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Unsteady 3D magnetic reconnection in the Reconnection Scaling Experiment[1] T.P. INTRATOR, Los Alamos Natl Lab, T.D. OLSON, R.J. OBERTO — Magnetic reconnection changes the topology of magnetic field lines to a lower energy state. This process can liberate stored magnetic field energy and accelerate particles during unsteady, explosive events. This is one of the most important processes in astrophysical, space and laboratory plasmas. The abrupt onset and cessation has been a long standing puzzle. We show the first three-dimensional (3D) laboratory example of onset and stagnation of magnetic reconnection between magnetized and parallel current channels (flux ropes) driven by magnetohydrodynamic (MHD) attraction and an external kink mode, which is a 3D plasma current driven instability. Antiparallel magnetic field lines carried by these colliding flux ropes annihilate and drive an electric field. The inflow soon exceeds a threshold for the formation of a reconnection current layer. Magnetic flux and pressure pile up just outside this layer, and eventually become large enough to support MHD back-reaction forces that stall the inflow and stagnate the reconnection process.

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T.P. Intrator
Los Alamos Natl Lab

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