The National Ignition Facility: Ignition and Beyond

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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 stadium-sized 192-beam Nd-glass laser facility, will produce 1.8 MJ and 500 TW of ultraviolet light. When complete, NIF will be sixty times more powerful than any existing ICF high energy laser system. NIF concentrates all the energy of up to 192 of these extremely powerful laser beams into a mm^3-sized target to conditions where targets filled with a deuterium-tritium mix will ignite and burn, liberating more energy than is required to initiate the fusion reactions. NIF will provide unprecedented and extreme scientific environments to study high energy density science: temperatures about 100 million K, a radiation temperature of over 3.5 million K, densities of 1,000 g/cm^3 and 100 billion times atmospheric pressure. These conditions have never been created in a laboratory and exist naturally only in the interiors of the stars and during thermonuclear burn. The NIF Project is scheduled for completion in March 2009. Experiments are planned for NIF later in FY2008 and FY2009 in support of the National Ignition Campaign (NIC)—a national effort for ignition experiments with participation from General Atomics, LLNL, Los Alamos National Laboratory, Sandia National Laboratories, and the University of Rochester Laboratory for Laser Energetics. The primary goal for NIC is to conduct credible 192-beam ignition experiments in 2010. When the NIF is complete, the long-sought goal of achieving self-sustaining nuclear fusion and energy gain in the laboratory will be much closer to realization. The talk will provide an update on the status of NIF, discuss NIF technical capabilities, NIC, high energy density science experiments on NIF and the plans to transition NIF to a national user facility. The talk will also describe the challenges for inertial fusion energy including our research and development efforts exploring new concepts for inertial fusion energy drivers and targets. By 2010, NIF will be managed as a national user facility to fully exploit its scientific potential. Users of NIF will include researchers from the DOE national laboratories, fusion energy researchers, scientists from academia, and other national and international users.

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