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Linear Stability of Electrostatic Drift Waves in Helical plasmas

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The linear gyrokinetic mode equation is numerically solved to investigate the stability properties of the electrostatic drift waves in helical plasmas. The mode equation is rather exact except for the ballooning representation, and is 1D in the space and 2D in the velocity space, as is FULL code [1]. The circulating and trapped particles are correctly treated, and in the electrostatic regime, ion temperature gradient mode (ITG) and trapped electron mode (TEM) are expected to be unstable with k_perp*rho_i<~1. The electron temperature gradient mode (ETG) can also become unstable with k_perp*rho_e<~1.0. As a model of helical plasmas, LHD [2] is considered, whose MHD equilibria are obtained by VMEC code [3].

The non-axisymmetric equilibrium properties of helical plasmas are expected to affect the stability, through the curvature of field line, which is mainly determined by the magnetic field strength B, and the perpendicular wave number k_perp, which is strongly depending on the geometry (R, Z). These local effects on the stability can be investigated by the local parameter dependence of the growth rate in the ballooning formalism, and in fact, the local growth rate was found to be sensitive to the field line label (alpha) as well as the theta_k in the helical systems in the MHD case [4]. However it is found that in the drift wave case, their dependence is very weak. The local parameter dependence is investigated and the destabilizing mechanism is discussed.

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