Demonstration of anisotropic fluid closure capturing the kinetic structure of magnetic reconnection

OBIOMA OHIA, MIT, JAN EGEDAL, UW-Madison, VYACHESLAV LUKIN, NRL, WILLIAM DAUGHTON, LANL —

Weakly-collisional magnetic reconnection, a process linked to solar flares, coronal mass ejections, and magnetic substorms, has been widely studied through fluid and kinetic simulations. While two-fluid models often reproduce the fast reconnection rate of kinetic simulations, significant differences are observed in the structure of the reconnection regions [1]. Recently, new equations of state that accurately account for the development of anisotropic electron pressure due to the electric and magnetic trapping of electrons have been developed [2]. Using these equations of state, guide-field fluid simulations have been shown to reproduce the detailed reconnection region observed in kinetic simulations [3]. Implementing this two-fluid simulation using the HiFi framework [4], we study the force balance of the electron layers in guide-field reconnection and derive scaling laws for the heating observed in these layers.


1Supported by DOE, NSF and NASA