

$^{40}\text{Ca}(^{28}\text{Si},\alpha 2p\gamma) E=122 \text{ MeV}$ **2009Ge14**

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Alan L. Nichols, Balraj Singh, Jagdish K. Tuli		NDS 113, 973 (2012)	15-Apr-2012

Includes $^{28}\text{Si}(^{36}\text{Ar},2p\gamma)$.

2009Ge14: $E=122 \text{ MeV}$; $^{28}\text{Si}(^{36}\text{Ar},2p\gamma), E=140 \text{ MeV}$; measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO), (particle) γ coin., using Gammasphere array with 103 HPGe detectors and Microball for charged particles at Argonne and Lawrence Berkeley National Laboratories. The results presented in the paper are from four experiments carried out at two laboratories. Four SD and well-deformed bands were identified. Compared with cranked Nilsson-Strutinsky calculations.

2009Ge14 state that details of this study are to be published elsewhere (see their reference 29). Main emphasis in this work is on SD bands and a well-deformed band. Several other structures known from other studies such as **1998Sv01** are incompletely shown by **2009Ge14**.

 ^{62}Zn Levels

See **2009Ge14** for discussion of SD band configurations. These are labeled as $[p_1, p_2, n_1, n_2]$, where p_1 and n_1 denote number of proton and neutron holes in high-j $1f_{7/2}$ orbital; p_2 and n_2 denote the number of particles in the high-j $1g_{9/2}$ orbital. Valence configuration for ^{62}Zn is $\pi(2p_{3/2}1f_{5/2})^2 \otimes \nu(2p_{3/2}1f_{5/2})^4$, or $[00,00]$ in above terminology.

E(level) [†]	J $\pi^{\ddagger}$	E(level) [†]	J $\pi^{\ddagger}$	E(level) [†]	J $\pi^{\ddagger}$	E(level) [†]	J $\pi^{\ddagger}$
0 [#]	0 ⁺	10725.4 ^a 19	14 ⁻	16807		23343.2 ⁱ 25	24 ⁺
953.9 [#] 8	2 ⁺	11546.1 ^d 18	14 ⁺	16817.7 ⁱ 20	18 ⁺	24053.7 ^g 23	24 ⁻
1805.1 [@] 8	2 ⁺	11651.5 ^e 18	13 ⁻	17349.9 ^j 20	18 ⁺	24469 ^j 3	24 ⁺
2185.6 [#] 11	4 ⁺	11787.6 ^b 19	15 ⁺	17364.4 20	18 ⁻	25346.1 ^h 23	25 ⁽⁻⁾
2743.4 [@] 11	4 ⁺	11960.7 ^c 19	16 ⁺	17407.1 ^g 19	18 ⁻	26175 ⁱ 3	26 ⁺
3707.6 [#] 13	6 ⁺	12329.5 ^f 18	14 ⁻	17477.4 ^f 20	20 ⁻	26743.7 ^g 25	26 ⁻
4347.5 [@] 13	6 ⁺	12811.8 19	15 ⁻	17508.2 22	(18 ⁻)	27318 ^j 3	26 ⁺
4904.6 ^{&} 15	7 ⁻	12992.7 ^e 18	15 ⁻	18414.4 ^h 21	(19 ⁻)	28162 ^h 3	27 ⁽⁻⁾
6081.6 ^{&} 17	9 ⁻	13155.5 ^d 19	16 ⁺	18500.9 ^e 20	21 ⁻	29474 ⁱ 3	28 ⁺
6113.6 ^a 17	8 ⁻	13725.4 ^f 18	16 ⁻	18678.1 ⁱ 20	20 ⁺	29683 ^g 3	28 ⁻
7421.4 ^{&} 18	11 ⁻	14444.3 19	17 ⁻	19399.3 ^g 19	20 ⁻	30436 ^j 3	28 ⁺
7422.4 ^a 17	10 ⁻	14540.9 ^e 19	17 ⁻	19477.8 ^j 21	20 ⁺	31213 ^h 3	(29 ⁻)
7975.8 ^b 17	9 ⁺	14645.5 20	16 ⁺	19599.6 23		32917 ^g 3	(30 ⁻)
8436.7 ^c 18	10 ⁺	14831.5 20	16 ⁺	19676.0 ^f 20	22 ⁻	33361 ⁱ 3	30 ⁺
9024.3 ^a 18	12 ⁻	15041.1 ⁱ 19	16 ⁺	20472.0 ^h 21	21 ⁽⁻⁾	33799 ^j 3	(30 ⁺)
9048.1 ^b 18	11 ⁺	15294.6 ^d 21	18 ⁺	20858.1 ⁱ 23	22 ⁺	34600 ^h 3	(31 ⁻)
9213.4 ^{&} 18	13 ⁻	15413.8 ^f 19	18 ⁻	21036.2 ^e 21	23 ⁻	36496 ^g 3	(32 ⁻)
9464.6 ^c 18	12 ⁺	15481.8 ^j 23	(16 ⁺)	21614.6 ^g 20	22 ⁻	38365 ^h 3	(33 ⁻)
9822.8 ^d 19	12 ⁺	16372.2 ^e 19	19 ⁻	21852.9 ^j 23	22 ⁺	40454 ^g 4	(34 ⁻)
9959.8 ^b 18	13 ⁺	16572.4 ^h 23	(17 ⁻)	22781.0 ^h 21	23 ⁽⁻⁾	42518 ^h 4	(35 ⁻)
10374.6 ^c 18	14 ⁺	16716.4 19	18 ⁺	23178.7 ^f 22	24 ⁻		

[†] From least-squares fit to $E\gamma$, assuming 1 keV uncertainty for each γ ray.

[‡] As proposed in **2009Ge14**.

[#] Band(A): g.s. band.

[@] Band(B): Band based on 2⁺.

[&] Band(C): Band based on 7⁻, $\alpha=1$.

^a Band(c): Band based on 8⁻, $\alpha=0$.

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$^{40}\text{Ca}(^{28}\text{Si},\alpha 2p\gamma) E=122 \text{ MeV}$ **2009Ge14 (continued)** ^{62}Zn Levels (continued)^b Band(D): Band based on $9^+, \alpha=1$.^c Band(d): Band based on $10^+, \alpha=0$.^d Band(E): Band based on 12^+ .^e Band(f): Band based on $13^-, \alpha=1$.^f Band(F): Band based on $14^-, \alpha=0$.^g Band(G): SD-1 band, $\alpha=0$. Possible configurations=[22,23] or [22,13]; former is preferred.^h Band(g): SD-2 band, $\alpha=1$. Possible configurations=[22,23] or [22,13]; former is preferred.ⁱ Band(H): Well-deformed band based on 16^+ . Percent population=2. Possible configuration=[22,02].^j Band(I): SD-3 band, $\alpha=0$. Possible configurations=[22,22] or [22,24]. $\gamma(^{62}\text{Zn})$

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π
415	10374.6	14^+	9959.8	13^+	1522	3707.6	6^+	2185.6	4^+
416	9464.6	12^+	9048.1	11^+	1548	14540.9	17^-	12992.7	15^-
495	9959.8	13^+	9464.6	12^+	1586	11960.7	16^+	10374.6	14^+
557	4904.6	7^-	4347.5	6^+	1602	9024.3	12^-	7422.4	10^-
558	2743.4	4^+	2185.6	4^+	1603	9024.3	12^-	7421.4	11^-
611	9048.1	11^+	8436.7	10^+	1604	4347.5	6^+	2743.4	4^+
640	4347.5	6^+	3707.6	6^+	1610	13155.5	16^+	11546.1	14^+
663	12992.7	15^-	12329.5	14^-	1626	9048.1	11^+	7421.4	11^-
678	12329.5	14^-	11651.5	13^-	1633	14444.3	17^-	12811.8	15^-
719	14444.3	17^-	13725.4	16^-	1675	16716.4	18^+	15041.1	16^+
733	13725.4	16^-	12992.7	15^-	1688	15413.8	18^-	13725.4	16^-
815	14540.9	17^-	13725.4	16^-	1701	10725.4	14^-	9024.3	12^-
851	1805.1	2^+	953.9	2^+	1724	11546.1	14^+	9822.8	12^+
873	15413.8	18^-	14540.9	17^-	1777	16817.7	18^+	15041.1	16^+
910	10374.6	14^+	9464.6	12^+	1791	9213.4	13^-	7422.4	10^-
911	9959.8	13^+	9048.1	11^+	1805	1805.1	2^+	0	0^+
913	13725.4	16^-	12811.8	15^-	1827	11787.6	15^+	9959.8	13^+
936	9959.8	13^+	9024.3	12^-	1831	16372.2	19^-	14540.9	17^-
938	2743.4	4^+	1805.1	2^+	1842 [†]	18414.4	(19^-)	16572.4?	(17^-)
954	953.9	2^+	0	0^+	1860	18678.1	20^+	16817.7	18^+
959	16372.2	19^-	15413.8	18^-	1862	7975.8	9^+	6113.6	8^-
969	15413.8	18^-	14444.3	17^-	1868	17349.9	18^+	15481.8	(16^+)
1024	18500.9	21^-	17477.4	20^-	1884	16716.4	18^+	14831.5	16^+
1028	9464.6	12^+	8436.7	10^+	1891	19399.3	20^-	17508.2	(18^-)
1072	9048.1	11^+	7975.8	9^+	1894	7975.8	9^+	6081.6	9^-
1105	17477.4	20^-	16372.2	19^-	1928	16372.2	19^-	14444.3	17^-
1161	10374.6	14^+	9213.4	13^-	1962	18678.1	20^+	16716.4	18^+
1175	19676.0	22^-	18500.9	21^-	1993	19399.3	20^-	17407.1	18^-
1177	6081.6	9^-	4904.6	7^-	2015	21614.6	22^-	19599.6	
1197	4904.6	7^-	3707.6	6^+	2035	19399.3	20^-	17364.4	18^-
1209	6113.6	8^-	4904.6	7^-	2043	9464.6	12^+	7421.4	11^-
1232	2185.6	4^+	953.9	2^+	2058	20472.0	$21^{(-)}$	18414.4	(19^-)
1309	7422.4	10^-	6113.6	8^-	2064	17477.4	20^-	15413.8	18^-
1340	7421.4	11^-	6081.6	9^-	2071	16716.4	18^+	14645.5	16^+
1341	7422.4	10^-	6081.6	9^-	2127	19477.8	20^+	17349.9	18^+
1341	12992.7	15^-	11651.5	13^-	2129	18500.9	21^-	16372.2	19^-
1360	21036.2	23^-	19676.0	22^-	2140	15294.6	18^+	13155.5	16^+
1385	14540.9	17^-	13155.5	16^+	2142	23178.7	24^-	21036.2	23^-
1396	13725.4	16^-	12329.5	14^-	2180	20858.1	22^+	18678.1	20^+
1447	12992.7	15^-	11546.1	14^+	2199	19676.0	22^-	17477.4	20^-
1512	10725.4	14^-	9213.4	13^-	2214	21614.6	22^-	19399.3	20^-

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(^{28}\text{Si},\alpha 2p\gamma) E=122 \text{ MeV}$ **2009Ge14 (continued)** $\gamma(^{62}\text{Zn})$ (continued)

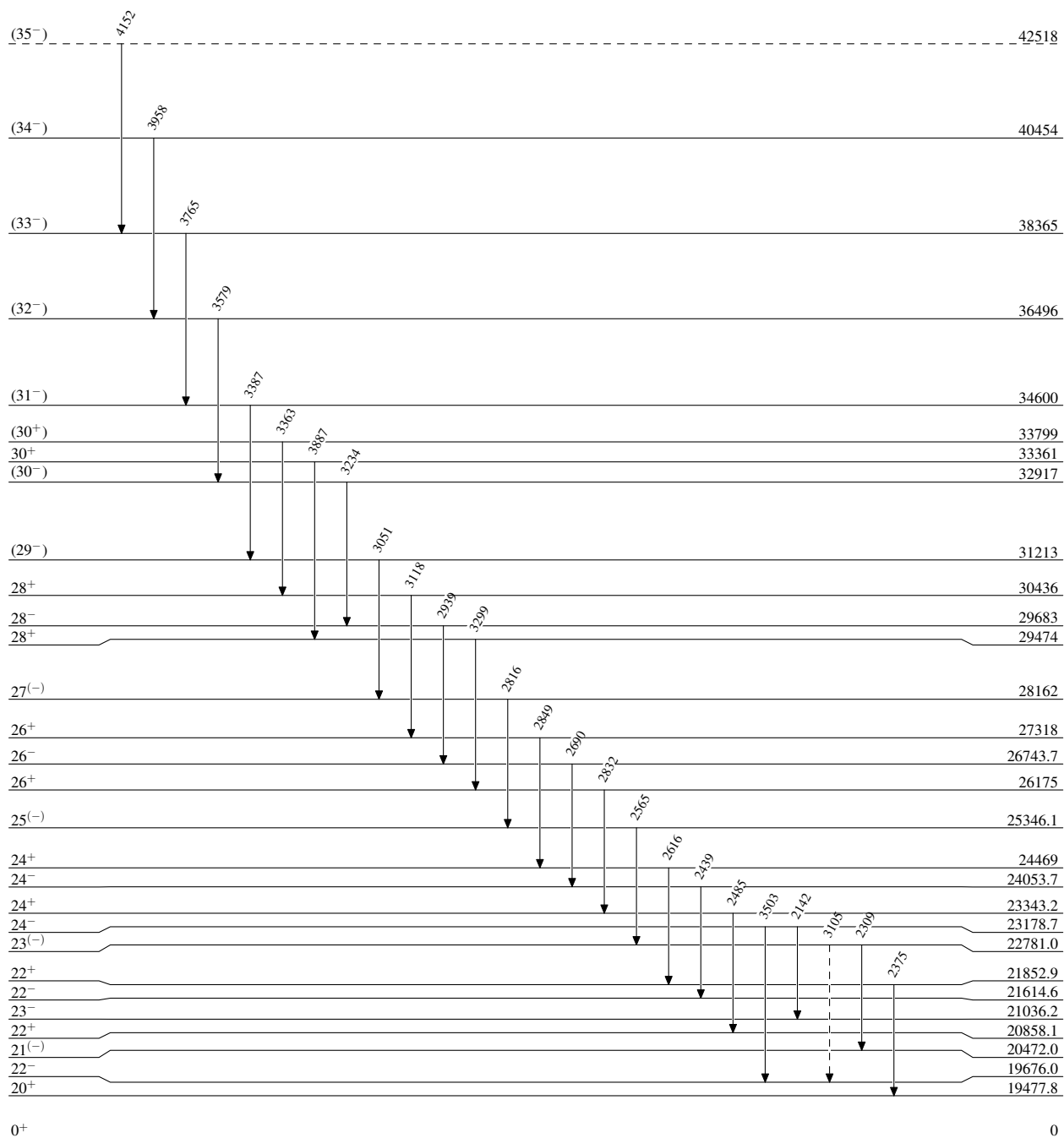
E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
2309	22781.0	23 ⁽⁻⁾	20472.0	21 ⁽⁻⁾	
2333	11546.1	14 ⁺	9213.4	13 ⁻	
2355	8436.7	10 ⁺	6081.6	9 ⁻	
2375	21852.9	22 ⁺	19477.8	20 ⁺	
2402	9822.8	12 ⁺	7421.4	11 ⁻	
2437	12811.8	15 ⁻	10374.6	14 ⁺	
2439	24053.7	24 ⁻	21614.6	22 ⁻	
2483	14444.3	17 ⁻	11960.7	16 ⁺	
2485	23343.2	24 ⁺	20858.1	22 ⁺	
2535	21036.2	23 ⁻	18500.9	21 ⁻	
2565	25346.1	25 ⁽⁻⁾	22781.0	23 ⁽⁻⁾	
2581	14540.9	17 ⁻	11960.7	16 ⁺	
2616	24469	24 ⁺	21852.9	22 ⁺	
2627	11651.5	13 ⁻	9024.3	12 ⁻	
2690	26743.7	26 ⁻	24053.7	24 ⁻	
2816	28162	27 ⁽⁻⁾	25346.1	25 ⁽⁻⁾	
2832	26175	26 ⁺	23343.2	24 ⁺	
2849	27318	26 ⁺	24469	24 ⁺	
2858	14645.5	16 ⁺	11787.6	15 ⁺	
2939	29683	28 ⁻	26743.7	26 ⁻	
2963	17407.1	18 ⁻	14444.3	17 ⁻	DCO=0.59 24
2994	20472.0	21 ⁽⁻⁾	17477.4	20 ⁻	DCO=0.61 20 for 2994+3001.
3001 [†]	18414.4	(19 ⁻)	15413.8	18 ⁻	DCO=0.61 20 for 2994+3001.
3027	19399.3	20 ⁻	16372.2	19 ⁻	
3043	14831.5	16 ⁺	11787.6	15 ⁺	
3051	31213	(29 ⁻)	28162	27 ⁽⁻⁾	
3105 [†]	22781.0	23 ⁽⁻⁾	19676.0	22 ⁻	
3115	21614.6	22 ⁻	18500.9	21 ⁻	
3116	12329.5	14 ⁻	9213.4	13 ⁻	
3118	30436	28 ⁺	27318	26 ⁺	
3234	32917	(30 ⁻)	29683	28 ⁻	
3299	29474	28 ⁺	26175	26 ⁺	
3305	12329.5	14 ⁻	9024.3	12 ⁻	
3363	33799	(30 ⁺)	30436	28 ⁺	
3387	34600	(31 ⁻)	31213	(29 ⁻)	
3495	15041.1	16 ⁺	11546.1	14 ⁺	
3503	23178.7	24 ⁻	19676.0	22 ⁻	
3579	36496	(32 ⁻)	32917	(30 ⁻)	
3639	17364.4	18 ⁻	13725.4	16 ⁻	
3682 [†]	17407.1	18 ⁻	13725.4	16 ⁻	
3765	38365	(33 ⁻)	34600	(31 ⁻)	
3887	33361	30 ⁺	29474	28 ⁺	
3958	40454	(34 ⁻)	36496	(32 ⁻)	
3983	19399.3	20 ⁻	15413.8	18 ⁻	DCO=1.1 4
4152	42518?	(35 ⁻)	38365	(33 ⁻)	
4184	19477.8	20 ⁺	15294.6	18 ⁺	
4229	11651.5	13 ⁻	7421.4	11 ⁻	
4757	16716.4	18 ⁺	11960.7	16 ⁺	
4856	16817.7	18 ⁺	11960.7	16 ⁺	
5388	17349.9	18 ⁺	11960.7	16 ⁺	DCO=1.15 34

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

$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) E=122 \text{ MeV}$ 2009Ge14

Legend

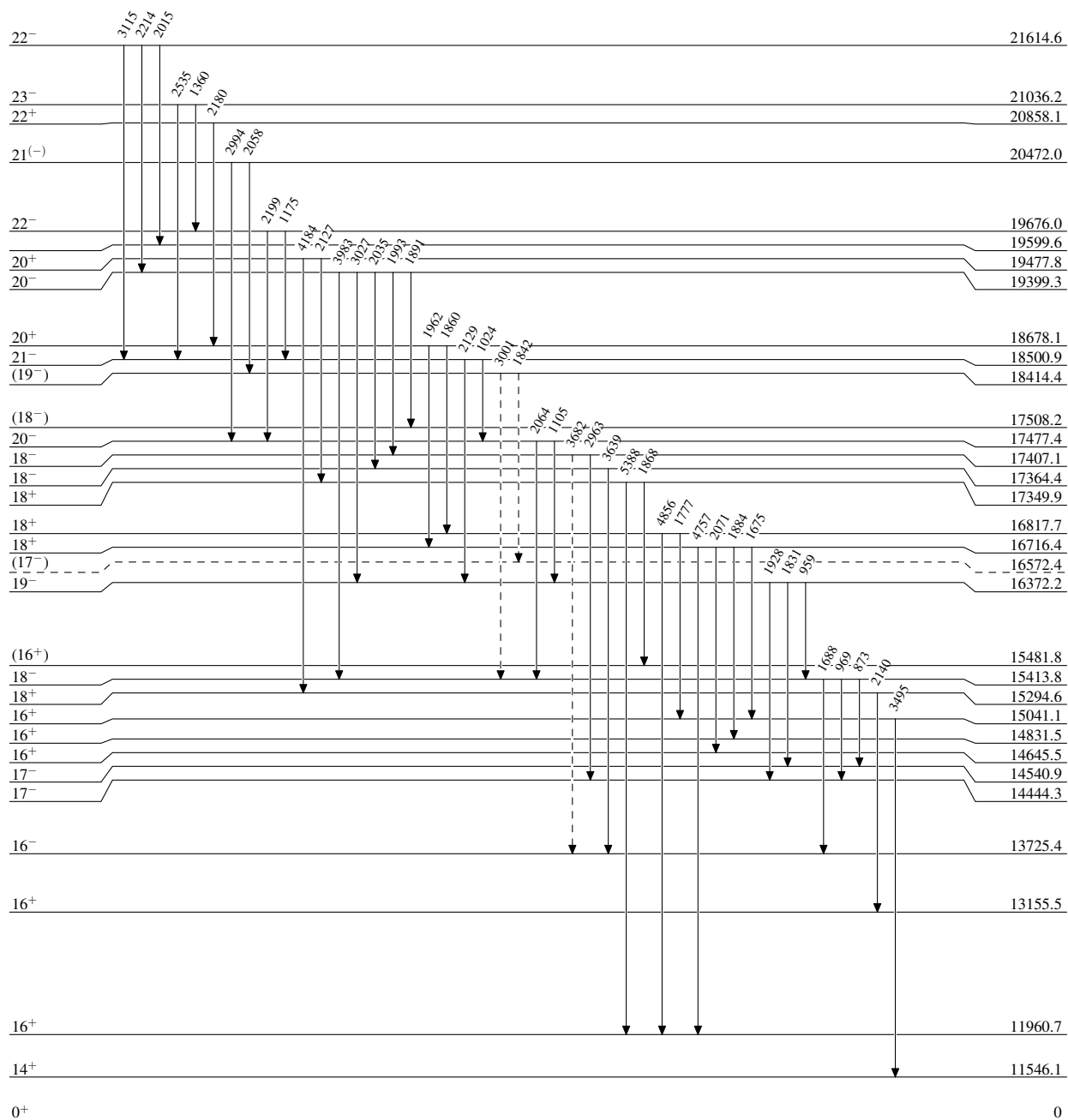
Level Scheme

-----► γ Decay (Uncertain) $^{62}_{30}\text{Zn}_{32}$

$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) E=122 \text{ MeV}$ 2009Ge14

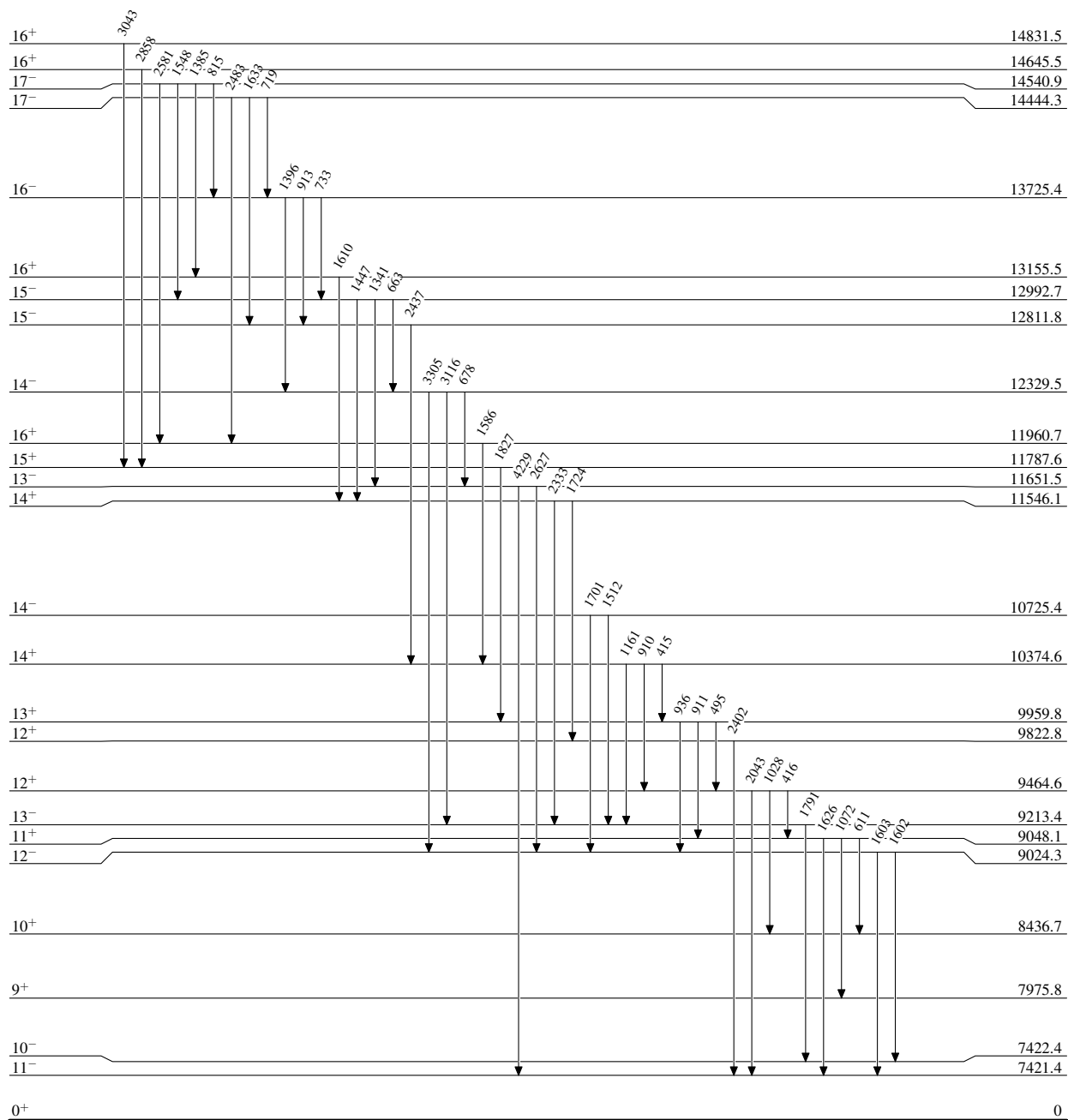
Legend

Level Scheme (continued)

-----► γ Decay (Uncertain) $^{62}_{30}\text{Zn}_{32}$

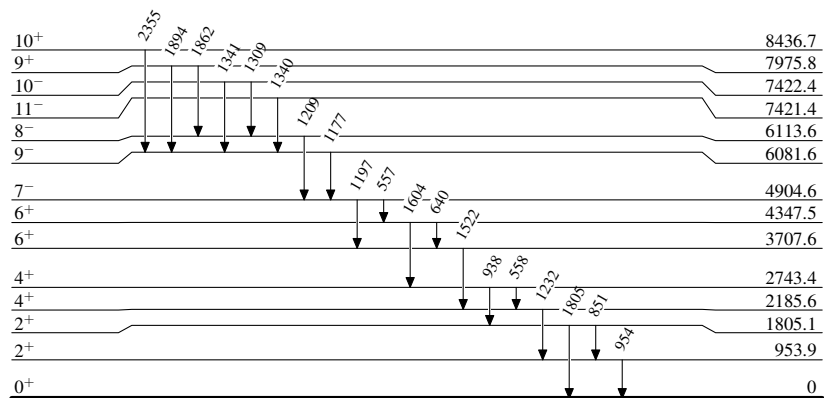
$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) E=122 \text{ MeV}$ 2009Ge14

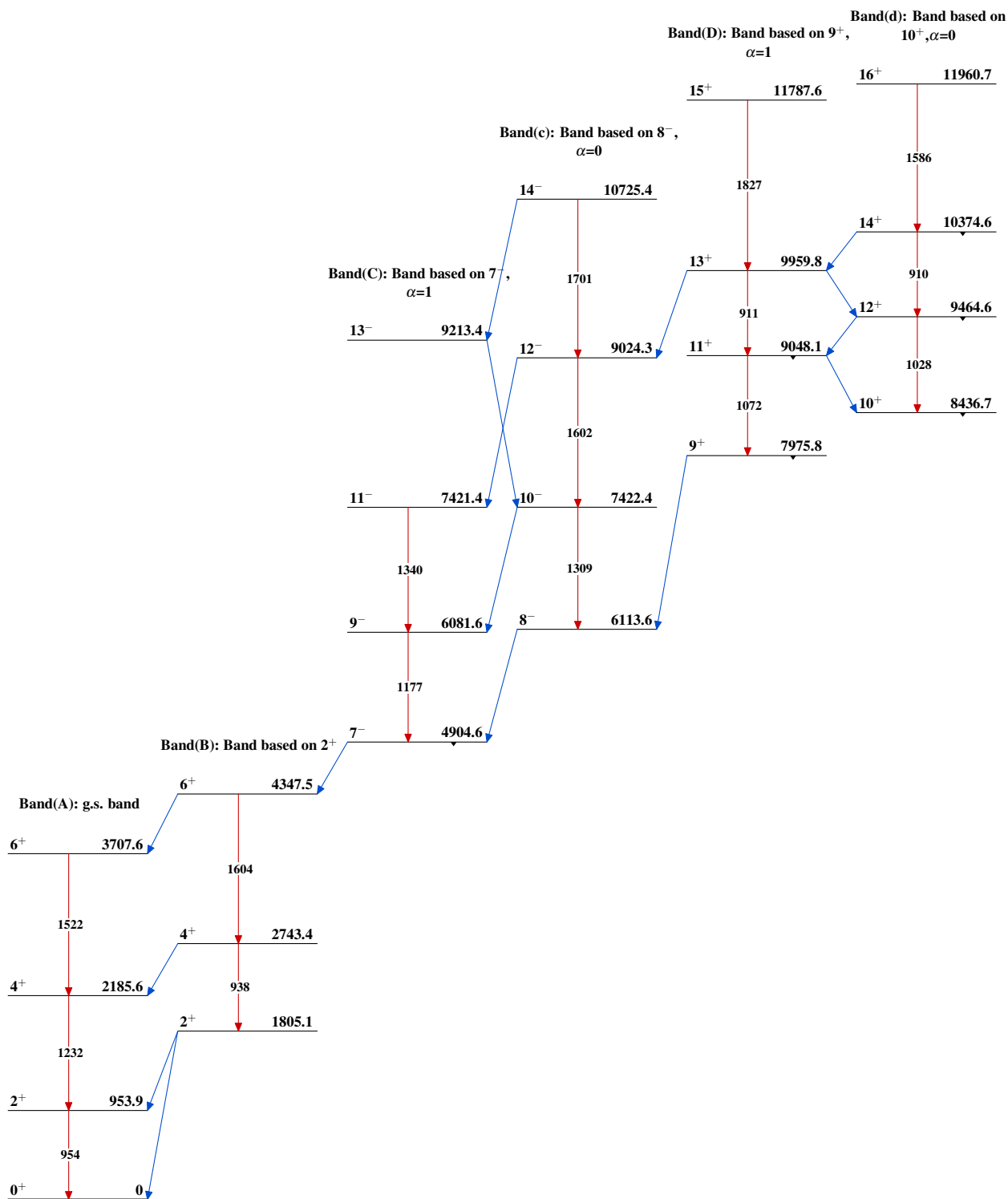
Level Scheme (continued)

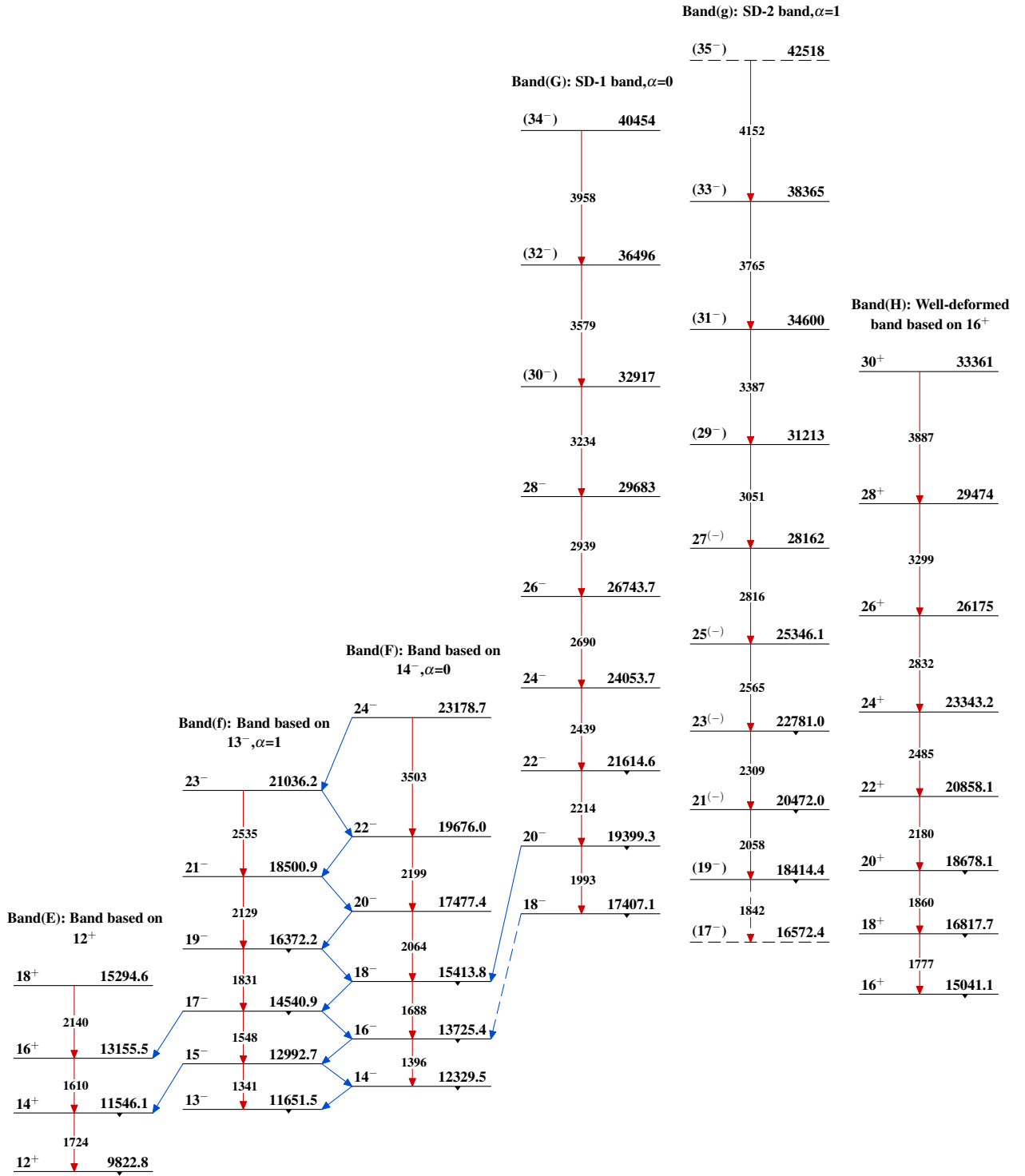


$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) E=122 \text{ MeV}$ 2009Ge14

Level Scheme (continued)

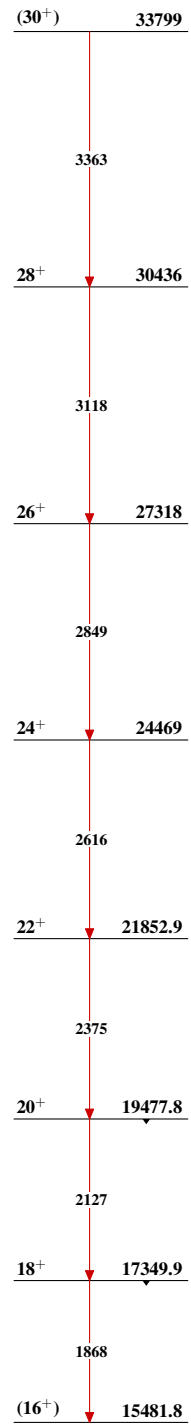
 $^{62}_{30}\text{Zn}_{32}$

$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) \text{ E}=122 \text{ MeV} \quad 2009\text{Ge14}$ 

$^{40}\text{Ca}(^{28}\text{Si}, \alpha 2p\gamma) E=122 \text{ MeV}$ 2009Ge14 (continued)

$^{40}\text{Ca}(^{28}\text{Si},\alpha 2p\gamma) \text{E}=122 \text{ MeV}$ **2009Ge14 (continued)**

Band(I): SD-3 band, $\alpha=0$



$^{62}_{30}\text{Zn}_{32}$