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Hartree-Fock-Bogoliubov Predictions for Ground State Properties of Even-even Mo Isotopes

Exotic nuclei with large proton or neutron excess are of intense current interest due to their potential to exhibit unusual properties and their importance in reactions for astrophysical simulations. Shape changes, modified shell closures, and the emergence of new modes of excitation are among the phenomena of interest to both nuclear structure and reaction theories. Developing improved theoretical descriptions can also be expected to impact astrophysical simulations. In order to simulate astrophysical processes such as the r-process and to better understand the production mechanisms for nuclei heavier than iron, it is important to obtain precise nuclear structure data and neutron capture cross sections. Radioactive ion beam facilities provide excellent opportunities for the exploration of the properties of exotic nuclei, primarily of neutron-rich isotopes.

We have performed a theoretical study of the evolution of nuclear ground state shapes for nuclei in the A~100 mass region, where many interesting nuclear properties have been experimentally observed. Utilizing the framework of a self-consistent Hartree-Fock-Bogoliubov approach with the Gogny D1M and D1S finite-range effective interactions, implemented in an axially-symmetric deformed basis, we investigated the ground-state nuclear shapes for the even-even molybdenum isotopes, from 80Mo to 130Mo. We will present results for nuclear potential energy surfaces, nuclear shapes, nuclear binding energies, two-neutron separation energies, root-mean-square charge distributions, and single-particle energy levels. We will offer new insights into shape coexistence and shape evolution and outline open questions.

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