Mathematical Modeling of Magnetic Jets Acceleration Processes

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Mathematical modeling of space plasma acceleration in the vicinity of accretion disk leading to formation of subluminal jets in active galaxy nuclei and close stellar systems is one of the most complicated and theoretically important problems. The mechanism of acceleration including hydrodynamic, magnetohydrodynamic and radiative transfer models is being widely discussed for a long time but every model gives explanation only for a part of effects observed.

An 2D axial symmetric MHD model for the formation of a jet in the vicinity of a compact object surrounded by a thin accretion disk with a supersonic accretion regime is constructed, assuming that the plasma is perfectly electrically conducting and taking into account central compact body gravitation. Problem-oriented numerical code based on separative physical processes computation using unstructured triangular meshes is developed. The code uses natural approximation for both gas and magnetic parts of MHD equations system. The source of jet matter is described using boundary conditions.

A stable collimated jet of plasma along the z-axis symmetric about the plane of the accretion disk is obtained. The source of jet energy in the model is gravitational energy of central object. The jet is collimated by magnetized funnel which has form of Laval nozzle, flow parameters are continuous and smooth inside funnel. The funnel has optically thick hot unmagnetized walls. The parameters of the outflow are in good agreement with available observational data on the structure and properties of jets.

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References

[1] M.P. Galanin, V.V. Lukin, V.M. Chechetkin (2009) Mathematical modeling of a jet in the vicinity of a compact object, *Astronomy Reports* **53**, 295–309.

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