

$^{40}\text{Ca}(^{28}\text{Si},\alpha\text{pn}\gamma)$ 2020Ru03

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Huang Xiaolong, and Wang Xianghan		NDS 204,1 (2025)	30-Jun-2023

Dataset adapted from a dataset in the XUNDL database from 2020Ru03 compiled by E.A. McCutchan (NNDC,BNL), March 1, 2021.

2020Ru03: E(^{28}Si)=122 MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(\theta)$ (DCO), (particle) γ -coin using the Gammasphere array consisting of 101 HPGe detectors and the Microball 4π array of 95 element CsI(Tl) detectors at the ATLAS-ANL facility. Target was 99.975% enriched ^{40}Ca with a thickness of 0.5 mg/cm². Deduced high-spin rotational states, and interpreted in terms of cranked Nilsson-Strutinsky calculations, with proposed configurations.

 ^{62}Ga Levels

E(level) [†]	J π [‡]	Comments
0.0	0 ⁺	
570.7 [#] 3	1 ⁺	T=0
816.8 [#] 4	3 ⁺	
1193.6 [#] 4	5 ⁺	
2373.4 8	6 ⁺	
2434.5 [#] 6	7 ⁺	
3491.8 8	7	
3922.0 8	8 ⁺	
4657.5 11	8	
4789.2 [#] 8	9 ⁺	
4945.0 9	9 ⁺ ,10 ⁺	
5735.4 [#] 9	11 ⁺	
6842.8 [#] 10	13 ⁺	
8588.6 [#] 13	15 ⁺	
9976.0 [#] 15	17 ⁺	
10044.7 [@] 19	(15 ⁺)	
10505? 3		
11132? ^{&} 3	(16 ⁺)	
11860.6 [@] 20	(17 ⁺)	
12390 3		
12701.1 23	(18)	
13085.1 ^{&} 25	18 ⁽⁺⁾	
13610 3	J	
13933 3	(19 ⁺)	
14081.8 [@] 22	(19 ⁺)	
15376 ^{&} 3	(20 ⁺)	
15460? 3		
15722 3	J+1	
16821? [@] 4	(21 ⁺)	
x? ^a	J1	
2043.9+x? ^a 17	(J1+2)	
4437.5+x? ^a 23	(J1+4)	

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

[‡] As given by 2020Ru03, based on previous assignments for low-lying levels, and DCO ratios in the present experiment.

[#] Seq.(D): $\Delta J=2$ sequence based on 1⁺.

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$^{40}\text{Ca}(^{28}\text{Si}, \alpha p n \gamma)$ **2020Ru03 (continued)** ^{62}Ga Levels (continued)

@ Band(A): $\Delta J=2$ band based on (15^+) .

& Band(B): $\Delta J=2$ band based on (16^+) .

^a Band(C): $\Delta J=2$ band.

 $\gamma(^{62}\text{Ga})$

DCO ratios are for 30° and 83° geometry. With gates on $\Delta J=2$, quadrupole transitions (946.2, 1107.4, 1240.9, 1387.4, 1745.8, 2354.8), expected ratios are: ≈ 0.6 for $\Delta J=1$, dipole, and 1.0 for $\Delta J=2$, quadrupole transitions. Lower or higher DCO values as compared to ≈ 0.6 for $\Delta J=1$, dipole suggest mixed $\Delta J=1$, D+Q (generally M1+E2) transitions. Less frequent $\Delta J=0$, dipole transitions are expected to have $\text{DCO} \approx 0.9$.

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	Comments
246.1 2	100	816.8	3^+	570.7	1^+		E2 in 2020Ru03 from literature.
376.8 2	100	1193.6	5^+	816.8	3^+		E2 in 2020Ru03 from literature.
570.7 3	100	570.7	1^+	0.0	0^+		M1 in 2020Ru03 from literature.
790.2 7	3.4 5	5735.4	11^+	4945.0	$9^+, 10^+$		
867.3 4	15.0 7	4789.2	9^+	3922.0	8^+	D+Q	DCO=0.39 9 M1+E2 in 2020Ru03.
946.2 4	81.6 29	5735.4	11^+	4789.2	9^+	Q	DCO=1.01 9 E2 in 2020Ru03.
1022.9 5	4.6 4	4945.0	$9^+, 10^+$	3922.0	8^+		
1057.3 7	5.4 5	3491.8	7	2434.5	7^+		$\Delta J=0$ in 2020Ru03 from literature.
1107.4 5	77.9 28	6842.8	13^+	5735.4	11^+	Q	DCO=1.04 9 E2 in 2020Ru03.
1118.3 8	3.8 7	3491.8	7	2373.4	6^+		$\Delta J=1$ in 2020Ru03 from literature.
1165.7 8	7.4 5	4657.5	8	3491.8	7		$\Delta J=1$ in 2020Ru03 from literature.
1179.8 8	4.7 8	2373.4	6^+	1193.6	5^+		M1+E2 in 2020Ru03 from literature.
1240.9 5	100.0 35	2434.5	7^+	1193.6	5^+	Q	DCO=1.07 10 E2 in 2020Ru03.
1387.4 7	36.1 14	9976.0	17^+	8588.6	15^+	Q	DCO=1.09 13 E2 in 2020Ru03.
1487.4 6	21.1 10	3922.0	8^+	2434.5	7^+	D+Q	DCO=0.69 15 M1+E2 in 2020Ru03.
1745.8 8	70.4 26	8588.6	15^+	6842.8	13^+	Q	DCO=1.03 11 E2 in 2020Ru03.
1815.7 14	8.4 4	11860.6	(17^+)	10044.7	(15^+)	(Q)	DCO=1.19 53 (E2) in 2020Ru03.
1953.3 [#] 17	6.6 4	13085.1	$18^{(+)}$	11132?	(16^+)		(E2) in 2020Ru03 from rotational and yrast character.
2043.9 17	7.0 4	2043.9+x?	$(J1+2)$	x?	J1	(Q)	DCO=1.25 50 (E2) in 2020Ru03.
2112.0 14	9.8 5	15722	J+1	13610	J	D	DCO=0.50 23 $\Delta J=1$ in 2020Ru03.
2221.0 17	12.5 7	14081.8	(19^+)	11860.6	(17^+)	(Q)	DCO=0.88 24 (E2) in 2020Ru03.
2290.5 15	6.4 5	15376	(20^+)	13085.1	$18^{(+)}$		(E2) in 2020Ru03 from rotational and yrast character.
2354.8 9	65.5 25	4789.2	9^+	2434.5	7^+	Q	DCO=1.16 13 E2 in 2020Ru03.
2393.6 16	7.6 4	4437.5+x?	$(J1+4)$	2043.9+x?	$(J1+2)$	(Q)	DCO=1.02 34 (E2) in 2020Ru03.
2725.1 18	8.5 7	12701.1	(18)	9976.0	17^+	(D)	DCO=0.71 21 $\Delta J=1$ in 2020Ru03.

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$^{40}\text{Ca}(^{28}\text{Si}, \alpha \text{pn} \gamma)$ **2020Ru03** (continued) $\gamma(^{62}\text{Ga})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
2739.6 [#] 31	4.1 11	16821?	(21 ⁺)	14081.8 (19 ⁺)			(E2) in 2020Ru03 from rotational and yrast character.
2758.7 [#] 18	3.3 3	15460?		12701.1 (18)			
3109.0 20	3.2 4	13085.1	18 ⁽⁺⁾	9976.0 17 ⁺		(D+Q)	DCO=0.37 26 (M1+E2) in 2020Ru03 .
3201.6 21	3.1 8	10044.7	(15 ⁺)	6842.8 13 ⁺		(Q)	DCO≈1 (E2) in 2020Ru03 .
3271.8 27	1.6 3	11860.6	(17 ⁺)	8588.6 15 ⁺			(E2) in 2020Ru03 from ΔJ^π .
3634.2 24	2.7 4	13610	J	9976.0 17 ⁺			
3661.6 [#] 31	1.4 3	10505?		6842.8 13 ⁺			
3801.6 25	3.5 6	12390		8588.6 15 ⁺			
3956.9 26	3.1 3	13933	(19 ⁺)	9976.0 17 ⁺		(Q)	DCO=1.0 6 (E2) in 2020Ru03 .
4106.2 [#] 29	0.9 2	14081.8	(19 ⁺)	9976.0 17 ⁺			(E2) in 2020Ru03 from ΔJ^π .

[†] From [2020Ru03](#).

[‡] Evaluators assign Q for $\Delta J=2$, quadrupole transitions, and D or D+Q for $\Delta J=1$, dipole or dipole+quadrupole transitions, whereas [2020Ru03](#) assign E2 for the former and M1+E2 for the latter.

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

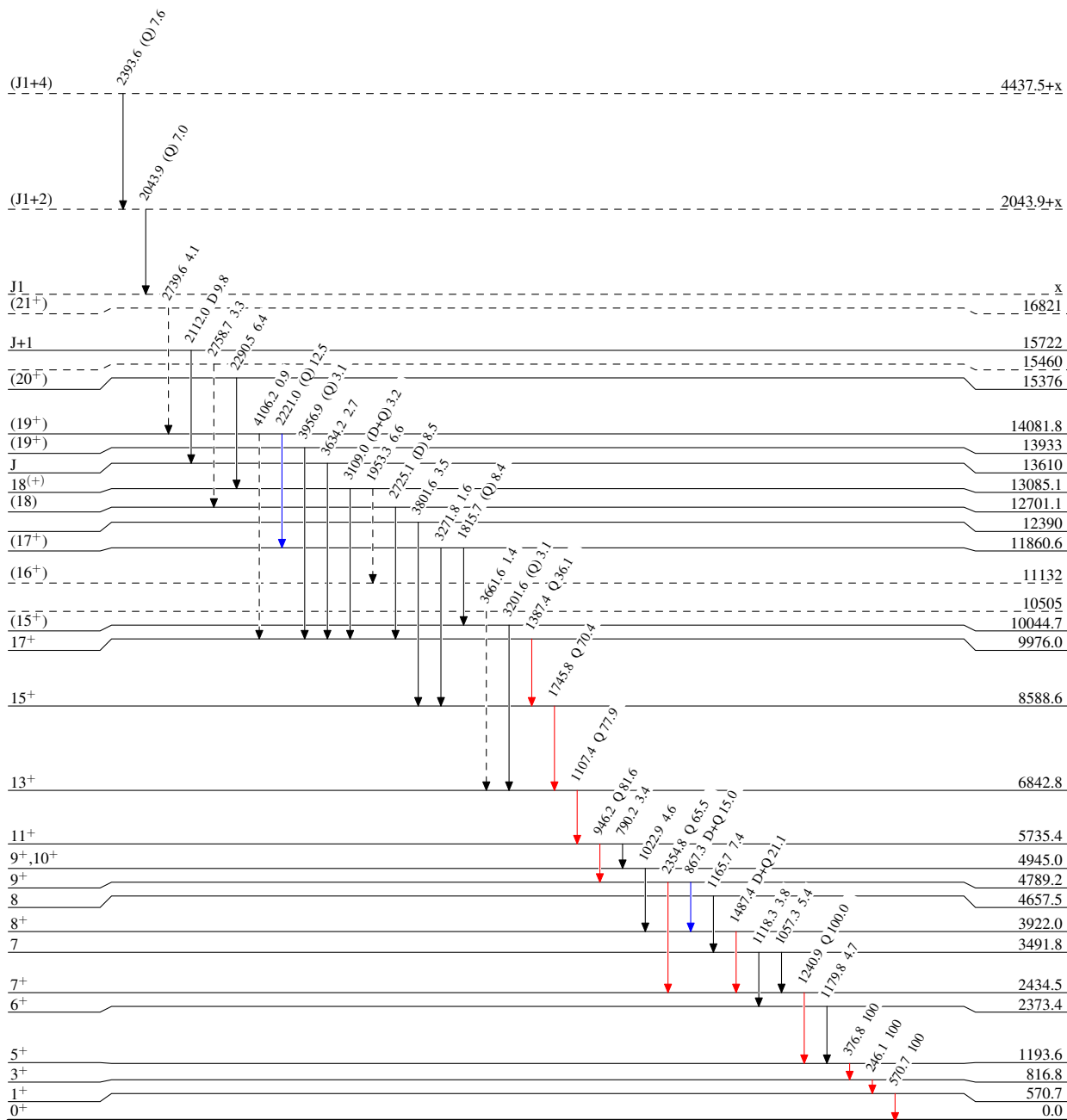
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Legend

Level Scheme

Intensities: Relative I_γ

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ γ Decay (Uncertain)

 $^{62}_{31}\text{Ga}_{31}$

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