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Experimental Observations of 3D Dynamics of Magnetic Flux Ropes[1] PAUL BELLAN, EVE STENSON, AUNA MOSER[2], Caltech — Laboratory plasma experiments reveal that when electric current flows along open magnetic field lines, strong unbalanced MHD forces evolve the plasma through a sequence of distinct morphologies. The forces drive flows that convect frozen-in magnetic flux associated with the magnetic field created by the electric current so the flowing plasma effectively carries its own pinching force. The result is a self-collimating, MHD-driven plasma jet. The jet kinks at a critical length determined by the Kruskal-Shafranov kink instability. The kink can spawn a localized fine-scale, much faster instability that rips the jet apart resulting in localized explosive 3D reconnection. This secondary instability has been identified as a Rayleigh-Taylor instability and has free energy coming from the effective gravity inherent in the kink-induced jet lateral acceleration. When current flows along an arched magnetic flux tube having solar corona loop morphology, MHD forces drive plasma jets from *both* ends towards the apex; these jets fill the flux tube with just the right amount of plasma to maintain constant density while the flux tube volume increases as a result of hoop-force-driven major radius expansion.

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