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Dynamic Compression Experiments on Hydrogen and Deuterium in the Warm Dense Liquid. MICHAEL DESJARLAIS, CHAD MCCOY, KYLE COCHRANE, THOMAS MATTSSON, Sandia National Labs, MARCUS KNUDSON, Wash. State Univ. / Sandia National Labs, RONALD REDMER, Univ. Rostock — Recently a shock-ramp platform has been developed on the Z Accelerator to access off-Hugoniot states in liquids. The accelerator delivers a two-step current pulse; the first accelerates the electrode to a constant velocity, which upon impact with the sample cell creates a well-defined shock, the subsequent current rise produces ramp compression from the initially shocked state producing relatively cool (1-2 kK), high pressure (>300 GPa), high compression (10 to 15-fold compression) states. This technique allows experimental access to the region of phase space where hydrogen is predicted to undergo a first-order phase transition from an insulating molecular-like to a conducting atomic-like liquid. Here we discuss the experimental platform, survey various theoretical predictions for the liquid-liquid, insulator-to-metal transition in hydrogen, and present results of experiments on both deuterium and hydrogen that clearly show an abrupt transition to a metallic state. We also present results from recent experiments at higher temperatures (3-4 kK) and compare the observations to both first-principles theory and previous step-wise loading experiments that exhibited a minimum metallic conductivity. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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