The asymmetry term in the nuclear-matter incompressibility deduced from the isoscalar giant monopole resonance in the Sn and Cd isotopes

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Giant resonances are vibration modes of the nuclear collective motion. Among these resonances, the isoscalar giant monopole resonance (ISGMR) and the isoscalar giant dipole resonance (ISGDR) come from compression modes and provide direct information on the nuclear incompressibility.

We have carried out giant resonance measurements using inelastic scattering of 386 MeV α particles at extremely forward angles, including 0°. The obtained data are analyzed in the multipole decomposition method. The bulk property of the incompressibility has been studied for various nuclei through the ISGMR measurements. To investigate the asymmetry term of the nuclear incompressibility, K_τ, we have measured the ISGMR strength distributions in the Sn and Cd isotopes. By using the focus property of the GRAND RAIDEN spectrometer, we have obtained completely "background-free" spectra. The centroid energies of the ISGMR in the Sn isotopes were significantly lower than the theoretical predictions. The K_τ in the empirical expression for the nuclear incompressibility has been determined to be -550±100 MeV from the moment ratios, $\sqrt{m_1/m_{-1}}$, of the ISGMR [1]. From the Cd isotopes, the extracted value for K_τ is -500±50 MeV. These numbers are consistent with values of K_τ = -370±120 MeV obtained from an analysis of the isotopic transport ratios in medium-energy heavy-ion reactions [2], K_τ = -500^{+120}_{-100} MeV obtained from constraints placed by neutron-skin data from anti-protonic atom across the mass table [3], and K_τ = -500±50 MeV obtained from theoretical calculations using different Skyrme Hamiltonians and RMF Lagrangians [4].

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