## Main field of study: 011200 Physics

Area of specialization: Physical Optics and Lasers

Department of Optics

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**The study of possibility of the sensitivity increase of the spectral methods for substance detection using multifrequency radiation filtration**

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The thesis considers the idea of ​​optimization the registration of vanishingly small concentrations of substances by spectroanalytical methods. The increase of sensitivity is achieved for the spectra of rather complex form. The spectrum of element under analysis taken as a whole is considered for the signal that carries the information on the element concentration or even its presence in the matter. The noise reduction occurs due to the radiation summation of all spectral components of the element with a single receiver. It is shown that detecting the radiation of a plurality of lines of one element may be treated as the multiplexing used in the devices in optical communications. Variants of possible scheme based on both the conventional transmission diffraction gratings and those based on volume hologram gratings are considered. Calculation of the complex filter parameters for the registration of traces of methane proves the consistency of the theoretical model.

# The list of the publications:

1. Пермякова Е. С., Толмачев Ю. А., Немец В. М., Щеулин А.С. (ГОИ) «О возможности оптимизации метода обнаружения элемента по эмиссионным спектрам», Российская молодежная конференция по физике и астрономии «Физика.СПб», Санкт-Петербург, 23-24 октября 2013.
2. Пермякова Е. С. Толмачев Ю. А. «Спектр вещества как носитель информации о следах вещества», 24 международная конференция «Лазеры. Измерения. Информация», Санкт-Петербург, 2014.
3. [E. S. Permyakova](http://link.springer.com/search?facet-creator=%22E.+S.+Permyakova%22), [Yu. A. Tolmachev](http://link.springer.com/search?facet-creator=%22Yu.+A.+Tolmachev%22) «The spectrum of substance for the carrier of information on the substance traces», Optical Memory and Neural Networks, Vol. 24, No.1, pp 48-53, January 2015
4. E. S. Permyakova, T. V. Statsenko, Yu. A. Tolmachev «Frenel lens for the generator of encoded sequences of ultrashort pulses. The spectral evidence of series of pulses formation», Optical Memory and Neural Networks (Information Optics), Vol. 21, No. 2, pp. 63-69, 2012