

¹⁵⁶Gd(p,p'),(d,d') 1981Go13,1967Bi05

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 2537 (2012)	1-Mar-2012

Additional information 1.

¹⁵⁶Gd(p,p') reaction studied with E(p)=40 MeV (1981Go13) and ¹⁵⁶Gd(d,d') reaction studied with E(d)=12 MeV (1967Bi05).

Searches for the collective 1⁺ level at 3070 keV have been made with the (p,p') reaction. The level has not been seen and the limit on the cross section has been used to deduce a limit on the spin mode of excitation (1986We04,1989Fr03).

1981Go13: (p,p'), E(p)=40 MeV. Self-supporting target 1.2 mg/cm² thick. scattered protons detected using a magnetic spectrograph with FWHM=24 keV. p(θ) measured at laboratory angles from 12° to 60°, in steps of 1.5°. Level energies believed correct to 5 keV. Absolute differential cross sections measured but not reported. Emphasis is on hexadecapole effects and 4⁺ levels. Data for other levels are from the figures.

1967Bi05: (d,d'), ED=12 MeV. Isotope-separated target with >99% enrichment. Measured d' spectra at 60, 90 and 125° in a magnetic spectrograph, although the 60° data were used in only a few cases. 19 excited levels observed, with J^π values given for most. From spectra, FWHM May be 10 1515 keV.

Other studies: see 1963Li11; 1986We04; 1989Fr03.

¹⁵⁶Gd Levels

E(level) [†]	J ^π [‡]	S# [@]	Comments
0 ^{&}	0 ⁺	9760	
89 ^{&}	2 ⁺	2350	
288 ^{&}	4 ⁺	180	
585 ^{&}	6 ⁺	19	
1048 ^a	0 ⁺	5	
1130 ^a	2 ⁺	5	
1154 ^b	2 ⁺	46	
1242 ^c	1 ⁻	9	
1276 ^c	3 ⁻	116	
1298 ^a	4 ⁺		E(level),J ^π : From 1981Go13. 1967Bi05 do not report a level at 1298 keV. Instead, they propose this 4 ⁺ level to be at 1324 keV.
1324?		2	J ^π : 1967Bi05 assign this as the 4 ⁺ member of the first excited K ^π =0 ⁺ band. Other studies put this 4 ⁺ state at 1298 keV and do not support the existence of a level at this energy.
1355 ^b	4 ⁺	13	
1410 ^c	5 ⁻	13	
1462	4 ⁺	10	
1511	4 ⁺	2	J ^π : 1967Bi05 report J ^π =(2 ⁺).
1770	2 ⁺		
1827	2 ⁺	5	J ^π : 1967Bi05 report J ^π =(1 ⁻).
1852	3 ⁻	42	
1952			J ^π : Peak may possibly be associated with either or both of the 1952.36, 4 ⁻ , and the 1952.39, 0 ⁻ , levels. However, since both of these levels are of unnatural parity, this level may be distinct from them. 1981Go13 report J ^π =4 ⁺ ,(5 ⁻).
2010 5	4 ⁺		J ^π : 1981Go13 assign J ^π =(4 ⁺ ,3 ⁻).
2040 5	4 ⁺ ,(3 ⁻)		
2093 5	3 ⁻		J ^π : Associated with the 2103.28, 3 ⁻ , adopted level. 1981Go13 assign J ^π =4 ⁺ ,(3 ⁻).
2177 5	2 ⁺	12	J ^π : Peak associated with both the 2174.338, 2 ⁺ , and the 2181.384, 2 ⁺ , Adopted Levels. 1981Go13 assign J ^π =4 ⁺ , while 1967Bi05 assign (2 ⁺).
2257 5	4 ⁺		
2309 5	4 ⁺		
2375 5	4 ⁺		
2521 5	(4 ⁺ ,5 ⁻)		
2722 5	4 ⁺		
2761 5	4 ⁺		

Continued on next page (footnotes at end of table)

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^{156}Gd Levels (continued)

† From **1981Go13** and/or **1967BI05**. Uncertainties are a few keV.

‡ From adopted values. Where these differ from those inferred from these inelastic-scattering data (primarily from **1981Go13** and/or **1967BI05**), this is pointed out.

Label= $d\sigma/d\Omega(\mu\text{b/sr})$.

@ (d,d') cross sections at 125° (**1967BI05**).

& Band(A): $K^\pi=0^+$ g.s. band.

^a Band(B): First excited $K^\pi=0^+$ band.

^b Band(C): $K^\pi=2^+$ γ -vibrational band.

^c Band(D): $K^\pi=1^-$ octupole-vibrational band.

$^{156}\text{Gd}(\text{p,p}'),(\text{d,d}') \quad 1981\text{Go13,1967B105}$

			Band(D): $K^\pi=1^-$ octupole-vibrational band
		Band(C): $K^\pi=2^+$ γ-vibrational band	<u>5⁻ 1410</u>
Band(B): First excited $K^\pi=0^+$ band	<u>4⁺ 1355</u>		
	<u>4⁺ 1298</u>		<u>3⁻ 1276</u>
			<u>1⁻ 1242</u>
		<u>2⁺ 1154</u>	
	<u>2⁺ 1130</u>		
Band(A): $K^\pi=0^+$ g.s. band	<u>0⁺ 1048</u>		
	<u>6⁺ 585</u>		
	<u>4⁺ 288</u>		
	<u>2⁺ 89</u>		
	<u>0⁺ 0</u>		