

**Adopted Levels, Gammas**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 132, 1 (2016)	4-Dec-2015

Q( $\beta^-$ )=1365 4; S(n)=7448 5; S(p)=7387 9; Q( $\alpha$ )=-1236 10    2017Wa10  
 S(2n)=13783 5; S(2p)=17097 9    2017Wa10

Additional information 1.

Model calculations that may be of interest: bandhead energies 1990Na14.

<sup>157</sup>Eu Levels

The <sup>160</sup>Gd(p, $\alpha$ ) reaction has been studied (1980ShZL), and the evaluator has created a list of levels from a plot of the  $\alpha$  spectrum, but these levels are not included here. These data suggest the existence of about six additional levels between 760 and 950 keV; otherwise, all of the (p, $\alpha$ ) peaks can be related to Adopted Levels.

Cross Reference (XREF) Flags

- A    <sup>157</sup>Sm  $\beta^-$  decay
- B    <sup>158</sup>Gd(pol t, $\alpha$ )
- C    <sup>160</sup>Gd(p, $\alpha$ )

E(level) †‡	J $^\pi$ #	T <sub>1/2</sub>	XREF	Comments
0.0 @	5/2 <sup>+</sup>	15.18 h 3	ABC	% $\beta^-$ =100 $\mu$ =+1.50 2; Q=+2.6 3 J $^\pi$ : Measured by resonance ionization spectroscopy (1990Al34), $\pi$ from Nilsson orbit assignment. <sup>153</sup> Eu, <sup>155</sup> Eu, and <sup>159</sup> Eu all have ground-state spins of 5/2 <sup>+</sup> and are assigned as the 5/2[413] state. T <sub>1/2</sub> : From weighted average of 15.16 h 5 (1962Ho16), 15.10 h 5 (1964Sh21), 15.23 h 3 (1965CaZZ), and 15.15 h 4 (1966Da19). $\mu$ : From 2011StZZ compilation and based on 1990Al34 by resonance ionization spectroscopy; uncertainty includes only statistical components. Q: From 2011StZZ compilation and based on 1990Al34 by resonance ionization spectroscopy. $\Delta\langle r^2 \rangle(151,157) \approx \lambda(157,151)=0.779$ fm <sup>2</sup> 6 (1990Al34) given directly and $\lambda(156,157)=0.086$ 9 and $\lambda(157,158)=0.060$ 8 by subtraction of table entries. Uncertainties include only the statistical components. RMS charge radius $\langle r^2 \rangle^{1/2}=5.1351$ fm 75 (2013An02).
76.709 @ 6	7/2 <sup>+</sup>		ABC	
177 @ 4	9/2 <sup>+</sup>		B	
197.863 & 6	5/2 <sup>-</sup>		ABC	
263.228 & 14	7/2 <sup>-</sup>		ABC	
≈296 @	(11/2 <sup>+</sup> )		B	
350 & 4	9/2 <sup>-</sup>		B	
394.334 <sup>a</sup> 9	3/2 <sup>+</sup>		ABC	
453.500 <sup>a</sup> 12	5/2 <sup>+</sup>		ABC	
457 & 4	11/2 <sup>-</sup>		B	E(level): Unresolved from 453 level in (pol t, $\alpha$ ) reaction.
539 <sup>a</sup> 4	7/2 <sup>+</sup>		B	
584 & 4	(13/2 <sup>-</sup> )		B	
645 <sup>a</sup> 4	9/2 <sup>+</sup>		B	
670.419 25			A	
716.31 5			A	

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**Adopted Levels, Gammas (continued)**

<sup>157</sup>Eu Levels (continued)

E(level) <sup>†‡</sup>	J <sup>π</sup> #	XREF	Comments
724 <sup>&amp;</sup> 4	(15/2 <sup>-</sup> )	B	
971.99 <sup>c</sup> 9	3/2 <sup>+</sup>	ABC	
988.38 10		A	
1021.27 10		A	
1057 <sup>b</sup> 4	1/2 <sup>+</sup>	B	
1073 4		B	
≈1098		B	
1145 <sup>b</sup> 4	(5/2 <sup>+</sup> )	B	Probably a doublet in (pol t,α). The 3/2 <sup>+</sup> and 5/2 <sup>+</sup> members of this band are expected to lie close together. J <sup>π</sup> : positive analysing power indicates 5/2 <sup>+</sup> (1979Bu05 in (pol t,α)).
≈1247		B	
≈1300		B	
1322 <sup>b</sup> 4	(7/2 <sup>+</sup> )	B	
1360.92 13		A	
1369 4		B	
1377.32 12		A	
1382.94 80		A	
1404 4		B	
1418.47 18		A	
1463.12 7		ABC	
1562 4		B	
1603 4		B	
1635 4		B	
1711 4		B	
1823 4		B	
1850 4		B	
1945 4		B	
2035 4		B	

<sup>†</sup> The pseudolevels included in the <sup>157</sup>Sm β- decay are not included here.

<sup>‡</sup> From least-squares fit to the γ energies where γ's are present, that is, the levels populated by the β- decay of <sup>157</sup>Sm; other values are from the (pol t,α) reaction.

# The J<sup>π</sup> and Nilsson orbital assignments are primarily based on the interpretation of (pol t,α) results in terms of the predicted Nilsson orbitals and the associated bands. Where the γ's are observed, the decay modes support these assignments.

@ Band(A): 5/2[413] band, A=10.96.

& Band(B): 5/2[532] band, A=9.34.

<sup>a</sup> Band(C): 3/2[411] band, A=11.83.

<sup>b</sup> Band(D): 1/2[420] band, A=14.7, a=1.0.

<sup>c</sup> Band(E): 1/2[411] band.

γ(<sup>157</sup>Eu)

E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>γ</sub> <sup>†</sup>	I <sub>γ</sub> <sup>†</sup>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>	E <sub>i</sub> (level)	J <sub>i</sub> <sup>π</sup>	E <sub>γ</sub> <sup>†</sup>	I <sub>γ</sub> <sup>†</sup>	E <sub>f</sub>	J <sub>f</sub> <sup>π</sup>
76.709	7/2 <sup>+</sup>	76.701 7	100	0.0	5/2 <sup>+</sup>	394.334	3/2 <sup>+</sup>	317.46 7	7.8 5	76.709	7/2 <sup>+</sup>
197.863	5/2 <sup>-</sup>	121.147 7	8.50 16	76.709	7/2 <sup>+</sup>			394.351 16	71.7 10	0.0	5/2 <sup>+</sup>
		197.870 8	100.0 3	0.0	5/2 <sup>+</sup>	453.500	5/2 <sup>+</sup>	59.168 10	99.5 25	394.334	3/2 <sup>+</sup>
263.228	7/2 <sup>-</sup>	65.44 10	5.4 17	197.863	5/2 <sup>-</sup>			190.273 17	100 3	263.228	7/2 <sup>-</sup>
		186.55 3	60 3	76.709	7/2 <sup>+</sup>			376.70 11	26 3	76.709	7/2 <sup>+</sup>
		263.207 22	100 5	0.0	5/2 <sup>+</sup>			453.47 6	36 10	0.0	5/2 <sup>+</sup>
394.334	3/2 <sup>+</sup>	196.461 9	100.0 14	197.863	5/2 <sup>-</sup>	670.419		216.95 6	32 4	453.500	5/2 <sup>+</sup>

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Adopted Levels, Gammas (continued) $\gamma(^{157}\text{Eu})$  (continued)

$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$	$E_i(\text{level})$	$J_i^\pi$	$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_f$	$J_f^\pi$
670.419		276.05 3	100 3	394.334	3/2 <sup>+</sup>	1021.27		758.2 3	37 9	263.228	7/2 <sup>-</sup>
		472.65 6	78 5	197.863	5/2 <sup>-</sup>			823.39 10	100 8	197.863	5/2 <sup>-</sup>
		670.46 11	51 4	0.0	5/2 <sup>+</sup>	1360.92		966.2 3	36 7	394.334	3/2 <sup>+</sup>
716.31		321.78 10	33 4	394.334	3/2 <sup>+</sup>			1163.14 14	100 8	197.863	5/2 <sup>-</sup>
		453.1 4	39 10	263.228	7/2 <sup>-</sup>	1377.32		1300.1 3	46 10	76.709	7/2 <sup>+</sup>
		518.46 <sup>‡</sup> 11	41 <sup>‡</sup> 4	197.863	5/2 <sup>-</sup>			1377.40 12	100 8	0.0	5/2 <sup>+</sup>
		716.40 7	100 6	0.0	5/2 <sup>+</sup>	1382.94		988.2 1	73 32	394.334	3/2 <sup>+</sup>
971.99	3/2 <sup>+</sup>	518.46 <sup>‡</sup> 11	92 <sup>‡</sup> 10	453.500	5/2 <sup>+</sup>			1185.65 12	100 9	197.863	5/2 <sup>-</sup>
		577.69 12	100 15	394.334	3/2 <sup>+</sup>	1418.47		1155.04 24	100 19	263.228	7/2 <sup>-</sup>
988.38		534.60 20	13 3	453.500	5/2 <sup>+</sup>			1220.82 25	89 17	197.863	5/2 <sup>-</sup>
		594.24 17	20 3	394.334	3/2 <sup>+</sup>	1463.12		1386.35 10	34.5 22	76.709	7/2 <sup>+</sup>
		988.38 13	100 15	0.0	5/2 <sup>+</sup>			1463.16 9	100 6	0.0	5/2 <sup>+</sup>

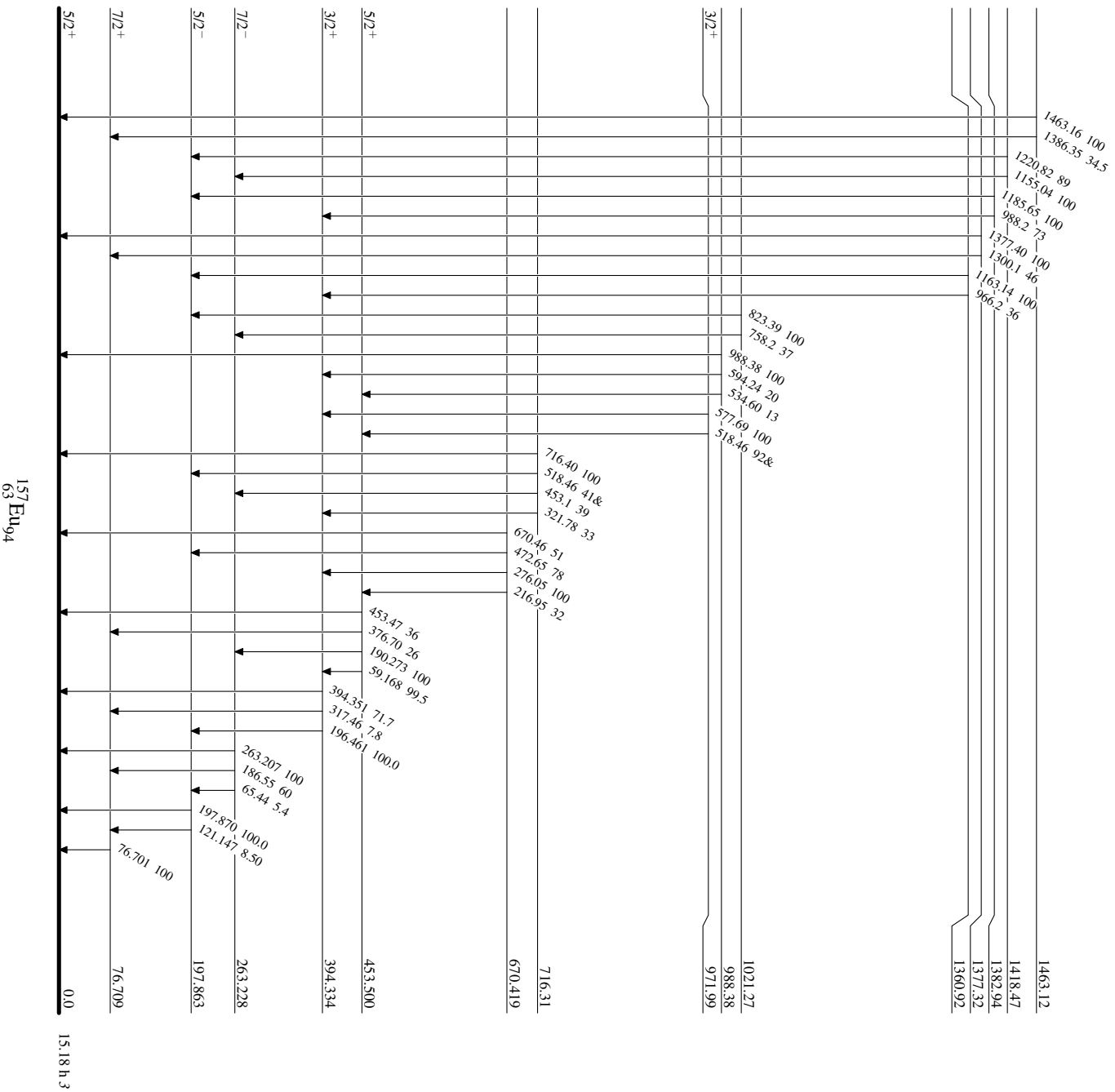
<sup>†</sup> From the  $\beta^-$  decay of  $^{157}\text{Sm}$ .

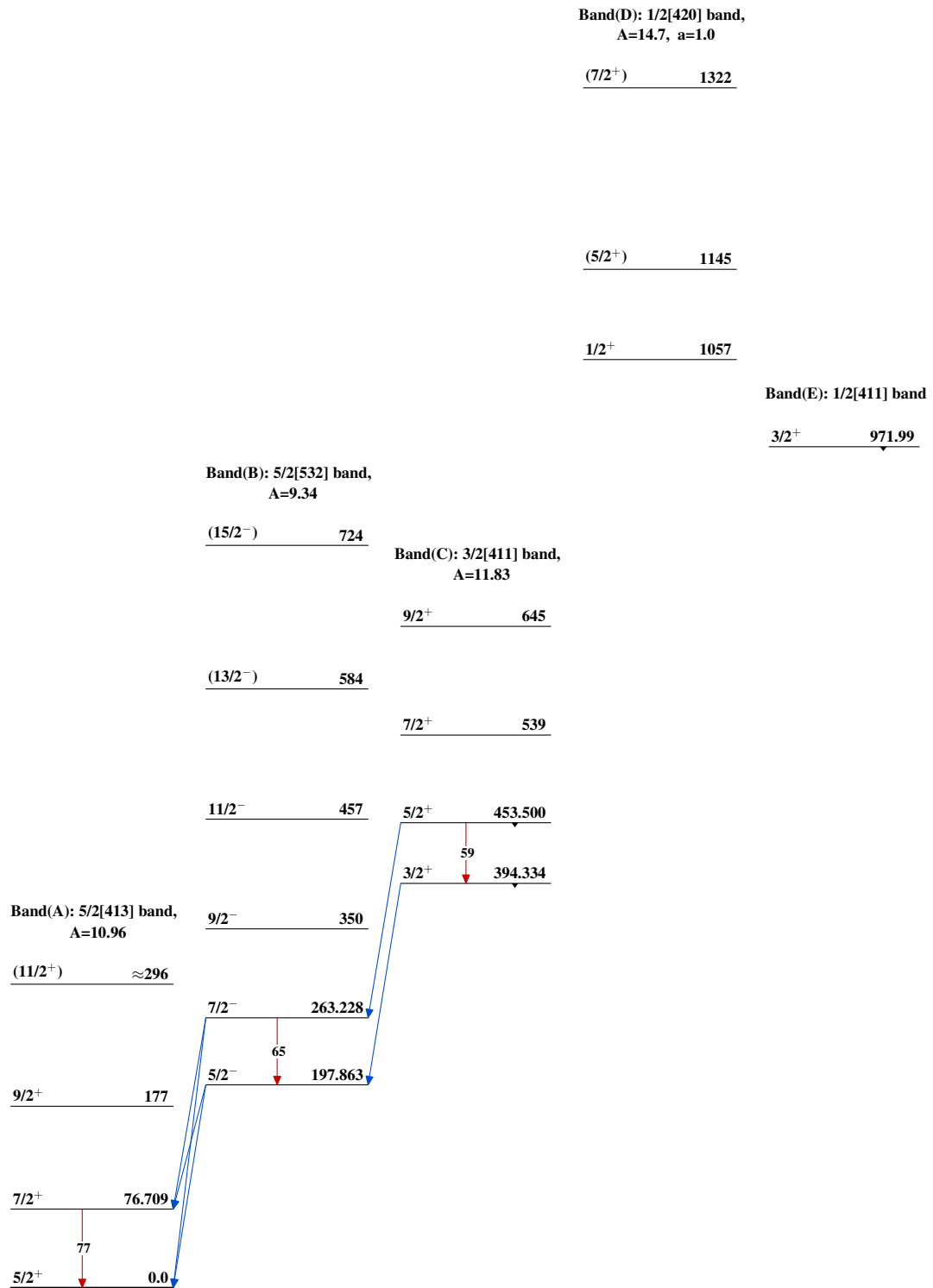
<sup>‡</sup> Multiply placed with undivided intensity.

**Adopted Levels, Gammas**

**Level Scheme**

Intensities: Relative photon branching from each level  
& Multiply placed: undivided intensity given



Adopted Levels, Gammas $^{157}_{63}\text{Eu}_{94}$