Abstract for Master's Thesis

«Spatio-temporal plasma dynamics under femtosecond laser irradiation »

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In this study the dynamics of a laser plasma with high spatial (20 μm) and temporal (50 fs) resolution by the method of probing laser interferometry is experimentally investigated.

The description of set-ups for interferometric diagnostics is given. The analysis of the interference pattern is also available in detail. Open source software for automated interferogram processing was developed.

The interaction of a slightly relativistic femtosecond laser pulse (800 nm, 55 fs, 10 Hz, on-target intensity ~10^{18} W/cm^2) with a controlled pre-plasma that was created by a nanosecond laser pulse(1064 nm, 8 ns, 10 Hz, on-target intensity ~10^{12} W/cm^2) on molybdenum target was experimentally studied. The plasma density dynamics depending on the angle of incidence of the heating radiation, as well as on the time delay between nanosecond and femtosecond pulses was investigated. It is shown that the interaction of a powerful femtosecond pulse with such nanosecond pre-plasma can lead to additional ionization.

Diagnostics of the filament plasma channel formed by focusing high-power femtosecond radiation (800 nm, 55 fs, 10 Hz, 1-20 mJ, 7.5 mm FWHM) by lens with a focal length of 50 cm in air was carried out. It is shown that in the single filamentation mode (1-2 mJ) the electron plasma density is ~ 10^{18} cm^{-3}. As a result of using transverse laser microinterferometry, individual filaments can be resolved during multiple filamentation.