Abstract for Master's Thesis

«Increased brightness x-ray source based on relativistically intense laser-plasma interaction using surface structured targets»

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The work is devoted to the study of the generation of fast plasma electrons, hard x-ray and gamma radiation at relativistic laser interaction with surface structured targets. Such surfaces can enhance the efficiency of energy conversion into the x-ray radiation and increase the hot electron temperature and may be used in different applications.

In this work, the effect of the contrast of laser pulses on the structured targets is studied. The suppressed melting threshold was detected for the sub-wavelength scale structured material. Local melting leading to distortion of initial structures was detected at a fluence of $0.2 \pm 0.1 \frac{J}{\text{cm}^2}$ and below for silicon nanowires, or 3–5 times lower compared to the flat substrate melting threshold.

Diagnostics of plasma showed a significant increase in the total number of electrons with energies of more than 300 keV on structured targets. It experimentally demonstrated that the hot electron temperature increases by 1,5 times with a silicon nanowires in comparison with a flat silicon. It is shown that with the use of a structured targets, it is possible to enhance the flux of x-ray radiation from the plasma. The highest efficiency of pulse energy conversion was found for a structured tungsten target ($2 \pm 0{,}25 \times 10^{-4}$ %).