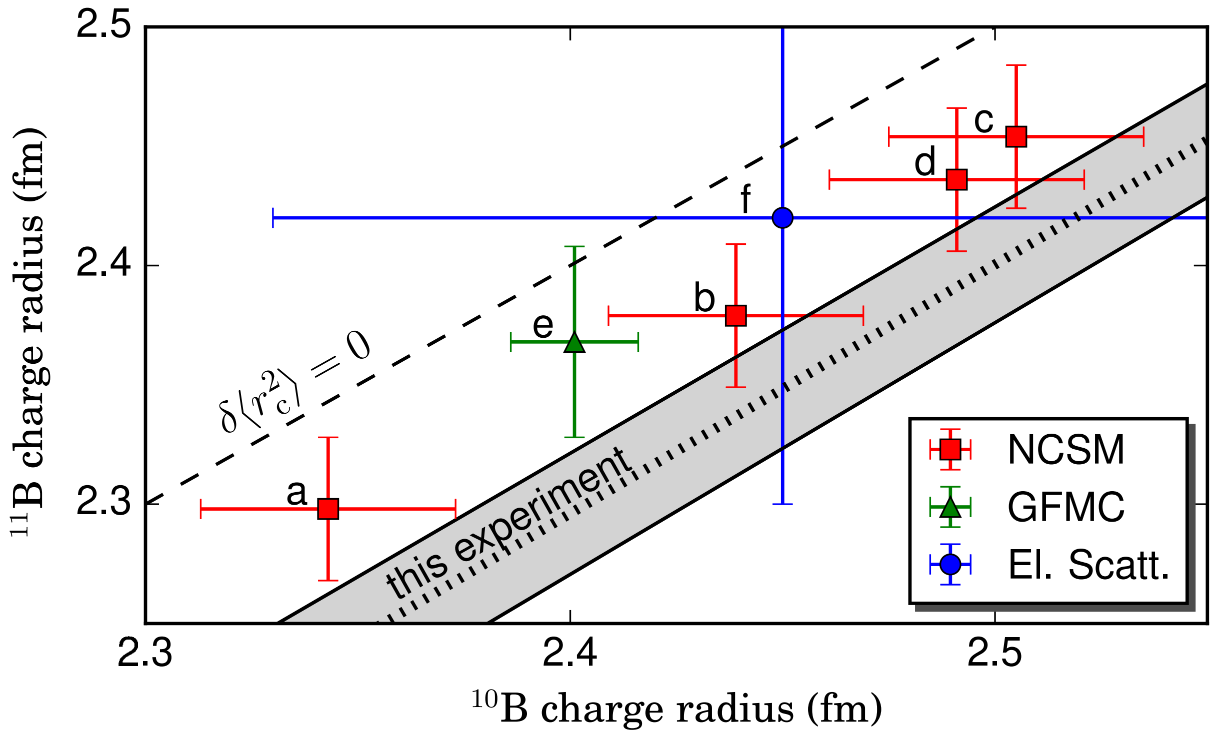
Nuclear Charge Radii of $^{10,11}B$

Objectives

- Perform a multidisciplinary study of boron nuclei involving atomic physicists and nuclear theorists
- Measure the difference of charge of ^{10}B and ^{11}B radii with high precision using atomic spectroscopy
- Combine high-accuracy QED mass-shift calculations and ab-initio nuclear theory calculations of the nuclear charge radius



Nuclear charge radii as obtained in GFMC and NCSM nuclear structure calculations compared with the old experimental value from electron scattering data, and the new difference band established by the atomic physics experiment.

Impact

- Atomic spectroscopy largely improves the experimental precision from electron scattering
- Perform most accurate QED mass-shift calculations for five-electron systems
- The charge radii are evaluated by folding in the proton and neutron intrinsic radii along with the relativistic Darwin-Foldy term; spin-orbit corrections were found to be negligible
- Benchmark the no-core shell model and the Green's function Monte Carlo approaches, test and validate nuclear Hamiltonians and currents
- The experiment and nuclear theory results all agree that ^{11}B has the smaller charge radius, although the theoretical values are systematically above the experiment by about one standard deviation.

Accomplishments

- Bernhard Maaß et al., Phys. Rev. Lett. 122, 182501 (2019)