

P4.3002 Numerical simulation of Penning gas discharge in 2D/3D setting

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.3002.pdf>

This work presents a numerical simulation of the Penning discharge in 2D/3D formulation. The simulation is based on the electrostatic Particle-In-Cell (PIC) method using structured rectangular grids and implemented in the VSim [1] software package. To simulate the kinetic processes in a gas-discharge plasma, the Monte-Carlo collision method was used. The calculations were carried out for several sets of chemical kinetics reactions, and their comparison is given. Various characteristics of the Penning discharge in 2D and 3D formulation were calculated, such as anodic/cathodic currents, the distribution of charged particles in space and energies, etc. Dependences of the discharge current on the applied external magnetic field obtained experimentally and numerically are in reasonable agreement. The experiment [2] show that there exists I_{max} and corresponding B_{max} after which further increase in B leads to decrease in I . Our calculations showed that a similar behavior of the discharge current is observed in the simulation. Such a behavior of the discharge current from the magnetic field is due to the disturbance of the axial symmetry of the field ϕ and the redistribution of electrons.

References

- [1] C. Nieter, J.R. Cary, VORPAL: a versatile plasma simulation code, *Journal of Computational Physics* 196, 2004
- [2] A.V. Sy, *Advanced Penning-type source development and passive beam focusing techniques for an associated particle imaging neutron generator with enhanced spatial resolution*, Berkley: University of California, 2013

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