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Imaging the propagation of shock waves with both high temporal and high spatial resolution using XFELs

ANDREAS SCHROPP, SLAC National Accelerator Laboratory, 2575 Sand Hill Rd., Menlo Park, CA 94025, USA

The emergence of x-ray sources of the fourth generation, so called x-ray free-electron lasers (XFELs), comes along with completely new research opportunities in various scientific fields. During the last year we developed an x-ray microscope based on beryllium compound refractive lenses (Be-CRLs), which is especially optimized for the XFEL environment and provides focusing capabilities down to 100nm and even below. Based on magnified x-ray phase contrast imaging, this new setup enables us to pursue high-resolution x-ray imaging experiments with single XFEL-pulses. In a first experiment, carried out at the Matter in Extreme Conditions (MEC) endstation of the LCLS, the performance of the instrument was investigated by direct imaging of shock waves in different materials. The shock wave was induced by an intense 150ps optical laser pulse. The evolution of the shock wave was then monitored with the XFEL-beam. In this contribution we report on first analysis results of phase contrast imaging of shock waves in matter.

In collaboration with Brice Arnold, Eric Galtier, Hae Ja Lee, Bob Nagler, Jerome Hastings, SLAC National Accelerator Laboratory, 2575 Sand Hill Rd., Menlo Park, CA 94025, USA; Damian Hicks, Yuan Ping, Gilbert Collins, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94551, USA; and Robert Hoppe, Vivienne Meier, Jens Patommel, Frank Seiboth, Christian Schroer, Institute of Structural Physics, Technische Universität Dresden, D-01062 Dresden, Germany.