Characterization of low-density rear-driven collisional plasma jets from thin foils

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Magnetized low density, collisional plasma jets are found in astrophysical systems, such as accretion discs or polars, and they also show potential as a platform to study transport properties in astrophysical plasmas. However, no systematic study of their properties has been conducted yet. Through experiments in kilojoule laser facilities, we aim to benchmark a range of rear-driven jets from foils of different thicknesses and materials.

We studied free propagation of jets, their collisions with a static object and the collisions between two counterpropagating jets. The setup was also placed inside a split pair coil, which provides an external magnetic field of 5-10 T. A streak camera was used to track jet velocity and density was measured with 4-frame interferometry and x-ray radiography.

The results can be used to plan experiments with focus on specific jet properties, as well as providing a benchmark for hydrodynamic codes. The data on collisions and magnetized jets provides insight into compression waves and the effects of strong external magnetic fields, which are used for the study of transport properties of plasmas.