A plasma mixing measure for collisionless magnetic reconnection

Seiji Zenitani[1]
[1] Kyoto U

Magnetic reconnection is a fundamental process of (1) change in magnetic topology, (2) energy transport, and (3) plasma mixing. Previous studies have largely focused on the first two aspects, while little attention has been paid to the plasma mixing during magnetic reconnection. In this presentation, partially inspired by a recent diagnosis in geophysical fluid dynamics, we propose a new measure to mark electron mixing sites in the reconnection system. Combining the forward- and backward-time mixing fractions, we introduce a finite-time mixing fraction (FTMF). The FTMF is tested in several cases of symmetric and asymmetric reconnection systems. Surprisingly, if the timestep is appropriately set, the FTMF marks the electron-scale dissipation region very well. For example, it marks the magnetospheric side of the X line in asymmetric reconnection, in agreement with the site of the nonideal energy dissipation. The mixing site is loosely related to the nonideal energy dissipation, which is a driver term of the single-fluid entropy. Implications of these results, current technical issues, and future prospects will be discussed.