Research of formation of jet plasma current in magnetosphere at powerful explosion

M.O. Vasilyev(1), E.L. Stupitsky(2), A.S. Kholodov(1), A.Ju. Repin(2).

(1) Central Institute of Physics and Technology, Russia, (2) Moscow Physical Technical Institute, Russia

On the basis of the detailed theoretical analysis the physical model is developed and the opportunity of formation of jet current of plasma in magnetosphere is appreciated as a result of development of flutter instability at the front of a plasma cloud with high initial specific energy. It is shown, that for plasma with $E \approx 10^{21}$ erg and $M = 10^6$ gr at its scattering in equatorial area $\varphi \leq 15^0$ the fastest growth of disturbance with wave number $k = 6$ is possible. Restriction of wave number k from above is caused by viscosity. The range of explosions of 400–700 km where conditions for development flutter instability are optimum is determined.

As the description of nonuniform at the front plasma demands a detailed settlement grid numerical researches were carried out on 2D to algorithm. Initial disturbance were not set, they were generated during calculation and not focused on borders of settlement area. The quantity disturbance stayed as a result of evolution of indignations approximately met to theoretical estimations ($k \approx 6$). It is shown, that during the further evolution one ascending plasma jet is formed.

Special laboratory modelling formation of jet current of plasma in a magnetic field with use of laser plasma is executed. Correctness of the developed theoretical representations about development of flutter instability is confirmed and the explanation of an inclination of a plasma jet to the west from a plane of a magnetic meridian is given.