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Effects of nuclear deformation on the fine structure of the Isoscalar Giant Quadrupole Resonance from even-even neodymium isotopes using proton inelastic scattering

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Abstract content
   (Max 300 words)

A systematic experimental investigation of the phenomenon of fine structure, with emphasis on the region of the Isoscalar Giant Quadrupole Resonance (ISGQR), in nuclei across stable even-even neodymium isotopes has been performed. Measurements were made using the K600 Magnetic Spectrometer of iThemba Laboratory for Accelerator Based Sciences, a facility which is situated at Faure near Cape Town, South Africa. Unique high energy-resolution inelastic proton scattering excitation energy-spectra were obtained at an incident proton energy of E_p = 200 MeV on targets ^{142,144,146,148,150}Nd. Nuclei with mass number A ≈ 150 and neutron number N ≈ 90 are of special interest since they occupy that region of the nuclide chart wherein the onset of permanent prolate deformation occurs. The stable neodymium (Z = 60) isotopes have been chosen in the present study, in order to investigate the effects accompanying the onset of deformation, on the excitation energy spectra in the ISGQR region (9 ≤ E_x ≤ 15 MeV), since they extend from the semi-magic N = 82 nucleus (¹⁴²Nd) to the permanently deformed N = 90 (¹⁵⁰Nd) nucleus.

In order to enhance the ISGQR in the excitation energy spectra measured, a Discrete Wavelet Transform (DWT) background subtraction was carried out. The resonance widths extracted show a systematic broadening of the ISGQR, moving from spherical to highly deformed nuclei as has already been observed for the Isovector Giant Dipole Resonance Resonance (IVGDR) excited by &gamma-capture. Energy scales were extracted for the resonance region using a Continuous Wavelet Transform (CWT) technique. Experimental details, data extraction and analysis techniques, together with preliminary results will be presented.

Apply to be
 consider for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD)?

PhD

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

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Would you like to
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Yes

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