

Two Types of Cascaded Parametric Processes during the Process of Formation of Light Filament

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Abstract. One of the basic characteristics of the light filament is the asymmetric white spectrum. In a typical experiment, when single infrared laser pulse (Ti-Sapphire – 800 nm) propagates in gases with power above the critical for self-focusing, asymmetric deformation of the pulse spectrum and energy transfer to the higher frequencies are observed. The spectrum of the high intensity infrared pulse broadens to the visible region. As a result it is observed white light in the pulse center.

The basic theoretical studies explain this effect through plasma generation. The recent observations of white light from single filament in fused silica exclude this opportunity. This is the reason for searching new mechanisms leading to asymmetrical broadening of the pulse spectrum up to the visible region. In the present work we suggest nonlinear model for explanation of this effect, based on two types of parametric processes. The basic one is cascaded harmonic generation with THz frequency delay to the higher frequencies, combined with four-photon parametric mixing. The theoretical results are compared with experimental data.