Temperature gradient effects on magnetic stochastization

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This paper describes the effects of a temperature gradient on magnetic reconnection and the formation of stochastic magnetic fields.

Magnetic reconnection is a key mechanism in transport processes in weakly collisional plasmas, both in space and in magnetic fusion experiments. In weakly collisional plasmas, resistive reconnection cannot always explain the observed reconnection rates, faster than resistive reconnection rates are possible due to electron inertia. Parallel electron compressibility can further accelerate this process, yielding fast reconnection rates comparable with those estimated from tokamak plasma instabilities.

The presence of a temperature gradient makes it necessary to describe the reconnection process of field lines that have different temperatures. In a collisionless plasma, this requires a kinetic description of the electrons. Using such a model it is found that a temperature gradient perturbs the vorticity and current distributions in the reconnection layer [1] and thus the entire magnetic island geometry [2].

During the growth of neighbouring island chains, the temperature gradient will therefore modify the positions of secondary and higher-order island chains, thereby altering the onset of stochasticity and destruction of the last KAM-torus.

[1] H.J. de Blank and G. Valori, Plasma Phys. Control. Fusion **45**, A309 (2003).

[2] E.V. van der Plas and H.J. de Blank, 31st EPS Conference on Plasma Phys. London, 28 June – 2 July 2004 ECA Vol. **28G**, P-2.073 (2004)