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Laboratory experiment to investigate collisionless shock production and dynamics[1] A.L. MOSER, S.C. HSU, J.P. DUNN, D.T. MARTENS, LANL, C.S. ADAMS, E.C. MERRITT, A.G. LYNN, M.A. GILMORE, UNM, C. THOMA, D.R. WELCH, Voss Scientific, LLC — Many shock waves in astrophysical systems are collisionless: the system scale is smaller than the collision mean-free-path, and plasma effects provide the required dissipation. Laboratory measurements of collisionless shocks would provide the spatial and temporal resolution not provided by current space measurements, providing insight into shock formation, dynamics, and shock–particle interactions. An experiment at LANL aims to produce ∼1-cm-thick, ∼30–50-cm-diameter collisionless shocks via head-on collision of two railgun-produced hydrogen plasma jets. Jets with initial temperatures of a few eV, densities of $\sim 10^{15}$ cm^{-3}, and velocities of ∼100 km/s will propagate ∼1.1 m before colliding; PIC simulations predict shock-like behavior at planned jet parameters. Identification and characterization of collisionless shocks requires measurement of several plasma parameters both up- and down-stream of the shock. Interferometer and spectrometer measurements giving plasma density, temperature, and velocity will be augmented with a Schlieren imaging system and electrostatic probes; B-dot probes will provide magnetic field data. The ability of collisionless shocks to accelerate particles to super-thermal velocities will be investigated with ion energy analyzers. We present here an overview of the experiment, including preliminary data.

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