OPTICAL METHODS APPLICATION FOR MEASURING HELICON DISCHARGE PLASMA PARAMETERS [[1]](#footnote-1)\*)

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Today application of a helicon discharge for plasma creating has become widespread in various fields of engineering and technology, from the production of microcircuits to plasma rocket engines. Application and further development of a helicon discharge relies on the ability to determine plasma parameters and ongoing processes control. Helicon discharge installation has been created in the Kurchatov Institute for studying the occurring plasma processes. A series of model experiments was carried out to study the dependence of plasma parameters on the magnitude of the magnetic field in the region of the RF antenna and the magnetic field profile.

Laser-induced fluorescence (LIF) method was used to measure the concentration of singly charged argon ions Ar II on the axis of the setup. We used a three-level spectroscopic scheme with pumping at a laser wavelength λL = 611.5 nm and recording fluorescent radiation at λFLU = 460.9 nm. A wavelength-tunable EXPLA NT342A-SH optical parametric oscillator pumped by the third harmonic of a Nd: YAG laser was used as a source of exciting radiation. We also used a set of two Avaspec-mini spectrographs made according to the Czerny-Turner scheme with a recording element in the form of a CCD ruler of 3648 pixels. Registration of radiation was carried out in various sections of the installation. The inverse Abelian transformation was carried out by the Peirce method to calculate the radial distributions of the electron temperature. The electron temperature was determined by the method of relative intensities from a large array of recorded lines (more than 70 ArII lines).

The measurements carried out show the expected increase in the concentration of argon ions with an increase in the magnitude of the magnetic field under the antenna, with characteristic values NArII = 4±2 \* 1012 cm-3. The characteristic electron temperature on the axis of the setup was Te = 3±0.3 eV. Three profiles of the magnetic field of the plasma source were proposed: with a flat field distribution in the region of the RF antenna, with an increase in the magnetic field in the region of the antenna, and a configuration with a magnetic trap in the region of the RF antenna. According to the measurement results, the configuration with a magnetic trap was found to be optimal in terms of density and plasma profile.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Lt/ru/EM-Kutuzov.docx) [↑](#footnote-ref-1)