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1P43 - Experimental Investigation of Colliding Plasma Flows

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This experimental investigation of colliding plasma flows which are frozen-in opposing magnetic fields was conducted to better understand and describe microscopic instabilities and macroscopic-flow patterns. The Plasma Physics and Sensors Laboratory (PPSL), located at Wright-Patterson AFB, developed an experimental setup where a pulsed power system is used to create colliding flows through an Ohmic explosion process from a parallel arrangement of fine-metallic wires creating conditions similar to that of colliding winds in binary star systems. These laboratory experiments create collisionless and collisional shocks in succession. The collisionless shock forms through interpenetration and mixing of the initial portion of flows emitted from fine metallic wires. The latter collisional shock is formed by the colder and denser partially-ionized metallic gases from the wire. This collisional period is conducive to observations of radiative shocks. To characterize these experiments, several optical diagnostics were utilized. This effort shows light emission imaging results collected during experiments of colliding flows agree with theoretical developments in (M. A. Malkov, V. I. Sotnikov 2018), progress on numerical interferometric analysis to extract atomic and electron volumetric densities when symmetry is not available, and progress on a non-equilibrium spectroscopic model under developed to analyze spectral data and provide electron density measurements to complement the other diagnostics.

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