

$^{154}\text{Gd(d,p)} \quad 1986\text{Sc25}, 1967\text{Tj01}$

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 160, 1 (2019)	21-Oct-2019

Additional information 1.

1986Sc25: E(d)=14 MeV and 20 MeV. Enriched (95% ^{154}Gd) target of Gd_2O_3 , having a thickness of $50 \mu\text{g}/\text{cm}^2$, and deposited on $4.3 \mu\text{g}/\text{cm}^2$ thick carbon backings. Outgoing protons were analyzed in a Q3D spectrograph and were detected using a multiwire detector. The resolution (FWHM) was 5 keV. Measured energy spectra and cross sections at $\theta=45^\circ$ only.

1967Tj01: E(d)=12.1 MeV. Targets prepared by deposition on carbon foils (thickness $\approx 40 \mu\text{g}/\text{cm}^2$) of isotope-separated Gd material in an isotope separator. Reaction products were analyzed in a broad-range magnetic spectrograph and detected in photographic plates. The resolution achieved was not better than ≈ 13 keV. Accuracy of the measured excitation energies was 3 keV below 1 MeV and 5 keV otherwise. Measured spectra at $\theta=60^\circ$, 90° and 125° .

 $^{155}\text{Gd Levels}$

E(level) [#]	J^π @	$L^\dagger$	S&a	Comments
0.0 ^c	3/2 ⁻	1	0.131 6	E(level): determined as 0.18 16 by 1986Sc25.
59.97 ^c 10	5/2 ⁻		0.0058 12	
86.37 ^d 17	5/2 ⁺	2	0.0214 22	
105.32 ^{‡d}	3/2 ⁺		0.111 16	L: L=2+4 for the unresolved 105+107 peak (1969Ja04).
107.58 ^{‡d}	9/2 ⁺		0.141 18	L: L=2+4 for the unresolved 105+107 peak (1969Ja04).
121.05 ^p 19	11/2 ⁻	5	0.048 3	
146.00 ^c 14	7/2 ⁻	3	0.512 10	
214.42 ^d 15	13/2 ⁺	6	0.233 8	
230.1 ^d 3	11/2 ⁺		0.0122 21	
251.78 ^c 17	9/2 ⁻	5	0.096 4	
268.62 ^e 13	3/2 ⁺	2	0.152 5	
286.86 ^f 16	3/2 ⁻	2,3	0.0130 18	L: reported values are inconsistent with the adopted J^π . 1986Sc25 report L=0,1,4.
321.38 ^{‡f}	5/2 ⁻	3,2	0.109 6	
326.09 ^{‡e}	5/2 ⁺		0.023 4	
350.32 ^g 22	7/2 ⁺		0.0085 25	
367.61 ^h 12	1/2 ⁺	0	0.140 10	
393.44 ^f 13	7/2 ⁻	3	0.283 10	
423.41 ^{‡e}	7/2 ⁺		0.020 3	J^π : 1986Sc25 report $J^\pi=(5/2^+), 7/2^+$.
427.24 ^{‡h}	3/2 ⁺		0.025 3	
450.56 ^{‡i}	3/2 ⁻	1	0.266 11	
454.47 ^{‡j}	5/2 ⁻		0.041 16	
485.02 ^f 25	(9/2 ⁻)		0.043 7	J^π : 1986Sc25 report $J^\pi=5/2^-, 7/2, 9/2, 11/2^-$.
488.82 ^h 15	5/2 ⁺	(2)	0.044 8	
533.7 ^c 4	13/2 ⁻		0.0051 13	
553.52 ^j 16	(7/2 ⁻)	(3)	0.335 15	L: From 1969Ja04 (d,t) for E=556. This peak most likely includes contributions from both the 553 and 559 levels.
559.31 ^k 14	1/2 ⁻	0,1	0.397 16	L: from 1986Sc25. J^π : 1986Sc25 report $J^\pi=1/2^-, 3/2^-$.
581.9 ⁱ 3	5/2 ⁻		0.011 4	
592.57 ^l 15	3/2 ⁻	1	0.036 4	
614.92 ^k 19	3/2 ⁻		0.183 12	
648.3 ^l 4	5/2 ⁻		0.015 4	
659.01 ^k 16	5/2 ⁻		0.152 10	
692.4 ^j 3	(9/2 ⁻)		0.036 5	
752.67 ^m 18	5/2 ⁺	1,3	0.044 7	L: value inconsistent with the adopted J^π .

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$^{154}\text{Gd(d,p)}$ **1986Sc25,1967Tj01 (continued)** ^{155}Gd Levels (continued)

E(level) [#]	J ^π @	L [†]	S&a	Comments
786.87 ^k 22	7/2 ⁻		0.362 18	
804.1 3	(9/2 ⁻)		0.021 4	J ^π : 1986Sc25 report J ^π =7/2 ⁺ to 13/2 ⁺ or 9/2 ⁻ . They indicate that it may be the 9/2 ⁻ member of 1/2[530].
815.9 ⁿ 3	3/2 ⁺ ,5/2 ⁺	5	0.0052 22	L: associated by 1969Ja04 with a peak having E=813. However, this peak may correspond to the 804 peak or a composite of the 804, 816 and 827 peaks of 1986Sc25.
827.9 5			0.011 3	
860.17 21	(13/2 ⁺)	6	0.048 4	Possibly the 13/2 ⁺ member of the 5/2[642] band (1986Sc25). L: from 1986Sc25.
873.48 ⁿ 21	(5/2 ⁺)		0.0210 24	J ^π : 1986Sc25 report J ^π =5/2 ⁺ .
987.1 4			0.0151 25	
1002.94 ^o 20	1/2 ⁻		0.072 7	J ^π : 1986Sc25 report J ^π =1/2 ⁻ ,3/2 ⁻ from resonance-averaged n capture.
1013.13 ^o 21	3/2 ⁻		0.031 4	
1023.89 20			0.130 13	
1027.3 6	1/2 ⁻ ,3/2 ⁻ ,5/2 ⁻		0.032 10	
1035.1 3	1/2 ⁺ ,3/2 ⁺		0.012 3	
1057.1 6			0.0144 20	
1060.9 ^o 4	(5/2 ⁻)		0.0105 17	E(level): this energy is given as 1070.9 by 1986Sc25, and this level is interpreted by them as being a member of the K-2 γ-vibrational band built on the g.s. The evaluator has assumed that this number is a typographical error (and should be 1060.9), since the "1070.9 level" is not otherwise mentioned in their paper, whereas, the 1060.599 level populated in (n,γ) is referred to in several places as being this band member. J ^π : 1986Sc25 report 5/2 ⁻ ,7/2 ⁻ and tentatively assign this level as the 5/2 ⁻ member of the indicated band.
1079.65 20	1/2 ⁻ ,3/2 ⁻		0.038 4	
1092.2 4			0.0052 17	
1104.49 ^o 23	(7/2 ⁻)		0.031 5	J ^π : 1986Sc25 report J ^π =7/2 ⁻ .
1112.02 21			0.045 5	
1129.89 22	3/2 ⁻	0,1,2,4	0.135 13	L: from 1986Sc25. J ^π : 1986Sc25 report 1/2 ⁻ ,3/2 ⁻ .
1140.9 4			0.015 3	
1158.9 3	(13/2 ⁺)	5,6	0.085 7	L: from 1986Sc25. J ^π : 1986Sc25 tentatively assign this as the 13/2 ⁺ member of 7/2[633].
1173.3 3			0.031 3	
1192.59 16	1/2 ⁺ ,3/2 ⁺		0.0171 21	
1197.9 7	3/2 ⁻ ,5/2 ⁻ ,7/2 ⁻		0.0058 17	J ^π : 1986Sc25 report J ^π =5/2 ⁻ ,7/2 ⁻ .
1225.17 20	3/2 ⁻ ,5/2 ⁻ ,7/2 ⁻		0.0190 21	J ^π : 1986Sc25 report J ^π =5/2 ⁻ ,7/2 ⁻ .
1233.6 4			0.0157 18	
1246.5 3	(1/2 ⁻ ,3/2 ⁻)		0.0224 24	
1292.0 9	3/2 ⁺		0.0064 24	
1297.24 ^q 18	7/2 ⁺	4	0.089 8	J ^π : 1986Sc25 report J ^π =5/2 ⁺ ,7/2 ⁺ .
1306.97 22			0.065 6	
1312.8 9			0.017 4	
1335.16 22			0.047 6	
1343.4 3	3/2 ⁻ ,5/2 ⁻ ,7/2 ⁻		0.036 5	J ^π : 1986Sc25 report J ^π =5/2 ⁻ ,7/2 ⁻ .
1362.2 3	5/2 ⁻ ,7/2 ⁺		0.107 11	J ^π : 1986Sc25 report J ^π =5/2 ⁺ .
1380.3 5			0.009 4	J ^π : 1986Sc25 report J ^π =1/2,3/2,5/2 ⁺ .
1405.0 3			0.041 8	
1415.9 7			0.027 5	
1425.1 6			0.013 3	J ^π : 1986Sc25 report J ^π =1/2,3/2,5/2 ⁺ .
1437.53 20			0.244 24	J ^π : 1986Sc25 report J ^π =5/2 ⁻ ,7/2 ⁻ .
1452.3 8			0.037 8	
1470.3 3	5/2 ⁺		0.130 13	
1484.5 7			0.021 4	

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$^{154}\text{Gd}(\text{d,p})$ **1986Sc25,1967Tj01 (continued)** ^{155}Gd Levels (continued)

E(level) [#]	J^π [@]	S& ^a	Comments
1505.9 4		0.037 5	
1518.2 4	3/2 ⁺ , 5/2 ⁺ , 7/2 ⁺	0.040 5	J^π : 1986Sc25 report $J^\pi=3/2^+, 5/2^+$.
1536.8 4		0.028 5	
1546.1 3		0.20 3	
1554.8 9		0.017 9	
1561.5 5		0.049 9	
1587 5		0.032 ^b	
1604 5		0.083 ^b	
1626 5		0.233 ^b	
1653 5		0.041 ^b	
1704 5		0.028 ^b	
1745 5		0.063 ^b	
1794 5		0.066 ^b	
1822 5		0.042 ^b	
1843 5		0.175 ^b	
1869 5		0.055 ^b	
1899 5		0.053 ^b	
1932 5		0.079 ^b	

[†] Unless noted otherwise, the listed values are from (d,t) (1969Ja04).

[‡] Listed value is taken from the (n, γ) data, which were used by 1986Sc25 to obtain a more accurate split of the intensity in peaks that correspond to more than one level.

[#] For levels below 1580 keV, the values are those of 1986Sc25. Above this energy they are those of 1967Tj01. The values of 1986Sc25 represent averages of all of their (d,p) and (d,t) measurements.

[@] From adopted values. Cases where these differ from those deduced from these studies are pointed out. The values reported by 1986Sc25 take into account information from other sources as well as from their data.

[&] Label= $d\sigma/d\Omega(\text{d,p})$ (mb/sr).

^a Values at $\theta=45^\circ$ and for $E(\text{d})=20$ MeV.

^b From 1967Tj01, measured at $\theta=60^\circ$ and $E(\text{d})=12.1$ MeV.

^c Band(A): 3/2[521] band, g.s. band.

^d Band(B): 3/2[651] band.

^e Band(C): 3/2[402] band.

^f Band(D): 3/2[532] band.

^g Band(E): 5/2[642] band.

^h Band(F): 1/2[400] band.

ⁱ Band(G): 1/2[530] band.

^j Band(H): 5/2[523] band.

^k Band(I): 1/2[521] band.

^l Band(J): "beta vibration" built on the g.s. ($K^\pi=3/2^-$).

^m Band(K): 1/2[660] band.

ⁿ Band(L): "beta vibration" built on the 3/2[651] band ?

^o Band(M): K-2 γ vibration built on the g.s.

^p Band(N): 11/2[505] bandhead.

^q Band(O): 7/2[404] bandhead.

 $^{154}\text{Gd}(\text{d,p})$ **1986Sc25,1967Tj01**

Band(A): 3/2[521] band,
g.s. band

<u>13/2⁻</u>	<u>533.7</u>
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<u>9/2⁻</u>	<u>251.78</u>
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<u>7/2⁻</u>	<u>146.00</u>
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<u>5/2⁻</u>	<u>59.97</u>
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<u>3/2⁻</u>	<u>0.0</u>
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 $^{155}_{64}\text{Gd}_{91}$

¹⁵⁴Gd(d,p) **1986Sc25,1967Tj01 (continued)**

Band(C): 3/2[402] band

7/2⁺ 423.41

5/2⁺ 326.09

3/2⁺ 268.62

Band(B): 3/2[651] band

11/2⁺ 230.1

13/2⁺ 214.42

9/2⁺ 107.58
3/2⁺ 105.32

5/2⁺ 86.37

¹⁵⁵Gd₆₄

$^{154}\text{Gd}(\text{d,p})$ 1986Sc25,1967Tj01 (continued)

		Band(I): 1/2[521] band	
		<u>7/2⁻</u>	<u>786.87</u>
		Band(H): 5/2[523] band	
		<u>(9/2⁻)</u>	<u>692.4</u>
		<u>5/2⁻</u>	<u>659.01</u>
		<u>3/2⁻</u>	<u>614.92</u>
		Band(G): 1/2[530] band	
		<u>5/2⁻</u>	<u>581.9</u>
		<u>(7/2⁻)</u>	<u>553.52</u>
		<u>1/2⁻</u>	<u>559.31</u>
		Band(F): 1/2[400] band	
		<u>5/2⁺</u>	<u>488.82</u>
		<u>3/2⁻</u>	<u>450.56</u>
		<u>5/2⁻</u>	<u>454.47</u>
		<u>3/2⁺</u>	<u>427.24</u>
		<u>7/2⁻</u>	<u>393.44</u>
		Band(E): 5/2[642] band	
		<u>1/2⁺</u>	<u>367.61</u>
		<u>7/2⁺</u>	<u>350.32</u>
		<u>5/2⁻</u>	<u>321.38</u>
		<u>3/2⁻</u>	<u>286.86</u>

