Interaction of the relativistic laser pulse with the melted metal surface

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Annotation of the graduation work

Investigation of high-energy particles generation and in particular generation of hard x-ray radiation and gamma radiation is an important and interesting problem of studying of high power laser-matter interaction. This is connected both with the solution of a large number of applications and with understanding and identifying regularities of physical processes.

We have investigated the possibility of increasing of hard x-ray radiation yield in case of interaction of the relativistic laser pulse with microstructured by the action of the laser pre-pulse (ahead the main pulse for a few nanoseconds) surface of the melted gallium target. In the experiments we used the laser radiation delivered by the Ti:Sa laser system (wave length - 800 nm, pulse duration - 50 fs, pulse energy - up to 75 mJ, repetition rate - 10 Hz, contrast at the nanosecond scale - $5 \cdot 10^{-8}$).

Comparison of results of the optical shadowgraphy of the plasma plume formed by the action of the laser pre-pulse with results of measurements of the energy distribution in the focal area allowed us to bind the micro-jets formation with the features of energy fluence.

Variation of the artificially created laser pre-pulse parameters (energy and lead time) allows us to establish the nature of the impact of the preplasma formed by the action of the laser pre-pulse on the hard x-ray generation after interaction of the main pulse with preplasma. We achieved generation of the hard x-ray photons (with energy up to 5 MeV) and twofold increase of hard x-ray yield in the energy range above 100 keV with intensity of the main pulse about $3 \cdot 10^{18}$ W/cm^2 and optimal parameters of the laser pre-pulse.