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Measurement of shock wave density using quantitative x-ray phase contrast imaging DAMIEN HICKS, JON EGGERT, PETER CELLIERS, HYE-SOOK PARK, SEBASTIEN LE PAPE, PRAVESH PATEL, BRIAN MADDOX, GILBERT COLLINS, Lawrence Livermore National Laboratory, THOMAS BOEHLY, University of Rochester, BENJAMIN BARBREL, Ecole Polytechnique
— Determining the density in a shock wave at multi-Mbar pressures using traditional impedance matching methods suffers from the dual problems of increasing uncertainty in the material standard and the increasing precision required to measure shock velocities. We present results from laser-driven shock wave experiments employing a technique designed to achieve *direct* density measurements of a shock wave. Point projection of a laser-plasma x-ray source is used to produce a phase contrast image snapshot of an expanding shock wave. Using an iterative algorithm to determine the propagation of refracted x rays at the shock front, the resulting optical depth of the image is tomographically inverted to determine the shock density. By simultaneously measuring the shock velocity using VISAR, absolute equation-of-state points are determined. This technique has been extended to produce phase contrast images of shocks in aluminum using high-energy, short-pulse laser-produced x rays. This work was performed under the auspices of the US DOE by LLNL under Contract No. W-7405-ENG-48 and by the University of Rochester under Cooperative Agreement No. DE-FC03-92SF19460.

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