Ab initio calculations of the structure of p-shell nuclei

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In recent year, there has been significant progress in computational approaches to nuclear structure, with advances in many-body techniques, realistic interactions based on QCD, ever-increasing computing power, and Bayesian methods to estimate uncertainties. I briefly review several ab initio methods, such as Monte Carlo methods, nuclear Lattice simulations, and Configuration Interaction methods. State-of-the-art two- and three-nucleon interactions obtained from chiral effective field theory (EFT) provide a theoretical foundation for nuclear theory with (in principle) controlled approximations. With highly efficient numerical codes, tuned to the current generation of supercomputers, we can perform ab-initio nuclear structure calculations for a range of nuclei to a remarkable level of numerical accuracy.

Next, I present recent results for No-Core Configuration Interaction calculations of *p*-shell nuclei using chiral EFT interactions up to next-to-next-to-leading order. I show the dependence of the ground state energies as well as excitation energies on the chiral order. I discuss the convergence pattern of the chiral expansion and methods to estimate the uncertainties arising from the truncation of the chiral expansion. Finally, will compare results obtained with different interactions, and discuss results for other observables such as charge radii, magnetic and quadrupole moments, as well as electromagnetic transitions.

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