Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Visualizing the femtosecond emergence and picosecond evolution of an anisotropic nanoplasma. C BACELLAR, A CHATTERLEY, F LACKNER, S PEMMARAJU, LBNL, R TANYAG, C BERNANDO, D VERMA, S OCONNELL, USC, M BUCHER, ANL, K FERGUSON, T GORKHOVER, R COFFEE, G COSLOVICH, D RAY, T OSIPOV, SLAC, D NEUMARK, UC BERKELEY, C BOSTEDT, ANL, A VILESOV, USC, O GESSNER, LBNL — The dynamics of strong-field induced nanoplasmas are studied using femtosecond time-resolved X-ray coherent diffractive imaging (CDI) at the Linac Coherent Light Source (LCLS). Intense 800nm laser pulses ($\approx 10^{15}$W/cm^2, 50fs) are employed to initiate nanoplasma formation in sub-micron sized helium droplets. Plasma formation and evolution dynamics are probed by femtosecond x-rays pulses ($\approx$100fs, 600eV) across timescales ranging from femtoseconds to hundreds of picoseconds. Anisotropic surface softening is observed within tens of femtoseconds after exposure to the NIR pulse. The softening continues over 300fs, after which the anisotropic surface profile stabilizes with $\approx$30% larger extension along the laser polarization axis compared to the perpendicular direction. The saturation of the surface width is contrasted by an increase in anisotropic material loss that is twice as pronounced along the laser polarization axis, resulting in significantly distorted shapes with aspect ratios of $\approx$1.5 and beyond. The results will be discussed within the framework of an anisotropic plasma expansion model that provides new insight into strong-field induced nanoplasma formation and relaxation dynamics.

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Date submitted: 29 Jan 2017 Electronic form version 1.4