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Thomson Scattering Measurements of Bow-shocks in Radiatively-cooled Magnetically Accelerated Plasma Flows

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Shock formation in dense, hot plasma flows where radiation loss is important continues to be an interesting topic for a variety of physics areas in HEDP and beyond. Characterization of the upstream and downstream plasma conditions can help determine the energy balance across the shock and access fundamental parameters including the plasma compressibility. Pulsed power-driven, large spatial scale flows can generate long timescale, stationary shocks for such detailed studies.
Data are presented from 2 pulsed power drivers; the 1MA, 100ns COBRA device at Cornell University and a 200kA, 1us driver at UC San Diego. Shocks are imaged using interferometry and gated self-emission, along with time-integrated x-ray imaging and optical spectroscopy. In addition, optical Thomson scattering is applied to examine the plasma velocity across the shock and the local temperature where possible.
Bow-shock formation using different Z materials show clear differences in the Mach cone angle and cooling profiles. Heating ahead of the shock position is indicative of an upstream radiative precursor a high flow densities. In experiments with multiple colliding shocks, both regular reflection and possible transition to Mach reflection is observed.

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