DPP14-2014-001748

Abstract for an Invited Paper
for the DPP14 Meeting of
the American Physical Society

Reaction-in-Flight Neutrons and the Stopping Power in Cryogenic NIF Capsules

ANNA HAYES, Los Alamos National Laboratory

Recent experiments in cryogenic DT capsules at the National Ignition Facility (NIF) observed high-energy reaction-in-flight (RIF) neutrons via threshold (>15 MeV) neutron reactions on thulium foils. This represents the first measurements of RIF neutrons in inertial confinement fusion plasmas. RIF neutrons are produced by a two-step process. In the first step, a primary 14.1 MeV DT neutron knocks a triton or deuteron up to a spectrum of energies from 0 to more than 10 MeV. In the second step, the energetic knocked-on ion undergoes a DT reaction with a thermal ion, producing a neutron above the primary 14 MeV peak. Transport and energy loss of the knock-on ions inducing the RIF reactions directly affect the RIF production rate, and RIF measurements can be used to determine the stopping power for charged particles in the plasma. Here we present the formalism for extracting the stopping power from the measured RIF signals. We find that the stopping power extracted from these measurements is consistent with a strongly coupled quantum degenerate plasma for the high-density cold fuel surrounding the hotspot of the compressed capsule. These RIF measurements represent the first determination of stopping powers in strongly coupled plasmas.