Viscous-enstrophy scaling law for Navier-Stokes reconnection
ROBERT M. KERR, University of Warwick — Simulations of perturbed, helical trefoil vortex knots and anti-parallel vortices find \( \nu \)-independent collapse of temporally scaled \( (\sqrt{\nu}Z)^{-1/2} \), \( Z \) enstrophy, between when the loops first touch at \( t_\Gamma \), and when reconnection ends at \( t_x \) for the viscosity \( \nu \) varying by 256. Due to mathematical bounds upon higher-order norms, this collapse requires that the domain increase as \( \nu \) decreases, possibly to allow large-scale negative helicity to grow as compensation for small-scale positive helicity and enstrophy growth. This mechanism could be a step towards explaining how smooth solutions of the Navier-Stokes can generate finite-energy dissipation in a finite time as \( \nu \to 0 \).