# Observation of MHD modes with fluctuations and profile reflectometry in Tore-Supra

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MHD modes are one of the concerns for current and next step devices integrity , in particular in burning plasmas. Although not able to access the mode structure like magnetic coils, reflectometry offers high sensitivity and radial localisation.

On Tore-Supra, MHD modes are detected from 10 to 200 kHz with the D-band reflectometer in fixed frequency mode in discharges with fast electrons or ions [1]. In ICRH heated plasmas, modes are observed in the acoustic frequency range, 40-70 kHz. The observed frequency agrees with the frequency predicted for both Geodesic Acoustic Modes (GAMs) and Beta Alfvén Eigenmodes BAEs, but their structure and their excitation by fast ions advocate for an identification as BAEs. The excitation threshold depends on various parameters such as the ICRH power, the minority fraction and the density, in agreement with the theoretical prediction.
In LHCD plasmas, electron fishbones have been detected below 20 kHz. Periodical jumps (0.1 s) of the fishbone frequency are observed. These jumps are linked to spontaneous transition between fishbones at different wavenumber and a redistribution of the fast electrons that are resonant with these modes.

Profile reflectometry can also be used to localize low frequency tearing modes [2]. Owing the plasma rotation, a tomography reconstruction of the density profile inside the q=1 surface has been made during a sawtooth period. The growth of the dense core, the so-called “Mexican hat" [3] is clearly visible. An island like density perturbation of small amplitude is also detected at the q=1 surface. This island exists during the whole sawtooth period as observed with fixed frequency reflectometry.

**References**

[1] R. Sabot, et al, 22nd FEC, Geneva (2008), submitted to Nucl. Fusion
[2] L. Vermare et al, Plasma Phys. Control. Fusion **47** 1895 (2005)
[3] A. Sirinelli et al, 8th IRW, St Petersburg, (2007).