Phase-Contrast Imaging of Hydrodynamic Shocks in Water with a Betatron X-ray Source*

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Laser wakefield accelerators (LWFA) are a promising alternative for generating bright radiation sources at a fraction of the size and cost of conventional synchrotron-like facilities. The X-ray bursts emitted from a LWFA have sub-micron size, femto-second duration and low beam divergence, thus making them suitable for imaging small-scale dynamic phenomena. In this work we will image the evolution of hydrodynamic shock waves produced by the interaction of a long laser pulse with a stream of water. By taking advantage of the unique properties of plasma-based accelerators, the X-ray pulses will capture the full dynamic evolution of the propagating shock. We have made preliminary measurements and simulations of electron beam and X-ray characteristics, are developing a continuous carbon-free (water) target, and have performed radiograph hydrodynamic simulations of the laser-target interaction using CRASH software.

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