

## Progress in MHD Studies at TEXTOR

ABSTRACT. Within the last few years, MHD phenomena at TEXTOR has been extensively studied by various microwave diagnostics, such as the Electron Cyclotron Emission (ECE), the Pulsed Radar reflectometer and the O-mode fast reflectometer. The influence of large and small-scale MHD modes on plasma transport properties has been studied. Measurements confirm that the confinement is improved within the magnetic island, compared to the background plasma as evidenced by a secondary temperature maximum at the centre of the island. The perpendicular heat diffusivity inside the island is estimated to be in the order of  $0.01 \text{ m}^2/\text{s}$ , which is close to the neoclassical value. Evidence of a small mode with higher  $m$  number between the  $q = 1$  and 2 radii is given.

Making use of the mode rotation, assumed to be a rigid rotor, it has been possible to obtain information on the topology of the  $m = 1$  precursor mode leading to sawtooth collapses. It becomes clear that this precursor cannot be described by an  $m = 1$  cold tearing-mode island but by a hot crescent wrapped around a cold high-density bubble.

The mode rotation studies with the ECE-Imaging diagnostic have shown that the purely poloidal component of plasma rotation due to diamagnetism can be significant in some Ohmic and NBI-heated discharges at TEXTOR, especially when large modes are present with low toroidal ion velocity. It is confirmed that if the  $m = 1, 2$  and 3 modes with  $n = 1$  number are coupled, they have their X or O-points in phase at the LFS, in agreement with the results obtained at RTP.

The broadband temperature and density fluctuations and their influence to the plasma transport properties are a relatively new subject of study at TEXTOR. First evidence for a difference between the normalized power spectra outside and inside  $q = 1$  surface has been observed from a cross-correlation analysis between various ECE-Imaging channels or from the autocorrelation function. From the measurements one can conclude that the turbulent structures inside the  $q = 1$  surface are separated from the turbulence outside the  $q = 1$  surface. This fits nicely with the observation that  $q = 1$  surface acts as a barrier for the thermal transport. Correlation length and time measured inside  $q = 1$  are in agreement with the observed turbulent heat-diffusivity. To justify this conclusion, similar experiments are planned at Tore Supra tokamak.