

Application of multi-frequency Doppler backscattering for studying edge-localized modes on the Globus-M2 tokamak

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This report presents the results of using Doppler backscattering (DBS) diagnostics on the Globus-M2 spherical tokamak to study edge localized modes (ELMs) which are observed in the high confinement mode (H-mode) [1]. ELMs originate and develop inside the confinement area near separatrix where the temperature is higher than material limit for any contact diagnostic method. So, it is possible to investigate their appearance only using non-contact diagnostic methods, in particular, DBS. The study of ELMs is an important task, due to the fact that their crashes lead to pulsed emissions of particles and energy [2].

Plasma parameters were measured with two multifrequency DBS systems installed on the Globus-M2 tokamak. The first one makes it possible to probe the plasma at four frequencies: 20, 29, 39 and 48 GHz, which corresponds to the peripheral region $0.8 < \rho < 1$ [3]. The second scheme uses six frequency channels: 50-75 GHz with a step of 5 GHz, which makes it possible to study the inner plasma regions $0.4 < \rho < 0.8$ [4]. Using the results of DBS measurements, the temporal dependences of the amplitude and phase of the backscattered signal were obtained. They showed a strong change in the amplitude of the density fluctuations and their velocity during the ELM burst. Also, there was a dependence of their behavior on the radius. The profile of plasma rotation velocity in different phases of the ELM was obtained. The properties of filament structures, i.e., filaments, arising at this time, were studied.

References

- [1] V.V. Solokha et al 2023 Plasma Physics Reports, Vol. 49, No. 4, pp. 419–427
- [2] A.W. Leonard 2014 Physics of Plasmas 21 090501
- [3] V.V. Bulanin et al 2021 Rev. Sci. Instrum. 92 033539
- [4] A.Y. Yashin et al 2022 JINST 17 C01023