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Shell Model Calculations of Some Exotic Nuclei Near Doubly Magic ^{132}Sn

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Unrestricted large-scale shell model calculations in the ^{132}Sn region for the nuclei $^{136,\,138}$Xe and ^{138}Ba have been performed using the shell model code NushellX@MSU for windows by employing the effective interactions jj56pna, jj56pnb, kh5082, cw5082, jj56cdb and khhe near the closed doubly magic ^{132}Sn core with model space jj56pn. The calculated excitation spectra, binding energies and reduced transition probabilities B(E2; $0_1^+ \rightarrow 2_1^+$) are compared with available experimental data. A good global agreement were obtained for all isotopes under study.

KEYWORDS: Shell Model, Reduced Transition Probabilities, $90 \leq A \leq 149$, NushellX@MSU.

1. INTRODUCTION

The existence of the traditional nuclear magic numbers at 2, 8, 20, 28, 50, 82, and 126 suggests that nucleons are moving in orbits with pronounced shell structures in analogy to atoms, atomic nuclei have definite orbits that are separated by large energy gaps at these numbers, and nuclei that have their valence nucleons close or far from the magic numbers can behave very differently. One important questions whether these traditional magic numbers persist in exotic mass regions where nuclear structure and nuclear astrophysical research are currently focused[1] the study of neutron rich nuclei above the strongest dou-bly closed ^{132}Sn are interesting for many reasons.[2] Sarkar and Sarkar[3] performed large basis untruncated shell model calculations to study A = 130 neutron rich nuclei above the core ^{132}Sn using (1 + 2) nuclear Hamiltonians realistic CWG and empirical SMPN and t heir results shows good agreement with the experimental data. Shell model calculations were performed by Majeed to study neutron-rich even–even $^{132-136}$Te using a realistic interaction derived from CD-Bonn nucleon–nucleon potential for the positive and negative parity states and the transition rates B(E2; $0_1^+ \longrightarrow 2_1^+$) the calculated results were compared with recently available experimental data.[4] Covello et al.,[5] reported shell model study on Sn isotopes beyond N = 82 employing a realistic effective interaction derived from CD-Bonn potential renormalized through use of $V_{\text{low-k}}$ approach, their conducted study agrees very well with the experimental data which gives confidence in the predictive power of our realistic shell-model calculations. A large-scale shell model calculations has been performed by Almayyali,[6] to study the energy levels and reduced transition probabilities for neutron rich even–even $^{62-76}$Zn. They reported that their calculations agrees well with the experimental data and they confirm that using fixed values for proton and neutron effective charges, were unable to reproduce the experimental reduced transition probabilities, which proves the limitation of the model space and effective interactions that has been used in their study. Jassim et al.,[7] had employed large scale-shell model calculations is *sdpf* shells by considering the higher configurations outside the core by means of a microscopic theory which is called core-polarization effects, to study the electron scattering form factors as well as the reduced transition probabilities for ^{24}Mg nucleus. The structure of neutron-rich isotones $N = 82 - 84$ nuclei near ^{132}Sn has been studied by Sarkar and Sarkar[8] by performing shell model calculations using available effective interactions obtained from the well-studied ^{208}Pb region after proper scaling. Their calculations agrees well with the experimental data except for the $N = 84$ isotones, their results are not agreed with the experiment. Sarkar and Sarkar[9] had used the recent experimental information for ^{132}Sn region, they had obtained an empirical Hamiltonian by some modifications of (CW5082) originally derived from the ^{208}Pb region. Their results with this empirically obtained Hamiltonian showed a remarkable improvements in comparison with the experimental data.

The aim of the present work is to study the excitation spectra including the high J^π-values, binding energies and reduced transition probabilities $B(E2; 0_1^+ \longrightarrow 2_1^+)$ for ^{136,138}Xe and ^{138}Ba isotopes by means of large-scale shell

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