Exploring the universe through Discovery Science on the National Ignition Facility*

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Highlights from research done on the National Ignition Facility (NIF) through the Discovery Science program will be presented. Plasma nuclear reactions relevant to stellar nucleosynthesis and nuclear reactions in high energy astrophysical scenarios are being studied. [1] Equations of state (EOS) at very high pressures (1-1000 Mbar, or 0.1-100 TPa) relevant to planetary cores, brown dwarf interiors, and white dwarf envelopes are being measured on NIF, and show that the level of ionization can significantly affect the degree of compressibility of the EOS. [2-6] Studies of Rayleigh-Taylor instabilities in planar and cylindrical geometries at high Reynolds number relevant to supernovae explosions and ICF implosions are being investigated. [7-12] Relativistically hot plasmas [13,14] and target-normal sheath acceleration (TNSA) proton acceleration [15,16] are also being studied on the NIF ARC laser. Experiments to study magnetic reconnection at high energy densities are underway. [17] High velocity, low density interpenetrating plasmas that generate collisionless astrophysical shocks, magnetic fields, bursts of neutrons, and accelerate particles relevant to cosmic ray generation are being studied on NIF. [18-20] And NIF experiments have demonstrated strong suppression of heat conduction in a laboratory replica of galaxy-cluster turbulent plasmas. [21]

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