

## The complexity of low-lying $0^+$ excitations

Remarkable measurements with the  $(p,t)$  reaction using the Q3D magnetic spectrograph at the University of Munich MP tandem accelerator revealed many  $0^+$  excitations lying at relatively low excitation energies in rare earth region nuclei. A total of 11 excited  $0^+$  states were observed in  $^{158}\text{Gd}$  below an excitation energy of about 3.1 MeV. This abundance of  $0^+$  states in a single nucleus provides significant new information on this poorly understood phenomenon. Theory, however, predicts less  $0^+$  states than those experimentally characterised. The combination of Coulomb-excitation, electron-conversion,  $(p,t)$  and  $^{3}\text{He},n$  transfer reactions at iThemba LABS will provide a means to characterise the nature of these exciting  $0^+$  states.

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