DIPLOMA THESIS ABSTRACT

Self-action effects and optical harmonics generation under interaction of mid-infrared ultrashort laser pulses with gaseous media and solids

Graduate student: Rozhko Mikhail Viktorovich
Scientific director: Fedotov Andrey Borisovich

In the master's dissertation the experimental results aimed at studying the effects of self-action and the generation of optical harmonics in the interaction of ultrashort laser pulses of the mid-infrared spectral range with gaseous media and solids are presented. Using mid-infrared femtosecond laser pulses with a central wavelength of 3.9 μm and a duration of 80 fs, an anomalous dispersion of atmospheric air in the spectral range 3.7 - 4.15 μm was measured. It is shown that when the femtosecond radiation path was 60 m, the group delay was 1.8 ps between the spectral components of the "wings" of the pulse. The anomalous dispersive properties of air are confirmed by theoretical analysis using the full model of air refractivity including the entire HITRAN-database manifold of infrared transitions. In the region of anomalous dispersion of atmospheric air a regime of soliton self-compression of high-powerful femtosecond pulses at a central wavelength of 3.9 μm and energy of 20 mJ was experimentally demonstrated. Under these conditions the possibility of compression of propagating pulses from a duration of 100 fs to 35 fs is shown. A subrelativistic generation of high-order optical harmonics is obtained for oblique focusing of s-polarized pulses at a central wavelength of 3.9 μm, duration of about 100 fs, and energy of 20 mJ on surface of transparent dielectrics. In this case all the generated optical harmonics (up to the 11th order) have p-polarization properties.