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Experiments with photon beams at the HIGS facility

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The angular-momentum selectivity in photon-induced nuclear reactions enables strategic investigations of nuclear and nucleon structure via excitation of the internal electric charge and current distributions as expressed through single-particle and collective motion responses. The narrow energy resolution and high polarization of laser Compton gamma-ray (γ-ray) beams offer a complementary probe to bremsstrahlung beams for studying nuclear phenomena. The High Intensity Gamma-ray Source (HIγS) at the Triangle Universities Nuclear Laboratory (TUNL) is the highest intensity Compton gamma-ray source in the world [1]. The γ-ray beam at HIγS is produced by Compton-back scattering of electrons from photons inside the optical cavity of a storage-ring based free electron laser. This unique facility provides circularly and linearly polarized γ-ray beams with beam polarization greater than 95% and beam energy resolution as low as 2% over the energy range from 2 to 110 MeV. These beam capabilities enable a broad research program that includes nuclear structure and reactions, nuclear astrophysics, fission, few-nucleon reaction dynamics, nucleon structure, and detector R&D.

An overview of the current research program at HIγS will be presented that includes highlights of recent results in several research areas, e.g., studies of collective electromagnetic nuclear responses using nuclear resonance fluorescence, photon-induced reactions important in nuclear astrophysics, photofission, few-nucleon reaction studies, and the determinations of the low-energy electric and magnetic structure parameters of the nucleons using Compton scattering. The talk will conclude with a discussion about future directions for the HIγS research program and the facility.

[1] H.R. Weller *et al.*, "Research Opportunities at the Upgraded HIGS Facility,"Prog. Part. Nucl. Phys. **62**, 257 (2009).

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