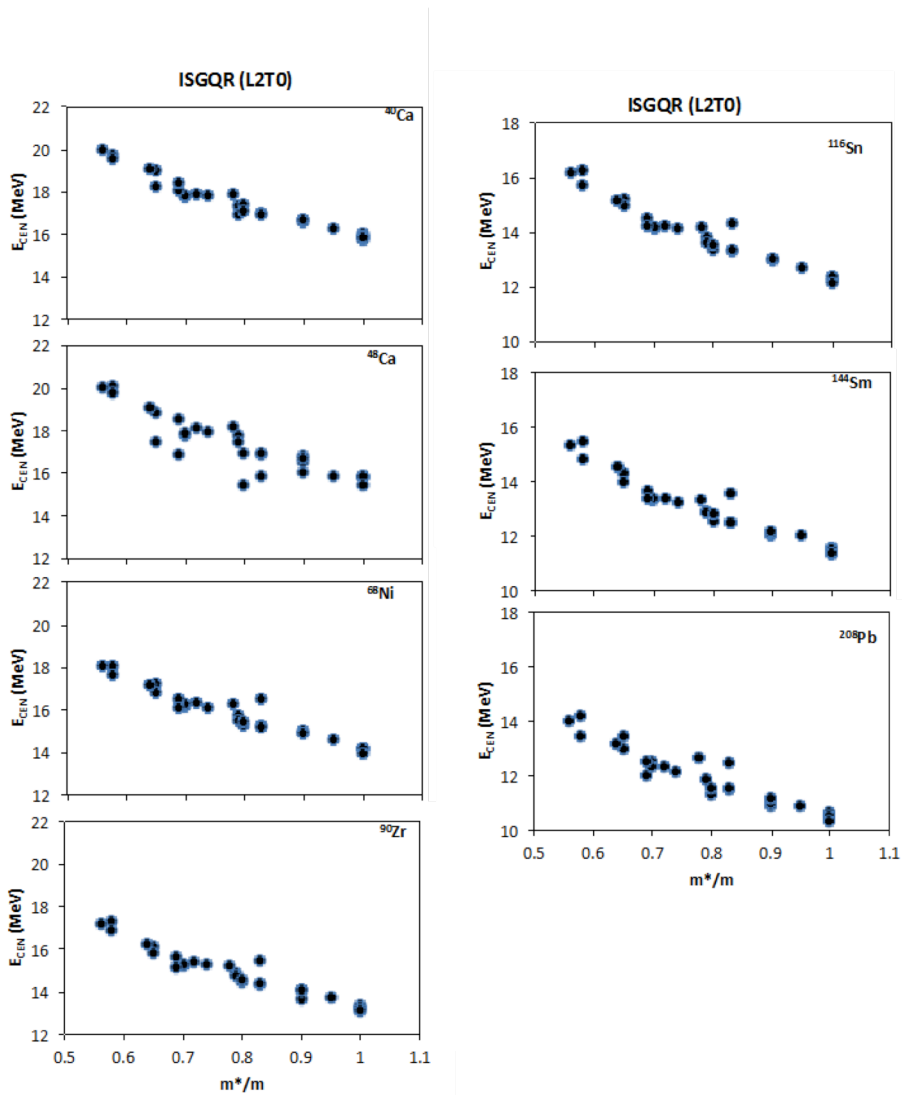


## Isoscalar giant quadrupole resonances in select spherical nuclei and the effective mass

M.R. Anders, G. Bonasera, and S. Shlomo

We carried out fully self-consistent Hartree-Fock based Random Phase Approximation (HF-RPA) calculations of the centroid energies of Isoscalar and Isovector resonances up to  $L=3$ . We selected various spherical nuclei over a wide range of mass. We perform very precise calculations using over 30 commonly employed Skyrme-type effective nucleon-nucleon interaction found in the literature.

Pearson Correlation function is also calculated for every Nuclear Matter property and each resonance. By looking at which interactions predict correctly the experimental value, and if we have a high correlation, we can set limits on the values of Nuclear Matter. For example Fig. 1 shows the



**FIG. 1.** Results of the HF-RPA calculations, each point is a different Skyrme interaction. Plotted are the centroid energies,  $E_{\text{cen}}$ , of the ISGQR for  $^{40}\text{Ca}$ ,  $^{48}\text{Ca}$ ,  $^{68}\text{Ni}$ ,  $^{90}\text{Zr}$ ,  $^{116}\text{Sn}$ ,  $^{144}\text{Sm}$ ,  $^{208}\text{Pb}$  as a function of the effective mass. The dashed line represent the experimental error range.

calculated Centroid Energies of the Isoscalar Giant Quadrupole Resonance plotted against the effective mass, here we see a trend of decreasing Energy with increasing effective mass. We also see that the interactions with effective mass between 0.7-0.9 reproduce the data better. Similar analysis is performed for other quantities [1] and these results will be used to fit a new interaction with improved predictive power.

[1] G. Bonasera *et al.*, in preparation for publication.