ELECTRODYNAMIC CHARACTERISTICS AND MICROWAVE FIELD STRUCTURE OF A RESONANCE DISCHARGE IN A minimum-B magnetic mirror [[1]](#footnote-1)\*)

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The paper presents the results of numerical and analytical calculations of the microwave field structure and the distribution of the absorbed microwave power in a cylindrical resonator placed in a minimum-B magnetic mirror. The resonator is excited through a slit in the sidewall (Fig. 1). The dependence of the discharge impedance on the concentration of electrons is calculated (Fig. 2). The cyclotron resonance conditions (ω=Ωe) are satisfied in the central region of the resonator for the microwave field ω/2π=2.45 GHz. These discharges are interesting in the development for sources of ion beams and plasma-chemical reactors [1].

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| Изображение выглядит как текст, антенна  Автоматически созданное описание  Fig. 1. Geometric model of the resonator | Fig. 2. Change in the impedance of the resonator when the electron density changes |

The density of electrons in the discharge at low pressures (10–4 Torr) is significantly lower than the critical density (nc=mω2/4πe2). Therefore, the absorption of the electromagnetic wave occurs in the region of cyclotron resonance. An increase in gas pressure is accompanied by a significant increase in the electron density up to 3⋅1011 cm–3 [2] and a qualitative restructuring of the spatial distribution of the electromagnetic field. Experimental measurements of wave polarization with high-frequency probes confirm this.

Numerical simulation with the Comsol Multiphysics® (the license belongs to the Faculty of Physics of Moscow State University) showed that there are several absorption bursts at certain electron densities on the impedance dependence of a plasma-filled resonator (Fig. 2). A qualitative restructuring of the electromagnetic field occurs in the interval between bursts, which is consistent with the results of the experiment.

References

1. G. Castro, D. Mascali, S. Gammino, G. Torrisi, F. P. Romano, L. Celona, C. Altana, C. Caliri, N. Gambino, D. Lanaia, R. Miracoli, L. Neri и G. Sorbello // *Plasma Sources Sci. Technol.,* **26**, 2017, 055019.
2. V.V. Andreev, I. A. Voldiner, M.A. Korneeva // *Plasma Physics Reports,* **43,** 2017, 1119.

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