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A study of the Isovector Giant Dipole Resonance across the neodymium and samarium isotope chains

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Abstract content
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The decay of giant resonances in nuclei is a prime example of how a well-ordered collective excitation dissolves into a disordered motion of internal degrees of freedom in fermionic quantum many-body systems. Fine structure in the excitation energy region of the Isovector Giant Dipole Resonance (IVGDR) in a range of neodymium isotopes (^{142, 144, 146, 148, 150}Nd) has been observed in high energy-resolution proton inelastic scattering experiments at zero degrees using the K600 magnetic spectrometer of iThemba LABS. This study was extended to include experiments on ¹⁵⁰Sm and ¹⁵²Sm, which were performed in December 2014. The analysis of both the neodymium and samarium isotope chains will yield insight into the transition from spherical to deformed nuclei and provide information about the dominant damping mechanisms. It is important to note that for nuclei with 88 < N < 92, a detailed study of the IVGDR is of specific interest since this is the nuclear region in which a transition from spherical to permanently deformed nuclei occurs. Studying the samarium isotopes in conjunction with the neodymium isotope chain will also allow for the influence of the proton number, Z, on the fine structure of the IVGDR as function of nuclear deformation to be studied. An extensive data analysis procedure, which included cross-section extraction for comparison with existing photo-absorption data and theoretical predictions as well as a wavelet analysis was performed on the data for each of the above-mentioned isotopes. These results will be presented and conclusions to the study will be drawn.

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PhD

Main supervisor (name and email)
and his / her institution

Prof. John Carter
University of the Witwatersrand

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