generation of superthermal plasma flows in current sheets formed in diScharge in krypton [[1]](#footnote-1)\*)

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In this work, acceleration of krypton plasma was studied along the width of the current sheet
(the largest transverse dimension of the sheet). Acceleration occurs at the metastable stage of the current sheet evolution and during acceleration, the magnetic energy accumulated in the vicinity of the sheet is transformed into the kinetic energy of the plasma [1].

Studies were carried out at the TS-3D device by spectral methods [2, 3]. The current sheets were created in a magnetic field with *X* line in krypton, the magnetic field gradient was ~0.57 kG/cm, the initial working gas pressure was ~33 mTorr, and the amplitude value of the current in the sheet was of 45 kA. Part of the experiments was carried out in 3D magnetic configuration in which magnetic field *BZ* = 2.9 kG was applied along the direction of the current [4].

Measurements were carried out by a two-channel optical system, in which the plasma radiation was collected both from the central quasi cylindrical region extended along the direction of the current in the sheet and along the sheet width, which allowed us to determine the temperature and energy of accelerated krypton flows.

Spectral lines of krypton ions Kr II 473.9 nm and Kr III 501.6 nm were recorded simultaneously in both directions in the same pulse of the experimental device using a Nanogate 1UF programmable digital camera with a duration of the gate pulse Δ*t*gate = 1 µs. The Nanogate 1UF camera is an electron-optical sensor with an image intensifier based on microchannel plate with a CCD matrix as a detector.

It was found that the maximum energy of Kr II ions during acceleration is reached in the 2D magnetic configuration, *Wx*max ≈ 420 eV, and the directed energy of krypton ions *Wx*max is ~6 times higher than their thermal energy. It was shown that the measured energy of accelerated krypton ions Kr II and Kr III, in general, agrees with the estimate of the work of Ampère’s forces acting in the current sheets, which were determined from magnetic measurements [5]. It is assumed that the acceleration of krypton ions Kr II and Kr III is spatially inhomogeneous along the perpendicular to the middle plane of the current sheet. This hypothesis needs to be proved experimentally.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Lt/ru/FE-Kyrie.docx) [↑](#footnote-ref-1)