«The light bullets formation during femtosecond filamentation in transparent dielectrics»

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This paper presents the results of numerical simulation of the light bullets formation and supercontinuum generation processes during filamentation of mid-IR femtosecond pulses in fused silica and fluorides. A similarity parameter of the filamentation process before plasma formation is introduced. This parameter is the ratio between diffraction and dispersion lengths of wave packet. It is found that a threshold power of light bullet formation determines by this similarity parameter and doesn't depend on the radiation wavelength and medium characteristics. Its value decreases monotonously with an increase of similarity parameter's value. It is shown that the anti-Stokes shift of the visible band of light bullet's spectrum depends on the pulse energy when the similarity parameter is small, and does not depend on the energy in the region of its optimum value. It is found that the wavelength of the anti-Stokes wing's cut-off in the light bullet's spectrum decreases with an increase of ionization process multiphoton order. We determine different regimes of filamentation of Gaussian radiation focused by the axicon in the regime of anomalous group velocity dispersion.

The introduction of the similarity parameter for the processes of light bullets formation and supercontinuum generation under conditions of anomalous group velocity dispersion allows us to study the dynamics of light bullets in different condensed media on the basis of a general approach, as well as to scale the results of laboratory and theoretical studies on real systems.