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Some applications of chiral EFT in one- and two-baryon sectors

December 17, 2019
2:15 pm
Newton room (Staudinger Weg **9**, 01-122)

Abstract

In this talk, I will present several studies in one- and two-baryon sectors within the framework of chiral effective field theory (EFT). First, I will focus on the study of nucleon sigma term, which is an important quantity as it is related to the composition of the nucleon mass and the dark matter searches. We developed a covariant chiral EFT for light baryon masses at N3LO (full one-loop order) in a finite and discretized space-time, and performed the analysis of high-statistic lattice QCD data. Using the obtained quark mass dependence of the nucleon mass, we precisely determined the sigma terms of the nucleon via the Feynman-Hellmann theorem. Next, I will present our ongoing research on the baryon-baryon scattering. Nowadays, the existing chiral potentials are based on the non-relativistic chiral EFT. To investigate the relativistic effects, we constructed a relativistic nucleon-nucleon and hyperon-nucleon potentials at the leading order. We obtained results for the scattering phase shifts and the data, which are comparable with the ones of the non-relativistic chiral forces at next-to-leading order. I also briefly introduce a new approach based on the time-ordered perturbation theory and discuss the issues of renormalization for the baryon-baryon scattering.