INFLUENCE OF ELECTROSTATIC WAVES ON COLLECTIVE MOTION OF ELECTRONS IN CROSSED ELECTRIC AND MAGNETIC FIELDS [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.123

1,2,3Marusov N.A., 1,3Sorokina E.A., 3Kiriy P.A.

1NRC “Kurchatov Institute”, Moscow, Russia, marusov\_na@nrcki.ru
2Moscow Institute of Physics and Technology, Dolgoprudny, Russia
3RUDN University, Moscow, Russia

It is well known that fluctuations of the electric potential in a magnetized plasma may result in anomalous mobility of plasma components across magnetic field [1]. In particular, the related transport of particles and plasma energy plays a key role in the description of physical processes in low-pressure plasma discharges in crossed electric $E$ and magnetic fields $B$, such as various modifications of magnetron discharges, stationary plasma thrusters, sources of multiply charged ions, etc. It is believed that electrostatic oscillations in such systems give rise to the directed motion of the electrons along the stationary electric field from the cathode to the anode, which affects the spatial distribution of the field itself [2].

In this work, within the framework of the kinetic model, we study the influence of electrostatic azimuthal wave on the collisionless dynamics and distribution function of electrons in the inhomogeneous radial electric $E=E\left(r\right)e\_{r}$ and constant axial magnetic fields $B=Be\_{z}$ (reversed magnetron configuration). We solve the collisionless kinetic equation with a source $S=δ\left(t\right)n\_{0}\left(r\right)γ\_{0}\left(v\right)$, where $δ\left(t\right)$ is a delta-function of time $t$, $n\_{0}$ and $γ\_{0}$ are the space and velocity distributions, respectively. This source simulates the evolution of a given initial distribution of electrons injected into the system or produced in it as a result of ionization processes. The solution of the kinetic equation is found by the method of the inverse integration over trajectories and the subsequent averaging of the distribution function over time, which is equivalent to the action of weak collisions, [3]. The characteristic dependences of the distribution function on the following parameters are calculated: the phase of the Larmor rotation, cosine of the pitch angle between the direction of the external magnetic field and particle velocity. The first moments of the distribution function are obtained. The dependence of the value of the axial current of electrons on the wave vector and the amplitude of perturbations is investigated.

This research was supported by the Russian Foundation for Basic Research, project No. 18-29-21041.

References

1. B.B. Kadomtsev. *Plasma Turbulence*. London: Academic Press, 1965.
2. G.S. Janes, R.S. Lowder. Anomalous electron diffusion and ion acceleration in a low-density plasma // Physics of Fluids. – 1966. – V. 9. – №. 6. – P. 1115-1123.
3. Ilgisonis V.I., Sorokina E.A., Yurchenko E.I. Collisionless current generation in the center of

the tokamak plasma by an isotropic source of alpha-particles // Plasma Physics Reports. –2010. – V. 36. – № 1. – P. 1-14.

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