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NUMERICAL SIMULATION OF PLASMA JET EXPANSION IN A LABORATORY EXPERIMENT *)

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A number of studies of astrophysical processes both in the Universe and in laboratory conditions, advanced thermonuclear technologies, as well as processes in the Earth's ionosphere are directly related to the study of such formations as jets. A promising direction in the study of the Jets area is the planning of active geophysical rocket experiments (AGRE) in the Earth's exosphere [1]. Both planning and processing of data from experiments already conducted are impossible without constructing physical and included observation models.

The AGRE conducted in the 90s of the 20th century involved the injection of high-speed aluminum plasma jets into the environment, obtained using explosive plasma jet generators (EPJGs) developed at the Institute of Geophysical Problems of the Russian Academy of Sciences [2]. Modeling the evolution of such a plasma formation over long periods of time requires taking into account many factors, including determining the initial distribution of plasma parameters (injection scenario). Previously, the reasons for injection reduction were based only on one-dimensional spherically symmetric radiation-gasdynamic calculations without taking into account plasma effects [3].

The report presents multidimensional physical and mathematical models of the initial stage of expansion of an aluminum plasma jet within the framework of reanalysis of a laboratory experiment. Comparative modeling was conducted using a number of independent numerical techniques. In the simulation, plasma models were used for the equation of state of aluminum and ambient air, taking into account the separation of electron and ion temperatures. The presented method can be used to estimate the parameters of the obtained jets for promising AGRE.

Numerical modeling was carried using two software packages MARPLE (KIAM RAS) [4] and FRONT [5] on the k60 and k100 supercomputers of the Center for Collective Use IAM them. M.V. Keldysh RAS.

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