Contribution ID: **374**

Type: **Poster**

Magneto-thermal Reconnection Processes, Related Angular Momentum Transport issues and Formation of High Energy Particle Populations

Tuesday, 18 October 2016 08:30 (4 hours)

In the context of a two-fluid theory of magnetic reconnection [1], when the longitudinal electron thermal conductivity is relatively large, the perturbed electron temperature tends to become singular [2] in the presence of a reconnected field component and an electron temperature gradient. A transverse thermal diffusivity is introduced in order to remove this singularity while a finite inductivity"can remove the singularity of the corresponding transverse plasma displacement [1]. Then i) a newmagneto-thermal reconnection"producing mode, driven by the electron temperature gradient, and involving a considerable range of scale distances is found [3]; ii) the characteristic widths of the layers in which magnetic reconnections takes place remain significant even when the macroscopic distances involved in the process are very large; iii) the phase velocities of the modes that are found can be both in the direction of the electron diamagnetic velocity as well as those in the opposite (ion) direction. A numerical solution of the complete set of equations has been carried out and followed by a simplified analytical reformulation of the problem. The mode growth rate is related to the effects of a finite viscous diffusion coefficient or to those of a small electrical resistivity.

The features that can lead to a possible explanation of the fact that high energy particle populations are produced during reconnection events involve mode-particle resonances producing the transfer of energy to super-thermal particle populations [4] and the spatial near-singularity of the electron temperature that can enhance the thermal energy of particles in one region while depleting that of particles in a contiguous region [3].

The low collisionality modes that produce magnetic reconnection can extract angular momentum from the plasma column and thereby sustain a "spontaneous rotation"[5] of it. This process is to be considered in addition to that associated with electrostatic modes excited at the edge of the plasma column [5]. Supported by the U.S. DOE, award DE-FG02-03ER54700.

[1]B. Coppi, Phys. Fluids 8, 2273 (1965).
[2]B. Coppi, B. Basu, P. Montag, et al. Nucl. Fus., 55, 093018 (2015).
[3]B. Coppi, MIT (LNS) Report HEP 15/06 (2015). In print for Fizika Plazmy.
[4]B. Coppi, L. Sugiyama, J. Mark and G. Bertin Ann. Phys. 119, 370 (1979).
[5]B. Coppi, Nucl. Fus. 42, (2002).

Paper Number

TH/P1-33

Country or International Organization

United States

Primary author: Prof. COPPI, Bruno (M.I.T.)

Co-authors: Dr FLETCHER, Alexander (M.I.T.); Dr BASU, Bamandas (M.I.T.); SUGIYAMA, Linda (M.I.T.); Dr WHITE, Ryan L. (M.I.T.)

Presenter: Prof. COPPI, Bruno (M.I.T.)

Session Classification: Poster 1

Track Classification: THS - Magnetic Confinement Theory and Modelling: Stability