[1] Magnetic Reconnection and Self-organization of Laboratory and Space Astrophysical Plasmas

[2] Recent Development of Magnetic Reconnection Research for Laboratory and Space Astrophysical Plasmas

Combined abstract would be as follows;

Magnetic reconnection, a topological rearrangement of magnetic field lines, is a key for the self-organization processes in plasmas, and is seen in the evolution of solar flares, in the dynamics of the earth's magnetosphere, in the formation process of stars and occurs as a self-organization processes in fusion research plasmas. One of the most important questions is why reconnection occurs much faster than predicted by the classical MHD theory. In the past ten years, significant advances in understanding the physics of magnetic reconnection have been made through dedicated laboratory plasma experiments, observations from satellites, and numerical simulations. Extensive theoretical and experimental work has revealed that two-fluid effects, the different behavior of ions and electrons, are important within the thin, critical layer where reconnection occurs, such as is seen in the magnetosphere. This tutorial talk present fundamental physics of reconnection and reviews the recent significant progress made for laboratory and space plasmas with an additional focus on two-fluid effects. Significant findings are; (1) The reconnection dynamics are determined both by local and global conditions, (2) The profiles of the reconnection layer and reconnection rate change drastically as the plasma's collisionality is reduced, (3) Hall MHD effects have been measured in both laboratory and space plasmas with a key signature of an "out of reconnection plane" quadrupole field component, (4) Electrostatic and electromagnetic fluctuations and their spatial profiles were measured in the reconnection layer of both laboratory and space plasmas with notable similarities, and (5) The reconnection rate increases significantly when the ratio of the electron mean free path to the scale length exceeds unity. A new scaling of reconnection resistivity was obtained from the laboratory results with respect to this ratio. Impact of the recent improved understandings on research on space-terrestrial plasmas will be discussed.