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ABSTRACTS

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Due to their unique characteristics, organic film lasers find applications in sensorics, optics, optogenetics, and spectroscopy.

B-13

LASER SPECTROSCOPY OF LIGHT POLARIZATION FLUCTUATIONS

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The physical basis of a new experimental method for studying the spin dynamics of paramagnetic ensembles was laid by the work of E.B. Aleksandrov and V.S. Zapassky in 1981 [1]. The basis of the technique of laser *spectroscopy of polarization fluctuations* (SPF), also known as *spin noise spectroscopy* (SNS), is the registration of RF spectra (usually in the range up to 1 GHz) of Faraday rotation or ellipticity noise of light probing a system. In this case, information on the spectral composition of radiation in the optical frequency range is not retained; however, modulations at the recording frequencies make it possible to observe extremely small splittings of optical lines. This technique can not only be used to study EPR in low and zero magnetic fields, but also provide a number of other fundamental knowledge on the spin subsystem of the medium under study.

The key element of a modern SPF setup is a laser radiation source thanks to its extremely high spectral brightness, monochromaticity, and the possibility of smooth tuning. The report discusses the fundamentals of laser polarimetry and the features of application in technology of cw and mode-locked titanium-sapphire lasers, diode with an external and built-in resonator, as well as the use of different types of optical modulation to increase the sensitivity and information deepness of the response. The main experimental results of the SPbGU spin noise spectroscopy group over the past decade are presented.

1. *Alexandrov E.B. and Zapasskii V.S.* Magnetic resonance in the noise spectrum of Faraday rotation // JETP. 1981. V. 81, No. 7. P. 132–138.

B-14

PHOTODEGRADATION OF AQUEOUS SOLUTIONS OF PHENOXYACETIC ACIDS UNDER EXCILAMPS RADIATION

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Every year thousands of organic substances are synthesized for subsequent use as insecticides, herbicides, detergents, etc. They remain in the environment for a long time, and when they get into the atmosphere or into water sources they can lead to serious ecological consequences. The application of herbicides plays an important role in a productivity increase in agriculture. It should be noted that production, application, and assortment of pesticides, including herbicides, increases in the world every year. A study of transformations of stable toxic compounds in nature and a choice of optimal methods of herbicide utilization are important problems of environmental protection and rational use of natural resources. UV radiation can be used not only for disinfection of water and air, that is, for removal of pathogenic microorganisms, but also for decomposition of complex organic compounds. For study of photodegradation, an excilamp on working molecules KrCl with λ_{rad} = 222 nm, developed at the Institute of High Current Electronics of the SB RAS, was used as source of UV radiation. The results of direct photolysis of phenoxyacetic acids herbicides in aqueous solutions are discussed. The phototransformation occurs more slowly when the herbicides concentration increases. The use of the flow through reactor is more effective than operation in the stationary conditions. The prospect of using a wide range of excilamps with different characteristics for solving environmental problems is highlighted.

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B-15

INFLUENCE OF THE INTENSITY OF EXCITING RADIATION ON THE UP-CONVERSION LUMINESCENCE OF $NaYF_4$:Yb/Tm NANOLUMINOPHORES

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The modern biology and medicine methods actively research luminescent nanolabels. The main problem of using luminescent agents in biological media is separation of useful signal of markers from the background caused by autoluminescence of biological environment. This problem can be eliminated by using lanthanide based luminophores revealing intense up-conversion luminescence under NIR excitation.

In the given work different suspensions of newly synthesized nanophosphors based on $NaYF_4$:Yb:Tm in dimethyl sulfoxide were studied. The mechanism of up-conversion luminescence is implemented by transferring the energy of exciting radiation from ytterbium ("sensitizer") to thulium ("activator"). Two series of samples were prepared: for the first one the concentration of the sensitizer was varied while the concentration of the activator kept constant. In the other one the concentration of activator was changed at constant concentration of sensitizer. The dependences of the intensity of the most intense luminescence bands of thulium on the intensity of exciting radiation (980 nm) were revealed.

The obtained results allow one to clarify the models of mechanisms of up-conversion luminescence of complexes $NaYF_4$:Yb:Tm and determine the optimal ratio of the sensitizer and activator concentrations.

B-16

PLASMONIC JETS AND HOOKS: TOWARDS MANIPULATION OF LIGHT AT THE NANOSCALE

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We report on our recent approaches focused on the formation of a new class of subwavelength scale self bending light beams, discovered in 2015, in application to in-plane surface plasmon. For the particle with broken symmetry (Janus particle) the morphology of the field localization area depends on the orientation of the particle that resembles the two faces of "Janus bifrons". Photonic hook (PH) light [1] do not propagate along straight line but instead follow curved trajectory. Wavefront analysis of such asymmetric mesoscale structure reveals that the unequal phase of the transmitted plane wave results in the irregularly concave deformation of the wavefront inside the structure that then leads to creation of the PH. Such dielectric structures enabling the realization of ultracompact wavelength-scaled and wavelength selective new in-plane nanophotonic components.

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1. *Minin O.V. and Minin I.V.* The Photonic Hook: From Optics to Acoustics and Plasmonics. Springer, Cham, 2021. DOI: 10.1007/978-3-030-66945-4.