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Electromagnetic form factors and charge radii of light nuclei from chiral effective field theory

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The electromagnetic form factors play a crucial role in characterizing the charge and magnetization distribution inside a nucleus. They are essential for determining nuclear charge radii and the differential cross section of electron-nucleus scattering, and providing important corrections to Lamb shifts in ordinary and muonic atoms. Achieving a precise and accurate theoretical description of these form factors requires a thorough understanding of two- and three-body forces, two-body electromagnetic currents, and various relativistic effects.

In this talk we present a high-accuracy calculation of the charge form factors for A=2,3,4 nuclei using the latest two- and three-nucleon forces and charge density operators derived up through the fifth order in the chiral effective field theory. We predict the structure radii of the deuteron, alpha-particle, and the isoscalar combination of ^{3}H and ^{3}He, and conduct a comprehensive analysis of uncertainties from different sources. By combining the predicted structure radii of ^{2}H and ^{4}He with spectroscopic measurements of the deuteron-proton charge radius difference and ^{4}He charge radius, we extract the neutron and proton charge radii.

Parallel Session

Few-Body Systems

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