

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

Author: Zaloznaya E.D.

Scientific Supervisor: Dr. Sc. (Phys.-Math.), prof. Kandidov V.P.

During filamentation of femtosecond laser radiation in transparent dielectrics under conditions of anomalous group velocity dispersion (AGVD) can occur an extremely compressed wave packet with duration of several optical oscillations – the light bullet (LB). Its formation is accompanied by the broadening of frequency-angular spectrum – the generation of a supercontinuum (SC).

This paper presents the results of numerical simulation of the light bullets formation and supercontinuum generation process in the course of filamentation of mid-IR femtosecond pulses in fused silica and fluorides. We study the effect of anomalous group velocity dispersion on the light bullets arising and formation of a visible supercontinuum band. A similarity parameter of the filamentation process before plasma formation is introduced. This parameter is the ratio of diffraction length to dispersion one. It specifies the threshold power, the distance before the filament start and the number of light bullets. It is found that the transformation of spatio-temporal intensity distribution and the anti-Stokes shift of the visible band of SC depend on the pulse energy when the similarity parameter is small, and does not depend on the energy in the region of its optimum value.

Introduced similarity parameter allows us to scale the studies of femtosecond filamentation phenomenon on different medium.