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Nuclear Physics with an Effective Field Theory Around the Unitarity Limit

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Understanding the structure of nuclei from the underlying theory of strong interactions, QCD, has been a longstanding problem. Over the last quarter-century significant progress has been achieved with low-energy effective field theories (EFTs) of QCD and ab initio methods for the solution of the Schroedinger equation (and its many-body variants). Yet, this description remains highly complex. In particular, it does not explicitly incorporate the proximity of the unitarity limit, where the two-body system has S-wave bound states at zero energy and continuous scale invariance. Rich structures emerge in three- or more-nucleon systems from the anomalous breaking of scale invariance to a discrete subgroup, with the emergence of a dimensionful parameter. I show how this one three-body scale is sufficient to generate the spectra of light nuclei and quantum-liquid saturation in larger systems.

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