electron and krypton ion temperatures in the plasma current sheet according to results of spectral measurements [[1]](#footnote-1)\*)

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We investigated the evolution of intensity and broadening of Kr II и Kr III ions spectral lines emitted from plasma of the current sheet. Based on this data the electron and krypton ion temperatures were determined under various experimental conditions. The thermal processes in current sheets are of interest due to strong pulse heating of plasma (up to Temax ≈ 100 eV, Timax ≈ 300 eV) may lead to rapid current-sheet destruction, initiating the beginning of magnetic reconnection [1]. Similar phenomena may occur in the Sun just before solar flare. As applied to solar flares, the idea of «thermal trigger» was advanced by S.I. Syrovatskii [2] and was then developed in a number of articles (e.g., [3]).

The electron temperature in the current sheet was determined from the changes in time of the spectral lines intensities of krypton ions Kr II 473.9 nm и Kr III 501.6 nm. The method is based on the strong dependence of the ionization rates of emitting ions on the electron temperature Те in the range Те/Ei≤1, where Еi - ionization potential. The dependences of the ionization rates of krypton atoms and ions Kr I – Kr V on the electron temperature Te in the range 1÷200 eV were numerically calculated using the resuits from [4,5]. The calculations were carried out using the program Wolfram Mathematica. The ion temperature was determined by the Doppler broadening of the lines Kr II 473.9 nm и Kr III 501.6 nm, since the Stark broadening of the lines under experimental conditions can be neglected [6].

Current sheets were formed by a discharge in the krypton plasma, in the magnetic field with the X-line. The initial gas pressure was 33 mTorr, the amplitude of the electric current through the sheet was 45 kA, a gradient of the transverse magnetic field was ~ 0.6 kG/cm. Some experiments were performed when a uniform magnetic field with an induction of ~ 3 kG was applied along the X-line and plasma current. In these cases the magnetic configuration in which the current sheet was formed became three-dimensional (3D).

The plasma radiation was collected from a central quasi-cylindrical region elongated along the direction of the current. The spatial resolution of the measurements was ~ 2.6 cm. The spectral line profiles were recorded in one pulse of the experimental setup using a programmable electro-optical camera «Nanogate 1-UF».

It is established that maximum electron and ion temperatures are achieved in 2D magnetic configuration, and they are equal to Tе = 5 eV и Ti = 125 eV, respectively. The investigated regime of current sheet formation is, apparently, quasi-stationary. It is shown that the main channel of electron energy loss in plasma current sheet is ionization.

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