Isochoric heating into the warm dense matter regime by laser - solid produced K α x-rays

G. Dyer, T. Ditmire

Department of physics, University of Texas at Austin C1510, Austin Tx 78712

gilliss@physics.utexas.edu

R. Shepherd, J. Kuba, D. Price, A. Wootton, R. W. Lee, P. Patel

Lawrence Livermore National Laboratory, Livermore, CA

E. Fill

Max-Planck-Institut für Quantenoptik, D - 85748 Garching, Germany

The study of matter at near solid density and at temperatures of 1 - 10 eV is a great challenge to both experimentalists and theorists, because such matter exhibits internal energy density which is very high but insufficient to overpower the inter-atomic potentials. This form of matter, intermediate to condensed matter and plasmas, exists in many astrophysical systems. In this paper, we describe an experimental program to study solid-density matter heated to temperatures near 1 eV per atom with ultrafast pulses of x-rays. An intense, ultra-short laser pulse incident upon a thin foil produces a burst of K α x-rays, which are used to flash heat an adjacent bulk sample. Optical interferometric probing of the sample with sub-ps time resolution allows us to measure its expansion into vacuum upon heating. K α source target properties are optimized for irradiation of the adjacent sample. Initial results on K α yields and heating of Al foils will be discussed.

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