studies of plasma flow in the plasma focus discharge during its propagation in the ambient gas

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The experiments on investigating the plasma flows and using them to simulate astrophysical jets are conducted in NRC "Kurchatov Institute". Qualitative and quantitative parameters of the jets propagation environment have a significant influence on the structure and dynamics of the plasma flow. Therefore one of the main goals is to investigate the structure and dynamic of the plasma flows in different gases.

The paper presents the results of the study the propagation in the background gas of the plasma flows generated on PF-3 facilities. The research was conducted at a distance up to one meter from the place of generation. The data about the structure of the plasma flows on the levels 35, 65 and 95 cm from the anode was obtain by the high-speed cameras. Recording in mutually perpendicular directions allows to get the information about the volume of the object structure. Experiments on study the composition of ionization of neon jet were performed. The registration of the plasma flows on third section of the fly-camera (95 cm from the anode) with using color filters (FS-1 for NeII and KS-19 for NeI) was made. No fundamental differences in the front and structure of the plasma flows, this may indicate a lack of a clear separation of ions in the flow. However, we need study this question on levels closer to point of the flows generation.

Synchronous registration of the plasma flows by the streak-camera and high-speed cameras was performed. Streak-camera allows getting the information about the dynamic of the object during propagation in the background gas. Data from both diagnostics have high correlation: similar form of the front of the plasma flows, we can to see separate jets in common flow on data from streak-camera, which matched with the fronts on high-speed cameras. By the streak-camera data analysis may conclude that movement of the plasma jets has a rotate component.

Deceleration of the plasma flows by optical collimators was studied. Previously, it was shown that the plasma flows motion is described by the equation: V = V0 e–x/x0, where V0 is the initial velocity of the jet, X0 is the braking length. The braking force Fbreak ~V2. In specific conditions measurements at two distances for the correct determination of V0 and X0 is enough. The formula for the determination of average speeds and braking lengths was found.

Similar measurements were carried out on the installation CPF-4 (SFTI). Optic collimators measurement scheme was upgraded: ten PMT-115 are mounted for five double optic collimators, power supplies of the PMT are standardized, channel calibration performed. V0 and X0 are defined in discharges in hydrogen and argon at a stationary gas puffing and puffing at the pulse of argon.

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