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Studies of Few-Nucleon Systems and Nucleon Structure with Gamma-ray Beams

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The High Intensity Gamma Source (HI γ S) at the Duke Free Electron Laser Laboratory (DFELL), an important experimental facility of the Triangle Universities Nuclear Laboratory (TUNL), is located on the campus of the Duke University. The HI γ S facility, capable of delivering the most intense mono-energetic photon beam with either circularly polarized or linearly polarized photons in the world, opens up new opportunities for studies of the few-nucleon system through photodisintegration processes, and nucleon structure through Compton scattering. These measurements either with polarized or unpolarized few nucleon target systems provide high precision tests of the state-of-the-arts few-body calculations. Single polarized and double polarized Compton scattering experiments allow for significantly improved determinations of electric and magnetic polarizabilities of the nucleon, as well as spin polarizabilities of the nucleon, which so far have never been determined separately. In this talk, I will present latest results from HI γ S on the studies of few-nucleon systems and upcoming experiments. I will also discuss new experiments on polarized and unpolarized Compton scattering at HI γ S. This work is supported in part by the U.S. Department of Energy under Contracts No. DE-FG02-03ER41231, No. DE-FG02-97ER41033, and No. DE-FG02-97ER41041.