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Ultrafast small-angle x-ray scattering from laser-produced plasmas using an x-ray free electron laser[1] CHRISTIAN ROEDEL, SLAC - Natl Accelerator Lab, ALEXANDER PELKA, THOMAS KLUGE, MELANIE ROEDEL, THOMAS COWAN, Helmholtz-Centre Dresden-Rossendorf, ANDREAS KEMP, Lawrence Livermore National Laboratory, LUKE FLETCHER, WILL SCHUMAKER, SEBASTIAN GOEDE, ERIC GALTIER, HAE JA LEE, SIEGFRIED GLENZER, SLAC - Natl Accelerator Lab, SLAC/UNI JENA TEAM, HZDR TEAM, LLNL TEAM, SLAC TEAM — Small-angle x-ray scattering (SAXS) using ultrashort x-ray pulses from free electron lasers has the potential to resolve transient phenomena in dense laser-produced plasmas with nanometer spatial and femtosecond temporal resolution. As a proof-of-principle experiment, we demonstrated ultrafast SAXS from a laser-irradiated wire target using the Matter in Extreme Conditions (MEC) instrument at the Linac Coherent Light Source (LCLS). A 5 m Al wire was irradiated with a high-intensity laser pulse (up to 200 mJ, 50 fs) leading to a rapidly expanding laser plasma. X-ray pulses from the free-electron laser (60 fs, 5.5 keV) probe the laser produced plasma 80 ps after the interaction. The SAXS data reveals that an indentation of the dense plasma is initiated due to plasma expansion. The measurements will be discussed using two-dimensional particle-in-cell simulations of the laser plasma interaction.

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