Fast particle triggered modes: experimental investigation of Electron Fishbones on TORE SUPRA

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Fast particle driven MHD modes have been identified as a possible reason for energy losses [1]. Since α particles, generated by fusion reactions in the MeV energy range, will represent the main heating source in the future Tokamak like reactors the understanding of these instabilities seems to be crucial.

On TORE SUPRA fast ion driven modes as Toroidal-Alfven-Eigenmodes have been already experimentally identified [2].

Instabilities at frequencies consistent with electronic fishbones dispersion relation have been pointing out recently [3] and represent the subject of this work.

During the last experimental campaign, the influence of the Lower Hybrid heating power and of the $n_{//}$-index on the electronic fishbones behaviour have been systematically investigated; the simultaneous presence of two frequencies (3 and 8 kHz) that could belong to the branches of the low frequency regime have been identified. Energy estimation of the electrons involved in the modes formation is in good agreement with energy of fast particles generated by the LH wave; the energy analysis is completed by Hard X-ray measurements which are used to estimate fast electrons loss due to the fishbone like mode activity.

Temperature and density fluctuations are measured respectively by correlation of two dedicated ECE radiometer channels and by reflectometry technique; time and frequency analyses show a bursting regime which is related, via the current profile modification, to the low frequency temperature oscillation in the plasma core.

Finally new experiments for the next TORE SUPRA experimental campaign with Lower Hybrid Heating coupled with Electron Cyclotron Resonance Heating are illustrated with recent simulations.

[1] McGuire *et al.*, Phys. Rev. Lett 50 (1983); Chen *et al.*, Phys. Rev. Lett 52 (1984)

[2] Goniche *et al.*, Fusion Science & Technology **53**, (2008)

[3] Maget, Nucl. Fusion **46** (2006)