Abstract Submitted
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Ultrafast X-ray Coherent Diffractive Imaging of Pure and Doped Helium Droplets[1] C. BACELLAR, LBNL, L. GOMEZ, USC, J. CRYAN, LBNL, K. FERGUSON, S. SCHORB, SLAC, R. TANYAG, C. JONES, J. KWOK, M. SEIFRID, USC, B. POON, E. MALMERBERG, F. STURM, K. SIEFERMANN, F. WEISE, S. MARCHESINI, LBNL, D. ANIELSKI, A. RUDENKO, S. EPP, MPIK, L. FOUCAR, D. ROLLES, MPIMF, L. ENGLERT, MPE, M. HUTH, PNSensor, C. BOSTEDT, SLAC, A. VILESOV, USC, O. GESSNER, LBNL — Coherent diffractive imaging (CDI) experiments were performed on pure and doped helium droplets using femtosecond X-ray pulses from the Linac Coherent Light Source. 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 droplet size- and shape-distributions, which have only been determined indirectly in the past. The diffraction patterns from 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 reconstruction of real-space images from the diffraction patterns is ongoing. The results will provide new information on the dynamics of finite superfluid systems and of nanostructure formation in the extreme environment of a cryogenic nanomatrix.

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