

Abstract Submitted
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Dynamic high pressure: why it makes metallic fluid hydrogen

WILLIAM NELLIS, Harvard University — Metallic fluid H (MFH) was made by dynamic compression decades after Wigner and Huntington (WH) predicted it in 1935. The density of MFH is within a few percent of the density predicted by WH. MFH was made by multiple-shock compression of liquid H₂, which process is quasi-isentropic and thermally equilibrated. The compressions were isentropic but produced enough dissipation as temperature T and entropy S to drive the crossover from insulating H₂ to metallic H at 9-fold compressed atomic H density. T and S were tuned by temporally shaping the applied pressure pulse such that H₂ dissociated to H at sufficiently high density to make a highly degenerate metal. The basic ideas of dynamic compression, also known as supersonic, adiabatic, nonlinear hydrodynamics, were developed in the last half of the Nineteenth Century. Our purposes are to (i) present a brief review of dynamic compression and its effects on materials, (ii) review considerations that led to the sample holder designed specifically to make MFH, and (iii) present a inter-comparison of dynamic and static methods relative to their prospects for making metallic H. The full paper is published: J. Phys. Chem. Solids (2015), <http://dx.doi.org/10.1016/j.jpcs.2014.12.007>

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