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Three Dimensional Magnetic Field Reconnection in Flux Rope Experiments[1] WALTER GEKELMAN, University of California, Los Angeles — Magnetic flux ropes are bundles of twisted magnetic fields and their associated currents. One or more flux ropes are routinely generated in the Large Plasma Device at UCLA. When the current in a flux rope is large it is subject to a "kink" instability. If two side by side ropes kink they can collide and fully 3D magnetic reconnection occurs. In a reconnection process magnetic energy is destroyed. The energy is transformed to heat, energized particles and waves. In the UCLA experiment the time dependent magnetic fields, plasma flows, electron temperature, plasma density, and the space charge and inductive electric fields were measured at over 42,000 spatial positions throughout the plasma volume over several million rope collision experiments. Magnetic field lines are followed and used to derive quasi-seperatrix layers (QSL), extended surfaces within which reconnection occurs. Pinpointing the reconnection location(s), however, is non-trivial. We use the topological concepts of the winding number, a measure of how all field lines wind around every individual field line, as well as the twist and writhe to shed light on where reconnection occurs where there are no nulls in the magnetic field.

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