Transformation of frequency-angular spectrum of femtosecond laser radiation under filamentation in air.

Volkov M.V.

Transformation of frequency-angular spectrum of a pre-collimated laser radiation at a wavelength of 805nm under filamentation in air at atmospheric pressure is studied. Dependence on energy and focusing conditions is obtained. The influence of a beam quality on the spectrum is treated with special attention. For this purpose a spatial filter is designed, which gives an opportunity to study filamentation formed with a beam profile close to the ideal Gaussian shape. Critical power for filament formation from a beam with good spatial quality $M^2 = 1.16$ is lowered compared to the case of a beam with poor spatial quality $M^2 = 1.7$. Filament formation from a pre-collimated beam allows observation of relatively weak nonlinear effects that accumulate with propagation distance. Formation of spectrally isolated component in the IR part of spectrum is observed as well as four-wave mixing of this components with laser radiation at the main frequency resulting in blue-shifted radiation. Angular dependence on spectral amplitude of blue-shifted components is qualitatively studied. Investigation of the efficency of generation of on-axis anti-stokes radiation depending on focusing conditions makes it possible to estimate the change in dispersion inside the nonlinear filament core. A formation of strong blue-shifted "wing" with spectral amplitude of the same order as the amplitude of fundamental radiation is observed. Frequency-angular structure of this wing is examined. Physical models of wave mixing that may result in such frequency-angular structure are discussed.