§ 22. Temperature Gradient Driven Short Wavelength Modes in Sheared Slab Plasmas

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Anomalous transport is induced by turbulent plasma fluctuations with small scales, so called microinstabilities. The temperature gradient (TG) driven instabilities are proposed as the plausible candidates responsible for the anomalous transport and studied extensively. Since the electron transport is still anomalous even in discharges with an internal transport barrier (ITB). It was observed that after the formation of ITB, long wavelength modes are suppressed while short wavelength modes are not. The anomalous electron transport is possibly attributable to short wavelength modes.

In this work, we first confirm the explanation in Pu and Miguliuolo for the short wavelength temperature gradient modes. The growth rate hump in the short wavelength regime in Pu and Migliuolo is much slighter than that in Smolyakov et al. only due to different η_e and $k_{//}$. This local short wavelength mode is just attributable to the Landau damping/inverse Landau damping mechanism and the non-monotonic behaviors of the real frequencies as the wavelength varies. To study these modes in detail, the integral equation for ITG modes in arbitrary beta plasmas is upgraded and employed for the nonlocal study of short wavelength modes in a sheared slab.

Shown in Fig.1 are the frequencies and growth rates of the fundamental (S0) and higher harmonics (S1) short wavelength modes as functions of β_e, obtained from the low beta and full beta models. The S1 mode may be stabilized by a finite beta in both of modes. The fundamental modes cannot be stabilized by beta when the magnetic gradient effect is considered in the full beta model. The similar conclusion was reached for the conventional ITG modes.

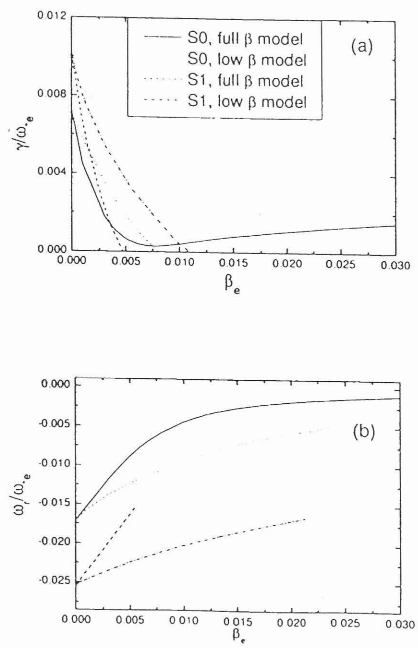

Fig. 1 Normalized growth rate (a) and frequency (b) as functions of beta.

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