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Nuclear chiral EFT in the precision era

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Chiral effective field theory provides a systematically improvable perturbative approach to deriving nuclear forces in harmony with the symmetries of QCD. Combined with modern few- and many-body methods, this framework represents a commonly accepted procedure for ab initio studies of nuclear structure and reactions. Recently, a new generation of nucleon-nucleon (NN) forces up to fifth order in the chiral expansion has been developed [1, 2]. By employing an appropriate regularization in coordinate space, which maintains the analytic structure of the amplitude, it was possible to significantly reduce the amount of finite-cutoff artefacts. In addition, a simple approach to estimating the theoretical uncertainty in few- and many-nucleon calculations from the truncation of the chiral expansion was proposed [1]. I will present the applications of the novel NN chiral potentials, along with the new analysis of the theoretical truncation errors, to NN and nucleon-deuteron scattering and to the properties of ${}^2\text{H}$, ${}^3\text{H}$, ${}^4\text{He}$ and ${}^6\text{Li}$ [1, 2, 3].

References

1. E. Epelbaum, H. Krebs, U.-G. Meißner, Eur. Phys. J. A 51, no. 5, 53 (2015).
2. E. Epelbaum, H. Krebs, U.-G. Meißner, arXiv:1412.4623 [nucl-th].
3. LENPIC Collaboration, arXiv:1505.07218 [nucl-th].

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