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A survey of the fine structure phenomenon of the Isovector Giant Dipole Resonance in nuclei across the periodic table at a forward scattering angle

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Abstract content
   (Max 300 words)

A survey of the fine structure phenomenon of the Isovector Giant Dipole Resonance (IVGDR) was carried out, using proton inelastic scattering at an incident energy of 200 MeV for a wide target-mass range of closed and near-closed nuclei: ²⁷Al, ⁴⁰Ca, ⁵⁶Fe, ⁵⁸Ni and ²⁰⁸Pb. The data obtained will provide an unique insight into the role of different damping mechanisms contributing to the decay of the IVGDR. In this work, a model-independent background subtraction procedure which eliminates the contributions due to the Isoscalar Giant Quadrupole Resonance (ISGQR) and the phenomelogical background effects was initially implemented before the cross-section spectra were converted to the equivalent photo-absorption cross-sections. The equivalent photo-absorption cross-sections were then compared with &gamma-capture reactions as a check for consistency. Characteristic energy scales from the experimental data will be extracted using the wavelet analysis technique. Three mother wavelets namely, the Morlet, Complex Morlet and Complex Lorentzian mother wavelets will be used to extract these energy scales. Recent studies have shown that, the Complex Lorentzian mother wavelet produces clearer, better defined, wavelet coefficient plots i.e. its power spectra have better separations of scales, therefore, this study promises a re-affirmation of this observation. Furthermore, experimental level densities will be extracted using the fluctuation analysis method. The method utilises the autocorrelation function which is a key tool in obtaining a measure of the cross-section fluctuations with respect to a stationary mean value. It also makes use of the Discrete Wavelet Transform (DWT) analysis which critical in removing the remaining physical background from other multipoles excited and any remaining instrumental background. The experimentally extracted level densities will then be compared with different theoretical parameterisations of the Hartree-Fock Bogoliubov (HFB), Hartree-Fock-Bardeen-Cooper-Schrier (HF-BCS) and Back-shifted-Fermi-Gas model (BSFG). Finally, the state-of-the-art microscopic models for excitation of the IVGDR e.g. the Quasi-particle phonon model (QPM) and the Second Random Phase Approximation (SRPA) will be compared to the experimental data.

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PhD

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

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Would you like to <br> submit a short paper <br> for the Conference
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No

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