The isoscalar monopole resonance in the A~90 region

D.H. Youngblood, Y.-W. Lui, Krishichayan,[1] J. Button, M.R. Anders, M.L. Gorelik,[2]
M.H. Urin,[2] and S. Shlomo
[1]*Dept. of Pure and Applied Physics, Guru Ghasidas University Bilaspur-495009 C G India*
[2]*National Research Nuclear University "MEPhI", Moscow, 115409 Russia*

The isoscalar giant monopole resonances (ISGMR) in ^{90,92,94}Zr and ^{92,96,98,100}Mo have been studied with inelastic scattering of 240 MeV α particles at small angles including 0°. Strength corresponding to approximately 100% of the ISGMR (E0) energy-weighted sum rule was identified in each nucleus. In all cases the strength consisted of two components separated by 7-9 MeV. Except for the mass 92 nuclei, the upper component contained 14-22% of the E0 energy weighted sum rule (EWSR), however 38% and 65% of the E0 EWSR was located in the upper components in ^{92}Zr and ^{92}Mo respectively. The energies of the ISGMR for ^{92}Zr and ^{92}Mo are 1.22 MeV and 2.80 MeV higher, respectively, than for ^{90}Zr, suggesting a significant nuclear structure contribution to the energy of the ISGMR in these nuclei.

The energy of the isoscalar giant monopole resonance(ISGMR) is related to the compression modulus of the nucleus(K_A)[1,2]as follows:

$$E_{GMR}=(\hbar^2 K_A/m\langle r^2\rangle)^{1/2} \qquad (1)$$

where m is the nucleon mass and $\langle r^2\rangle$ is the mean square nuclear radius. Using for E_{GMR} the experimental energies corresponding to the scaling model$\{(m_3/m_1)^{1/2}\}$ and radii obtained from Hartree-Fock calculations with the KDE0v1 interaction[4] having K_{NM} = 227.5 MeV, the experimental scaling model

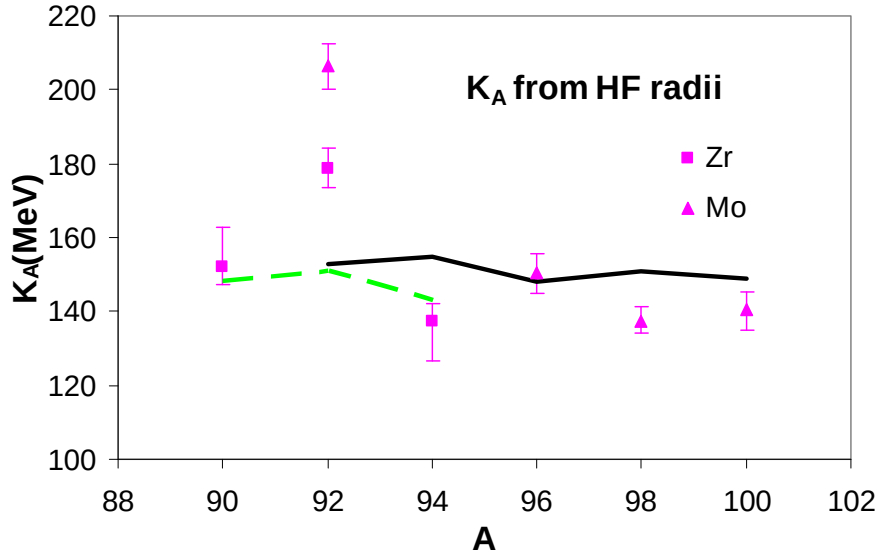

FIG. 1. The scaling model K_A values obtained from the measured scaling energies $(m_3/m_1)^{1/2}$ are shown for the Zr isotopes by squares and for the Mo isotopes by the triangles plotted versus A. The error bars reflect the uncertainties in $(m_3/m_1)^{1/2}$. Also shown are lines connecting the HF-based RPA values of K_A calculated within HF-RPA using the KDE0v1 interaction for the Zr (green-dashed) and Mo (black) isotopes.

values of K_A for the Zr and Mo isotopes were obtained from Eq. (1) and are plotted versus A in Fig. 1. For ^{92}Zr and ^{92}Mo, K_A values obtained from the experimental energies are 27 MeV (5σ) and 56 MeV (8σ) higher than the values predicted with HF-RPA.

[1] J.P. Blaizot, Phys. Rep. **64**, 171(1980).
[2] J. Treiner, H. Krivine and O. Bohigas, Nucl. Phys. **A371**, 253 (1981).