MICROSCOPIC ANALYSIS OF THE MEAN SQUARE CHARGE RADIUS $\langle R^2 \rangle$ IN EVEN–EVEN CERIUM (Ce) ISOTOPES, BASED ON DEFORMATION ENERGIES AND DEFORMATION PARAMETERS

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Abstract

This study investigates the mean square charge radius [1] and deformation energies of even–even nuclei within the mass range $116 \leq A \leq 140$, focusing on cerium isotopes. A microscopic approach is employed, combining the liquid drop model for macroscopic energy with Strutinsky shell corrections and BCS (Bardeen–Cooper–Schrieffer) pairing correlations for microscopic refinements. The shell corrections are derived by solving a Schrödinger equation with a deformed Woods–Saxon mean field. Numerical solutions, performed using an optimized FORTRAN program, identify equilibrium shapes by locating energy minima in deformation energy contour plots. From these equilibrium shapes, single–particle wave functions and the BCS approximation are used to calculate the mean square charge radius [2]. Theoretical results align closely with experimental data, confirming the robustness of the proposed model. This study advances our understanding of nuclear deformation and structure, particularly in isotopes far from spherical symmetry.

References

[1] A. Bohr and B. R. Mottelson, *Nuclear Structure, Vol. I & II* (World Scientific, 1998).

[2] P.-G. Reinhard, W. Nazarewicz, Phys. Rev. C **81**, 051303 (2010).