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Ultrafast phase contrast imaging of laser driven shocks using betatron X-rays D.J. CHAPMAN, M.E. RUTHERFORD, T.G. WHITE, D.E. EAKINS, Institute of Shock Physics, Imperial College London, UK, J.C. WOOD, K. PODER, N.C. LOPES, J.S.J. BRYANT, S.P.D. MANGLES, Z. NAJMUDIN, J.S. COLE, John Adams Institute for Accelerator Science, Imperial College London, UK, F. ALBERT, B.B. POLLACK, Lawrence Livermore National Laboratory, NIF and Photon Sciences, USA, K.T. BEHM, Z. ZHAO, A.G.R. THOMAS, K. KRUSHELNICK, Centre for Ultrafast Optical Science, University of Michigan, USA, W. SCHUMAKER, S. GLENZER, SLAC National Accelerator Laboratory, Photon Science, Stanford University, USA — Bright, high-energy photon sources, such as synchrotrons and more recently the new generation of X-ray free-electron lasers, offer the attractive combination of high brilliance, short pulse duration and high-energy X-rays. Betatron X-rays produced within a laser-plasma wakefield accelerator provide an exciting complementary energetic photon source to these large scale facilities. We describe the first proof-of-principle experiments imaging shock-front evolution in laser driven targets using wakefield betatron X-rays. These pioneering experiments were performed on the 400TW Gemini laser at the Rutherford Appleton Laboratory, UK. Shock waves were driven into silicon wafers along the [100] direction, and stroboscopically imaged perpendicular to the shock propagation direction using a $\approx$ 40 fs betatron X-ray pulse. These initial results showcase a promising, potentially table top sized X-ray source suitable for probing the response of materials under extreme condition.

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