Fully Self-Consistent HF-RPA Calculations with Modern Skyrme Interaction

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Recently we have determined a new set of parameters for the Skyrme interaction, namely KDE0 [1]. This Skyrme interaction was obtained by the fitting of the Hartree-Fock (HF) results to an extensive set of experimental data: binding energies for 14 nuclei ranging from the normal to exotic ones, charge rms radii for 7 nuclei, spin-orbit splittings for the 2*p* proton and neutron orbits of the ^{56}Ni nucleus and rms radii for the $1d_{5/2}$ and $1f_{7/2}$ valence neutron orbits in the ^{17}O and ^{41}Ca nuclei, respectively. Some constraints on the Skyrme parameters were also included: the critical density ρ_{cr} determined from the stability conditions for the Landau parameters, the quantity $P = 3\rho\, dS/d\rho$, directly related to the slope of the symmetry energy *S*, the enhancement factor κ, associated with the Thomas-Reiche-Kuhn sum rule for the isovector giant dipole resonance, and the Landau parameter G_0'.

We have carried out fully self-consistent HF based Random-Phase-Approximation (RPA) calculations for the strength function $S(E)$, centroid energies E_0 of the isoscalar giant monopole resonance (ISGMR) in ^{90}Zr, ^{116}Sn, ^{144}Sm, and ^{208}Pb following Ref. [2, 5]. A comparison with available experimental data is given in Table I, where *J* is the symmetry energy at the saturation density. We find a close agreement between our results for KDE0 interaction and experimental data. We have deduced the value of the nuclear matter incompressibility K = 230±20 MeV. Figure 1 shows $S(E)$ for the ISGMR obtained using the KDE0 and SG2 interactions.

Table I. Fully self-consistent HF based RPA results for breathing mode energy (in MeV)

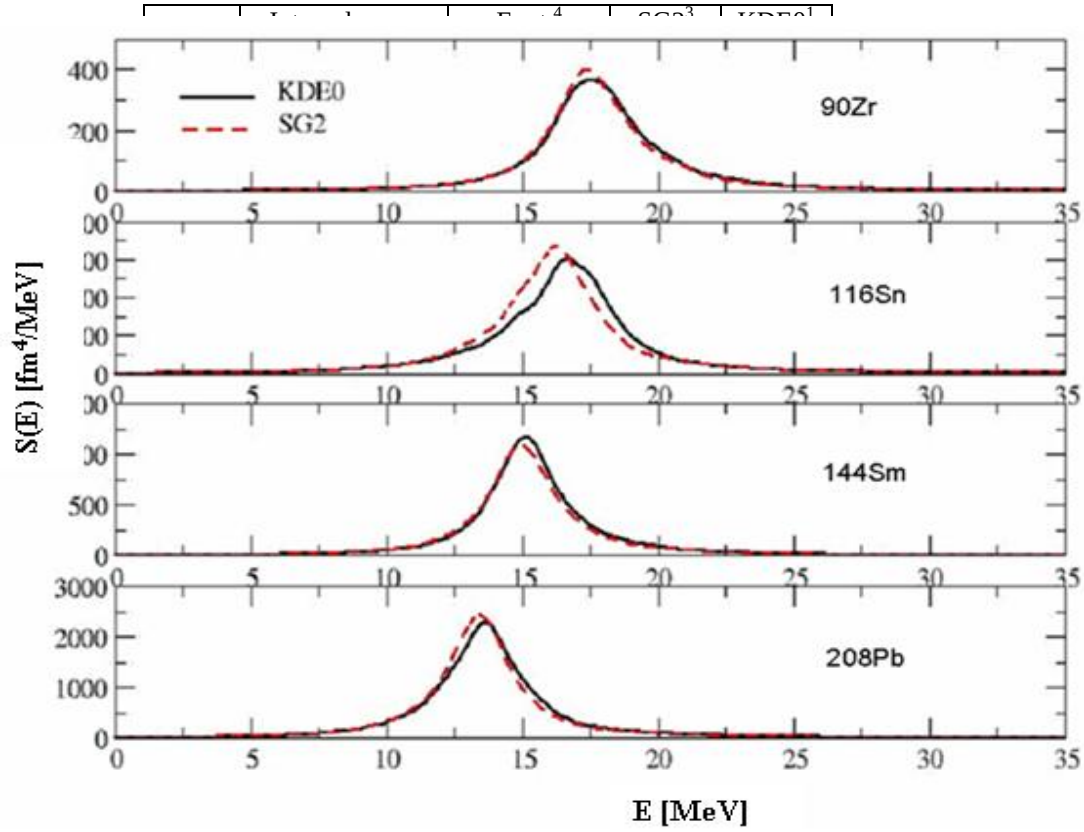

Figure 1. Isoscalar monopole strength functions.

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