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Single-particle states around 132Sn by realistic shell-model calculations

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Over the past several years various shell-model studies have been performed for neutron-rich nuclei beyond 132Sn, all leading to spectroscopic properties in very good agreement with the experimental data (see for instance [1,2] and references therein). In these works, a unique Hamiltonian has been used with the single-particle energies taken from the experiment and the two-body effective interaction derived from the CD-Bonn NN potential [3] renormalized by means of the Vlow-k approach [4].

Using this Hamiltonian calculations have been performed for the two isotopes 135,137Sb and the two isotones 135Te and 137Xe. These nuclei, having respectively one proton and one neutron outside doubly magic 132Sn, give the opportunity to investigate the evolution of single-particle states with increasing nucleon number. To this end, the properties of states with spin and parity corresponding to those of the single-particle orbits are discussed, with particular attention focused on the one-particle spectroscopic factors.
These quantities are indeed essential for mapping out the single-particle structure of nuclei and may now become available for exotic nuclei thanks to transfer experiments in inverse kinematics

Comparison shows that the calculated results reproduce very well the experimental excitation energies as well as the spectroscopic factors recently extracted for states in 137Xe from the (d,p) transfer reaction [5].This gives confidence in the predicted spectroscopic factors obtained for the other studied nuclei and provides insight into the evolution of the single-neutron and single-proton states outside 132Sn.

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