Abstract Submitted
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Lab experiments investigating astrophysical jet physics[1] PAUL BELLAN, Caltech — Dynamics relevant to astrophysical plasmas is being investigated in lab experiments having similar physics and topology, but much smaller time and space scales. High speed movies and numerical simulations both show that highly collimated MHD-driven plasma flows are a critical feature; these collimated flows can be considered to be a lab version of an astrophysical jet. Having both axial and azimuthal magnetic fields, the jet is effectively an axially lengthening plasma-confining flux tube with embedded helical magnetic field (flux rope). The jet velocity is in good agreement with an MHD acceleration model. Axial stagnation of the jet compresses embedded azimuthal magnetic flux and so results in jet self-collimation. Jets kink when they breach the Kruskal-Shafranov stability limit. The lateral acceleration of a sufficiently strong kink can provide an effective gravity which provides the environment for a spontaneously-developing, fine-scale, extremely fast Rayleigh-Taylor instability that erodes the current channel to be smaller than the ion skin depth. This cascade from the ideal MHD scale of the kink to the non-MHD ion skin depth scale can result in a fast magnetic reconnection whereby the jet breaks off from its source electrode.

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