

$^{40}\text{Ca}(^{40}\text{Ca},\alpha 2p n\gamma)$ 2010St05

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

2010St05: E(^{40}Ca)=185 MeV. Measured E γ , I γ , $\gamma\gamma$ -coin, (particle) γ coin, $\gamma\gamma(\theta)$ (DCO) using EUROBALL spectrometer consisting of composite cluster and clover detectors. Charged particles were detected using the Italian Silicon Sphere containing 40 silicon ΔE -E telescope detectors. The neutrons were detected with neutron wall NWALL consisting of 50 liquid scintillators. Experiments conducted at XTU tandem accelerator at Legnaro. Comparison with predictions of configuration dependent Cranked Nilsson-Strutinsky calculations.

 ^{73}Kr Levels

E(level) [†]	J π^{\ddagger}	T _{1/2}	Comments
0.0 [#]	3/2 ⁻		
143.2 [@] 7	5/2 ⁻		
366.1 8	(5/2 ⁺)		
391.7 [#] 8	7/2 ⁻		
431.9 ^{&} 12	9/2 ⁺	107 ns 10	%IT=100 T _{1/2} : from Adopted Levels. J π : from Adopted Levels.
509.3 ^a 12	(7/2 ⁺)		
658.9 [@] 9	9/2 ⁻		
1002.8 [#] 10	11/2 ⁻		
1063.5 ^a 13	(11/2 ⁺)		
1175.2 ^{&} 14	13/2 ⁺		
1371.1 [@] 11	13/2 ⁻		
1828.3 [#] 12	15/2 ⁻		
1889.2 ^a 14	(15/2 ⁺)		
2066.6 ^{&} 16	17/2 ⁺		
2284.2 [@] 13	17/2 ⁻		
2861.4 [#] 16	19/2 ⁻		
2933.8 ^a 16	(19/2 ⁺)		
3150.7 ^{&} 18	21/2 ⁺		
3381.2 [@] 17	21/2 ⁻		
3611.6 19			
4084.4 [#] 19	23/2 ⁻		
4133.8 ^a 18	(23/2 ⁺)		
4395.7 ^{&} 20	25/2 ⁺		
4644.2 [@] 20	25/2 ⁻		
5341.8 ^a 20	(27/2 ⁺)		
5404.4 [#] 21	27/2 ⁻		
5500.4 ^b 21	27/2 ⁽⁻⁾		
5606.7 ^{&} 23	29/2 ⁺		
6024.2 [@] 22	29/2 ⁻		
6196.2 22			
6562.4 [#] 24	31/2 ⁻		
6801.7 ^{&} 25	33/2 ⁺		
6995.4 ^b 24	(31/2 ⁻)		
7325.3 [@] 24	33/2 ⁻		
7882 [#] 3	35/2 ⁻		
8097 ^{&} 3	37/2 ⁺		

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⁴⁰Ca(⁴⁰Ca, α 2pn γ) 2010St05 (continued)

⁷³Kr Levels (continued)

E(level) [†]	J π [‡]	Comments
8445 ^b 3	(35/2 ⁻)	
8734 [@] 3	37/2 ⁻	
9389 [#] 3	39/2 ⁻	
9519 ^{&} 3	41/2 ⁺	
10345 [@] 3	41/2 ⁻	
11089 [#] 3	43/2 ⁻	
11231 ^{&} 3	45/2 ⁺	
12082 [@] 3	45/2 ⁻	
12951 [#] 3	47/2 ⁻	
13361 ^{&} 4	49/2 ⁺	
13957 [@] 4	49/2 ⁻	
14990 [#] 4	(51/2 ⁻)	
15983 ^{&} 4	(53/2 ⁺)	
16131 [@] 4	53/2 ⁻	
17288 [#] 4	(55/2 ⁻)	
18751 [@] 4	(57/2 ⁻)	
19149 ^{&} 4	(57/2 ⁺)	
19975 [#] 4	(59/2 ⁻)	
21903 [@] 4	(61/2 ⁻)	
22876 ^{&} 4	(61/2 ⁺)	Maximum configuration spin state of $\alpha=+1/2$ signature, this band does not show a strong decrease in quadrupole collective behavior.
23165 [#] 4	(63/2 ⁻)	

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

[‡] From 2010St05 based on $\gamma\gamma(\theta)$ (DCO) data for selected transitions, interconnecting dipole and quadrupole transitions, and band assignments.

Band(A): Band based on 3/2⁻, $\alpha=-1/2$. Proposed configuration= $\nu 3/2[312]$ at low spins, at higher spins this band is crossed by $\pi g_{9/2}^3 \otimes \nu g_{9/2}^3$ configuration.

@ Band(a): Band based on 5/2⁻, $\alpha=+1/2$. Proposed configuration= $\nu 3/2[312]$ at low spins, at higher spins this band is crossed by $\pi g_{9/2}^3 \otimes \nu g_{9/2}^3$ configuration.

& Band(B): Band based on 9/2⁺, $\alpha=+1/2$. Proposed configuration= $\pi g_{9/2}^2 \otimes \nu g_{9/2}^3$. This band does not show a strong decrease in quadrupole collective behavior.

^a Band(b): Band based on (7/2⁺), $\alpha=-1/2$. Proposed configuration= $\pi g_{9/2}^2 \otimes \nu g_{9/2}^3$.

^b Band(C): Side band.

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

DCO ratios for $\Delta J=1$ and $\Delta J=2$ transitions are shown by 2010St05 in their Fig. 3.

E γ	E _i (level)	J π _i	E _f	J π _f	Mult.	Comments
(66)	431.9	9/2 ⁺	366.1	(5/2 ⁺)		
143	143.2	5/2 ⁻	0.0	3/2 ⁻		
143	509.3	(7/2 ⁺)	366.1	(5/2 ⁺)		
223	366.1	(5/2 ⁺)	143.2	5/2 ⁻	(D)	$\Delta J=0$, dipole or $\Delta J=2$, Q transition from DCO data.

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$^{40}\text{Ca}(^{40}\text{Ca},\alpha 2\text{pn}\gamma)$ **2010St05** (continued) $\gamma(^{73}\text{Kr})$ (continued)

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
248	391.7	7/2 ⁻	143.2	5/2 ⁻		
267	658.9	9/2 ⁻	391.7	7/2 ⁻		
344	1002.8	11/2 ⁻	658.9	9/2 ⁻		
366	366.1	(5/2 ⁺)	0.0	3/2 ⁻		
368	1371.1	13/2 ⁻	1002.8	11/2 ⁻		
392	391.7	7/2 ⁻	0.0	3/2 ⁻		
456	2284.2	17/2 ⁻	1828.3	15/2 ⁻		
457	1828.3	15/2 ⁻	1371.1	13/2 ⁻		
516	658.9	9/2 ⁻	143.2	5/2 ⁻		
554	1063.5	(11/2 ⁺)	509.3	(7/2 ⁺)		
611	1002.8	11/2 ⁻	391.7	7/2 ⁻		
631	1063.5	(11/2 ⁺)	431.9	9/2 ⁺		
712	1371.1	13/2 ⁻	658.9	9/2 ⁻		
714	1889.2	(15/2 ⁺)	1175.2	13/2 ⁺		
744	1175.2	13/2 ⁺	431.9	9/2 ⁺		
825	1889.2	(15/2 ⁺)	1063.5	(11/2 ⁺)		
826	1828.3	15/2 ⁻	1002.8	11/2 ⁻		
867	2933.8	(19/2 ⁺)	2066.6	17/2 ⁺		
892	2066.6	17/2 ⁺	1175.2	13/2 ⁺		
913	2284.2	17/2 ⁻	1371.1	13/2 ⁻		
984	4133.8	(23/2 ⁺)	3150.7	21/2 ⁺		
1033	2861.4	19/2 ⁻	1828.3	15/2 ⁻		
1044	2933.8	(19/2 ⁺)	1889.2	(15/2 ⁺)		
1085	3150.7	21/2 ⁺	2066.6	17/2 ⁺		
1097	3381.2	21/2 ⁻	2284.2	17/2 ⁻		
1158	6562.4	31/2 ⁻	5404.4	27/2 ⁻		
1195	6801.7	33/2 ⁺	5606.7	29/2 ⁺		
1199	4133.8	(23/2 ⁺)	2933.8	(19/2 ⁺)		
1208	5341.8	(27/2 ⁺)	4133.8	(23/2 ⁺)		
1211	5606.7	29/2 ⁺	4395.7	25/2 ⁺		
1223	4084.4	23/2 ⁻	2861.4	19/2 ⁻		
1245	4395.7	25/2 ⁺	3150.7	21/2 ⁺		
1263	4644.2	25/2 ⁻	3381.2	21/2 ⁻		
1295	8097	37/2 ⁺	6801.7	33/2 ⁺		
1301	7325.3	33/2 ⁻	6024.2	29/2 ⁻		
1320 [†]	5404.4	27/2 ⁻	4084.4	23/2 ⁻	(Q)	DCO=0.9 <i>I</i> DCO for 1320 doublet.
1320 [†]	7882	35/2 ⁻	6562.4	31/2 ⁻	(Q)	
1380	6024.2	29/2 ⁻	4644.2	25/2 ⁻		
1409	8734	37/2 ⁻	7325.3	33/2 ⁻		
1416	5500.4	27/2 ⁽⁻⁾	4084.4	23/2 ⁻		
1422	9519	41/2 ⁺	8097	37/2 ⁺		
1450	8445	(35/2 ⁻)	6995.4	(31/2 ⁻)		
1495	6995.4	(31/2 ⁻)	5500.4	27/2 ⁽⁻⁾		
1507	9389	39/2 ⁻	7882	35/2 ⁻		
1545	3611.6		2066.6	17/2 ⁺		
1552	6196.2		4644.2	25/2 ⁻		
1611	10345	41/2 ⁻	8734	37/2 ⁻		
1700	11089	43/2 ⁻	9389	39/2 ⁻		
1712	11231	45/2 ⁺	9519	41/2 ⁺		
1737	12082	45/2 ⁻	10345	41/2 ⁻		
1862	12951	47/2 ⁻	11089	43/2 ⁻		E_γ : 1882 in $^{40}\text{Ca}(^{36}\text{Ar},2\text{pn}\gamma),(^{40}\text{Ca},\alpha 2\text{pn}\gamma)$ (2002Ke03), which is also listed in Adopted dataset. Value of 1862 in 2010St05 could be a misprint.
1875	13957	49/2 ⁻	12082	45/2 ⁻		

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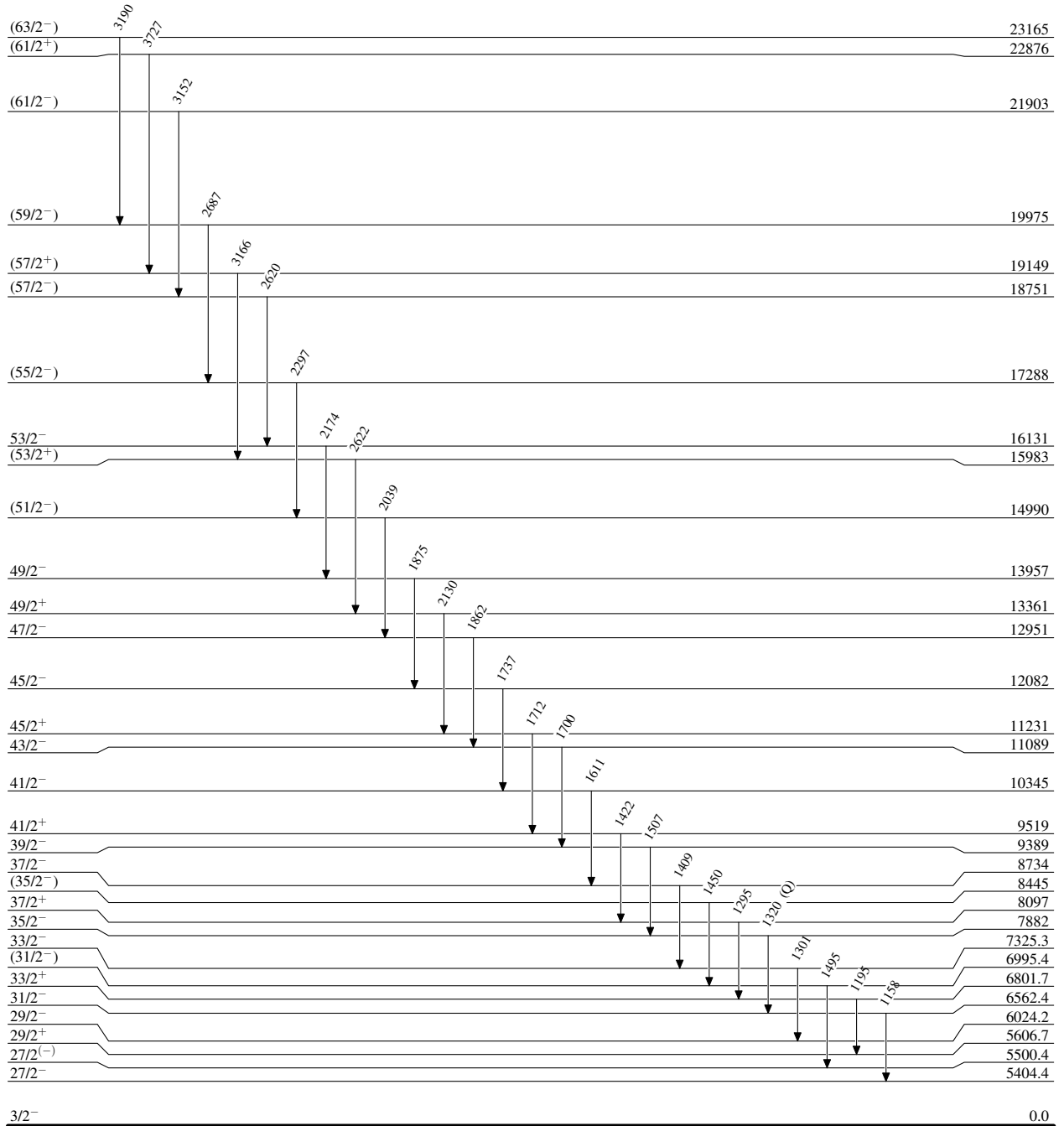
${}^{40}\text{Ca}({}^{40}\text{Ca},\alpha 2\text{pn}\gamma)$ 2010St05 (continued) $\gamma({}^{73}\text{Kr})$ (continued)

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
2039	14990	(51/2 ⁻)	12951	47/2 ⁻	2687	19975	(59/2 ⁻)	17288	(55/2 ⁻)
2130	13361	49/2 ⁺	11231	45/2 ⁺	3152	21903	(61/2 ⁻)	18751	(57/2 ⁻)
2174	16131	53/2 ⁻	13957	49/2 ⁻	3166	19149	(57/2 ⁺)	15983	(53/2 ⁺)
2297	17288	(55/2 ⁻)	14990	(51/2 ⁻)	3190	23165	(63/2 ⁻)	19975	(59/2 ⁻)
2620	18751	(57/2 ⁻)	16131	53/2 ⁻	3727	22876	(61/2 ⁺)	19149	(57/2 ⁺)
2622	15983	(53/2 ⁺)	13361	49/2 ⁺					

† Multiply placed.

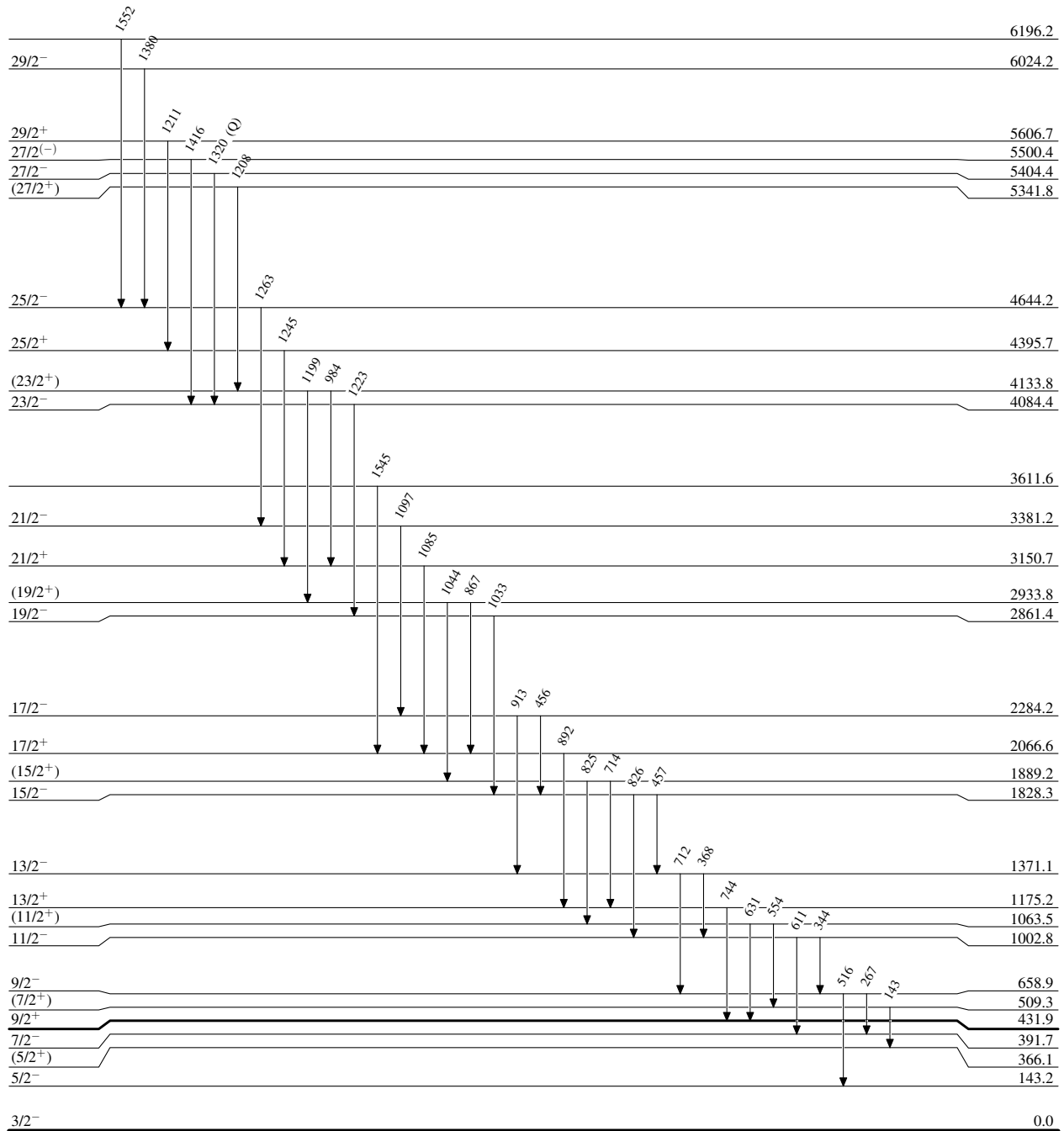
${}^{40}\text{Ca}({}^{40}\text{Ca}, \alpha 2p n \gamma)$ 2010St05

Level Scheme



${}^{40}\text{Ca}({}^{40}\text{Ca}, \alpha 2p n \gamma)$ 2010St05

Level Scheme (continued)

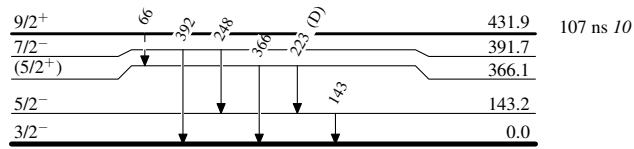


107 ns 10

${}^{40}\text{Ca}({}^{40}\text{Ca}, \alpha 2p n \gamma)$ 2010St05

Legend

Level Scheme (continued)

-----► γ Decay (Uncertain) ${}^{73}_{36}\text{Kr}_{37}$

$^{40}\text{Ca}(\alpha^{40}\text{Ca}, \alpha 2\text{pn}\gamma)$ 2010St05