The intricate behavior of charge radii along the chain of Ca isotopes, including the unexpectedly large charge radius of neutron-rich $^{52}$Ca, poses a daunting challenge for nuclear theory.

The charge radii of proton-rich isotopes $^{36,37,38}$Ca are challenging as properties of these systems are impacted by the interplay between nuclear superfluidity and weak binding.

Calculations carried out within nuclear density functional theory with the recently optimized Fayans functional show that the combination of a novel interaction and a state-of-the-art theoretical method can successfully explain the behavior of charge radii from the lightest to the heaviest Ca isotopes.

This success can be attributed to a better understanding of the peculiar ways in which protons interact with each other at large distances outside the surface of a proton-rich calcium nucleus.

Accomplishments


Charge radii of calcium isotopes. New data are shown in red squares and compared with theoretical values.