^{160}Gd(^{9}Be,4nγ):E=57 MeV 2012Sw01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 194,460 (2024)	31-Oct-2022

2012Sw01: E(^{9}Be)=57 MeV. Target=4.36 mg/cm^2, enriched ^{160}Gd (>95%). Gamma rays detected by CAESAR array consisting of six HPGe detectors, and three larger HPGe detectors, all Compton suppressed, at the 14UD tandem accelerator at the Australian National University Heavy Ion Accelerator Facility. Measured Eγ, Iγ, $\gamma\gamma$-coin, lifetime of an isomer by γ(t). Deduced high-spin levels, J^π, configurations.

^{165}Er Levels

E(level)†	J$^\pi$‡	T$_{1/2}$	Comments
0.0#	5/2$^-$		
62.8a *1*	7/2$^+$		
167.4a *1*	11/2$^+$		
175.9# *1*	9/2$^-$		
372.4a *1*	15/2$^+$		
435.5# *1*	13/2$^-$		
550.6@ *1*	11/2$^-$	0.25 μs *3*	%IT=100 T$_{1/2}$: from the Adopted Levels.
678.4a *2*	19/2$^+$		
706.2@ *1*	13/2$^-$		
772.4# *1*	17/2$^-$		
882.4@ *1*	15/2$^-$		
1078.4@ *2*	17/2$^-$		
1317.8& *1*	(15/2$^-$)		This level decays only by 767.2γ.
1506.0& *1*	(17/2$^-$)		Iγ(188.2):Iγ(623.6):Iγ(799.8)=13 *1*:24 *2*:62 *4*.
1823.0 *1*	(19/2)	0.37 μs *4*	%IT=100 T$_{1/2}$: from 799.8γ(t) (2012Sw01). Possible configurations=ν5/2[523]$\otimes\pi$7/2[523]$\otimes\pi$7/2[404] for J^π(1823 level)=19/2$^+$; ν5/2[642]$\otimes\pi$7/2[523]$\otimes\pi$7/2[404] for J^π(1823 level)=19/2$^-$; ν7/2[633]$\otimes\pi$7/2[523]$\otimes\pi$7/2[404] or ν11/2[505]$\otimes\nu$5/2[523]$\otimes\nu$5/2[512] for J^π(1823 level)=21/2$^-$. Iγ(317.0):Iγ(1050.6):Iγ(1144.6)=100 *8*:5 *1*:17 *2*.
x*b*	(19/2$^-$)		
101.8+x*b* *1*	(21/2$^-$)		
242.0+x*b* *2*	(23/2$^-$)		
410.8+x*b* *2*	(25/2$^-$)		
603.3+x*b* *2*	(27/2$^-$)		Magnitude of g_K-g_R=0.31 *+5−3*.
816.5+x*b* *2*	(29/2$^-$)		Magnitude of g_K-g_R=0.33 *+10−7*.
1049.3+x*b* *2*	(31/2$^-$)		Magnitude of g_K-g_R=0.39 *+5−4*.
1298.6+x*b* *2*	(33/2$^-$)		Magnitude of g_K-g_R=0.33 *+6−5*.
1564.9+x*b* *2*	(35/2$^-$)		Magnitude of g_K-g_R=0.31 *7*.
y*c*	(19/2$^+$)		
188.7+y*c* *1*	(21/2$^+$)		
393.8+y*c* *2*	(23/2$^+$)		
615.0+y*c* *2*	(25/2$^+$)		
852.0+y*c* *2*	(27/2$^+$)		
1103.3+y*c* *2*	(29/2$^+$)		
1368.7+y*c* *3*	(31/2$^+$)		

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^{165}Er Levels (continued)

† From least-squares fit to Eγ data, assuming ΔEγ=0.1 keV uncertainty, when Eγ is taken from Fig. 16 in 2012Sw01 where uncertainty for Eγ is not stated.
‡ As given in 2012Sw01, based on earlier assignments in literature for low-lying levels, and from band structures in the present work for higher energy, and high-spin (≥15/2) levels.
# Band(A): g.s. band.
@ Band(B): K^{π}=11/2$^-$ band.
& Band(C): Band based on (15/2$^-$).
a Band(D): K^{π}=5/2$^+$.
b Band(E): K^{π}=(19/2$^-$) band. The floating bands based on 19/2 are in early coincidence with respect to the delayed isomeric transitions, so must decay through the isomer. Authors state "It is highly likely that one of these bands is the isomer band, while the other decays into the isomer bandhead through a low-energy E1 transition (<60 keV). This transition may be obscured by strong x rays between 40 and 60 keV." Intrinsic g factors, g_K-g_R for the band based on (19/2$^-$) assume K=19/2 and Q_0=6.6 b (from 1995Mo29). Theoretical value=0.56 *5* for 19/2$^+$ configuration and 0.46 *5* for 19/2$^-$ configuration.
c Band(F): Band based on (19/2$^+$). See comments for band based on (19/2$^-$).

γ(^{165}Er)

E$_\gamma$	I$_\gamma$ †	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
62.8		62.8	7/2$^+$	0.0	5/2$^-$	
101.8 *1*	40 *3*	101.8+x	(21/2$^-$)	x	(19/2$^-$)	
104.6		167.4	11/2$^+$	62.8	7/2$^+$	
113.1		175.9	9/2$^-$	62.8	7/2$^+$	
140.2 *1*	83 *8*	242.0+x	(23/2$^-$)	101.8+x	(21/2$^-$)	
155.6		706.2	13/2$^-$	550.6	11/2$^-$	
168.8 *1*	100 *7*	410.8+x	(25/2$^-$)	242.0+x	(23/2$^-$)	
175.9		175.9	9/2$^-$	0.0	5/2$^-$	
176.2		882.4	15/2$^-$	706.2	13/2$^-$	
188.2 *1*		1506.0	(17/2$^-$)	1317.8	(15/2$^-$)	Iγ=13 *1* in the delayed γ-ray spectrum.
188.7 *1*	95 *6*	188.7+y	(21/2$^+$)	y	(19/2$^+$)	
192.5 *1*	75 *6*	603.3+x	(27/2$^-$)	410.8+x	(25/2$^-$)	
196.0		1078.4	17/2$^-$	882.4	15/2$^-$	
205.0		372.4	15/2$^+$	167.4	11/2$^+$	
205.1 *1*	66 *6*	393.8+y	(23/2$^+$)	188.7+y	(21/2$^+$)	
213.2 *1*	61 *7*	816.5+x	(29/2$^-$)	603.3+x	(27/2$^-$)	
221.2 *1*	70 *10*	615.0+y	(25/2$^+$)	393.8+y	(23/2$^+$)	
232.8 *1*	51 *5*	1049.3+x	(31/2$^-$)	816.5+x	(29/2$^-$)	
237.0 *1*	46 *7*	852.0+y	(27/2$^+$)	615.0+y	(25/2$^+$)	
242.0‡ *1*	19 *7*	242.0+x	(23/2$^-$)	x	(19/2$^-$)	
249.3 *1*	45 *6*	1298.6+x	(33/2$^-$)	1049.3+x	(31/2$^-$)	
251.3 *1*	40 *6*	1103.3+y	(29/2$^+$)	852.0+y	(27/2$^+$)	
259.6		435.5	13/2$^-$	175.9	9/2$^-$	
265.4 *1*	40 *6*	1368.7+y	(31/2$^+$)	1103.3+y	(29/2$^+$)	
266.3 *1*	27 *6*	1564.9+x	(35/2$^-$)	1298.6+x	(33/2$^-$)	
268.1		435.5	13/2$^-$	167.4	11/2$^+$	
306.0		678.4	19/2$^+$	372.4	15/2$^+$	
309.0‡ *1*	24 *8*	410.8+x	(25/2$^-$)	101.8+x	(21/2$^-$)	
317.0 *1*		1823.0	(19/2)	1506.0	(17/2$^-$)	Iγ=100 *8* in the delayed γ-ray spectrum.
331.8		882.4	15/2$^-$	550.6	11/2$^-$	
336.9		772.4	17/2$^-$	435.5	13/2$^-$	
361.3 *1*	26 *4*	603.3+x	(27/2$^-$)	242.0+x	(23/2$^-$)	
374.7		550.6	11/2$^-$	175.9	9/2$^-$	
383.2		550.6	11/2$^-$	167.4	11/2$^+$	
400.0		772.4	17/2$^-$	372.4	15/2$^+$	
405.7 *1*	30 *10*	816.5+x	(29/2$^-$)	410.8+x	(25/2$^-$)	

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$\gamma(^{165}Er)$ (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Comments
446.0 *1*	25 *3*	1049.3+x	$(31/2^-)$	603.3+x	$(27/2^-)$	
482.1 *1*	40 *7*	1298.6+x	$(33/2^-)$	816.5+x	$(29/2^-)$	
488.3[‡] *1*	25 *6*	1103.3+y	$(29/2^+)$	615.0+y	$(25/2^+)$	
515.6 *1*	34 *6*	1564.9+x	$(35/2^-)$	1049.3+x	$(31/2^-)$	
516.7[‡] *1*	32 *6*	1368.7+y	$(31/2^+)$	852.0+y	$(27/2^+)$	
623.6 *1*		1506.0	$(17/2^-)$	882.4	$15/2^-$	Iγ=24 *2* in the delayed γ-ray spectrum.
767.2 *1*		1317.8	$(15/2^-)$	550.6	$11/2^-$	Iγ=18 *2* in the delayed γ-ray spectrum.
799.8 *1*		1506.0	$(17/2^-)$	706.2	$13/2^-$	Iγ=62 *4* in the delayed γ-ray spectrum.
1050.6 *1*		1823.0	(19/2)	772.4	$17/2^-$	Iγ=5 *1* in the delayed γ-ray spectrum.
1144.6 *1*		1823.0	(19/2)	678.4	$19/2^+$	Iγ=17 *2* in the delayed γ-ray spectrum.

[†] From early $\gamma\gamma$-coin with the delayed 317-, 800- or 624-keV γ rays (2012Sw01). Delayed γ-ray intensities from the 1823-keV isomer (2012Sw01), and 1506-keV and 1318-keV levels are given under comments.

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

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Level Scheme

Intensities: Relative I_γ

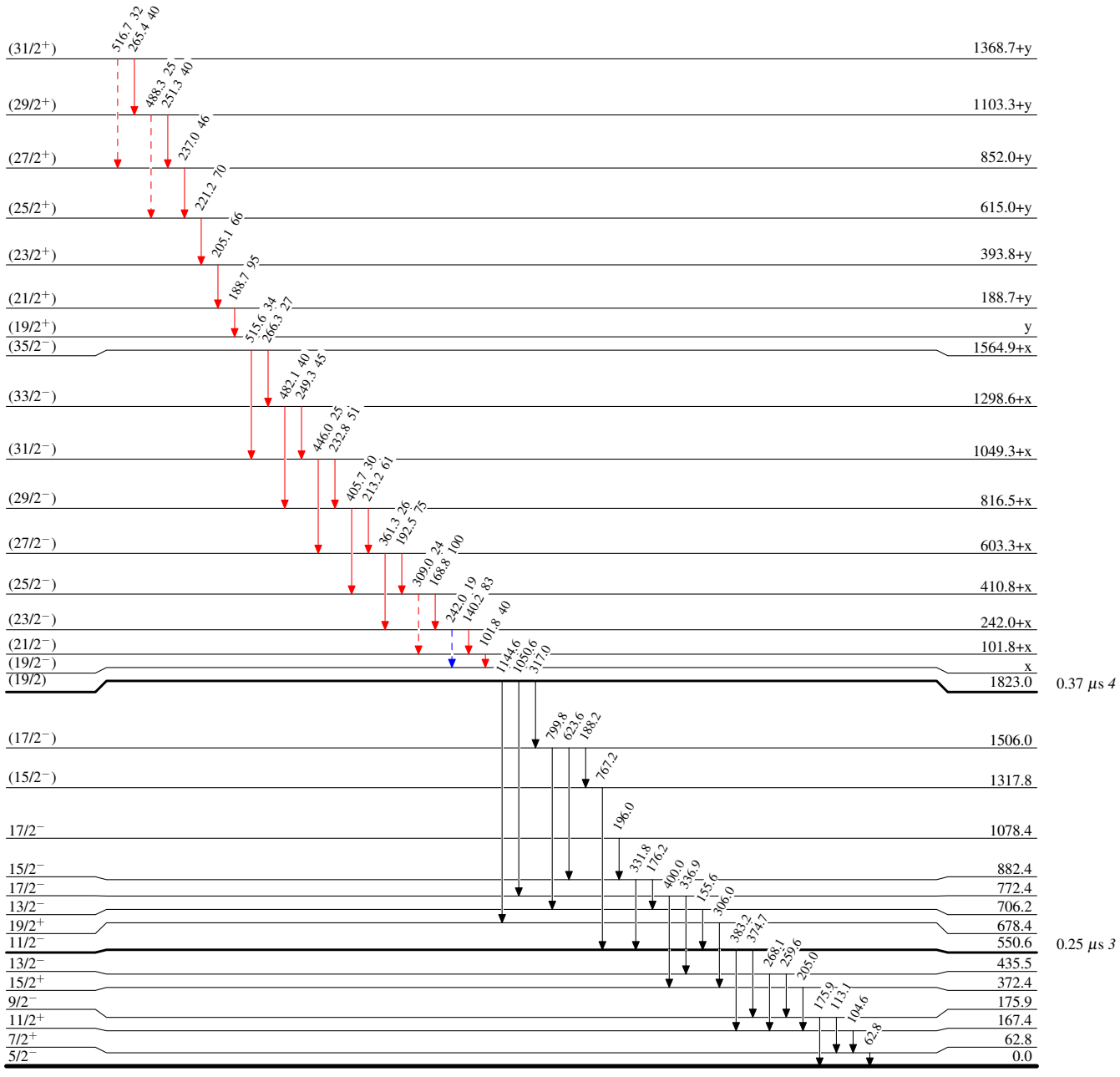
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{165}_{68}Er_{97}$

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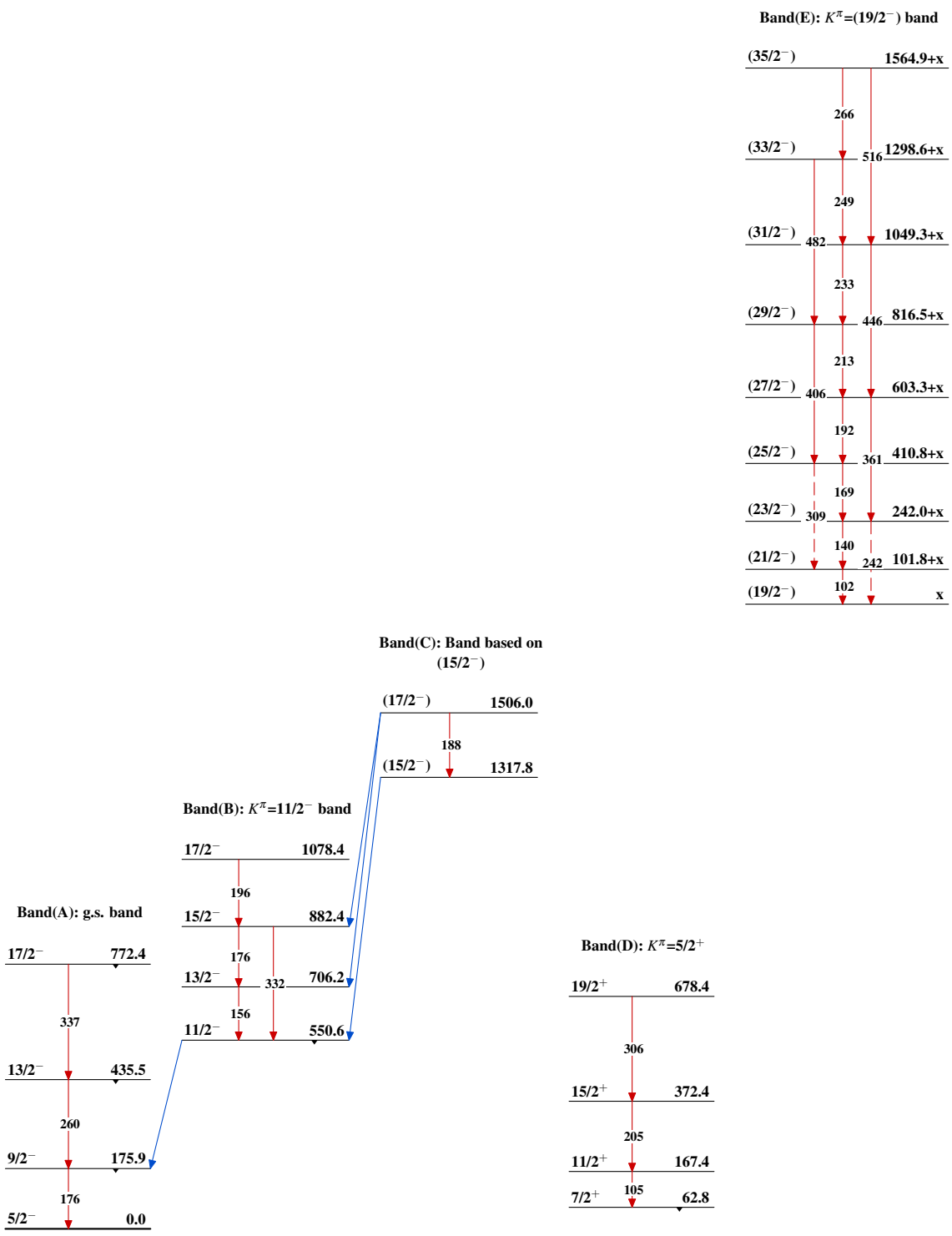

$^{165}_{68}Er_{97}$

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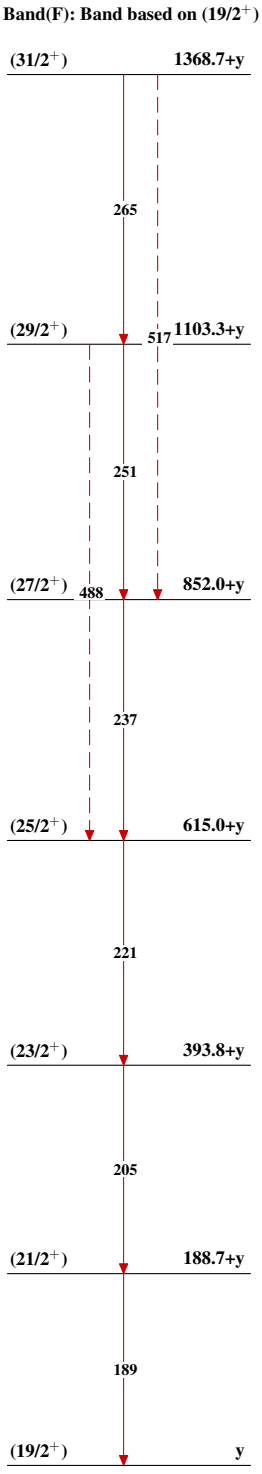

$^{165}_{68}Er_{97}$