Endogenous Magnetic Reconnection and Associated Processes of Relevance to Fusion Burning Plasmas

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The main characteristic of an endogenous magnetic reconnection process is that its driving factor lays within the layer where a drastic change of magnetic field topology occurs. This kind of process is shown to take place when an electron temperature gradient is present in a magnetically confined plasma and when the evolving electron temperature fluctuations are anisotropic [1]. Then [2] two classes of reconnecting modes are identified. The localized class of mode involve a reconnected field $\tilde{B}_x$ of odd parity (as a function of the radial variable), contrary to the commonly considered reconnecting modes, characteristic phase velocities and growth rates associated with a finite effective resistivity. The width of the reconnection layer remains significant even when large macroscopic distances are considered. In view of the fact that there are plasmas in the Universe with considerable electron thermal energy contents, these features of the considered modes can be relied upon in order to produce generation or conversion of magnetic energy and high energy particle populations through a sequence of mode-particle resonances [3]. With their excitation these modes acquire momentum in the direction of the main magnetic field component and the main body of the plasma column should recoil in the same direction. Referring to toroidal confinement configurations it may be argued that these modes can induce a "spontaneous rotation" in the main body of the plasma column [4]. An illustrative example of endogenous reconnection is that of "electrostatic" resistive modes whose growth rate is due to the product of the local density gradient and a gravity force. *Supported in part by the U.S. DOE.

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