Hall thruster plasma simulation using completely kinetic two dimentional axial-azimuthal model (2D 3V Full PIC) [[1]](#footnote-1)\*)

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Hall thruster (HT) is a plasma device in the coaxial channel of which an axial electric and radial magnetic field is created. Despite more than a half-century history of the study of physical processes occurring in a HT discharge plasma, a number of open questions remain. One of such questions is the anomalous conductivity across the magnetic field: the classical collisional transport mechanism on heavy particles and the wall conductivity is not enough to describe the experimental value of the electron current [1].

Radial-axial geometry is typical for HT modeling; for such models, it is possible correctly to take into account the interaction with the wall and secondary electron emission. Nevertheless, these models do not provide an correct value of the electron current without artificial increase due to Bohm conductivity, which does not reflect the physics of the process. On the other hand, azimuthal oscillations and waves in a plasma can significantly affect the electron current in a HT [2], however, this effect can be directly taken into account either in three-dimensional models or in axial-azimuthal discharge models.

The report is devoted to numerical study of the processes, which are occurred in axial-azimuthal plane in Hall thruster plasma. The study is carried out using a completely kinetic two-dimensional coordinate and three-dimensional velocity axial-azimuthal model. The calculation of plasma parameters is performed by the particle-in-cell method in a self-consistent electric and external magnetic fields. The report presents both one-dimensional (averaged over the azimuthal component) and two-dimensional distributions of the main parameters (potential, concentration, electron and ion velocities, etc.), as well as the main characteristics of the observed waves.

References

1. J.-P. Boeuf, Journal of Applied Physics 121, 011101 (2017)
2. V. Nikitin, D. Tomilin, A. Lovtsov and A. Tarasov, “Gradient-drift and resistive mechanisms of the anomalous electron transport in Hall effect thrusters”, EPL, 117 (2017) 45001
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Lt/ru/FM-Khmelevskoi.docx) [↑](#footnote-ref-1)