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STUDY OF DESYNCHRONIZED EDGE LOCALIZED MODES USING MULTI-FREQUENCY DOPPLER BACKSCATTERING ON THE GLOBUS-M2 TOKAMAK *)

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Nowadays, the main operating mode of tokamaks - the enhanced confinement mode or H-mode, is characterized by large values of the pressure gradient at the periphery [1], which is the cause of a large number of instabilities, in particular, edge localized modes (ELMs). ELMs are considered to be a development of the peeling-balloon instability and lead to pulsed particle and energy releases from the confinement region onto the first wall and divertor plates, which can lead to damage of the machine [2]. Because of this, the study of the onset and development of ELMs is an important and urgent task today, which is being carried out also on the spherical tokamak Globus-M2. Different types of edge localized modes are observed on this device: synchronized ones appear only in the presence of an external trigger in the form of some other instability (in the case of Globus-M2 it is sawtooth oscillations in the center of the plasma). However, the most interesting are the desynchronized ELMs that have appeared relatively recently after the tokamak modernization and, consequently, the improvement of the plasma parameters, and which occur spontaneously in the H-mode [3]. Presumably, they belong to type III or V and are fully analogous to modes on other tokamaks, but further research is required to fully understand their structure.

One of the powerful ways to study ELMs is the Doppler backscattering (DBS) diagnostics installed on the Globus-M2 tokamak. It includes 2 multi-frequency reflectometers with tilted antennas for plasma probing. The first has four frequencies and allows to probe the peripheral regions of the plasma $0.8<\rho<1.1$, the second has six frequencies and is needed to probe more central regions $0.4<\rho<0.8$ [4]. This diagnostic allows us to estimate density fluctuations in the plasma and measure its rotation velocity perpendicular to the magnetic field, and hence the radial electric field E_r. Due to the application of multi-frequency probing, it is possible to construct radial profiles of the electric field and density fluctuations. In this work, the effect of desynchronized ELMs on E_r at radii $0.4<\rho<1.1$ is investigated. It turns out that during them it increases over the entire measurement interval. This shows that the influence of the edge modes also extends to the inner regions of the plasma, which is not consistent with the general ideas, but has been confirmed experimentally not only at Globus-M2 [5]. In addition, a comparison of the results with synchronized ELMs and limit cycle oscillations (LCO) is given.

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