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Laser shocks in diamond anvil cells pre-compressed to 6 GPa: Revealing the density and temperature contributions of the transition to conductive fluid hydrogen PAUL LOUBEYRE, STEPHANIE BRYGOO, CEA, RYAN RYGG, LLNL, MARIUS MILLOT, Berkeley University, AMY LAZICKI, LLNL, DYLAN SPAULDING, Berkeley University, PETER CELLIERS, JON EGGERT, LLNL, TOM BOEHLY, LLE Rochester, GILBERT COLLINS, LLNL, RAYMOND JEANLOZ, Berkeley University — The quest for metallic hydrogen at high pressures represents a longstanding problem in condensed matter physics. It seems that pressures in excess of 400 GPa are needed to observe the metallic state of crystalline hydrogen. On the other hand, electrically conductive fluid hydrogen has been observed at much lower pressures, first by gas-gun compression and subsequently by laser-shock compression of cryogenic deuterium. But the relation between conductive and metallic states of hydrogen is debated, due to the combined influence of density and temperature. When the density contribution is predominant, a first-order plasma phase transition (PPT) is expected, and can be considered to represent the metallization of dense fluid hydrogen. We revisit this question by presenting Hugoniot measurements on deuterium pre-compressed in diamond anvil cells up to 6 GPa. The temperature and density contributions to electrical conductivity can be disentangled. The prediction of ab-initio calculations are compared to our data set, and a reasonable location for expecting the PPT transition line will be discussed.

Paul Loubeyre
CEA

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