Contribution ID: **114** Type: **Contributed Oral/Poster**

A new probe into three-nucleon-force effects on reaction observables

Thursday, 14 July 2016 10:10 (15 minutes)

Understanding of the roles of three-nucleon forces (3NFs) in nuclear few- and many-body systems is one of the fundamental subjects in nuclear physics. Recently, 3NFs are constructed with chiral effective field theory in which two-, three-, and many-nucleon forces are treated consistently and systematically. The chiral 3NF effects have been analyzed in few-body systems and nuclear matter, and the binding energies of light nuclei and the saturation property in symmetric nuclear matter were well reproduced. Furthermore, it was found that the chiral 3NF effects improve the agreement between theoretical and experimental cross sections for nucleus-nucleus elastic scattering.

We propose to use proton knockout reactions (p,2p) as a new probe into chiral 3NF effects on reaction observables. In many-body systems, 3NF effects can be represented by the density-dependence of nucleon-nucleon effective interaction. Proton knockout reactions from a deeply bound orbit must be suitable for probing 3NF effects since such reactions occur mainly in the internal region of the target nucleus in which the density is high.

In this talk, we construct a microscopic framework of distorted-wave impulse approximation based on a nucleon-nucleon g-matrix interaction and microscopic optical potentials including chiral 3NF effects. And then, we analyze a kinematic condition which is favorable for probing the 3NF effects, and clarify the roles of chiral 3NF for knockout reactions. The chiral 3NF effects significantly change the peak height and full-width-at-half-maximum of the triple differential cross section of (p,2p) reactions.

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Track Classification: Theoretical developments of direct reactions