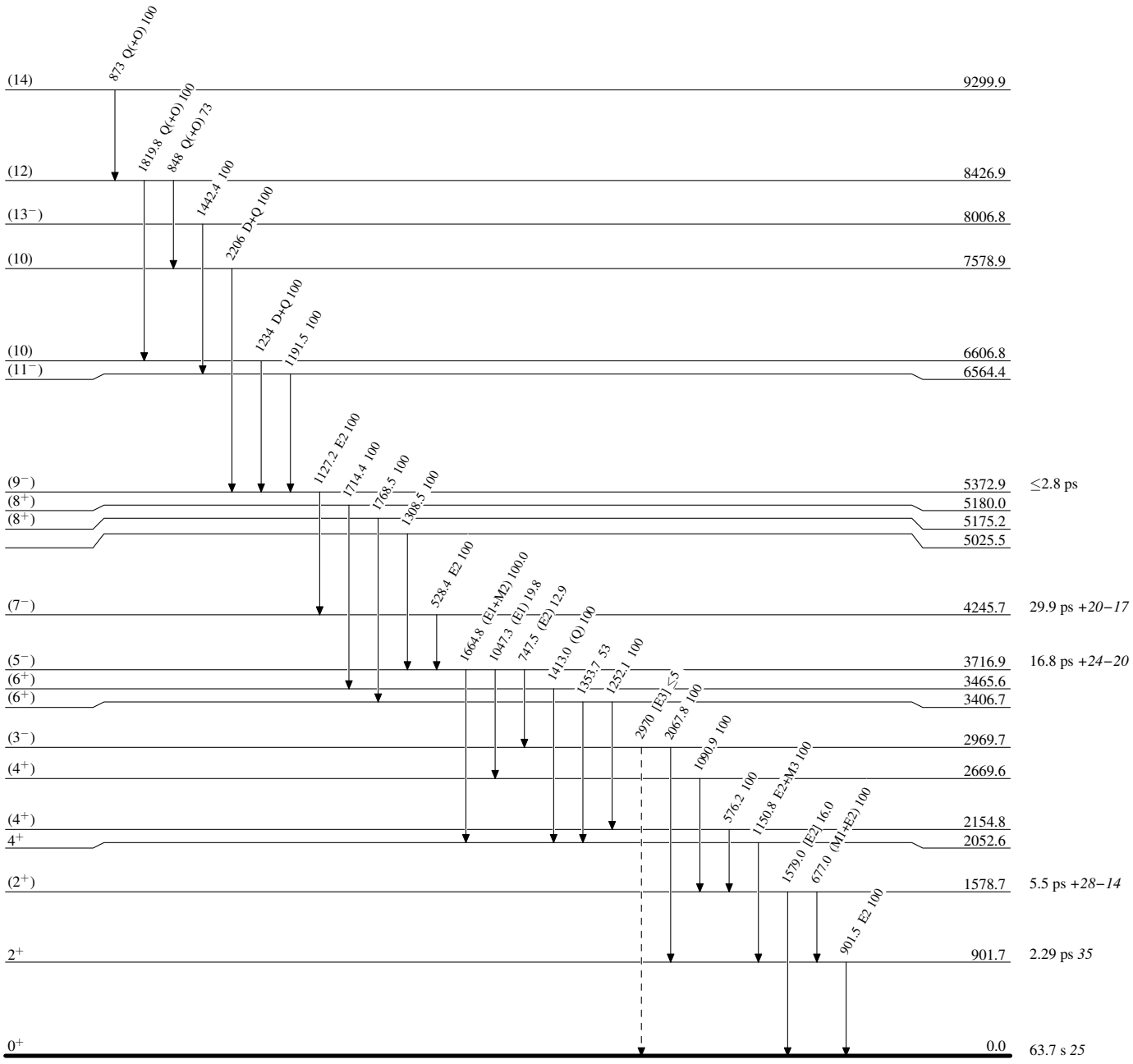
Adopted Levels, Gammas

Legend

Level Scheme

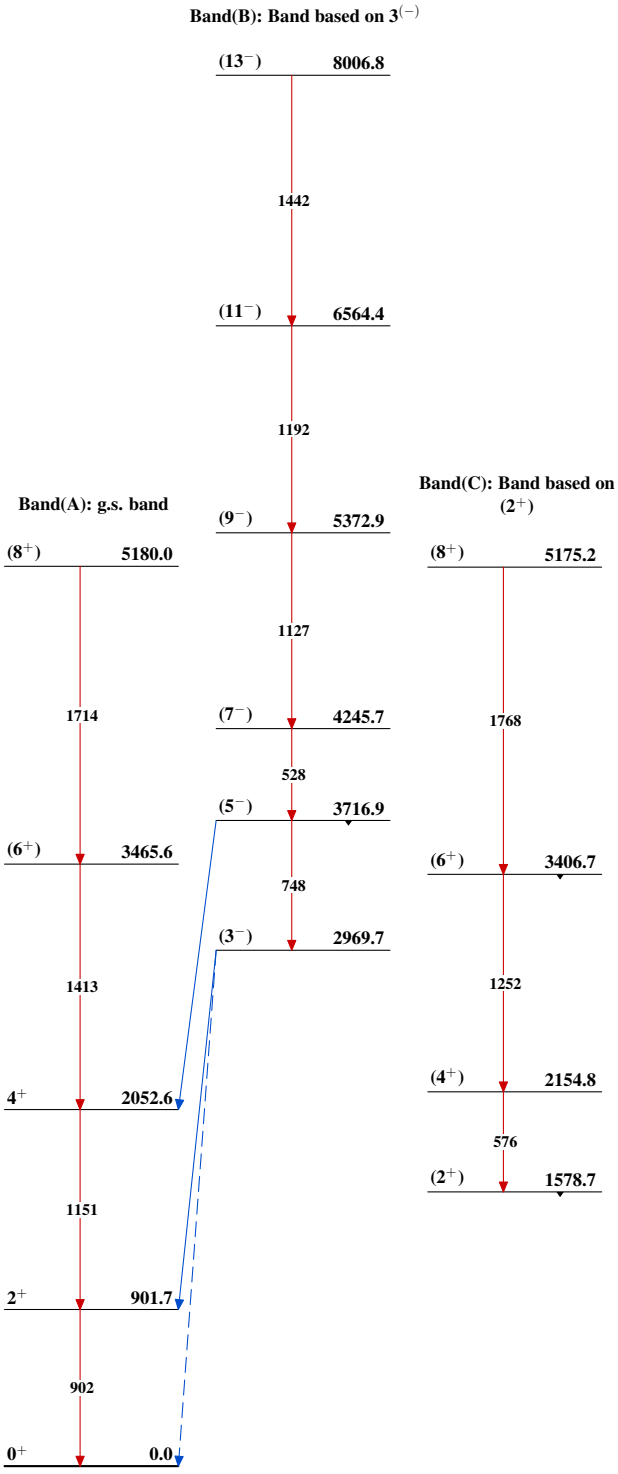
Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{64}_{32}Ge_{32}$

Adopted Levels, Gammas



$^{64}_{32}Ge_{32}$