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Ab initio predictions of atomic nuclei

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Atomic nuclei are strongly-interacting quantum many-nucleon systems whose wave function is governed by the Schrödinger equation. In the early 1990s, Steven Weinberg formulated the (chiral) effective field theory (EFT) method. It promises a way to derive an interaction potential for nucleons that manifestly obeys the symmetries of QCD. However, devising a potential using the tools of EFT is just the beginning of the next problem: to actually solve the many-nucleon Schrödinger equation. Ab initio methods, employed with EFT, approximate exact solutions of the Schrödinger equation and offer a handle on the theoretical uncertainty of the prediction. Reliable theoretical errors make it possible to infer the significance of a disagreement between experiment and theory. I will present recent progress in ab initio predictions of nuclear properties and attempts at quantifying theoretical errors.

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