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ABSTRACTS

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ELECTRON HOLE LIQUID IN DIAMONDS FORMED BY NANOSECOND LASER PULSES

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Electron-hole liquid (EHL) is a condensed state of non-equilibrium charge carriers, which can exist in some semiconductor materials at low temperature and high carrier density.

Phenomenon of EHL is a promising thing for development of diamond based electronic devices, such as opto-electronical switches. Earlier in our paper [1] we showed that the presence of EHL strongly increases the photoconductivity of diamond sample.

In the current paper we present the latest results of EHL research, carried out by our group for diamond samples. It was shown that the behavior of different charge carriers states (EHL, free excitons, electron-hole plasma) can differ in different samples, used in reserch.

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1. *Lipatov E.I., Genin D.E. and Tarasenko V.F.* Pulsed photoconductivity in diamond upon quasi-continuous laser excitation at 222 nm at the formation of an electron–hole liquid // JETP Lett. 2016. **103**. P. 663–668.

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CARBON ELECTRONICS AND PHOTONICS

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Diamond surpasses all known semiconductors in basic parameters, second only to gallium arsenide and graphene (a quasimetallic form of carbon) in electron mobility. For a long time, the widespread use of diamond in electronics was limited by the high cost and poor quality of both natural and synthetic raw materials. Currently, the technology of synthesis and doping of diamond has reached the necessary level for the breakthrough of diamond into electronics and photonics [1, 2]. In the first place, diamond based electronic devices will ensure long term and efficient operation in high temperature conditions and high levels of ionizing radiation, in the subterahertz frequency range [3].

The future belongs to photonic integrated devices, including based on diamond [4, 5]. Photonic integrated circuits will be combined devices of quantum electronics, photonics and spintronics. Quantum computers based on photoactive centers in diamond are potentially capable of operating at room and elevated temperatures [6]. Photoactive point centers in diamond are promising candidates for single photon sources for the quantum key distribution system [7], as well as elements of the active medium of integrated laser sources [8].

The report provides an overview of the current state of the development of carbon electronics and photonics in the world, as well as the results of research in this area carried out at the Institute of High Current Electronics SB RAS and Tomsk State University.