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Helicity Annihilation in Trefoil Reconnection: Simulations ROBERT M. KERR, University of Warwick — The simulated evolution and self-reconnection of a perturbed trefoil vortex knot is compared to the Scheeler et al, PNAS 111 (2014) experiment. To have a single initial reconnection, as in the experiments, the trefoil is perturbed by 4 weak vortex rings. Visualizations show that the simulations and experiments undergo similar topological changes. Quantitative comparisons using the helicity and global topological number show that both are preserved for a long period before reconnection begins, as in the experiments. Unlike the experiments, once reconnection begins, a significant fraction of the helicity is dissipated and the global topological number changes by a discrete amount in a fixed time. Helicity spectra and physical space correlations show that the change in helicity is associated with the appearance of negative helicity at lower wavenumbers and in the outer regions of the trefoil. Furthermore, using a range of Reynolds numbers, with the highest comparable to the experiments, it is demonstrated that a Reynolds number independent fraction of the initial helicity is dissipated in a finite time. This observation does not violate any current mathematics restricting the strong growth of Navier-Stokes norms as the viscosity goes to zero due to the structure of the trefoil.

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