Exploring the universe through discovery science on NIF

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New regimes of science are being experimentally studied at high energy density facilities around the world, spanning drive energies from microjoules to megajoules, and time scales from femtoseconds to microseconds. The ability to shock and ramp compress samples to very high pressures and densities allows new states of matter relevant to planetary and stellar interiors to be studied. Shock driven hydrodynamic instabilities evolving into turbulent flows relevant to the dynamics of exploding stars (such as supernovae), accreting compact objects (such as white dwarfs, neutron stars, and black holes), and planetary formation dynamics (relevant to the exoplanets) are being probed. The dynamics of magnetized plasmas relevant to astrophysics, both in collisional and collisionless systems, are starting to be studied. High temperature, high velocity interacting flows are being probed for evidence of astrophysical collisionless shock formation, the turbulent magnetic dynamo effect, magnetic reconnection, and particle acceleration. And new results from thermonuclear reactions in hot dense plasmas relevant to stellar and big bang nucleosynthesis are starting to emerge. A selection of examples providing a compelling vision for frontier science on NIF in the coming decade will be presented.

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