## Imaging Anisotropic Nanoplasma Dynamics in Superfluid Helium Droplets

The dynamics of strong-field induced nanoplasmas inside superfluid helium droplets are studied using single-shot, single-particle femtosecond time-resolved X-ray coherent diffractive Linac imaging (CDI) at the Coherent Light Source (LCLS). Intense (~$5x10^{15}$ $W/cm^2$, ~50 fs) 800 nm laser pulses are employed to initiate nanoplasma formation in sub-micron (200nm - 800nm) sized helium droplets. The dynamics of the nanoplasma formation and subsequent droplet evolution are probed by x-rays pulses (~100fs, 600eV) that are delayed with respect to the near-infrared (NIR) pulses by 10's of femtoseconds to hundreds of picoseconds. Pump-probe time-delay dependent effects in the CDI patterns reveal distinct dynamics evolving on multiple timescales. Very fast (<100fs) appearing features indicative of electronic dynamics are observed, such as droplet surface melting and a sharp decrease in scattering cross section. Meanwhile slower (≥1ps) dynamics associated with structural changes are also measured, corresponding to nuclear motion leading to a decrease in droplet size and ultimately to droplet disintegration. In particular, the CDI images exhibit strong indications of anisotropic dynamics governed by the NIR polarization axis, providing previously inaccessible insight into the mechanisms of nanoplasma formation and evolution.