Master's thesis abstract

Cross-range nonlinear optics and attosecond physics driven by ultrashort pulses in the mid-infrared

Glek P. B.

Scientific advisor: Zheltikov A. M.

Recently, relativistic optical physics has emerged as one of the most interesting and rapidly developing fields of laser physics. Its main research areas are particle acceleration to energies of the order of several MeV and generation of broadband electromagnetic radiation with wavelengths spanning from the gigahertz range up to the X-ray range. Ultrashort subterawatt mid-infrared (mid-IR) laser pulses are a new promising tool for nonlinear optical physics, plasma physics, and relativistic physics.

In the master's thesis, we identify new regimes of cross-range nonlinear-optical transformations of high-power mid-IR laser pulses. Supercomputer simulations, which agree with the experiments, allowed to reveal the unusual properties of high-order optical harmonics driven by ultrashort pulses on the laser-plasma surface. The physical scenarios leading to the efficient generation of high-energy secondary radiation due to subrelativistic and relativistic optical nonlinearities are analyzed. We studied the possibilities of subterewatt laser sources operating in the mid-IR range to accelerate electrons to energies up to 10 MeV.