EXPERIMENTAL TEST OF RESONANT ABSORPTION THEORY

Progress Report
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Abstract

The laser-shockfront interaction experiment has been performed using the 100 psec FWHM pulses available from our newly installed high-pressure laser amplifier. The interaction time is so short that the hydrodynamic expansion which distinguishes H_2 targets from D_2 is absent. Good experimental reproducibility results.

Progress Report

In the last report of progress in the laser-shockfront interaction experiment, preliminary measurements of the scaling with laser intensity of the hot electron temperature, T_h , in resonance absorption were described. Much of the intervening time has been spent expanding these measurements. Experiments have been performed in D_2 in the pressure range 36-46 torr. For gas pressures and Mach numbers for which the critical surface is on the steep translational shockfront, T_h is seen to rise as the shock thickness is decreased. The narrow range of pressures in which signals can be obtained prevents an accurate determination of the scaling of this behavior. Signals have been obtained in N_2 at pressures of 19-25 torr. T_h is lower, about 20 keV, and shows only a weak dependence on pressure and laser intensity.

In H_2 , the hot electron spectrum produced with 500 psec pulses was not found to be reproducible, presumably due to faster target disassembly. For this experiment shorter laser pulses are required, and so a high priority has been placed on the installation of our new high-pressure CO_2 laser amplifier. This device has just come on line and is capable of producing 100 psec pulses of energy 80 mJ. Breakdown of the shock-

front should occur on the rising portion of this pulse; the 10-20 psec risetime should freeze out all hydrodynamic plasma motion. Preliminary experiments in H_2 and D_2 confirm that reproducibility in data thus results: both gases produce the same hot electron temperatures. These temperatures are greater than those produced by 500 psec pulses, but not as hot as would be predicted by the intensity scaling measured at 500 psec. Details of the continuation of these experiments will be forthcoming.

This work has been reported at the APS Plasma Physics Division Meeting, Boston, November 13, 1979.¹

REFERENCE

1. P. Kolodner and E. Yablonovitch, Bull. Am. Phys. Soc. 24, 990 (1979).