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WAVEGUIDE MICROMODIFICATIONS INDUCED BY MULTI-PULSE FILAMENTATION IN LiF CRYSTAL *

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Lithium fluoride (LiF) is a unique material for studying the process of femtosecond laser filamentation due to the formation of stable fluorescent color centers (CCs), such as F_2 and F_3^+ CCs, in irradiated areas [1-3]. Using LiF, it is possible to experimentally study fluorescent tracks of both single-pulse and multi-pulse filamentation. One of the experimentally observed facts is the elongation of the tracks in LiF during multi-pulse filamentation [4,5]. This work is devoted to the study of the nature of this phenomenon and the development of a mathematical model that reproduces the observed modification of LiF.

The developed model takes into account two channels of CCs formation: excitonic and electron-hole channels. The relative contributions of these channels depend on the accumulated CCs density. This model describes modification of the refractive index in colored areas of LiF crystal. Each subsequent laser pulse propagates in a medium modified by all previous pulses.

The model was used to simulate a waveguide structure evolution during multi-pulse filamentation at a wavelength of 3 μm, located in the spectral region of anomalous group velocity dispersion. Results of the simulation qualitatively reproduce the experimentally recorded elongation of the fluorescent tracks of filamentation during femtosecond laser irradiation.

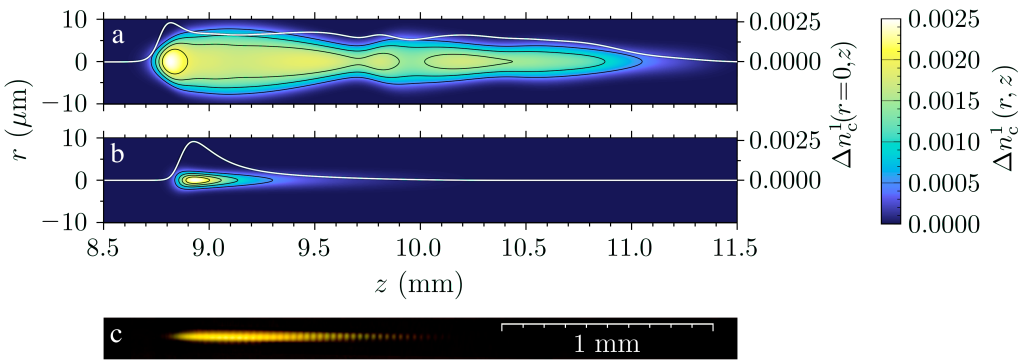

Fig.1. Spatial distribution of CCs density induced in LiF by single laser pulse: result of simulation with electron-hole channel of CC formation (a), simulation with excitonic channel only (b), experimental picture (c).

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