UCRL-JC-123154 Abs

Abstract submitted to
24th ECLIM University of Madrid
3-7 June 1996

Electron Density Measurement of a Colliding Plasma Using Soft X-ray Laser Interferometry*

A. S. Wan, T. W. Barbee, Jr., R. Cauble, P. Celliers, L. B. Da Silva,
J. C. Moreno, P. W. Rambo, G. F. Stone, J. E. Trebes, and F. Weber

Lawrence Livermore National Laboratory
Livermore, California 94550

We have employed a soft x-ray Mach-Zehnder interferometer, using a neonlike yttrium x-ray laser at 155 Å as the probe source, to study interpenetration and stagnation of two colliding plasmas. The understanding of the collision and subsequent interaction of counter-streaming high-density plasmas is important for the design of indirectly-driven inertial confinement fusion hohlraums. In a vacuum hohlraum, as the plasma stagnates on the hohlraum axis, single fluid codes predict the creation of jets of high-velocity, high-density plasmas which can destroy the symmetry of the capsule implosion before capsule ignition. Using a 1-ns temporally squared pulse with an intensity of 3 x 10^{14} W/cm^2 incident on thick gold slabs with separations of 500 – 1000 μms, we observed a peaked density profile at the symmetry axis and a wide stagnation region with width of order 100 μm. We compare the measured density profile with density profiles calculated by the radiation hydrodynamic code LASNEX and a multi-specie fluid code which allows for interpenetration. The measured density profile falls in between the calculated profiles using collisionless and fluid approximations. By using different target materials and irradiation configurations, we can vary the collisionality of the plasma. We hope to use x-ray laser interferometry as a mechanism to validate and benchmark our numerical codes used for the design and analysis of high-energy-density physics experiments.

* *Work performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under contract number W-7405-ENG-48*