Investigation OF turbulence iN the GLOBUS-M2 TOKAMAK BY DOPPLER BACKSCATTERING [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.064

1Yashin A.Yu., 1Bulanin V.V., 1Petrov A.V., 1Ponomarenko A.M., 2Gusev V.K., 2Kurskiev G.S., 2Minaev V.B., 2Patrov M.I., 2Petrov Yu.V., 2Sakharov N.V.

1Peter the Great St.Petersburg Polytechnic University, Saint-Peterburg, Russian Federation,
 alex\_yashin@list.ru
2Ioffe Institute, Saint-Peterburg, Russian Federation

Using the Doppler backscattering diagnostics [1], the first studies of the time dependences of the turbulence spectra during the transition to the improved confinement mode were carried out on the Globus-M2 spherical tokamak [2]. Two multi-frequency Doppler reflectometers were used for research: a four-frequency reflectometer with probing frequencies of 20, 29, 39 and 48 GHz and a six-frequency one with frequencies of 50, 55, 60, 65, 70, 75 GHz. The probe wave was directed into the plasma at an angle θ to the surface of an equal refractive index at the plasma boundary with polarization directed along the magnetic field (O-mode). The power of scattered radiation is proportional in the born approximation to the intensity of scattering density fluctuations, which makes it possible, in principle, to measure the amplitude of small-scale turbulent plasma fluctuations. Multi-frequency plasma probing allowed determining turbulence parameters for a wide range of radii and for significantly different plasma parameters.

The spectral characteristics of plasma turbulence during the transition to the improved confinement mode were studied on the new Globus-M2 tokamak. The magnetic configuration of the tokamak with a major radius R = 0.35 m, a minor radius a = 0.22 m, and an elongation k = 1.9 had a single X-point. The ion toroidal drift was directed towards the X-point. Additional heating was carried out by a beam of neutral deuterium into a deuterium plasma. The studies were performed in L-H transition modes with the following discharge parameters: toroidal magnetic field BT = 0.7 T, plasma current Ip = 270-290 kA, plasma density <ne> = (3-7)·1019 m-3. The beam power was 0.7-0.8 MW at an atomic energy of 28 keV. In discharges with similar parameters in the H-mode, the energy confinement time was increased by more than three times compared to the energy confinement time in the Globus-M tokamak at a magnetic field of 0.4 T with the same beam parameters with the same geometry of the vacuum chamber [3].

Suppression of small-scale plasma turbulence was registered and studied. Data on the evolution of turbulence spectra are obtained. It is important that these data obtained for various discharge regions indicate the peripheral location of turbulence suppression.

This work was supported by the Ministry of science and higher education of Russian Federation in the framework of the state contract in the field of science under project No. 0784-2020-0020 using the Federal Joint Research Center "Material science and characterization in advanced technology" (project RFMEFI62119X0021), including the unique scientific facility "Spherical tokamak Globus-M".

References

1. Bulanin V.V. et al 2011 Tech. Phys. Lett. 37 340–343
2. Minaev V.B. et al 2017 Nucl. Fusion 57 066047
3. Kurskiev G.S. et al 2019 Nucl. Fusion 59 066032
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/BX-Yashin.docx) [↑](#footnote-ref-1)