Title: Nuclear charge densities in spherical and deformed nuclei

Abstract: Precise measurements of atomic transitions affected by electron-nucleus hyperfine interactions offer sensitivity to explore basic properties of the atomic nucleus and study fundamental symmetries, including the search for new physics beyond the Standard Model of particle physics. In particular, such measurements, augmented by atomic and nuclear calculations, will enable extraction of the higher-order radial moments of the charge density distribution in spherical and deformed nuclei. The new data impose higher precision requirements on a theoretical description.

In Ref. [1] we assess the precision of nuclear charge density calculations by studying the behavior of relativistic and center-of-mass motion corrections to the second and fourth charge radial moments. The proper inclusion of the spin-orbit charge density and other correction terms is essential when aiming at extraction of subtle effects which become particularly visible in isotopic trends. It is also important when developing high-quality nuclear energy density functionals optimized using heterogeneous datasets involving absolute charge radii, differential charge radii, and charge form factor properties deduced from electron scattering data.

[1] P.G. Reinhardt and W. Nazarewicz, Phys. Rev. C (2021) in press; arXiv:2101.00320

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