Fifth Article

Ground state properties of polonium isotopes using covariant density functional theory

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Abstract

In the framework of the Relativistic Hartree-Bogoliubov (RHB) mean-field model, a Covariant Density Functional Theory (CDFT) is used to systematically investigate the triaxial shape evolution of even–even polonium isotopic chain (N=102–148). Two different effective interactions, i.e., the Density-Dependent Meson-Exchange (DD-ME2) and the new parameter set of Density-Dependent Point-Coupling (DD-PCX) interactions, are utilized in the current study. Besides, the new parameter free proxy-SU(3) model is used to investigate the ground state shapes of polonium isotopes. CDFT calculations with both parameter sets, predict shape coexistence in the neutron deficient side of polonium isotopic chain, which meets the same prediction of the proxy-SU(3) scheme. The predicted shapes of nuclei are in good agreement with several experimental studies, as well as other theoretical models presented in the current paper. Also, one triaxial ground state is predicted by DD-ME2, DDPCX, and proxy-SU(3) but for three different nuclei. Different ground state properties like binding energy per nucleon, two-neutron separation energy and proton- neutron- and charge radii are presented in comparison with available experimental data as well as other theoretical models, like the Finite-Range Droplet Model (FRDM), the Infinite Nuclear Matter Model (INMM) and Deformed Relativistic Hartree-Bogoliubov theory in Continuum (DRHBc).