The first results of dispersion interferometer operation on plasma density control on the Globus-M2 tokamak [[1]](#footnote-1)\*)

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The first plasma in the next-generation spherical tokamak Globus-M2 [1] with a 2.5 times increased magnetic field was obtained in 2018 at the Ioffe Institute. Currently, work is underway to achieve the design parameters: a toroidal magnetic field on the axis of 1 T and a plasma current of 0.5 MA [2,3]. Also, it is planned to increase the discharge duration up to 0.7 s in regimes with non-inductive current drive. As the simulations predict, under the new experimental conditions, the operating range in plasma density will also increase significantly [4].

Until recently, monitoring of plasma density was carried out using a microwave interferometer operating at a wavelength of 0.8 mm. The main disadvantage of this diagnostic is the strong refraction of the probing beam in high-density plasma, leading to failure in measurements. In addition, density profile measurements can be carried out periodically during the discharge using the Thomson scattering diagnostics. Unfortunately, the obtained data is hardly applied to control density in the discharge. A dual-frequency dispersion interferometer based on a CO2 laser, which was developed at the Budker Institute of Nuclear Physics, is free of the aforementioned disadvantages. It is not affected by the refraction and rotation of the plane of polarization in a magnetic field due to the choice of the optimal wavelength of the probing radiation, an innovative optical scheme, and an automated data acquisition system. Also, it is possible to avoid the influence of vibrations by passing the rays of both wavelengths along the same path.

In 2019, the integration of the dispersion interferometer into the tokamak diagnostic system was completed and the first experimental results were obtained. The probing scheme of the interferometer, which is placed in the equatorial plane of the tokamak, is identical to the scheme of the Thomson scattering diagnostics. This circumstance allows a direct comparison of the data of the two diagnostics. Future plans include work to incorporate a dispersion interferometer into the tokamak density control circuit.

The experiments were performed on the Unique Scientific Facility "Spherical Tokamak Globus-M", which is incorporated in the Federal Joint Research Center "Material Science and Characterization in Advanced Technology" (project ID RFMEFI62119X0021). The measurements of the parameters of the plasma discharge were carried out as part of the state task of the Ministry of Science and Higher Education of the Russian Federation.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/AS-Shulyatiev.docx) [↑](#footnote-ref-1)