Deformed Shell Model Study of Heavy $N = Z$ Nuclei and Dark Matter Detection

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There has been considerable interest in investigating the structure of the nuclei in the mass region $A = 60 - 100$ and in particular odd-odd $N = Z$ nuclei as these nuclei are expected to give new insights into neutron-proton (np) correlations that are hitherto unknown. Some of the even-even nuclei in this region show shape coexistence like for example ^{72}Kr and oblate shape in the ground state as in ^{68}Se. Also many even-even $N = Z$ nuclei in this region are waiting point nuclei for rp-process nucleosynthesis and hence are of astrophysical interest. The Deformed Shell Model based on HF states (DSM) has been found to be quite successful in describing many spectroscopic properties, double beta decay half-lives, $\mu - e$ conversion in the field of the nucleus, inelastic electron-nucleus scattering etc. in this region.

Within the framework of DSM with isospin projection, calculations are performed in the model space consisting of $2p_{3/2}$, $1f_{5/2}$, $2p_{1/2}$ and $1g_{9/2}$, with ^{56}Ni as the inert core, for $T = 0$ and $T = 1$ bands in the odd-odd nucleus ^{66}As where there is new data. The results are compared with experiment as well as with shell model. In another application, DSM has been used to calculate LSP (a dark matter condidate) detection rates for scattering from ^{72}Ge. The detailed results for these two will be presented.