

$^{156}\text{Gd}(n,n'\gamma)$  1996Ko41,1983BeZC

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## Additional information 1.

**1983BeZC**: enriched (96.5%  $^{156}\text{Gd}$ )  $\text{Gd}_2\text{O}_3$  target of mass 17 g. target irradiated by fast-reactor neutrons. Measured  $\gamma$ 's from 60 keV to 3 MeV. Observed 290 transitions, 80 of which are new. Authors list  $E_\gamma$  and  $I_\gamma$  for only the 39 strongest of these. They state that they observe 60 levels up to an energy of 2838.7 keV. Energies and  $J^\pi$  values are quoted for 17 of these. No level scheme is given.

**1996Ko41**: carried out Hauser-Feshbach-Moldauer statistical-model calculations of the population of the excited states of several nuclides. These authors compare their results with the data of **1983BeZC** and thus provide some insight into these data. results presented for  $^{156}\text{Gd}$ ,  $^{158}\text{Gd}$  as well as for  $^{152}\text{Sm}$  and  $^{154}\text{Sm}$ .

Similar information is contained in **1995KoZQ**.

**1983BeZC** do not show their level scheme and the associated  $\gamma$ -ray transitions. The level scheme shown here May not be complete. it is based largely on that shown in **1996Ko41**, which was given to compare experiment with their calculations. Also included are those levels specifically mentioned by **1983BeZC**.

 $^{156}\text{Gd}$  Levels

E(level) <sup>†</sup>	$J^\pi$ #	S@&
0 <sup>a</sup>	0 <sup>+</sup>	
88 <sup>a</sup>	2 <sup>+</sup>	150
288 <sup>a</sup>	4 <sup>+</sup>	41
584 <sup>a</sup>	6 <sup>+</sup>	6.9
1049 <sup>b</sup>	0 <sup>+</sup>	4.3
1129 <sup>b</sup>	2 <sup>+</sup>	10
1169 <sup>d</sup>	0 <sup>+</sup>	2.8
1242 <sup>e</sup>	1 <sup>-</sup>	7.6
1247 <sup>c</sup>	3 <sup>+</sup>	6.9
1258 <sup>d</sup>	2 <sup>+</sup>	6.2
1276 <sup>e</sup>	3 <sup>-</sup>	7.8
1297 <sup>b</sup>	4 <sup>+</sup>	3.0
1366 <sup>f</sup>	1 <sup>-</sup>	5.3
1408 <sup>e</sup>	5 <sup>-</sup>	2.6
1416.0 <sup>‡a</sup>	10 <sup>+</sup>	
1462 <sup>d</sup>	4 <sup>+</sup>	2.4
1506 <sup>c</sup>	5 <sup>+</sup>	2.7
1539 <sup>f</sup>	3 <sup>-</sup>	3.6
1540 <sup>b</sup>	6 <sup>+</sup>	
1622 <sup>k</sup>	5 <sup>+</sup>	2.0
1637.9 <sup>‡e</sup>	7 <sup>-</sup>	
1715 <sup>g</sup>	0 <sup>+</sup>	0.4
1753 <sup>k</sup>	6 <sup>+</sup>	0.5
1765.9 <sup>‡d</sup>	6 <sup>+</sup>	
1771 <sup>g</sup>	2 <sup>+</sup>	1.5
1848.2 <sup>‡b</sup>	8 <sup>+</sup>	
1849.6 <sup>‡c</sup>	7 <sup>+</sup>	
1851 <sup>j</sup>	0 <sup>+</sup>	0.5
1851 <sup>h</sup>	3 <sup>-</sup>	1.5
1861 <sup>i</sup>	4 <sup>+</sup>	0.5
1909.3 <sup>‡k</sup>	7 <sup>+</sup>	

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<sup>156</sup>Gd(n,n'γ) **1996Ko41,1983BeZC** (continued)

<sup>156</sup>Gd Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup> #	S@&	Comments
1916	3 <sup>+</sup>	1.9	
1946	1 <sup>-</sup>	1.0	
1961	5 <sup>+</sup>	0.6	
1965	1 <sup>+</sup>	0.6	
2010.8 <sup>‡c</sup>	(8) <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J <sup>π</sup> =8 <sup>+</sup> .
2049.0 <sup>‡</sup>	2 <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J <sup>π</sup> =(1,2).
2058.0 <sup>‡g</sup>	(6) <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J <sup>π</sup> =6 <sup>+</sup> .
2134.1 <sup>‡d</sup>	(8) <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J <sup>π</sup> =8 <sup>+</sup> .
2160.7 <sup>‡</sup>	(3) <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J=(2,3).
2249.4 <sup>‡c</sup>	9 <sup>+</sup>		
2301.8 <sup>‡</sup>	2 <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J=(2,3).
2437.8 <sup>‡</sup>	(2) <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J=(1,2).
2838.7 <sup>‡</sup>	2 <sup>+</sup>		J <sup>π</sup> : 1983BeZC report J=(1,2).

<sup>†</sup> Nominal values from 1996Ko41, unless noted otherwise.

<sup>‡</sup> Energies as given by 1983BeZC.

# From adopted values.

@ Label=relative level population.

& Experimental values for fast-reactor-neutron irradiation (1983BeZC), as reported by 1996Ko41.

<sup>a</sup> Band(A): g.s. band.

<sup>b</sup> Band(B): First excited K<sup>π</sup>=0<sup>+</sup> band.

<sup>c</sup> Band(C): K<sup>π</sup>=2<sup>+</sup>, γ-vibrational band.

<sup>d</sup> Band(D): K<sup>π</sup>=0<sup>+</sup> band.

<sup>e</sup> Band(E): K<sup>π</sup>=1<sup>-</sup> octupole band.

<sup>f</sup> Band(F): K<sup>π</sup>=0<sup>-</sup> octupole band.

<sup>g</sup> Band(G): K<sup>π</sup>=0<sup>+</sup> band.

<sup>h</sup> Band(H): K<sup>π</sup>=2<sup>-</sup> band member.

<sup>i</sup> Band(I): K<sup>π</sup>=4<sup>+</sup> bandhead.

<sup>j</sup> Band(J): K<sup>π</sup>=0<sup>+</sup> bandhead.

<sup>k</sup> Band(K): K<sup>π</sup>=4<sup>+</sup> band.

γ(<sup>156</sup>Gd)

I<sub>γ</sub> normalization: there are no data from which to provide a normalization factor.

"New" γ-ray transitions reported by 1983BeZC. These authors do not place them in the level scheme.

E <sub>γ</sub>	I <sub>γ</sub> <sup>†</sup>	E <sub>i</sub> (level)	E <sub>γ</sub>	I <sub>γ</sub> <sup>†</sup>	E <sub>i</sub> (level)	E <sub>γ</sub>	I <sub>γ</sub> <sup>†</sup>	E <sub>i</sub> (level)
<sup>x</sup> 120.75 27	3.0 3		<sup>x</sup> 1116.3 7	3.4 1		<sup>x</sup> 1353.8 3	2.1 3	
<sup>x</sup> 126.35 19	3.8 4		<sup>x</sup> 1138.1 5	2.2 3		<sup>x</sup> 1407.9 4	2.1 4	
<sup>x</sup> 421.72 23	2.1 3		<sup>x</sup> 1183.4 4	6.9 11		<sup>x</sup> 1409.4 5	2.9 7	
<sup>x</sup> 663.40 29	2.1 4		<sup>x</sup> 1198.6 7	3.0 9		<sup>x</sup> 1455.6 4	2.7 4	
<sup>x</sup> 794.08 28	2.0 3		<sup>x</sup> 1205.3 3	6.0 7		<sup>x</sup> 1462.84 22	2.5 4	
<sup>x</sup> 819.55 23	3.7 4		<sup>x</sup> 1215.12 24	4.1 5		<sup>x</sup> 1497.92 29	2.2 5	
<sup>x</sup> 924.4 3	3.6 7		<sup>x</sup> 1283.69 20	2.8 3		<sup>x</sup> 1507.12 18	4.6 5	
<sup>x</sup> 956.23 25	3.4 4		<sup>x</sup> 1291.06 13	5.8 4		<sup>x</sup> 1707.0 4	5.2 8	
<sup>x</sup> 999.0 3	2.7 5		<sup>x</sup> 1325.20 21	3.1 3		<sup>x</sup> 1810.34 24	3.3 3	

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$^{156}\text{Gd}(n,n'\gamma)$  **1996Ko41,1983BeZC** (continued) $\gamma(^{156}\text{Gd})$  (continued)

$E_\gamma$	$I_\gamma^\dagger$	$E_i(\text{level})$	$E_\gamma$	$I_\gamma^\dagger$	$E_i(\text{level})$	$E_\gamma$	$I_\gamma^\dagger$	$E_i(\text{level})$			
$^x1824.00$	21	4.3	4	$^x2304.8$	5	2.4	5	$^x2497.8$	5	2.1	4
$^x1909.3$	8	3.2	9	$^x2348.9$	6	2.1	5	$^x2577.6$	5	2.4	4
$^x2093.41$	26	3.4	3	$^x2363.9$	5	2.5	5	$^x2663.3$	6	1.7	5
$^x2104.1$	4	2.3	3	$^x2437.8$	7	1.7	5	$^x2824.1$	6	1.5	4

$^\dagger$  Relative values.

$^x$   $\gamma$  ray not placed in level scheme.



$^{156}\text{Gd}(n,n'\gamma)$  1996Ko41,1983BeZC (continued)Band(G):  $K^\pi=0^+$  band $6^+$  2058.0Band(K):  $K^\pi=4^+$  band $7^+$  1909.3Band(H):  $K^\pi=2^-$  band  
member $3^-$  1851Band(I):  $K^\pi=4^+$   
bandhead $4^+$  1861Band(J):  $K^\pi=0^+$   
bandhead $0^+$  1851 $2^+$  1771 $6^+$  1753 $0^+$  1715 $5^+$  1622