FIRST RESULTS OF IONIC COMPONENT research at GLOBUS-M2 TOKAMAK USING the CNPA COMPACT ANALYZER [[1]](#footnote-1)\*)

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In 2018, at the Ioffe Institute a modernized spherical tokamak Globus-M2 was launched [1]. Currently, work is underway to gradually bring the facility to the maximum design parameters: a toroidal magnetic field on the axis of 1 T and a plasma current of 0.5 MA [2, 3]. The neutral beam injection (NBI) system was supplemented with a second injector with a beam particle energy up to 50 keV. Another heating method being developed at Globus-M2 is the injection of ion-cyclotron frequency waves into the plasma (ICRH). The use of NBI and ICRH leads to the production of high-energy ions in the plasma. The study of the retention and thermalization of high-energy ions is one of the points of the Globus-M2 scientific program. Atomic flux analyzers, ACORD-12 and ACORD-24M, available at Globus-M2, allow to study the ion component in energy range up to 30 keV. Thereby, a need arose for a new instrument capable of analyzing the fluxes of charge-exchange atoms in an extended energy range from thermal energies to 60 keV.

In 2022, the CNPA-09 compact analyzer of charge-exchange atoms was put into operation at Globus-M2, which detects particles with energy in range of 0.8÷60 keV in case of deuterium or 0.8÷120 keV in the case of hydrogen. The device has 44 channels and allows to get a detailed energy spectrum in one discharge. As part of experimental campaigns, measurements of charge-exchange atomic fluxes in discharges with NBI and in the ohmic mode were carried out. Energy spectra of charge-exchange atoms are obtained.

Comparison of the ion temperature calculated from the slope of the spectrum of charge-exchange atoms with the data of the ACORD-12 and ACORD-24 analyzers showed good agreement in ohmic discharges. In modes with the inclusion of a new injector, an acceptable agreement between the results was also observed. Discrepancies in ion temperature measurements – an underestimation by a factor of 1.5 according to CNPA data – were found when two injectors were operated simultaneously. It is assumed that the difference is due to the absence of a noticeable active recharging target in line of sight of CNPA-09 analyzer, leading to the measurement of the average temperature. ACORD analyzers register active fluxes of charge-exchange atoms from central region of the plasma, the local ion temperature is measured, the values ​​of which are noticeably higher than the average temperature.

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References

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3. V.B. Minaev, et al. // Proc. 46th EPS Conf. on Plasma Physics, Milan, 2019 ECA 43C P4-1084
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/BK-Shulyat%27ev.docx) [↑](#footnote-ref-1)