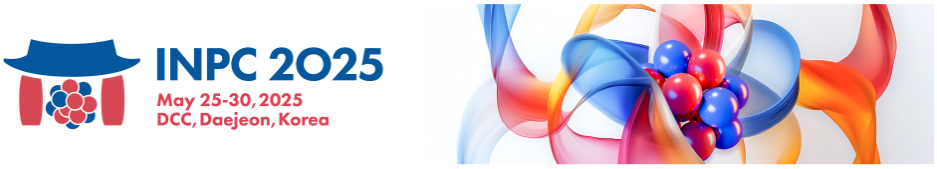

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Exact-exchange relativistic density functional theory for atomic nuclei

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The inclusion of nucleonic exchange energy has been a long-standing challenge for the relativistic density functional theory in nuclear physics. We propose an orbital-dependent relativistic Kohn-Sham density functional theory to incorporate the exchange energy with local Lorentz scalar and vector potentials, which are solved efficiently using the relativistic optimized effective potential method. The new theoretical framework is also extended to the three-dimensional coordinate space for the first time. The obtained binding energies and charge radii for spherical and axially deformed nuclei are benchmarked with the results given by the traditional relativistic Hartree-Fock approach, which involves intractable nonlocal potentials. It demonstrates that the present framework is not only accurate but also efficient. The triaxial neutron-rich 104-120Ru isotopes are investigated with the exchange correlations, which is beyond the current capacity of the traditional relativistic Hartree-Fock approach. The results notably indicate the γ-softness of these neutron-rich nuclei, which is consistent with experimental observations. This novel approach establishes a foundation for the study of nuclei without imposing any symmetry restrictions employing relativistic density functional with exchange correlations.

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