Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The role of core flattening during vortex reconnection JIACHENG HU, SEAN D. PETERSON, University of Waterloo — Vortex reconnection is the only fundamental vortex dynamics interaction capable of alternating the topology of vortex tubes. The process is so extreme that Moffatt and Kimura (2019) have considered it to be a viable path towards a finite-time singularity of the Navier-Stokes equations. To date, researchers have mainly focused on the effects of Reynolds number, leaving the roles of initial geometry relatively undocumented in the literature. Herein, we explore the contribution of initial collision angle to the reconnection process through simulations of vortex ring collisions. In particular, we investigate the influence of approach angle on the core flattening phenomenon during impact, which alters the reconnection process. The simulations elucidate the stages of core flattening and its physical underpinnings. A simplified inviscid finite area vortex model based on contour dynamics is introduced to complement the simulations and demonstrate that the primary core flattening mechanism is actually the result of the ejection of excess vorticity in the reconnection threads. Last, the relationship between core flattening and the end of the reconnection process will be discussed.

JiaCheng Hu
University of Waterloo

Date submitted: 10 Aug 2020 Electronic form version 1.4