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Various types of theoretical uncertainties by the examples of the elastic nucleon-deuteron scattering observables

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Collaboration

Abstract content

An estimation of the theoretical uncertainties present in the nuclear physics is an interesting issue. The necessity of reliable estimation of theoretical errors origins in a growing precision of experimental data as well as in the fact that currently, we are often in the position to study details of underlying physics. A study of the nuclear interaction within the elastic nucleon-deuteron (Nd) scattering can be a good example: while the two-nucleon potential is well known, the details of the three-nucleon force are still not clear. The elastic Nd scattering at energies up to 200 MeV can be used to study the three-nucleon interaction but to draw final conclusions based on the comparison of theoretical predictions and data estimation of theoretical uncertainties is necessary.

There are different types of theoretical uncertainties of the elastic Nd scattering observables. We are interested here in (a) the statistical errors arising from a propagation of uncertainties of parameters of two-nucleon interaction to three-nucleon system, (b) the truncation errors present for chiral interactions, (c) the regulator dependence also connected to chiral forces, (d) the numerical uncertainties as well as the uncertainties bound with the computational scheme used, and last but not least, in (e) the uncertainties arising from using the various models of nuclear interaction. It will be shown that the latter ones are a dominant source of uncertainties of modern predictions for the three-nucleon scattering observables.

To perform above studies we employ the One-Pion-Exchange Gaussian (OPE-Gaussian) nucleon-nucleon potential [1], for which the covariance matrix of its parameters are known. Among other interactions we also use the chiral forces at the fifth order of chiral expansion (N4LO) recently derived by the Moscow(Idaho)-Salamanca [2] and the Bochum-Bonn [3] groups. We use the Faddeev approach [4] to obtain the elastic Nd scattering cross section and various polarization observables. A systematic comparison of the various theoretical uncertainties and their dependence on the reaction energy as well as a comparison of the predictions with data will be discussed.

[1] R.Navarro Perez, J.E.Amaro, and E.Ruiz Arriola, Phys. Rev. C89, 064006 (2014).
[2] E.Epelbaum, H.Krebs, and Ulf-G.Meißner, Phys. Rev. Lett. 115, 122301 (2015).
[3] D.R.Entem, R.Machleidt, and Y.Nosyk, Phys. Rev. C96, 024004 (2017).
[4] W.Glöckle et al., Phys. Rept. 274, 107 (1996).

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