FINE STRUCTURE AND DYNAMICS OF ROTATING MAGNETIC ISLANDS IN THE TEXTOR TOKAMAK

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This report presents the fine structure of magnetic islands in space and time derived from local electron temperature (T_e) and density (n_e) measured by Thomson scattering (TS) and ECE diagnostics in the TEXTOR tokamak. The islands were excited in the plasma by an AC helical current in the dynamic ergodic divertor (DED) of TEXTOR.

The Thomson diagnostic measured simultaneously the T_e and n_e profiles at 5 kHz sampling rate in ~120 spatial points along a vertical chord of 90 cm high which crosses the plasma near the magnetic axis. These data are supplemented by ECE diagnostic measuring local electron temperatures in more than 10 spatial points along the major radius in the mid-plane and another toroidal cross section of the torus.

A high accuracy of TS measurements (up to 0.5% for n_e and 1% for T_e) made it possible to resolve fine radial profiles inside islands located at several magnetic surfaces with rational q values (q=1, 2 and 3) as well in coupling regions between the islands and their evolutions in time.

The combination of the TS and ECE data allowed a reconstruction of the island structure also in the poloidal and toroidal directions. The phase shift of T_e oscillations measured by TS and ECE diagnostics allowed the measurements of the island rotation velocities which are compared with those measured by RF reflectometer and magnetic probes.

It was found that electron isobars in the islands correspond to the expected shape of nested magnetic surfaces, however the lines of constant T_e and n_e show different positions of their x-points in the radial direction. This indicates that T_e and n_e are not functions of the poloidal magnetic flux around the island x-points.