PROPERTIES OF LONG range CORRELATIONS OF DENSITY AND ELECTRIC POTENTIAL FLUTUATIONS OF T-10 TOKAMAK PLASMA [[1]](#footnote-1)\*)

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Plasma turbulence studies in closed magnetic traps like tokamak demonstrate presence of various types of plasma fluctuations: SLF (stochastic low frequency, ~ 0-20 kHz), BB (broadband ~ 0-300 kHz), QCM (quasi-coherent mode, ~ 50 -150 kHz), GAM (geodesic-acoustic mode, ~ 20 kHz) [1]. A low frequency MHD tearing mode can also coexists in the plasma fluctuations spectra with the frequency ~ 7 kHz. The connection between the presence of these modes in the spectrum and the properties of anomalous transport is still an open question [1].

On the T-10 tokamak (R = 1.5 m, a = 0.3 m), the existence of the QCM oscillation mode was shown both in the core and in the edge plasma [2]. In recent studies outward turbulent flux associated with the GAM and QCM oscillation modes was carried out. It was shown that the QCM can make a significant contribution to the total turbulent flux of particles from the plasma [3].

The study of the properties of long-range correlations (LRC) at the frequencies of GAM, QCM and MHD tearing modes was carried out in a series of similar ohmic discharges with the following parameters: Вt = 2.2 T, Ip = 220 kA. The line-averaged electron density in its quasistationary phase of the discharge was about ne ~ 1–2 × 1019 m-3.

Fluctuations of the electron density and electric potential in the core region of the plasma on the low field side of the magnetic field were measured using a Heavy Ion Beam Probe (HIBP). A Multipin Langmuir Probe (MLP) was used to study these fluctuations in the edge plasma. Measurements of density fluctuations on the high field side were carried out by means of correlation reflectometry (CR).

This work presents measurements of the turbulent fluctuation spectrum of the QCM, GAM, MHD tearing modes. The analysis of amplitude dependence on global discharge parameters, such as density ne and temperature Te is presented. The PSD analysis of fluctuations spectrum of MLP signals is carried out. Using the ion saturation current and the floating potential signals transition from the SOL region to the main plasma is observed. During this transition, an extensive change in the nature of the electrostatic turbulence spectra is happening. The presence of a statistically significant level of quadratic coherence between the signals of electrical potential HIBP and MLP signals at the QCM, GAM and MHD tearing mode frequencies is shown. It is shown that QCM mode has it’s own magnetic component.

Referencies

1. V.A. Vershkov et al. Electron particle transport and turbulence studies in the T-10 tokamak //Nuclear Fusion, Volume 53, Number 8, 2013.
2. M. A. Drabinskiy et al. Radial structure of quasi-coherent mode in ohmic plasma of the T-10tokamak // Journal of physics: Conference series, Vol. 1383, XLVI Zvenigorod International Conference on Plasma Physics and Controlled Fusion 18–22 March 2019, Zvenigorod, Moscow Region, Russian Federation.
3. L.G. Eliseev et al. Measurement of geodesic acoustic modes and the turbulent particle flux in the T-10 tokamak plasmas // Journal of Physics: Conference Series, Volume 907, XLIV Zvenigorod International Conference on Plasma Physics and Controlled Fusion (ICPAF2017) 13–17 February 2017, Zvenigorod, Moscow region, Russian Federation.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/BM-Sergeev.docx) [↑](#footnote-ref-1)