

⁴⁸Ca(¹¹B,2np γ) 1977Na12,2003Ap01,2011Se09

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	25-Mar-2022

1977Na12: E(¹¹B)=25-50 MeV, measured E γ , I γ , $\gamma\gamma$ -coin, level lifetimes by recoil-distance method (RDM) and Doppler-shift attenuation method (DSAM) using Ge(Li) detectors.

2003Ap01: E(¹¹B)=35-40 MeV from Yale ESTU Tandem Van de Graaff accelerator. Measured E γ , I γ , $\gamma\gamma$ -coin, $\gamma(\theta)$ and $\gamma\gamma(\text{lin pol})$ using the YRAST array consisting of 24 escape-suppressed Ge detectors, three at 160°, eight at 126°, and seven segmented Clovers at 90°, six at 50°, and three LEPS detectors, one at 90° and two at 50°. Comparison with total Routhian surface calculations and with previous predictions of subshell closures at N=32 and 34.

2011Se09: E(¹¹B)=32 MeV. Measured lifetimes of the first 2⁺ and 4⁺ states using a plunger device at Cologne in $\gamma\gamma$ -coin arrangement using Euroball cluster detector array and five Ge detectors. Comparison with large-scale shell model calculations using KB3G and GXPF1A interactions.

⁵⁶Cr Levels

E(level) [†]	J ^{π}	T _{1/2}	Comments
0.0 [‡]	0 ⁺		
1006.65 [‡] 20	2 ⁺	3.81 ps 10	T _{1/2} : measured mean lifetime $\tau=5.49$ ps 14 (2011Se09).
1831.6 4	2 ⁺		
2076.6 [‡] 3	4 ⁺	2.18 ps 8	T _{1/2} : measured mean lifetime $\tau=3.15$ ps 11 (2011Se09). Other: mean lifetime $\tau\leq 3.4$ ps 6 or <4 ps (T _{1/2} <2.8 ps) (1977Na12), without applying feeding correction from higher level(s).
2281.7 8	(3)		
2681.7 11	4 ⁺		E(level),J ^{π} : level from 1977Na12. T _{1/2} : ≥ 0.7 ps (1977Na12), probably from DSAM.
3251.8 [‡] 6	6 ⁺		J=[6] in 1977Na12. T _{1/2} : ≥ 0.7 ps (1977Na12), probably from DSAM.
3860.8 8	(6)		E(level): due to reversed ordering of the 587.6 γ – 607.8 γ cascade in the Adopted dataset, this level corresponds to 3841.2 level in the Adopted Levels.
4448.5 [#] 6	7		J= $[\geq 7]$ in 1977Na12. T _{1/2} : ≥ 0.7 ps (1977Na12), probably from DSAM.
4753.2 [‡] 9	8 ⁺		
5602.1 [#] 8	9		J= $[\geq 8]$ in 1977Na12.
6884.9 13	(10)		
7057.6 [#] 10	11		
8767.7 [#] 12	13		

[†] From least-squares fit to E γ values.

[‡] Band(A): g.s. band.

[#] Band(B): Band based on J=7.

$\gamma(^{56}\text{Cr})$

A₂, A₄ and POL values are from 2003Ap01.

E γ [†]	I γ [@]	E _i (level)	J _i ^{π}	E _f	J _f ^{π}	Comments
^x 447.95 30						E γ ,I γ : from 1977Na12, I γ =4.5. This γ may be from 2274, (3 ⁺) level in the Adopted Levels.
450.1 7	3.8 7	2281.7	(3)	1831.6	2 ⁺	
587.6 [‡] 6	9.3 5	4448.5	7	3860.8	(6)	

Continued on next page (footnotes at end of table)

$^{48}\text{Ca}(^{11}\text{B},2\text{np}\gamma)$ **1977Na12,2003Ap01,2011Se09 (continued)** $\gamma(^{56}\text{Cr})$ (continued)

E_γ †	I_γ @	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	Comments
608.8 ‡ 6 824.90 25	14.2 5 17 3	3860.8 1831.6	(6) 2 ⁺	3251.8 1006.65	6 ⁺ 2 ⁺	M1+E2	$A_2=+0.08$ 7; $A_4=+0.25$ 6 pol= -0.85 33 $E_\gamma=824.3$ 7 (2003Ap01). $E_\gamma=824.98$ 25, $I_\gamma=11$ 2 (1977Na12).
848.6 6 850.1 10	14.5 5	5602.1 2681.7	9 4 ⁺	4753.2 1831.6	8 ⁺ 2 ⁺		E_γ, I_γ : from 1977Na12, $I_\gamma=7.7$. Note that an 848.6 γ is placed from a 5602, J=9 level in 2003Ap01.
1006.64 20	100 3	1006.65	2 ⁺	0.0	0 ⁺	E2	$A_2=+0.27$ 4; $A_4=0.00$ 4; pol= $+0.60$ 22 $E_\gamma=1006.9$ 5 (2003Ap01). $E_\gamma=1006.60$ 20, $I_\gamma=100$ (1977Na12).
1069.95 17	81 5	2076.6	4 ⁺	1006.65	2 ⁺		$A_2=+0.44$ 6; $A_4=+0.15$ 5 $E_\gamma=1069.8$ 5 (2003Ap01). $E_\gamma=1069.97$ 18, $I_\gamma=60.7$ (1977Na12). Sign of A_4 is inconsistent with $\Delta J=2$ transition.
1153.8 5	34.8 # 2	5602.1	9	4448.5	7	E2	$A_2=+0.59$ 8; $A_4=+0.07$ 7; pol= $+0.70$ 25 $E_\gamma=1153.6$ 5 (2003Ap01). $E_\gamma=1154.4$ 10 (1977Na12).
1175.18 50	63 4	3251.8	6 ⁺	2076.6	4 ⁺	E2	$A_2=+0.40$ 5; $A_4=-0.07$ 5; pol= $+0.45$ 17 $E_\gamma=1175.0$ 5 (2003Ap01). $E_\gamma=1175.36$ 50, $I_\gamma=45.0$ (1977Na12).
1196.76 22	34.2 2	4448.5	7	3251.8	6 ⁺		$A_2=-0.30$ 4; $A_4=+0.07$ 4; pol= $+0.35$ 60 $E_\gamma=1196.3$ 5 (2003Ap01). $E_\gamma=1196.85$ 22, $I_\gamma=17.9$ (1977Na12).
1282.8 10	9.1 8	6884.9	(10)	5602.1	9		
1455.5 6	31.0 # 2	7057.6	11	5602.1	9	Q	$A_2=+0.46$ 7; $A_4=-0.14$ 7
1500.1 12	19.5 # 2	4753.2	8 ⁺	3251.8	6 ⁺	(Q)	$A_2=+0.58$ 8; $A_4=+0.08$ 8 $E_\gamma=1501.3$ 7 (2003Ap01). $E_\gamma=1498.96$ 45, $I_\gamma=8.4$ (1977Na12, unplaced γ). Unweighted average of the two E_γ values taken.
1710.0 7	19.6 5	8767.7	13	7057.6	11	Q	$A_2=+0.24$ 8; $A_4=-0.31$ 8

† Weighted average of values from 2003Ap01 and 1977Na12, when values are available from the latter reference, otherwise from 2003Ap01. Exception for 1500.1 γ is noted.

‡ Ordering of the 587.6 γ – 607.8 γ cascade reversed in $^{238}\text{U}(^{48}\text{Ca},\text{X}\gamma)$ (2006Zh42), also given in the Adopted dataset.

Uncertainty of 0.6-1.0% in 2003Ap01 appears unrealistically low.

@ From 2003Ap01. Values from 1977Na12 are listed under comments.

& Assigned by evaluator based on $\gamma(\theta)$ and $\gamma(\text{pol})$ data in 2003Ap01.

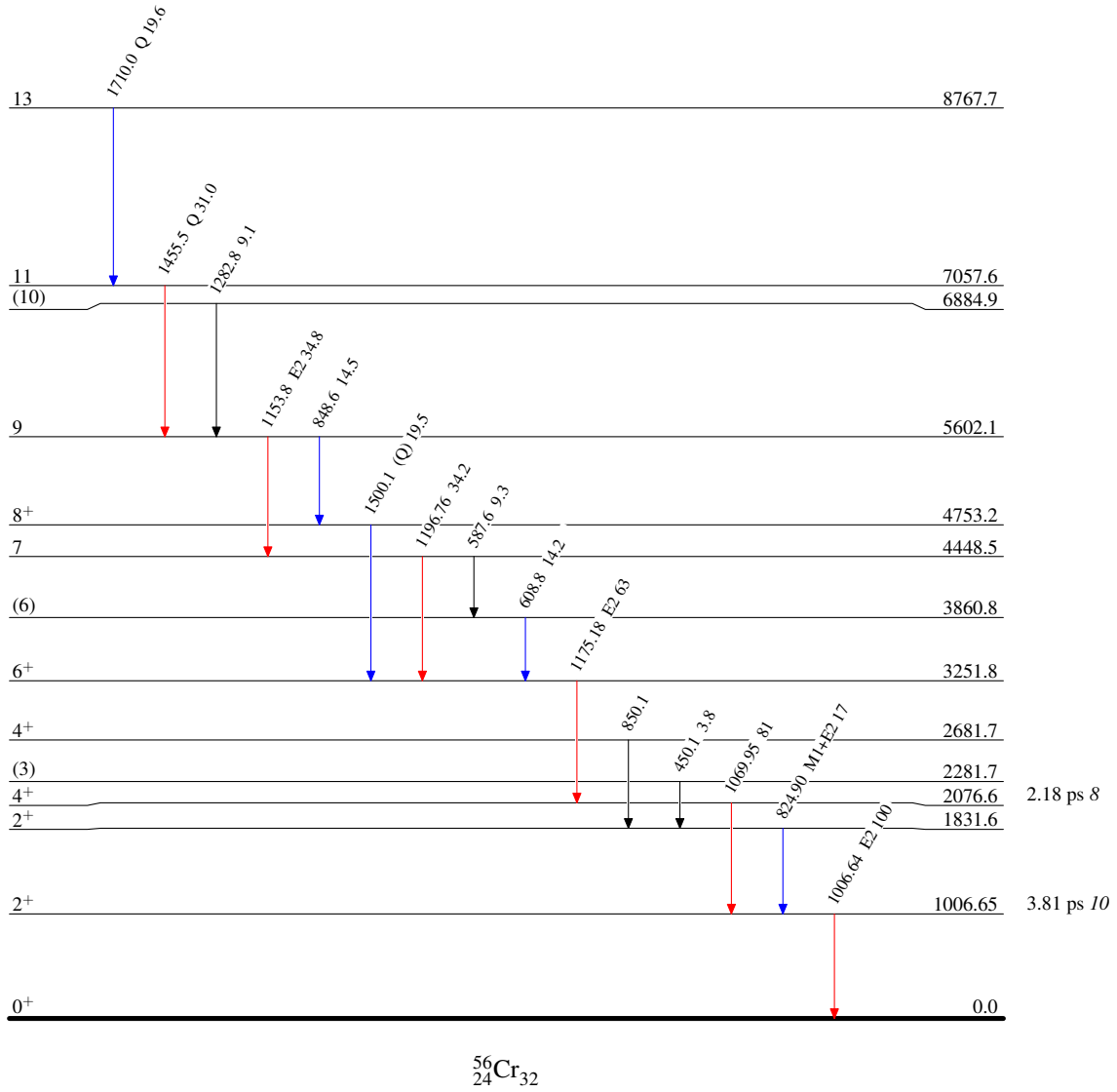
x γ ray not placed in level scheme.

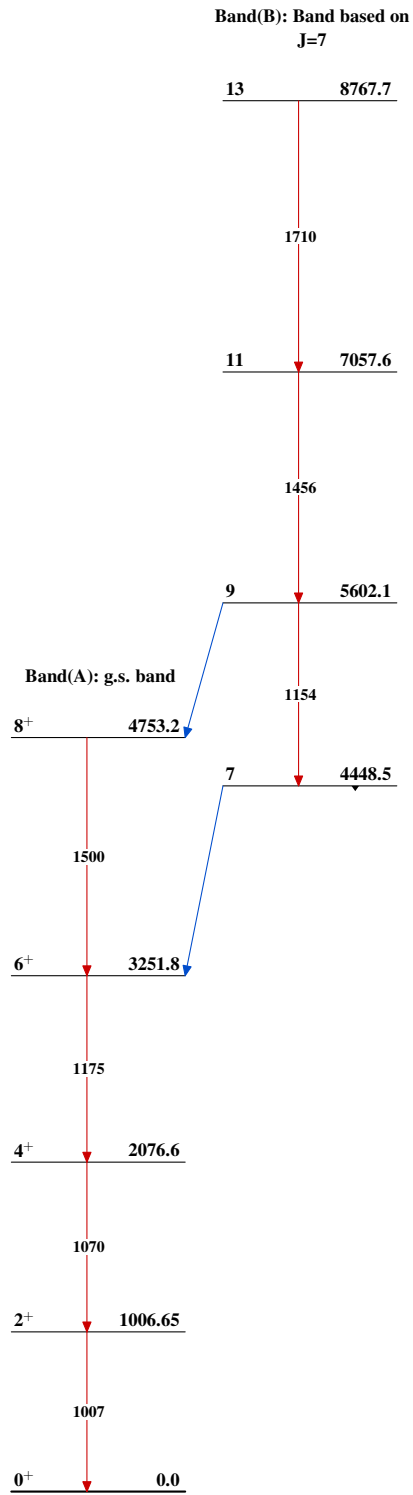
$^{48}\text{Ca}(^{11}\text{B},2\text{np}\gamma)$ 1977Na12,2003Ap01,2011Se09

Level Scheme
Intensities: Relative I_γ

Legend

- \rightarrow $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- \rightarrow $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- \rightarrow $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



$^{48}\text{Ca}(^{11}\text{B}, 2\text{np}\gamma)$ 1977Na12,2003Ap01,2011Se09 $^{56}_{24}\text{Cr}_{32}$