## $^{154}$Gd($^{3}$He,d), $^{154}$Gd($\alpha$,t) 1972Bo47,1972Ti05

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

Additional information 1.

1972Bo47: thin targets of nearly isotopically pure $^{154}$Gd. Reaction products were analyzed in an Enge-type magnetic spectrograph and recorded in photographic emulsions. For the ($^{3}$He,d) reaction, E($^{3}$He)=25.5 MeV and the differential cross section was measured at $\theta$(lab)=80°. For the ($\alpha$,t) reaction, E($\alpha$)=27.0 MeV and the differential cross section was measured at $\theta$(lab)=60°. Experimental resolution<20 keV (FWHM). DWBA analysis.

1972Ti05: enriched (99.35% $^{154}$Gd) metallic targets of ≈35 $\mu$g/cm$^2$ thickness evaporated onto ≈40$\mu$g/cm$^2$ carbon backings. Reaction products were analyzed using an Enge split-pole magnetic spectrograph and recorded in photographic emulsions. For the ($^{3}$He,d) reaction, E($^{3}$He)=24 MeV, FWHM=16 keV and differential cross sections were measured at $\theta$(lab)=30° and 40°. For the ($\alpha$,t) reaction, E($\alpha$)=25 MeV, FWHM≈12 keV and differential cross sections were measured at $\theta$(lab)=30° and 60°. DWBA analysis.

Both 1972Bo47 and 1972Ti05 deduced angular-momentum values for the transferred protons from the ratios of the ($^{3}$He,d) and ($\alpha$,t) reaction cross sections.

1981Ow02: these authors report a detailed study of the form factors for the single-proton transfer reactions ($\alpha$,t) and ($^{3}$He,d) on enriched targets of $^{152}$Sm, $^{154}$Gd (leading to states in $^{155}$Tb) and $^{156}$Gd. These were carried out at E($^{3}$He)=E($\alpha$)=35 MeV. The reaction products were analyzed using an Enge split-pole magnetic spectrograph and detected in a position-sensitive proportional counter. Only the low-energy (up to ≈0.5 MeV in $^{155}$Tb) portion of the spectrum is reported. The $J^\pi$ values and configuration assignments given here are the same as those given by 1972Bo47 and 1972Ti05.

### $^{155}$Tb Levels

| E(level)[†] | J$^\pi$[&] | S[ab] | Comments |
|---|---|---|---|
| 0.0[d] | 3/2$^+$ | 4.7 | |
| 65[d] 3 | 5/2$^+$ | 101 | |
| 152[d] 3 | 7/2$^+$ | 2.2 | |
| 252[e] 3 | 7/2$^-$ | 7.8 | |
| 272[f] | 5/2$^+$&9/2$^+$ | 6.8 | This peak is interpreted by 1972Ti05 and 1972Bo47 as being a doublet. |
| 318[e] 3 | 9/2$^-$ | <1 | E(level): from ($\alpha$,t) (1972Ti05). |
| 334[f] 3 | 7/2$^+$ | 18.5 | |
| 397[e] 3 | 11/2$^-$ | 36 | |
| ≈450[f] | 9/2$^+$ | <0.8 | E(level): from ($\alpha$,t) (1972Ti05). From ($^{3}$He,d), 1972Bo47 report a level at E=424 *6*. Since both 1972Ti05 and 1972Bo47 report only one peak in this region and since it is unlikely that each would see a peak not reported by the other, the evaluator has assumed that these two peaks are in fact the same. |
| 466[h] 3 | 7/2$^+$ | 8 | E(level): reported as 456 *2* by 1972Bo47. |
| 501[g] 3 | 5/2$^+$ | 161 | |
| 548[i] 3 | 3/2$^+$,5/2$^+$ | 56 | |
| 616 3 | | 21 | |
| ≈651[i] | 5/2$^+$ | ≈1.5 | |
| 727[k] 3 | (1/2$^+$) | 20 | |
| 745 3 | 7/2$^+$ | 12 | J$^\pi$: from identification of this level with the 743.9 level in $^{155}$Dy $\varepsilon$ decay. |
| 761[k] 3 | 3/2$^+$ | 26 | |
| 810[k] 3 | 5/2$^+$ | 11 | |
| 834 3 | 11/2$^-$ | 9.3 | Population in ($^{3}$He,d) and ($\alpha$,t) is that expected for the 11/2$^-$ member of the 7/2[523] band. |
| 863[j] 3 | (1/2$^-$) | 57 | |
| 907[j] 3 | (5/2$^-$) | 29 | |
| 926 3 | | 12.5 | |
| 950[j] 3 | 3/2$^-$ | 45 | |
| 1041[j] 3 | (9/2)$^-$ | 10.5 | |

Continued on next page (footnotes at end of table)

## $^{154}$Gd($^3$He,d), $^{154}$Gd($\alpha$,t) 1972Bo47,1972Ti05 (continued)

### $^{155}$Tb Levels (continued)

| E(level)[†] | Jπ[&] | S[ab] | Comments |
|---|---|---|---|
| 1061[‡] *3* | 5/2⁻ | | |
| 1085 *3* | | 40 | |
| 1119[#] *3* | | 89 | E(level): level assumed by the evaluator to be the same as the 1112 level of 1972Bo47. However, it is most likely not the same as the 7/2⁺, 1120.0 level in $^{155}$Dy ε decay, because, among other considerations, the ($^3$He,d) cross section is much larger than that expected for the L=4 transfer required by the 7/2⁺ assignment. |
| 1131[‡#] *5* | | | |
| 1205[‡@] *5* | | | |
| 1229[‡@] *10* | | | |
| 1251 *3* | | 2.3 | |
| 1307 *3* | | 6.3 | |
| 1354[‡] *3* | | 19[c] | E(level): from 1972Bo47. The evaluator has assumed that this is the same as the level reported by 1972Ti05 as having an energy of ≈1368. |
| 1455 *3* | 3/2⁻,5/2⁻ | 5.4 | Jπ: from association of this level with the 1452 level in $^{155}$Dy ε decay. |
| 1480 *3* | | 8.7 | |
| 1548 *3* | | 20 | |
| 1581 *3* | | ≈4 | |
| 1616 *3* | | 43 | |
| 1658 *3* | 5/2⁻ | 33 | Jπ: from association of this level with the 1656.4 level in $^{155}$Dy ε decay. |
| 1685 *3* | | 15.5 | |
| 1721 *3* | | 12.5 | |

[†] Listed values are from the ($^3$He,d) data of 1972Ti05, unless otherwise indicated.
[‡] From 1972Bo47.
[#] In their Fig.1, 1972Ti05 show two strong peaks slightly above and below 1100 kev. In their Table 2, 1972Ti05 report levels at 1085 and 1189 keV. This latter value is incorrect, most likely being a typographical error; and the recommended energy is 1119 keV (private communication from D. G. Burke, August, 2004).
[@] 1972Ti05 report a 1218 peak having dσ/dΩ=7.8, which they tentatively assign as the 7/2⁻ member of the 1/2[541] band. This peak is most probably associated with the 1205 and/or the 1229 peaks reported by 1972Bo47, but how its intensity is to be apportioned between them is uncertain.
[&] From adopted values.
[a] Label=dσ/dΩ(μb/sr).
[b] Listed values are for the ($^3$He,d) reaction at E($^3$He)=24 MeV and θ(lab)=40° (data as reported by 1972Ti05). The relative intensities of the strong peaks have uncertainties of ≈10%; and the absolute cross sections have an uncertainty of ≈25%.
[c] Value given by 1972Ti05 for the level they report at ≈1368.
[d] Band(A): g.s. band. Conf=3/2(411).
[e] Band(B): Kπ=5/2⁻[532] band. Due to strong Coriolis mixing, other h11/2-related Nilsson orbitals (primarily 7/2[523]) are expected to be important components in the makeup of this band.
[f] Band(C): Kπ=5/2⁺ band. Conf=5/2(413).
[g] Band(D): Bandhead of 5/2[402].
[h] Band(E): Probable 7/2[404] bandhead.
[i] Band(F): Member of a probable Kπ=1/2⁺ band. The 1/2[411] Nilsson State is likely a major component of this band, but other configurations are probably present as well.
[j] Band(G): Probably a member of the 1/2[541] band.
[k] Band(H): 1972Ti05 suggest that these states are part of a band which contains a small component of the 1/2[411] Nilsson state.

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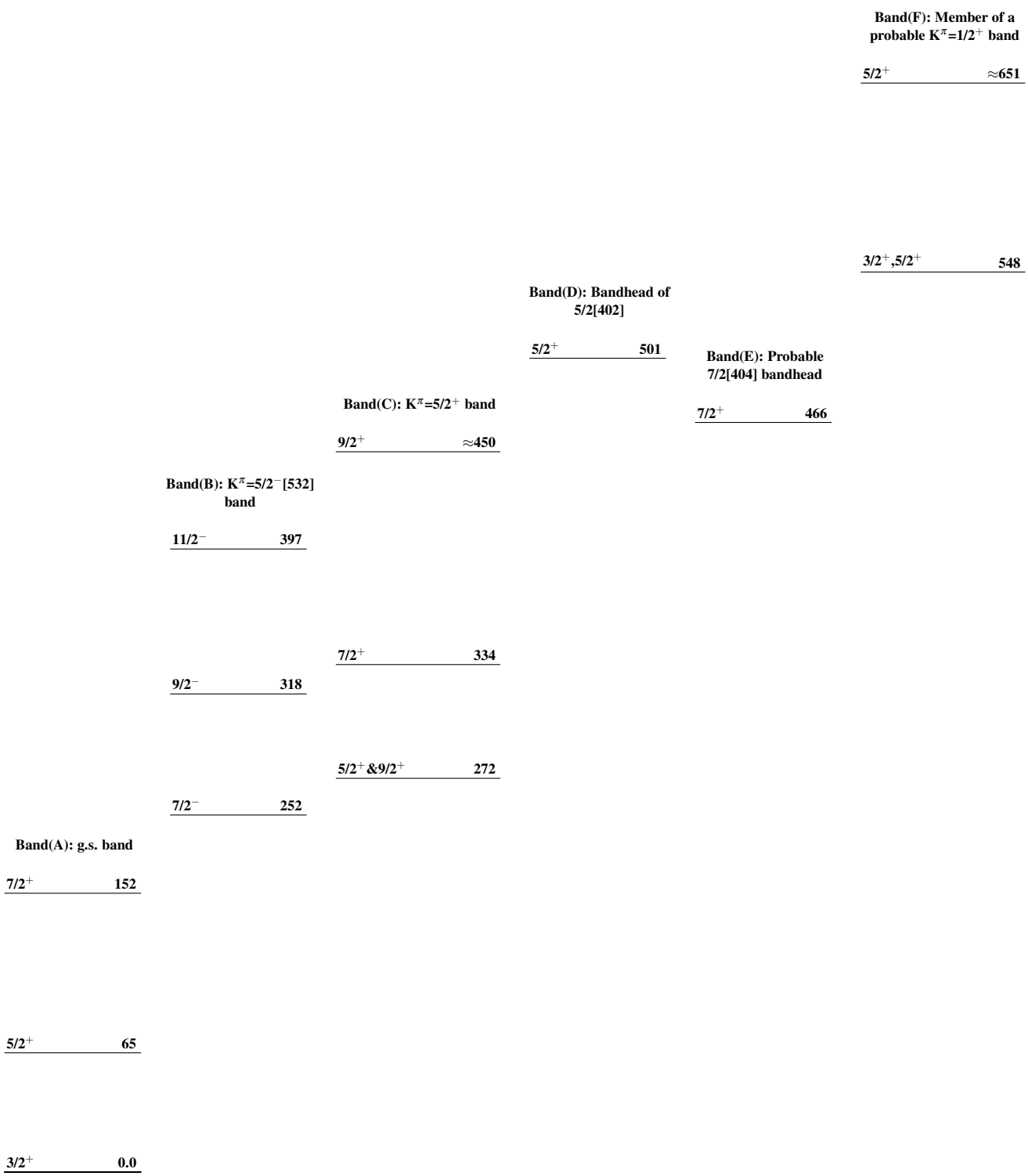


$^{155}_{65}Tb_{90}$

## $^{154}$Gd($^{3}$He,d), $^{154}$Gd($\alpha$,t) 1972Bo47,1972Ti05 (continued)

**Band(G): Probably a member of the 1/2[541] band**

**$(9/2)^-$ 1041**

**$3/2^-$ 950**

**$(5/2^-)$ 907**

**$(1/2^-)$ 863**

**Band(H): 1972Ti05 suggest that these states are part of a band which contains a small component of the 1/2[411] Nilsson state**

**$5/2^+$ 810**

**$3/2^+$ 761**

**$(1/2^+)$ 727**

$^{155}_{65}Tb_{90}$