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Blasting current sheets into flux ropes using laser plasmas[1] S. VINCENA, W. GEKELMAN, J. BONDE, UCLA Department of Physics and Astronomy — In plasmas, current sheets have been shown to break apart into three-dimensional flux ropes via turbulent magnetic reconnection[1]. Such events occur naturally anywhere from the sun to planetary magnetospheres. In nature, the onset of the breakup is random, but in this experiment it is seeded at a chosen time and location–allowing study of the dynamics in a repeatable laboratory experiment. In the Large Plasma Device (LAPD), current sheets are created using a LaB_6 cathode, with $T_e = 20$eV, $n \approx 4 \times 10^{12}\text{cm}^{-3}$, yielding cross-field dimensions $h = 0.9c/\omega_{pi}$ and $w = 3.8c/\omega_{pe}$ for a H plasma, and a Lundquist number $S = 8 \times 10^3$. The synchronization of the breakup from current sheet to flux ropes is achieved by the cross-field injection of a laser ablation plasma, whose lifetime is less than an ion cyclotron period. The system dynamics are explored using magnetic and emissive probes (providing total E) along with spectral measurements before and after the breakup.

[1] Daughton, W., et al., Nature Physics, v7 pp539-542 (2011).

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Stephen Vincena
UCLA Department of Physics and Astronomy

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