§20. Short Wavelength Temperature Gradient Ion Modes and Electron Temperature Gradient Modes in Sheared Slab Plasmas

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The anomalous electron transport is most possibly induced by the instabilities with much smaller size than ion gyri--radius. Temperature gradient driven instabilities in short wavelength regime is studied in a sheared slab with a kinetic integral equation code. The modes are excited by both finite η_i and η_e, and may be stabilized by the magnetic shear. The fundamental short wavelength mode can not be stabilized by the beta effect if the magnetic gradient drift effect is taken into account. The electron temperature gradient driven (ETG) mode in high beta plasma is also studied with the same code. A comparison between the short wavelength ion mode and the ETG mode is then given. The ceoss-field wavelength of the short wavelength ion mode is found to be longer than that of the ETG mode, while the growth rate of the short wavelength ion mode is significantly smaller than that of the ETG mode.

The ETG mode is driven by η_e only and can be stabilized by large enough beta. The ETG mode has a further shorter wavelength and then it is strongly influenced by the Debye shielding effects. The growth rate of the ETG mode is about 20 times larger than that of the short wavelength ion mode, while the radial width of the latter is about 10 times larger than that of the short wavelength of the ETG mode. Therefore, the turbulence transport induced by these short wavelength modes may be much higher than that by ETG turbulence.

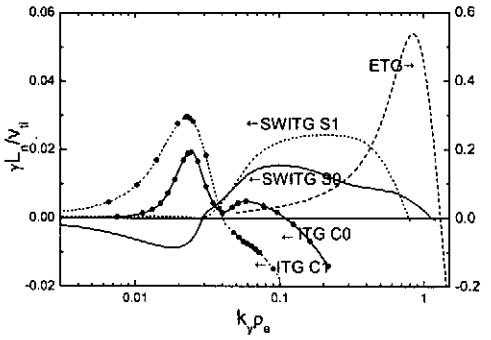

Fig. 1 Growth rate as functions of $k_\perp \rho_e$ for S0, S1, C0, C1 and ETG modes, respectively.

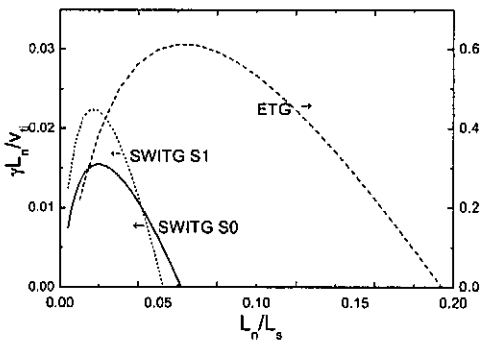

Fig.2 Normalized growth rate as functions of L_n / L_s at $\beta_i = \beta_e = 0$.

Reference: Zhe Gao, H. Sanuki, K. Itoh and J. Q. Dong, to be published in Plasma Science and Technology.