Effect of the magnetic configuration on fluctuations and turbulence in the TORPEX toroidal plasma

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The influence of the magnetic configuration on drift wave induced turbulence is a topic of paramount interest for magnetically confined plasmas in particular for fusion applications. The purpose of this study is to experimentally investigate the effect of the magnetic configuration on drift waves and turbulence in magnetized plasmas in the TORPEX toroidal device [A. Fasoli, *et al.*, this conference]. In TORPEX (R = 1 m, a = 0.2 m), a small vertical magnetic field $B_z \leq 4$ mT is superposed to a toroidal magnetic field $B_\varphi \leq 100$ mT to form a helimak magnetic configuration. Recently, an ohmic transformer system has been added which induces a toroidal electric field ($E_\varphi \leq 1.5$ Vm^{-1}) to produce a plasma current ($I_p < 1$ kA for ~3 ms) and to close magnetic field lines in the plasma. The plasma discharge is initiated by microwaves (2.45 GHz, $P_{RF} < 10$ kW) and is characterized by typical electron temperatures $T_e \sim$ 3-5 eV and densities $n_e \sim 3\times10^{16}$ m^{-3} for hydrogen and $n_e \sim 2\times10^{17}$ m^{-3} for argon. With the addition of ohmic power the density can rise up to $n_e \sim 3\times10^{18}$ m^{-3}. Low frequency electrostatic instabilities, identified as drift-interchange waves [F.M. Poli, *et al.*, this conference], are routinely observed in TORPEX plasmas by means of Langmuir probes providing the fluctuation profile and the local dispersion relation. The associated turbulent structures of the electron density are imaged in the spatio-temporal domain by an array of 86 electrostatic probes. A movable 3D magnetic probe provides magnetic fluctuation profiles at the poloidal midplane. In the open field line configuration, purely electrostatic fluctuations are observed which are localized at the maximum gradient density position on the low field side. We observe that the vertical magnetic field (or equivalently the connection length) is one key parameter in controlling both spatio-temporal properties of turbulent structures and spectral properties of the drift-waves. Preliminary studies will be presented on the transition from open to close field lines obtained by driving toroidal plasma current over a large portion of the poloidal cross section. In this case, electrostatic fluctuations are accompanied by magnetic fluctuations at the same frequency, in the range 5-15 kHz, localized at the position of maximum density gradient on both high and low field sides.

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