Master thesis annotation

Investigation of processes of transformation of femtosecond filament laser plasma energy in water at different focusing regimes

Ilalov A.S.

Laser filamentation attracts the interest of the world scientific community since the development of ultrashort pulse high power laser sources. To date, the phenomenon of filamentation of high-power laser radiation in the weak focusing conditions has been widely studied. The process of filamentation in gases has been well known, while the filamentation in a condensed medium is much less investigated. In this thesis the processes of transformation of femtosecond filament laser plasma energy in water at different focusing regimes from weak (NA=0.02) to strong (NA=0.1) were investigated. In the work, spatio-temporal structure of the filament, generated by intense femtosecond IR-pulse, and spectral properties of generated supercontinuum were studied in different focusing regimes. It was demonstrated that using spatially divergent incident femtosecond 1240-nm laser pulses in water leads to an efficient supercontinuum generation. Compared to filamentation processing convergent laser beams, the laser-induced plasma is less dense which leads to a longer filament and thus to more efficient energy transformation into supercontinuum radiation. Also for the first time, the possibility of optoacoustic method utilization to determine the regime of femtosecond visible and near IR filamentation process in water was studied. It was carried out that laser optoacoustic filament registration with broadband (~ 60 MHz) piezoelectric transducers allows to find out the regime of filamentation (single filament, multiple filamentation, superfilamentation), either to determine the size of the plasma channel generated in filamentation process. For the first time in practice, optoacoustic tomography of filaments was realized in water, and using the back projection method, the size of the optoacoustic source was restored.