Diploma thesis abstract

“Direct electron acceleration and ultrashort EM pulse generation by a tightly focused laser pulse with relativistic intensity”

Vais O.E.

Supervisor
PhD Bochkarev S.G.

Current femtosecond pulse petawatt (PW) technologies have enabled to reach very high concentration of laser energy in a tight focal spot with focal intensity up to 10^{22} W/cm^2. This makes it possible to produce fast electrons after vacuum electron acceleration and bright attosecond X-ray pulses in the nonlinear Thomson scattering of laser pulse by free electron or Compton scattering by colliding beams of particles.

In this paper we investigate features of the electron acceleration and the nonlinear Thomson scattering of tightly focused laser pulse by free electron, which are located close to the laser focus. Viewed mode, when the size of the focal spot D_F is comparable with the wavelength of the scattered radiation λ, is in the range of the paraxial approximation inapplicability. The description of laser fields is carried out using the exact solution of the Helmholtz equation. We analyzed the dependence of the secondary radiation characteristics, such as angular and spectral power distribution of the radiation energy, the optimal direction for observing and the radiation pulse duration on the position of the particle, the initial phase of the laser field, its description method and focus tightness for a fixed laser pulse power.