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Underlying mechanism responsible for even-parity ground state and one-neutron halo of ^{11}Be (remote)

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Using the axially deformed relativistic Hartree-Fock-Bogoliubov (D-RHFB) model, we explore the mechanism that triggers the novelties in ^{11}Be, i.e., the parity inversion and one-neutron halo which are well reproduced by the RHF Lagrangian PKA1. Following the evolution from spherical to large prolate shapes, it is illustrated that the evidently enhanced π-pseudo-vector (π-PV) and ρ-tensor (ρ-T) couplings in PKA1 are crucial for correctly describing even-parity ground state (GS) of ^{11}Be. By fragmentizing the even-parity orbit $1/2_2^+$, it is shown that the main fragment $1d_{5/2}$ strengthens the couplings with nuclear core to promise the even-parity GS, in which the ρ-T and π-PV couplings play an important role, and the other major one $2s_{1/2}$ remains weakly bound to form the halo in ^{11}Be. Furthermore, it is found that the attractive inherent correlations between the $2s_{1/2}$ and $1d_{5/2}$ fragments are essential not only in determining the parity inversion but also in stabilizing the one-neutron halo of ^{11}Be. Thus, an apparent picture of the deformed halo is achieved, which paves an efficient way to clarify the underlying mechanism responsible for the halos and other novelties in deformed unstable nuclei.

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