THE STUDY OF NEOCLASSICAL TEARING MODES USING DOPPLER BACKSCATTERING IN THE GLOBUS-M2 TOKAMAK [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.062

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

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

In tokamaks, magnetic islands developing as a result of the growth of the neoclassical tearing mode (NTM) have attracted much attention due to the constraints they impose on plasma pressure. Even when they occupy only a small part of the confinement area, magnetic islands have a significant influence not only on temperature profiles, but also on current and rotation velocities profiles. The key parameters determining the influence of the island on confinement are the width and rotation velocity of the formed islands [1]. If the frequency of the magnetic islands is well determined by magnetic probes located outside the plasma confinement area, different diagnostic techniques should be used to determine their width and localization. Work [2] has shown that Doppler backscattering (DBS), also called Doppler reflectometry, can be used as such a method.

On the spherical tokamak Globus-M2, the DBS method together with a series of magnetic probes [3] was used for the study of NTM properties. At the same time, two multi-frequency DBS systems were used, with two sets of probing frequencies ranging from 20 to 48 GHz and from 50 to 75 GHz accordingly. The application of such systems allowed measurements to be made in a wide area spanning from the separatrix to half of the small radius of the plasma. The tearing mode with a 2/1 mode number observed by magnetic probes during the plasma current plateau phase in the form of fluctuations at a frequency of about 10 kHz was also detected in the DBS diagnostic signals at the same time and at the same frequencies. At the same time, such fluctuations were not present on all DBS system channels, but only on those whose cut-off positions were near the magnetic surface q=2. The estimation of the size of the NTM region by means of DBS gives values of the order of three centimetres, which is assumed to be the width of the magnetic island. In addition to the NTM measurement results, the report analyses the causes of the oscillations in the DBS signals and compares the measured magnetic island width with simulation predictions [4].

The work was carried out with the financial support of RSF, project 18-72-10028. The experiments were carried out on the USF "Spherical Tokamak Globus-M", which is part of FCC "Material Science and Diagnostics in Advanced Technologies" (unique project ID RFMEFI62119X0021).

References

1. Waelbroeck F.L., 2009, Nucl. Fusion, 49, 104025
2. Estrada T. et al., 2012, Nucl. Fusion, 52, 082002
3. Patrov M.I. et al., 2007, Plasma Physics Reports, 33, 81–90
4. Dudkovskaya A.V. et al., 2018, Physics of Atomic Nuclei, 81, 1033–1036
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Mu/ru/BD-Yashin.docx) [↑](#footnote-ref-1)