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 описаниеFig. 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

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