CRASH: theory and experiments on radiative shocks

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Astrophysical systems in which radiation transport across a shock front contributes substantially to the properties and dynamics of the system may in certain respects be modeled in laboratory experiments under high-energy-density conditions. A series of experiments on the Omega laser facility have launched Be discs into shock tubes of Xe gas at atmospheric pressure, producing radiative shocks with speeds over 100 km/sec that are then diagnosed by x-ray pinhole radiography.

These experiments are found to develop rich internal structure. First, radiative losses lead to a very high compression of the shocked fluid. Second, these radiating, decelerating shock systems become susceptible to hydrodynamic instabilities of thin shocked layers. Third, heating and ablation of the shock tube material ahead of the radiative shock drives a secondary, inwardly directed radial shock, which we call a wall shock.

To predict and understand these and other complications of the radiation-hydrodynamic regime, a large computing effort has been undertaken (the Center for Radiative Shock Hydrodynamics). The code is three-dimensional, parallel, and solution-adaptive. Results produced by this code will be shown, as well as experimental data.

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