

# The Gamow-Teller resonance populated in $\beta$ -decay of odd-odd nuclei above $^{146}\text{Gd}$

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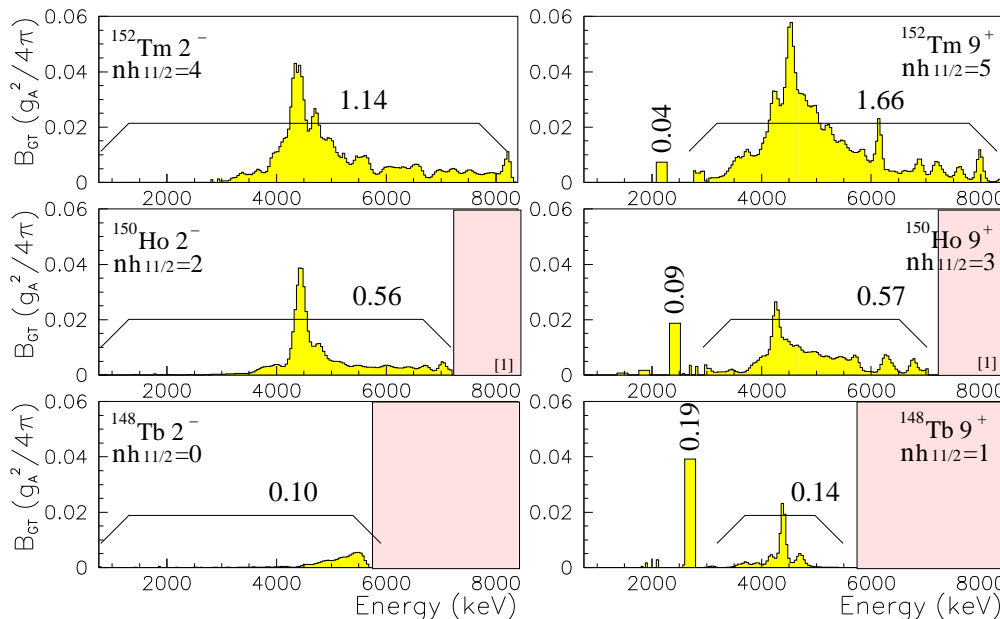
The nuclei around  $^{146}\text{Gd}$  represent the unique cases in the nuclide chart where the Gamow-Teller (GT) transition  $\pi h_{11/2} \rightarrow \nu h_{9/2}$  is accessible in  $\beta$ -decay. Among these nuclei, the odd-odd N=83 cases are of special interest for different reasons. In general they have two  $\beta$ -decaying isomers: one has spin-parity  $2^-$ , with an even number of  $\pi h_{11/2}$  particles in the main configuration, whereas the other one is a  $9^+$  state with an odd number of  $\pi h_{11/2}$  particles. Another reason for studying such nuclei is that the  $2^-$  isomer can be produced cleanly, i.e. without contamination from the  $9^+$  activity. Correspondingly, the  $9^+$  contribution can be obtained by subtraction. Different experiments were carried out at the GSI On-Line Mass-Separator with the aim of a systematic study of the  $\beta$ -decay of odd-odd N=83 nuclei. The  $\beta$ -decays of the isotope of interest were studied using a Total Absorption Spectrometer (TAS), a special device to detect entire cascades rather than individual gamma-rays. This has proved to be the best tool to reliably extract the GT strength ( $B_{\text{GT}}$ ) from experimental  $\beta$ -decay data.

In Fig. 1 we present the  $B_{\text{GT}}$  distribution for the six cases studied in this work. Each of them represents a different occupancy number of the  $\pi h_{11/2}$  orbital starting all the way from 0 protons ( $^{148}\text{Tb } 2^-$ ) to 5 protons ( $^{152}\text{Tm } 9^+$ ). The decay of  $^{150}\text{Ho}$  was the first of these cases measured with the TAS at GSI. The analysis and results are discussed in [1]. The decay of  $^{148}\text{Tb}$  was presented together with the former in [2]. Results on the decay of  $^{152}\text{Tm}$  are

presented here for the first time. As can be seen in the figure, in the low-spin cases the  $B_{\text{GT}}$  distribution is concentrated in a very narrow prominent peak at about 4.5 MeV, the GT resonance. This kind of decay occurs when a proton pair in the  $h_{11/2}$  orbital is broken, and one of the protons decays populating four quasi-particle (4qp) states in the daughter nucleus. On the other hand, the decay of the high-spin states has two different components: the decay of the paired particle as in the low-spin case, and the decay of the unpaired  $\pi h_{11/2}$  proton that can populate only one 2qp state in the daughter nucleus. The ratio between the  $B_{\text{GT}}$  value related to the 4qp states (the resonance) and to the 2qp state grows rapidly with the increase of the number of  $\pi h_{11/2}$  protons. This ratio is always bigger than what one would expect from an extreme single-particle approach. This indicates that a sizeable part of the  $B_{\text{GT}}$  that should go to the 2qp state is shifted to higher-lying levels in the daughter nucleus. This is a common phenomenon already observed in (p,n) reactions which has been interpreted theoretically [3]. The advantage of this work is that the effect is observed systematically in several decays and can therefore be properly quantified.

## References

- [1] D. Cano-Ott, PhD Thesis, Univ. de Valencia (2000).
- [2] E. Nácher *et al.* GSI Sci. Report 2001, 8.
- [3] G. F. Bertsch Nucl. Phys. A354, 157C (1981).



**Fig. 1** Gamow-Teller strength distributions observed in the decay of odd-odd N=83 nuclei. The numbers in the graphs represent integrated  $B_{\text{GT}}$  values in  $g_A^2/4\pi$  units.