

Ng Chung-Sung

C. S. Ng

Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska 99775, USA

L. Lin, and A. Bhattacharjee

Space Science Center

University of New Hampshire

USA

Three Dimensional Simulations of the Parker's Model of Solar Coronal Heating: Lundquist Number Scaling due to Random Photospheric Footpoint Motion

Center for Integrated Computation and Analysis of Reconnection and Turbulence and Center for Magnetic Self-Organization, University of New Hampshire, Durham, New Hampshire 03824, USA

Parker's model [Parker, *Astrophys. J.*, 174, 499 (1972)] is one of the mostly discussed mechanisms for coronal heating and has generated much debate. We have recently obtained new scaling results in two dimensions (2D) version of this problem suggesting that the heating rate becomes independent of resistivity in a statistical steady state [Ng and Bhattacharjee, *Astrophys. J.*, 675, 899 (2008)]. Our numerical work has now been extended to 3D by means of large-scale numerical simulations. Random photospheric footpoint motion is applied for a time much longer than the correlation time of the motion to obtain converged average coronal heating rates. Simulations are done for different values of the Lundquist number to determine scaling. In the large Lundquist number limit, we recover the case in which the heating rate is independent of the Lundquist number, predicted by previous analysis as well as 2D simulations. In the same limit the average magnetic energy built up by the random footpoint motion saturates at a constant level, due to the formation of strong current layers and subsequent disruption when the equilibrium becomes unstable. In this talk, we will present latest numerical results from large-scale 3D simulations, and discuss challenges in future developments.

This research is supported by NSF grant AST-0434322, NASA grant NNX08BA71G, and DOE.