

The National Ignition Facility: Its Role in Fusion Energy and the Emerging Field of High Energy Density Science

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The National Ignition Facility (NIF), the world's largest and most powerful laser system, is nearing completion at Lawrence Livermore National Laboratory (LLNL). The NIF is the U.S. Department of Energy (DOE) and National Nuclear Security Administration (NNSA) national center to study inertial confinement fusion (ICF) and the physics of extreme energy densities and pressures. NIF, a 192-beam Nd-glass laser facility, will produce 1.8 MJ and 500 TW of ultraviolet light. NIF concentrates all the energy of up to 192 of these extremely powerful laser beams into a mm³-sized target to conditions where they will ignite and burn, liberating more energy than is required to initiate fusion reaction. NIF will provide unprecedented and extreme scientific environments: temperatures about 100 million K, a radiation temperature of over 3.5 million K, densities of 1000 g/cm³ and 100 billion times atmospheric pressure —conditions that have never been created in a laboratory and exist only in the interiors of the stars and during thermonuclear burn. The NIF Project is scheduled for completion in March 2009. Ignition experiments are scheduled on NIF in FY2010. These experiments are executed through the National Ignition Campaign (NIC)—a national effort for ignition with participation from General Atomics, LLNL, Los Alamos National Laboratory, Sandia National Laboratories, and the University of Rochester Laboratory for Energetics. The talk will provide an update on the status of NIF, discuss NIF technical capabilities, NIC, high energy density science experiments on NIF and our plans to transition NIF to a national user facility. The talk will also describe the challenges for inertial fusion energy including our research efforts exploring new concepts for inertial fusion energy drivers.