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Abstracts

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This book contains the materials on the fundamental and applied problems of pulsed lasers. It may be interesting for researches and engineers working in the sphere of quantum electronics, spectroscopy, plasma physics, medicine, remote sensing and laser technologies.

Designed by *Kirill O. Osiev, osiev@inbox.ru*

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of the entire life cycle of this individual plasma channels subject to the repeated focusing events of optical radiation that causes the formation of sequential filament generations. The dependence of the number, position, and length of plasma channels in different generations on pulse energy and external focusing is established.

We have found that when the energy of the laser pulse propagating in silica increases, the plasma area spreads in all spatial dimensions and acquires pronounced nonuniformity of the longitudinal distribution of plasma channels number and exhibit clear grouping. The maximal number of plasma channels inside plasma region is produced by the first generation of light filaments; in turn, the number of filament generations is determined by laser pulse energy. The average length of elementary plasma channels in different filament generations varies only slightly but the minimal channels length decreases with an increase of the pulse energy.

F-3

FILAMENTATION OF LINEAR POLARIZED LASER PULSE IN NON-AXISYMMETRIC OPTICAL SCHEMES

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Intense femtosecond laser pulses with peak power above critical one propagate in gases in a nonlinear regime and undergo a beam collapse. This phenomenon, known as filamentation, occurs due to the dynamic balance between self-focusing and laser plasma-induced defocusing of the optical pulse [1, 2]. Studies of self-focusing and filamentation dependence on femtosecond laser pulse polarization were conducted in [3] and demonstrated strong influence of linear and circular pulse polarization on self-focusing and filamentation. They discussed axisymmetric optical scheme, but linear polarization orientation can crucially influence upon nonlinear processes in case of non-axisymmetric optical systems. So we conducted a series of experiments with tree different optical schemes: astigmatic beam propagation obtained via spherical mirror turn, two same linearly polarized beams superposition in plane of polarization or in plane perpendicular to polarization, beam propagation through a slit placed collinearly or normally to pulse linear polarization. Considerable influence of laser pulse linear polarization orientation relatively to preferential direction of non-axisymmetric optical scheme on its filamentation was experimentally demonstrated.

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F-4

NONLINEAR ABSORPTION IN $GaSe_{1-X}S_X$ CRYSTALS IN THE RANGE OF 680–1080 nm

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Down-conversion efficiency of ultrashort pulses of Ti : Sapphire and infrared nanosecond dye lasers in nonlinear GaSe crystal (without and under phase matching conditions) is limited by nonlinear (multiphoton) absorption. GaSe doping with light elements is one of the most efficient ways to reduce multiphoton absorption. Such doping is leading to short-wave shift of the transparency edge caused by bounded electrons and exciton absorption.

In this work two-photon absorption of femtosecond Ti:Sapphire лазера Chameleon Vision II (operation range 680–1080 nm) in heavily doped or solid solution $GaSe_{1-x}S_x$ (x = 0–0.44, 1) crystals, where x is the mixing ratio, is studied in details. It was shown experimentally that S-doping is resulted in multiple decrease of the two-photon absorption down to vanishing. Similar result is obtained from transparency analyses versus mixing ratio & pump wavelength under different pump intensities.

This study was supported by The Tomsk State University Academic D.I. Mendeleev Fund Program (research Grant No. 8.1.51.2015).

F-5

UV PHOTODETECTORS BASED ON WIDE-GAP ALGAN SEMICONDUCTORS

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UV spectral region in which the detectors are not sensitive to the radiation of the sun, but it is possible to detect radiation from man-made causes the greatest practical interest. In the atmosphere in the wavelength range 240–285 nm ozone and oxygen vapour strongly absorb solar radiation and that this range is proposed as solar-blind. Visible-blind range (290–390) nm is also very interesting from a practical point of view.

The report analyzed the technology and characteristics of the solar-blind and visible-blind detectors based on *pin* structures, as well as based on metal-semiconductor contact of AlGaN [1, 2]. The matrix photodetectors based on *pin* photodiodes, as well as results of investigations of avalanche photodiodes based on pin structures of AlGaN were considered. The latest developments in the field of discrete and matrix detectors based on Schottky barrier or metal-semiconductor-metal structure were analyzed. Further tasks in the development of detectors based on AlGaN are the optimization of structures, creating array detectors for different spectral ranges (including multispectral detectors), an increase in size and quality improvement of the photodetector arrays.

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F-6

OPTICAL RECTIFICATION AND DOWN-CONVERSION OF FS PULSES INTO MID-IR AND THZ RANGE IN $GASE_{1-X}S_X$

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Not phase-matched and phase-matched optical rectification (down-conversion) of femtosecond pulses into mid-IR and THz range in $GaSe_{1-x}S_x$, x = 0–0.44, were studied in comparison with that in a commerce rectifier ZnTe. Single crystal $GaSe_{1-x}S_x$ were grown by modified synthesis and vertical Bridgman technology. A 50 fs 300 nJ Ti : Sapphire laser operating at 800 nm was used as a pump source. Second 100 μm ZnTe sample was used as an electrooptical detector. Optical setup was disposed in N_2 gas fulfilled box to exclude water vapor interference.

Minimal wavelength of 8 μm was limited by the pump pulse spectral composition. Phase-matched power down-conversion efficiency was up to 100 times larger than not phase-matched but