Investigating the insulator to metal transition in dense fluid hydrogen with laser-driven dynamic compression

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Despite extensive theoretical and experimental studies in the past decades, the properties of fluid hydrogen remain not very well understood in the vicinity of the predicted first-order insulator-to-metal (IM) transition - also known as the Plasma Phase Transition. In particular, there is an apparent discrepancy between static compression experiments and dynamic compression experiments regarding the character and the necessary conditions of temperature and pressure of the IM transition.
We will describe two new schemes of laser-driven dynamic compression to recreate and diagnose high pressure, low entropy states of dense fluid hydrogen. We will report the results of these experimental campaigns at the National Ignition Facility and at the Omega Laser Facility and discuss their implications for our understanding of the metallization of dense fluid hydrogen for planetary, astrophysical and high energy density science.

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