Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

3D Effects in Magnetic Reconnection in Collisionless Relativistic Pair Plasma with Moderate Magnetization[1] GREGORY WERNER, DMITRI UZDENSKY, University of Colorado, Boulder — Magnetic reconnection is a plasma process that can efficiently harness stored magnetic energy to energize particles, resulting in heating and nonthermal particle acceleration (NTPA). Reconnection has been much studied in 2D, but it remains an important task to establish the extent to which 2D models apply to real 3D phenomena, with the prohibitive expense of 3D simulations allowing relatively few studies of 3D effects, typically in a limited range of regimes. We have recently observed significant 2D/3D differences in first-principles electromagnetic particle-in-cell (EM-PIC) reconnection simulations—in perhaps the most expedient regime for EM-PIC, viz., relativistic pair plasma with moderate magnetization (i.e., with plasma beta around 1). Reconnection in this regime may power intense high-energy flares from astrophysical sources such as pulsar wind nebulae and jets of accreting black holes. We find that, in 3D, the rates of reconnection and magnetic energy conversion slow down, flux ropes no longer merge and grow ad infinitum in neatly hierarchical fashion, and plasma and magnetic flux no longer stay trapped in those flux ropes—thus allowing more magnetic energy to be dissipated overall. Nevertheless, NTPA is remarkably similar in 2D and 3D.

[1]This work is supported by NSF and NASA.

Gregory Werner
University of Colorado, Boulder

Date submitted: 02 Jul 2019 Electronic form version 1.4