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Nucleon-deuteron scattering to investigate three-nucleon forces

Understanding the strong nuclear force is of fundamental importance to understand the formation of matter in the Universe. Since Yukawa's meson theory, the nuclear force had been formulated in terms of two-nucleon interactions. In the last two decades, three-nucleon forces (3NFs), which appear when more than two nucleons interact, have been revealed. The establishment of high-precision two-nucleon potentials and achievements of the ab-initio calculations with these forces suggest the necessities of 3NFs in describing various nuclear phenomena, e.g. nucleon-deuteron scattering observables, binding energies of nuclei, and equation of state of nuclear matter.

Nucleon-deuteron scattering offers good opportunities to investigate these forces by direct comparison between the rigorous numerical calculations in terms of Faddeev theory and the high-precision experimental data. With the aim of exploring the 3NFs, experimental programs of nucleon-deuteron scattering using the polarized beam and target systems are in progress at RIKEN, RCNP in Japan. I will review the three-nucleon force study from experimental points of view and touch upon the impact of these forces in nuclear physics and related fields.

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