Collisionality effects and Electrostatic Drift Turbulence in high density FTU plasmas.

G. Regnoli[1] , M. Romanelli[1], C. Bourdelle[3], M. De Benedetti[1], M. Marinucci[1], V. Pericoli[1],G. Granucci[2], C. Sozzi[2], O. Tudisco[1], E. Giovannozzi[1], ECRH, LH and FTU Team.

[1]*Associazione EURATOM-ENEA sulla fusione, C.R. Frascati, C.P. 65, 00044, Frascati, Italy.*
[2]*Associazione EURATOM-ENEA sulla fusion, IFP-CNR, Milano, Italy.*
[3]*Association EURATOM-CEA sur la Fusion DRFC/SCCP, CEA/Cadarache France.*

Microstability analysis of FTU high density plasmas has been achieved by using the code Kinezero [1]. The code calculates the linear stability of electrostatic drift modes in a toroidal plasma. These modes are characterized by wave numbers $k_\theta\rho_i$ ranging between 0.1 and 10^3 (ρ_i is the ion Larmor radius). In particular two subranges can be identified: modes linked to the ion drift dynamics ($0.1 < k_\theta\rho_i < 2$) and modes linked to the electron dynamics ($2 < k_\theta\rho_i < 10^3$). The contribution of trapped electrons at intermediate wave numbers is also included. The first version of the code has been upgraded in order to account for finite collisionality which is expected to play an important role in high density FTU plasmas. A "Krook" operator [2, 3] has been added to the linearized drift kinetic equation for the electron distribution function and the new dispersion relation for drift modes has been solved. The new version of the code has been tested and the results have been compared with the ones of GS2 code [3] while changing both the collision frequency and the density gradient as done in [4]. The results obtained are quantitatively and qualitatively in agreement with GS2 and show that at high collisionality the density gradient has a stabilizing effect for low $k_\theta\rho_i$ instabilities whereas at low collisionality the effect is opposite. However it is also shown here that, at high collisionality, for density gradients comparable with the temperature ones a change of turbulence occurs and modes with $k_\theta\rho_i \cong 1$ can be destabilized.
First results of microstability analysis by the new version of Kinezero of FTU pulses characterized by formation of e-ITB are also presented in this work.

References

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