Mega-joule experiments on the National Ignition Facility - on the road to produce a microscopic star in the laboratory*

Siegfried H. Glenzer

*Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94551, USA, glenzer1@llnl.gov

With completion of the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory the quest for producing a burning fusion plasma has begun. The goal of these experiments is to compress matter to densities and temperatures higher than the interior of the sun to initiate nuclear fusion and burn of hydrogen isotopes. In the first indirect-drive hohlraum experiments on NIF, we have demonstrated symmetric capsule implosions at unprecedented conditions of mega-joule laser energies. 192 simultaneously fired laser beams heat ignition hohlraums to radiation temperatures of 3.3 million Kelvin compressing 2-millimeter capsules by the soft x rays produced inside the hohlraum. Self-generated plasma-optics gratings on either end of the hohlraum tune the laser power distribution on the hohlraum wall producing symmetric x-ray drive as inferred from capsule self-emission measurements. These experiments indicate conditions suitable for compressing deuterium-tritium filled capsules with the goal to produce a microscopic star in the laboratory.