Microscopic Description Of Excitation Of Isoscalar Giant Dipole Resonance In ^{28}Si And ^{208}Pb.

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Studies of excitations of isoscalar giant dipole and monopole resonances (ISGDR and ISGMR, respectively) are of particular current interest since their parameters can be directly related to the value of nuclear incompressibility coefficient. In this work we perform self-consistent Skyrme Hartree-Fock (HF) Random-Phase-Approximation (RPA) calculations for the case of ISGDR excitation in ^{28}Si and ^{208}Pb. We use SL1 parametrization of the Skyrme effective interaction [1] which gives the value of nuclear matter incompressibility of 230 MeV.

Figure 1. Transition strength distribution for ISGDR excitation in ^{28}Si.

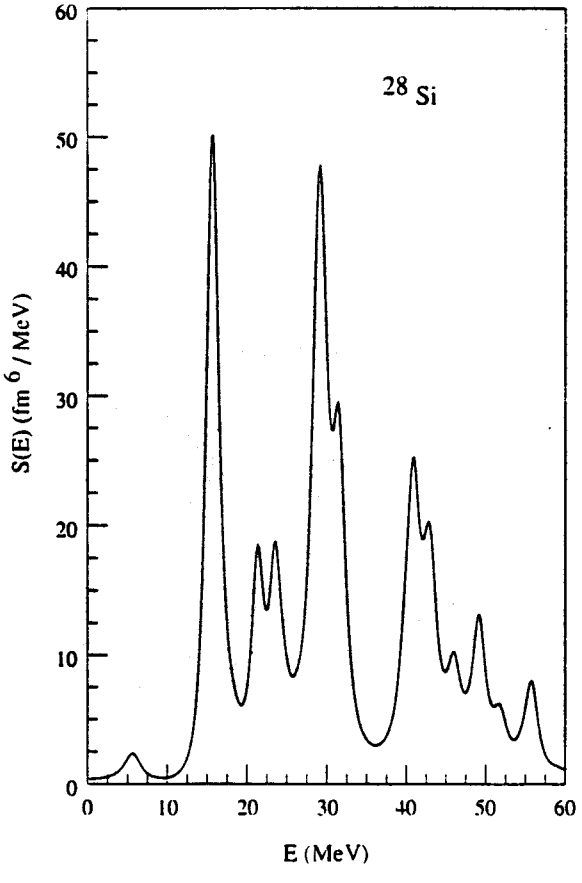
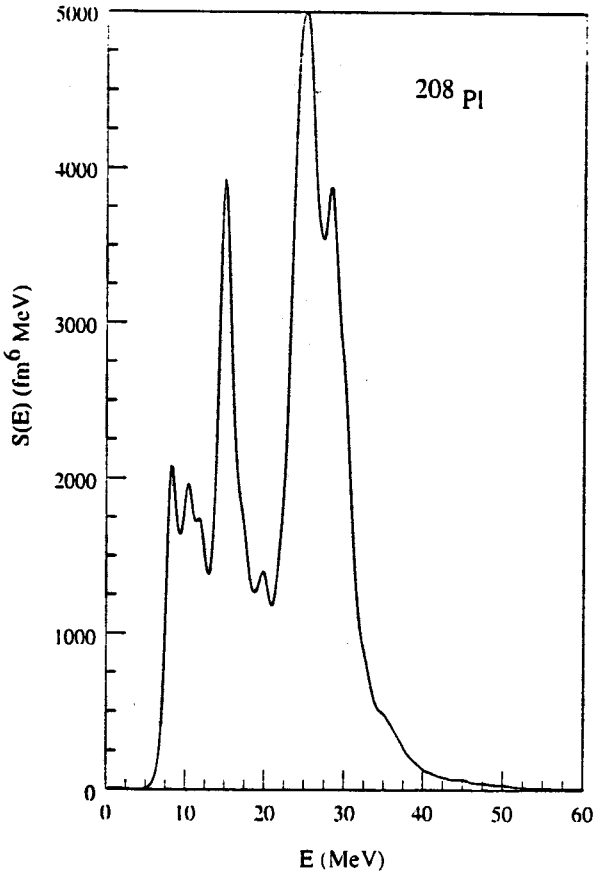


Figure 2. Transition strength distribution for ISGDR excitation in ^{208}Pl.



The transition strength distribution for ISGDR are obtained from studying the response of the system to the excitation operator

$$\hat{D} = \sum_{i=1}^{A} r_i^3 Y_{10}(\hat{\mathbf{r}}_i). \qquad (1)$$

The contribution from the spurious state is taken into account by subtracting the transition density $\delta\rho_{spur.}(\mathbf{r}, E) = a(E)\frac{\partial\rho_0}{\partial r}Y_{10}^*(\hat{\mathbf{r}})$ corresponding

to the center of mass motion from the isoscalar dipole (E1T0) transition density $\delta\rho_{L=1,T=0}(\mathbf{r}, E)$ found from the RPA results [2]. The resulting transition density for the E1T0 excitation is then given by:

$$\widetilde{\delta\rho}_{L=1,T=0}(\mathbf{r}, E) = \delta\rho_{L=1,T=0}(\mathbf{r}, E) - a(E)\frac{\partial\rho_0}{\partial r}Y_{10}(\hat{\mathbf{r}}). \quad (2)$$

The energy dependent coefficient $a(E)$ is found from the condition of the translational invariance of the system:

$$\int d\mathbf{r}\widetilde{\delta\rho}_{L=1,T=0}(\mathbf{r}, E)rY_{10}(\hat{\mathbf{r}}) = 0. \quad (3)$$

Our results for E1T0 transition strength distributions in ^{28}Si and ^{208}Pb are shown in Figures 1 and 2. The ISGDR centroid energies are found to be 30.9 MeV for ^{28}Si and 22.0 MeV for ^{208}Pb.

For comparison, the RPA calculations with SKM* force of Ref. [2] give the enrgy of 25 MeV for ISGDR excitation in ^{208}Pb, while the preliminary analysis of recent experimental data performed in [3] produces a significantly lower value of 19.3 MeV. Microscopic studies of ISGDR in other nuclei are currently underway.

References

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[3] H. L. Clark, Y. -W. Lui, and D. H. Youngblood, *Progress in Research*, Cyclotron Institute, Texas A&M University, June 1998 I12