Inferring the equation of state of shocked liquid deuterium


— The equation of state of light elements is essential to understanding the structure of Jovian planets. Here we present a combination of experimental techniques used to characterize warm dense deuterium. The OMEGA laser was used to directly drive a shock wave in a planar liquid-deuterium target. The shocked D2 conditions were diagnosed using VISAR and pyrometry to obtain the shock velocity and temperature. Two shock waves were launched with velocities of 17±0.9 and 23±1.0 km/s, as a result of intensity variations in the staggered laser beam drive. Using a blackbody approximation, a temperature of 0.4 to 0.8 eV range was inferred. Various equations of state models including SESAME, PROPACEOS, DFT-MD and Saumon & Chabrier EOS were used to obtain a range pressures (0.4-0.5 Mbar) and densities (0.65-0.88 g/cc). Differences between models will be discussed. Preliminary data from X-ray scattering, providing a direct measurement of microscopic state of the deuterium for extreme conditions not accessible with VISAR, will also be presented.

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