Magnetic Reconnection Driven by Thermal and Non-thermal Energy Densities*

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Magnetic reconnection is usually associated with conversion of magnetic energy into particle acceleration or thermal energy. But a specific reconnection process driven by plasma pressure gradients had been identified already in Ref. [1] with a consistent theory of (non-ideal) MHD $m^0=1$ modes in well confined plasmas. This process, based on an Ohm's law contribution to the electron momentum balance equation, remains also the basis for the explanation of the observed sawtooth oscillations of the central plasma pressure and for the inferred magnetic field structures due to fishbone oscillations [2] associated with injected high energy particle populations. A novel process [3], expected to have a wide range of applications, concerns an "alternator" involving magnetic reconnection sustained by a significant gradient of the longitudinal electron temperature and based on the electron thermal energy balance equation rather than on an Ohm's law. A comparison is made of the "alternator" with the Biermann Battery concept, involving magnetic fields growing out of misaligned electron temperature and density gradients, considering that, instead, the growth of reconnection [3] depends on the particle density gradient in addition to that (aligned with it) of the electron temperature.

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