

Abstract of diploma thesis:

Ionization processes in solids in the field of interfering ultrashort light pulses: physical scenarios, supercomputer modeling, laser experiment.

The research is conducted under supervision of Prof. A.M. Zheltikov by undergraduate student P.A. Zhokhov in the laboratory of photonics and nonlinear spectroscopy, general physics and wave processes department, Faculty of Physics, Lomonosov Moscow State University

The present diploma thesis is devoted to investigation of ultrafast ionization processes, taking place in transparent solid dielectrics irradiated by several beams of interfering laser pulses. By means of supercomputer modeling it is shown that maximum intensity, plasma density as well as energy deposition volume can be controlled in wider range than in single-beam case. The introduced two-beam radiation-matter interaction geometry allows realization of new nonlinear-optical regimes for ultrashort pulse conversion, supercontinuum generation, three-dimensional laser micro- and nano- materials processing, micro- and nanosurgery.

Another problem being investigated in present thesis is the supercontinuum generation and scattering in the multiple filamentation regime. It is shown both experimentally and theoretically that the multiple filaments being irradiated by reference laser pulse of small intensity cause coherent scattering of supercontinuum. The discovered phenomenon seems promising for all-solid-state transformation and compression of ultrashort pulses, coherent and quantum control tasks.

Scientific supervisor

Prof. A.M. Zheltikov