

Two Laser-Driven Nuclear Physics (LDNP) flagship experiments have been identified for the NSF OPAL Laser Facility

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Laser-ion acceleration mechanisms provide a unique opportunity for generating radioactive tritium beams, which are currently not available at accelerator facilities. Few datasets exist of tritium-induced reactions involving light, neutron rich nuclei like ${}^6\text{He}$, ${}^8\text{Li}$ and ${}^{11}\text{Be}$. However, these nuclei are of high interest for nuclear science because influence the r-process as “seed nuclei” [Ter01] and are also predicted to exhibit exotic structure [Qua18, Coc12, For05]. A new platform at the OMEGA-EP laser system at the University of Rochester (UR) Laboratory for Laser Energetics (LLE) is now in a position to support nuclear science experimentation [Sch22]. In a pilot study, 10^{13} tritons were accelerated to several MeV and directed onto a deuterated target, producing 108 fusion neutrons. Follow-up experiments using lithium and beryllium targets to measure the cross sections of di-neutron transfer reactions on these light nuclei will be discussed. This material is based upon work supported by the Department of Energy [National Nuclear Security Administration] University of Rochester “National Inertial Confinement Fusion Program” under Award Number(s) DE-NA0004144.

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[Qua18] Quaglioni et al: “Three cluster dynamics within the ab initio no-core shell model with continuum: How many-body correlations and a clustering shape ${}^6\text{He}$ ”, Physical Review C 97 (2018)

[Sch22] A. Schwemmlin et al: “First Demonstration of a Triton Beam Using Target Normal Sheath Acceleration”, Nuclear Inst. and Methods in Physics Research B 522 (2022)

[Ter01] M. Terasawa et al: “New nuclear reaction flow during r-process nucleosynthesis in supernovae: Critical role of light, neutron-rich nuclei”, The Astrophysical Journal, 562 (2001)

Primary authors: Dr FORREST, Chad (University of Rochester); Dr APRAHAMIAN, Ani (University of Notre Dame); Dr SCHWEMMLEIN, Arnold (University of Rochester); Dr SCHROEDER, Udo (University of Rochester); Dr WIESCHER, Michael (University of Notre Dame)

Presenter: Dr FORREST, Chad (University of Rochester)