Abstract Submitted
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Experiments on the tearing of a current sheet into a bundle of interacting flux ropes[1] WALTER GEKELMAN, TIM DEHAAS, BART VAN COMPERNOLLE, ALEX LATSHAW, University of California, Los Angeles, WILLIAM DAUGHTON, Los Alamos National Laboratory — A narrow ($\frac{\delta}{L} \approx .05, \delta \simeq 3-10\frac{c}{\omega_{pe}}, \delta$=1cm) current sheet is established in a magnetized (B_{0z} = 200G, He, Len = 17 m, Dia = 60 cm) plasma column. The current sheet is observed to tear into multiple magnetic islands in several Alfvén transit times. Volumetric magnetic field data is acquired at 16,500 spatial locations and 16,000 time steps (δt = .34 μs). The flux ropes appear as multiple "O" and "X" points when viewed in a plane perpendicular to the local current but, in fact are three-dimensional. The kink unstable ropes writhe, and twist about each other as the ensemble of ropes spin about the background axial magnetic field. Fast framing camera images ($\tau_{\rm exp} = 1\mu s$, 34,000 fps) clearly show the motion but differ from shot to shot. The movies are analyzed using correlation techniques. The rope dynamics becomes chaotic therefore correlation techniques using a fixed magnetic probe as well a He II line ($\lambda = 303A$) are used to generate 3D images of the ropes. An emissive probe is used to measure the plasma potential and the total electric field, $\vec{E} = -\nabla\phi - \frac{\partial\vec{A}}{\partial t}$, and plasma resistivity are evaluated. The perpendicular electric fields are two orders of magnitude larger than the parallel ones. The entropy and complexity of the flux ropes are evaluated.

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Walter Gekelman
University of California, Los Angeles

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