MS060.O01

EXAFS and laser-driven compression at the Omega and NIF facilities

Federica Coppari[1], Daniel B. Thorn[1], Gregory E. Kemp[1], R. Steven Craxton[2], Emma M Garcia[2], Bruce Remington[1], Yuan Ping[1], Jon H Eggert[1], Marilyn B Schneider[1]

[1]Lawrence Livermore National Laboratory, Livermore, United States, [2]Laboratory for Laser Energetics, Rochester, NY, United States

E-mail: coppari1@llnl.gov

The use of lasers to induce extreme compression states enables the study of material properties and equations of state at unprecedented pressures and temperature conditions. The combination of laser-driven compression and x-ray diagnostics provides a unique picture of the transformations taking place in high-energy-density matter. Structural probes, such as X-ray diffraction and X-ray absorption spectroscopy (EXAFS, Extended X-ray Absorption Fine Structure), have been developed at the Omega laser (University of Rochester, NY) [1,2,3] to investigate in-situ phase transitions occurring on nanosecond time scales as a result of laser-driven dynamic compression.

In the last couple of years we have initiated a series of experimental campaigns dedicated to the development of the EXAFS technique on the National Ignition Facility (NIF) (Lawrence Livermore National Laboratory, CA), the word's largest and most energetic laser facility, where much higher compression can be achieved. Optimization of the x-ray source, detector and geometry are key to good quality EXAFS measurements. In this talk I will discuss the experimental setup and show the results obtained at Omega and the new data collected on the NIF, discussing technical challenges and achievements, as well as the future directions this capability will enable.

This work was performed under the auspices of the US Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344

LLNL-ABS-723760

[1] J. R. Rygg et al, (2012) Review of Scientific Instruments 83, 113904

[2] Y. Ping et al, (2013) Review Scientific Instruments 84, 123105

[3] Y. Ping et al, (2013) Physical Review Letters 111, 06550

Keywords: EXAFS, laser-driven compression