Infrared and terahertz emission under filamentation of two-color femtosecond laser pulse

Abstract

Numerical simulation of low frequency (infrared and terahertz) radiation generation under the four-wave mixing of week visible seed pulse and powerfull filament field at the wavelength of 800 nm in degenerate (terahertz) and nondegenerate (infrared) regimes has been conducted.

The algorithm based on field model, which hasn't any restrictions on pulse duration, spectrum width or radiation divergence, has been developed to simulate four-wave mixing in argon. This algorithm allows to study ultrashort pulses with duration of few oscillations of electromagnetic field as well as low frequency terahertz radiation.

The possibility of generation of infrared pulses with duration of two electromagnetic field oscillations at the begining of filamentation under the nondegenerative four-wave mixing of the visible seed pulse and powerful femtosecond filament field is shown.

It's been found that spatial intensity profile of terahertz radiation has conical pattern as shown in experiments.

Contribution of photocurrent and nonlinear polarization to terahertz radiation generation is studied at different stages of filamentation. It's been found that high frequency contribution caused by nonlinear molecule response presents at all stages of filamentation, while low frequency contribution of photocurrent nonlinearity becomes significant at the clamping stage, when plasma density is close to its maximum value.

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