Magnetic form factors of light nuclei

U.S. DEPARTMENT OF ENERGY | Office of Science

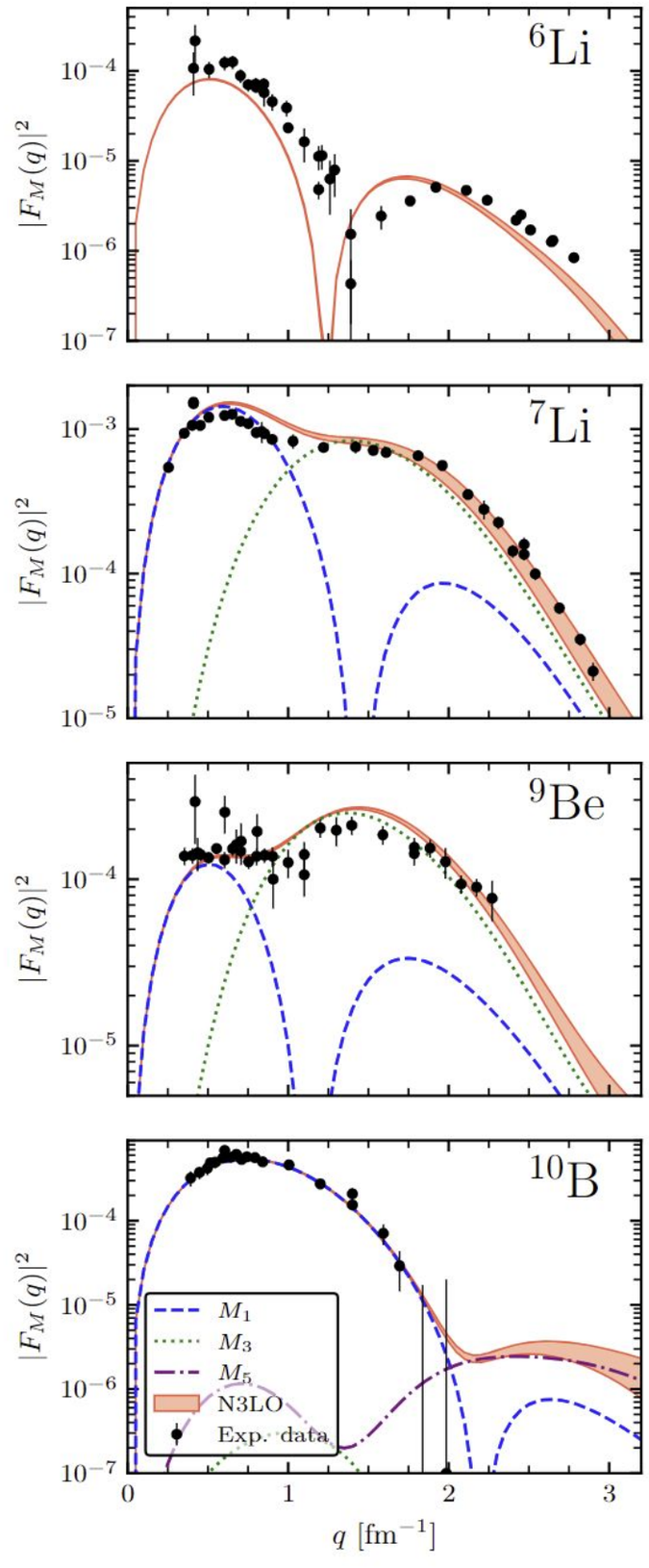
NUCLEI Nuclear Computational Low-Energy Initiative

Objectives

In this work, we present quantum Monte Carlo (QMC) calculations of magnetic form factors in the $6 \leq A \leq 10$ mass region. These calculations are compared to elastic electron scattering data where available to validate the chiral effective field theory (χEFT) approach to modeling the nucleus over a range of momentum transferred to the nucleus. Where the comparison could be made, the QMC results provide a good qualitative description of the data. Studying the form factors for radioactive mirrors of stable nuclei highlighted interesting structural features that could be probed by rare isotope facilities in the future due to recent advances in electron scattering techniques.

Impact

This work represents the first *ab initio* evaluation of magnetic form factors in the $7 \leq A \leq 10$ mass range. This work demonstrate the capacity of χEFT to provide agreement with the data at large momentum transfers, and it validated previous theoretical conjectures about the magnetic structure of these systems within a microscopic framework. The study of radioisotopes led to predictions of never-before-studied phenomena that are closely related to the structure of the nucleus. Studying the structure of these rare isotopes to validate these structural phenomena could have broad impacts for stellar astrophysics and nucleosynthesis research.



Accomplishments

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