

## ANNOTATION

**of a series of publications “Spectroscopy of spin noise”  
of Doctor of Sciences in physics and mathematics, leading researcher  
Valerii Sergeevich Zapasskii**

Spin noise spectroscopy is a new field of the magnetic resonance spectroscopy whose basis has been laid by E.B.Aleksandrov and E.B.Zapasskii in the paper published in Journal of Experimental and Theoretical Physics in 1981. In that paper, there has been proposed and realized experimentally (on atomic sodium) the idea of observation of magnetic resonance in the magnetization noise of the paramagnet. Initially this effect was considered to be of only academic value for the physics of nonperturbative (including quantum-nonperturbative) measurements. The situation has dramatically changed after demonstrating applicability of the spin noise technique to semiconductor systems in the form of Fourier spectroscopy in real time. After that, the spin noise spectroscopy has shown an explosive growth of its popularity and has revealed a number of new possibilities and unique properties. A considerable contribution to the development of this new field of research has been brought by the works of V.S.Zapasskii and his group. At present, the work on spin noise spectroscopy is carried out in many countries (Germany, France, USA, Japan) with commonly recognized priority of Russian science.

At present, Zapasskii's group is the only team in Russia that carry out experimental research in the spin noise spectroscopy. The unique experimental setup created in the group realizes the limiting sensitivity under conditions of high-precision tuning of the laser beam wavelength at sub-liquid-helium temperatures of the sample and, in terms of its performance, corresponds to the highest world standards.

During the last several years, there has been obtained a number of important original results that had an essential impact upon progress of the spin noise spectroscopy. In particular, there have been demonstrated fairly unexpected possibilities of the spin noise spectroscopy as a method of optical spectroscopy, capable of penetrating inside complex (e.g., inhomogeneously broadened) optical spectra. In the published papers, unique possibilities of the spin noise spectroscopy, usually inaccessible for linear optics, have been discovered and justified. There have been first obtained and studied spectra of spin noise of a single quantum well in a microcavity. There have been discovered and interpreted the giant spin noise observed in the

laser beam reflected from a high-Q microcavity with a semiconductor structure. There has been proposed and implemented the geometry of high polarization extinction that makes it possible to substantially increase polarimetric sensitivity of the spin noise spectrum. There has been proposed a new method of the “active” spin noise spectroscopy that substantially extended possibilities of the method.

The results obtained during the last several years have been published in high-rank journals (Physical Review, Physical Review Letters, etc.). In 2013, V.S.Zapasskii has published the review “Spin noise spectroscopy: from proof of principle to applications” in the journal “Advances in Optics and Photonics”. In 2009, V.S.Zapasskii, in coauthorship with E.B.Aleksandrov, has published a monograph “About Photons and Spins”, into which the description of the first experiment of the authors in spin noise spectroscopy has been included. In 2013, V.S.Zapasskii has been awarded with a medal of S.I.Vavilov of Rozhdestvensky Optical Society for the experimental achievements in the field of polarization magneto-optics and laser magnetic spectroscopy. In 1915, Scientific Council of Physics department has awarded V.S.Zapasskii with the first prize of the department for yje best scientific work. In 2016, V.S.Zapasskii was awarded with the D.S.Rozhdestvensky Prize of Russian Academy of Sciences for outstanding works in the field of optics “Laser spectroscopy of spin noise”.

Deputy head of the Chair of Photonics

Yu.V.Chizhov

Deputy head of the Spin Optics Laboratory

I.V.Ignat'ev