**MS20.O02**

## *Single-Shot X-Ray Coherent Diffractive Imaging of Superfluid He Nanodroplets*

O. Gessner[1], C. Bostedt[2], A. Vilesov[3]

*[1]Lawrence Berkeley National Laboratory, Ultrafast X-ray Science Laboratory, Berkeley CA, USA, [2]Linac Coherent Light Source and PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park CA, USA, [3]University of Southern California, Los Angeles CA, USA*

Single-shot coherent diffractive imaging (CDI) experiments were performed on pure and doped helium nanodroplets using femtosecond X-ray pulses from the Linac Coherent Light Source (LCLS). The superfluid nature of helium droplets presents a rare opportunity to study the onset of macroscopic quantum phenomena in finite, sub-micron scale systems. Despite the small X-ray scattering cross sections of atomic helium, high-quality single-shot CDI data were obtained that give direct access to sizes and shapes of individual nanodroplets. The diffraction patterns from helium droplets doped with xenon atoms differ starkly from the patterns from pure droplets. Strong indications for the formation of complex xenon structures inside the superfluid helium environment are observed, giving access to information about the structure and aggregation dynamics of the dopant species. The results are discussed with respect to the hydrodynamic properties of the superfluid droplets and compared to those of classical drops. An outlook on femtosecond time-resolved CDI experiments to study dynamics in pure and Xe-doped He nanodroplets will be given based on a new undulator-based X-ray pump/X-ray probe technique that is currently under development at LCLS.

**Keywords:** helium nanodroplets, ultrafast coherent diffractive imaging, superfluid dynamics