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# LBNL Nuclear Physics Forum

Thursday, June 15, 2015 @ 11:00 am

Building 88 Lounge (2nd floor)

*Cookies and coffee available from 10:15am*

Dr. Darren Bleuel

Lawrence Livermore National Laboratory

***“The search for nuclear-plasma interactions at the National Ignition Facility”***

Electron-mediated nuclear-plasma interactions (NPIs) such as Nuclear Excitation by Electron Capture (NEEC) or Transition (NEET) are expected to cause significant changes in reaction cross sections in High Energy Density Plasmas such as nuclear tests, National Ignition Facility (NIF) shots, and astrophysical settings. However, NPIs remain largely unobserved due to the extreme narrowness of nuclear transitions. We proposed to overcome this challenge with an experiment at the NIF by inducing NPIs on highly-excited (~1-5 MeV) nuclear states produced by nuclear reactions prior to their decay by spontaneous gamma-ray emission. The large density of nuclear states at these excitation energies increases the probability that the energy from the atomic transition will resonantly match an available nuclear transition. Neutrons from deuterium-tritium fusion in an indirect-drive exploding pusher capsule produce highly-excited  $^{133}\text{Xe}$  nuclei in both the imploding plasma and a control sample located outside the plasma. NPIs are expected to alter the angular momenta of excited nuclei in the plasma, thus affecting the subsequently-populated isomer fraction. Any difference in the  $^{133}\text{Xe}$  isomer-to-ground state population ratio between the in-plasma and control samples, measured in the same high-purity germanium detector, is indicative of plasma-induced effects. Preliminary findings from our first attempt to measure NPIs in  $^{133}\text{Xe}$  at the NIF will be presented.



Nuclear Science Division