THE PARAMETERS OF PULSED PLASMA FLOW, GENERATED UNDER GYRORESONANCE INTERACTION OF PLASMA ELECTRONS  
 WITH MICROWAVE FIELD [[1]](#footnote-1)\*)

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In works [1, 2] the parameters of plasma bunches created in a long mirror trap under gyroresonance interaction of electrons with a microwave field (mode TE118, 2.45 GHz) with a pulsed reverse magnetic field, were studied experimentally and numerically. Typical operating parameters of the experiment: the initial plasma density *n* = 1010 cm-3, the amplitude of the electric component of the microwave field E = 1 kV/cm, the induction of the magnetic field in the center of the mirror B=1200 G, the mirror ratio of 1.2. Impulse coils of the reverse magnetic field provide reduction of induction of a stationary magnetic field of the mirror in two symmetrically located areas to the level of classical ECR. With the subsequent restoration of the initial profile of the magnetic field, i.e. its increase in the presence of a microwave field, plasma bunches with an energetic (250-300 Kev) electron component are formed in these regions. When the initial magnetic field profile is fully restored, the bunches are dumped into the central region of the trap: electrons - under the action of diamagnetic force, ions-under the action of an electric field arising from the partial spatial separation of the electron and ion components of plasma bunches, and are held in the mirror for a long time. The computer simulation of the described process, carried out by the particle-in-cell method, showed that the average energy of ions (argon) in the process of discharge of bunches into the center of the mirror increases from 200 eV to 2-3 keV, which gives us an impetus for studying the possibility of collective acceleration of ions of plasma bunches in a magnetic field falling in space.

To this end, we adapted the three-dimensional model described in [2]. The main difference between the schemes is that one plasma bunch is created, and the stationary magnetic field decreases from the bunch generation region to the resonator end. At the initial time moment of the simulation, a neutral single-ionized low-temperature plasma (Te≤10eV) is simulated in the ECR regions of interactions, with the temperature of the ions not exceeding fractions of an electron-volt. The plasma density in the region of ECR interaction is *n* = 1010 cm-3.

The results of the computer simulation showed that the energy of the ion component significantly depends on the gradient of the magnetic field. For the typical parameters of the plasma bunch (the average energy of the electron component 250-300 keV and the density of the bunch *n* = 5x109 cm-3), the ion energy fixed at the end of the chamber varies in the range of 4-12 keV.

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References

1. Andreev V.V., Novitskiy A.A., Umnov A.M., Chuprov D.V. Instruments and Experimental Techniques. 2012. Т. 55. № 3. С. 301-312.
2. V.V. Andreev, A.A. Novitsky, A.M. Umnov IOP Conf. Series: Journal of Physics: Conf. Series 1094 (2018) 012014.

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