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ISGMR studies at iThemba LABS

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The Isoscalar Giant Monopole Resonance (ISGMR) is a collective excitation mode of the atomic nucleus, first discovered in 1977. Our current understanding of the ISGMR in stable nuclei relies heavily on experimental investigations conducted at the Texas A&M University (TAMU) Cyclotron Institute and the Research Center for Nuclear Physics (RCNP) over the past thirty years. These investigations involved small-angle (including 0°) inelastic α-particle scattering measurements at energies of 240 MeV and 386 MeV, respectively. However, these forward-angle measurements are all affected by unavoidable instrumental background. Inappropriate description of this background can significantly influence the shape of the E0 strength distribution, which is used to determine the ISGMR centroid energy, and thus the incompressibility of the nucleus. Also, the shape of the monopole strength was used in the interpretation of K-splitting effects in lighter nuclei such as 24Mg. Therefore, inelastic α-particle scattering experiments were performed at 200 MeV at iThemba LABS to provide an independent dataset for examining the impact of different background subtraction techniques, especially in the case of 24Mg, the even-even isotopes of Ca, as well as for 208Pb.
Since the measurements resulted in high-resolution data which revealed fine structure within the ISGMR strength distributions, the extraction of spin- and parity-resolved level densities of 0^+ states was made possible via fluctuation analysis. Wavelet analyses of the strength distributions provide access to characteristic energy scales, allowing for detailed comparisons with various theoretical models aimed at understanding the mechanisms responsible for the ISGMR decay width.
Selected results, along with future prospects, will be discussed.

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