Diploma thesis abstract

"Generation of fast electrons under interaction of laser pulse with sub-relativistic intensity with solid and liquid target surface".

Ivanov Konstantin.

Chief – Uryupina Daria.

At investigation of laser-plasma interaction considerable attention is paid to the question of high-energy particles generation. It is important not only for understanding of physical phenomena in plasmas but also from the point of view of many applications.

In the work the influence of laser pulse parameters (intensity, contrast) on "hot" electrons generation in plasma, created on a surface of solid and liquid targets by a laser pulse with sub-relativistic intensity, has been investigated. In all experiments laser pulse was delivered by Ti:sapphire laser system (pulse duration - 55fs, wavelength - 800nm, energy of a single pulse – up to 10mJ, energy of prepulse, leading the main pulse over 12.5ns – from 10^{-7} to 10^{-1} of main pulse energy repetition rate - 10Hz).

It was revealed the appearance of the several components of "hot" electrons in plasma, created onto a solid (iron) target, as laser pulse intensity increases from moderate to relativistic (from $7x10^{16}$ to $1.2x10^{18}$ W/cm^2). Acceleration of different electron components up to energies from tens keV to few MeV can be connected with mechanisms of resonant absorption, ponderomotive force acceleration and wakefield acceleration.

Fourfold growth of "hot" electrons energy (from 18 to 75 keV) was achieved in experiments with melted gallium target when the energy of prepulse was increased from $2x10^{-7}$ to 50^{-1} of main pulse energy at intensity $5x10^{16}$ W/cm^2. Such behavior strongly differs from experiments with solid-state targets. Optical shadowgraphy of plasma cloud, created by the prepulse, revealed that increase of "hot" electrons energy can be explained by effects of local electromagnetic field amplification on microstructures, formed on plasma-vacuum boundary.