Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Measurements of Magnetic Helicity within Two Interacting Flux Ropes[1] TIMOTHY DEHAAS, WALTER GEKELMAN, UC-Los Angeles — Magnetic helicity (H_M) has become a useful tool in the exploration of astrophysical plasmas. Its conservation in the MHD limit (and even some fluid approaches) constrains the global behavior of large plasma structures. One such astrophysical structure is a magnetic flux rope: a rope-like, current-carrying plasma embedded in an external magnetic field. Bundles of these ropes are commonly observed extending from the solar surface and can be found in the near-earth environment. In this well-diagnosed experiment (3D measurements of n_e, T_e, V_p, $\mathbf{B}$, $\mathbf{J}$, $\mathbf{E}$, $\mathbf{u_{flow}}$), two magnetic flux ropes were generated in the Large Plasma Device at UCLA. These ropes were driven kink-unstable, commencing complex motion. As they interact, helicity conservation is broken in regions of reconnection, turbulence, and instabilities. The changes in helicity can be visualized as 1) the transport of helicity ($\phi\mathbf{B}+\mathbf{E}\times\mathbf{A}$) and 2) the dissipation of the helicity ($-2\mathbf{E}\bullet\mathbf{B}$). Magnetic helicity is observed to have a negative sign and its counterpart, cross helicity, a positive one. These qualities oscillate 8% peak-to-peak. As the ropes move and the topology of the field lines change, a quasi-separatrix layer (QSL) is formed. The volume averaged H_M and the largest value of Q both oscillate but not in phase. In addition to magnetic helicity, similar quantities such as self-helicity, mutual-helicity, vorticity, and canonical helicity are derived and will be presented.

[1]This work is supported by LANL-UC research grant and done at the Basic Plasma Science Facility, which is funded by DOE and NSF.

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Date submitted: 21 Sep 2016 Electronic form version 1.4