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Studies of the Isoscalar Giant Quadrupole Resonance in stable even-even neodymium isotopes

Fine structure has been studied on the region of the Isoscalar Giant Quadrupole Resonance (ISGQR), for stable even-even nuclei of neodymium isotopes. The 200 MeV proton beams were delivered by the Separated Sector Cyclotron (SSC) facility of iThemba LABS. Measurements were made using the state-of-the-art K600 magnetic spectrometer, where unique high energy-resolution (ΔE ≈ 42 - 48 keV FWHM) proton inelastic scattering results were obtained on spherical to deformed ^{142}Nd, ^{144}Nd, ^{146}Nd, ^{148}Nd and ^{150}Nd target nuclei. In order to emphasize the ISGQR in the measured excitation energy spectra, a Discrete Wavelet Transform (DWT) background subtraction was carried out. A comparison of the resonance widths extracted shows a systematic broadening of the ISGQR (Γ = 3.220 MeV to 5.100 MeV), moving from spherical ^{142}Nd to highly deformed ^{150}Nd nuclei. Theoretical microscopic Quasiparticle-Phonon Model (QPM) calculations were performed for the ISGQR predictions. Characteristic energy scales, extracted using the Continuous Wavelet Transform (CWT) technique, allowed a comparison to be made between the experimental data and theoretical predictions in order to determine the dominant damping mechanisms.

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