In-situ diffraction in laser driven compression experiments: Probing the microstructure of material at planetary relavent conditions

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With the advent of increasingly powerful, and highly controllable laser systems, such as the National Ignition Facility (NIF) there is a peaked interest in the use of lasers to perform dynamic compression experiments relevant across a number of fields, from basic materials science to planetary physics. One key question in these experiments is how we gain information which takes us beyond a bulk understanding, to one which gives insight into the microstructural response during compression.

In this talk we discuss recent developments in the field of in-situ x-ray diffraction. In particular, we will present the results of novel white light Laue experiments which demonstrate the measurement of both strain anisotropy and estimates of defect densities in-situ. In addition, a novel single photon energy dispersive diffraction geometry will be discussed which may prove to be ideally suited to the harsh environments characteristic of the NIF. We will also discuss the opportunities afforded by next generation light sources such as LCLS, and Europe's XFEL project, which promise to provide techniques highly complimentary to those used at large scale laser facilities.