Adopted Levels, Gammas

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

 $Q(\beta^{-})=-14780 SY; S(n)=15470 40; S(p)=5057 4; Q(\alpha)=-2566 4$ 2021Wa16

Estimated $\Delta Q(\beta^{-})=200$ (2021Wa16).

Q(\varepsilon)=4517 4, Q(\varepsilon p)=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.

⁶⁴Ge Levels

Cross Reference (XREF) Flags

 64 As ε decay (69.0 ms) A

В

- ⁶⁵Se ε p decay (34.2 ms) ¹²C(⁵⁴Fe,2n γ),⁵⁴Fe(¹²C,2n γ) ⁴⁰Ca(³²S,2 $\alpha\gamma$) С
- D

E(level)	J^{π}	$T_{1/2}^{\dagger}$	XREF	Comments		
0.0‡	0+	63.7 s 25	BCD	$\% \varepsilon + \% \beta^+ = 100; \ \% \varepsilon p = ?$ T _{1/2} : from 1974Ro16 Other: 70 s 7 (1973Da01)		
901.7 [‡] 3	2+	2.29 ps 35	BCD	J^{π} : 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 2px) ⁵⁴ Fe(¹² C 2px) dataset		
1578.7 [@] 3	(2+)	5.5 ps +28-14	CD	J^{π} : 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,2n γ), ⁵⁴ Fe(¹² C,2n γ) dataset.		
2052.6 [‡] 4	4+		CD	J^{π} : $\Delta J=2$, E2+M3 γ to 2 ⁺ .		
2154.8 [@] 4	(4^{+})		С	J^{π} : γ to (2 ⁺); γ from (6 ⁺).		
2669.6 5	(4^{+})		CD	J^{π} : $\Delta J=1$, (E1) γ from (5 ⁻) (2003Fa01).		
2969.7 [#] 5	(3 ⁻)		CD	J^{π} : γ to 2 ⁺ ; $\Delta J=2 \gamma$ from (5 ⁻).		
3406.7 [@] 5	(6 ⁺)		С	J^{π} : γ to 4 ⁺ ; possible band assignment.		
3465.6 [‡] 6	(6^{+})		С	J^{π} : $\Delta J=(2) \gamma$ 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 ^π : Δ J=1, (E1+M2) γ to 4 ⁺ .		
4245.7 [#] 6	(7^{-})	29.9 ps +20-17	CD	J^{π} : $\Delta J=2$, E2 γ to (5 ⁻).		
5025.5 8		1	С	J^{π} : γ to 5 ⁻ .		
5175.2 [@] 7	(8+)		С	J^{π} : γ to (6 ⁺), possible band assignment.		
5180.0 [‡] 8	(8 ⁺)		С	J^{π} : γ to (6 ⁺); band assignment.		
5372.9 [#] 7	(9 ⁻)	≤2.8 ps	CD	J^{π} : $\Delta J=2$, E2 γ to (7 ⁻).		
6564.4 [#] 8	(11^{-})	-	С	J^{π} : γ to (9 ⁻); band assignment.		
6606.8 20	(10)		D	J^{π} : $\Delta J=1 \gamma$, D+Q γ to (9 ⁻). Positive parity proposed by 2003Fa01.		
7578.9 20	(10)		D	J^{π} : $\Delta J=1$, D+Q γ to (9 ⁻). Positive parity proposed by 2003Fa01.		
8006.8 [#] 10	(13 ⁻)		С	J^{π} : γ to (11 ⁻); band assignment.		
8426.9 21	(12)		D	E(level): 1820 γ in ¹² C(⁵⁴ Fe,2n γ), ⁵⁴ Fe(¹² C,2n γ) (1991En01) is placed from a 6065 level, instead.		

Adopted Levels, Gammas (continued)

⁶⁴Ge Levels (continued)

E(level)	\mathbf{J}^{π}	XREF	Comments
9299.9 23	(14)	D	J^{π} : $\Delta J=2 \gamma$ to (10). Positive parity proposed by 2003Fa01. J^{π} : $\Delta J=2 \gamma$ to (12). Positive parity proposed by 2003Fa01.

[†] From recoil-distance Doppler-shift (RDDS) method in ${}^{40}Ca({}^{32}S,2\alpha\gamma)$ (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^+) .

E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	I_{γ}^{\dagger}	$\mathbf{E}_f = \mathbf{J}_f^{\pi}$	Mult. [‡]	δ^{\ddagger}	Comments
901.7 1578.7	2 ⁺ (2 ⁺)	901.5 <i>3</i> 677.0 <i>3</i>	100 100 <i>5</i>	$\begin{array}{ccc} 0.0 & 0^+ \\ 901.7 & 2^+ \end{array}$	E2 (M1+E2)		B(E2)(W.u.)=27 +5-4 B(M1)(W.u.)=0.0056 19; B(E2)(W.u.)=21 7 Mult.: from $\gamma(\theta)$ in ¹² C(⁵⁴ Fe,2n\gamma), and RUL. B(M1)(W.u.) and B(E2)(W.u.) for $\delta(E2/M1)=10$
2052.6 2154.8 2669.6	4^+ (4 ⁺) (4 ⁺)	1579.0 <i>4</i> 1150.8 <i>4</i> 576.2 <i>3</i> 1090.9 <i>4</i>	16.0 <i>10</i> 100 100 100	$\begin{array}{ccc} 0.0 & 0^+ \\ 901.7 & 2^+ \\ 1578.7 & (2^+) \\ 1578.7 & (2^+) \end{array}$	[E2] E2+M3	+0.06 1	B(E2)(W.u.)=0.095 33 Mult.: $\Delta J=1 \gamma$ from
							¹² C(⁵⁴ Fe,2n γ), ⁵⁴ Fe(¹² C,2n γ) is inconsistent with ΔJ =2 from ΔJ^{π} .
2969.7	(3 ⁻)	2067.8 <i>5</i> 2970 [#]	100 8 ≤5	901.7 2^+ 0.0 0^+	[E3]		
3406.7	(6+)	1252.1 <i>4</i> 1353.7 <i>5</i>	100 5 53 3	$\begin{array}{cccc} 2154.8 & (4^+) \\ 2052.6 & 4^+ \\ 2052.6 & 4^+ \end{array}$			
3465.6 3716.9	(6^{+}) (5^{-})	1413.0 <i>4</i> 747.5 <i>3</i>	100 12.9 28	2052.6 4 ⁺ 2969.7 (3 ⁻)	(Q) (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 <i>31</i>	2669.6 (4+)	(E1)		B(E1)(W.u.)= $3.3 \times 10^{-6} 6$ I _{γ} : unweighted average of 16.7 9 (⁵⁴ Fe,2n γ) and 22.9 16 (³² S.2 $\alpha\gamma$).
		1664.8 <i>4</i>	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
4245.7	(7-)	528.4 <i>3</i>	100	3716.9 (5 ⁻)	E2		unreasonably high B(M2)(W.u.), as RUL(M2)=1. B(E2)(W.u.)=30.2 20 δ (M3/E2)=+0.07 8.

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

Adopted Levels, Gammas (continued)

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

E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	I_{γ}^{\dagger}	$\mathbf{E}_f \mathbf{J}_f^{\pi}$	Mult. [‡]	δ^{\ddagger}	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
							$\delta(M3/E2) = -0.04 \ 4.$
6564.4	(11^{-})	1191.5 4	100	5372.9 (9 ⁻)			
6606.8	(10)	1234 <i>1</i>	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 <i>1</i>	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 ¹²C(⁵⁴Fe,2n γ),⁵⁴Fe(¹²C,2n γ), when a level is populated in this reaction as well as in ⁴⁰Ca(³²S,2a γ). 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 $\gamma(\text{lin pol})$ data in ${}^{40}\text{Ca}({}^{32}\text{S},2\alpha\gamma)$. [#] Placement of transition in the level scheme is uncertain.



 ${}^{64}_{32}\text{Ge}_{32}$

Adopted Levels, Gammas



 $^{64}_{32}\text{Ge}_{32}$