Review on the report and proposal for the extension of the theme "Modern Trends and Developments in Raman Microspectroscopy and Photoluminescence for Condensed Matter Studies" and opening of the new project "Biophotonics".

The JINR Laboratory of Neutron Physics is successfully developing work in the field of vibrational - Raman microspectroscopy in combination with photoluminescent research in the framework of scientific theme # 04-4-1133-2018/2020. The scientific results obtained over the past three years can be divided into several sections, although all of them, of course, are interrelated.

1. In full accordance with the title of the theme, the leaders and performers of the themeundertook the study of one of the modern and at the same time quite complex approach for enhancing the informative, but weak in intensity, Raman signal – combined Surface Enhanced Raman Scattering (SERS) with coherent anti-Stokes Raman Scattering (CARS). It is important to note that the results obtained are published in the most specialized scientific journal for this area, "Journal of Raman Spectroscopy", are pioneering works in this direction in Russia and, of course, deserve high mark.**We also note that the number of publications in the world literature in the above-mentioned area are countedin units.**

2. No less impressive are the works published in the framework of the theme, of achieving an ultra-sensitive limit for detecting the Raman signal from the molecules of the studied bioorganic samples at the attomolar level using the SERS method. To achieve such results, silver dendrite nanostructures were proposed as SERS-active substrates. The obtained results are very important **in modern biosensorics based on Raman spectroscopy**, which the team of authors of this themeaims to focus on in the next three years in the proposed project "Biophotonics".

3. The third section of the topic completed to date relates to the synthesis and study of the luminescent characteristics of nanoparticles of the "core-shell" type.It is known that such structures are multifunctional and can be successfully applied in many applied aspects. The synthesized core-shell nanoparticles, in which phosphors based on $NaYF_4$ nanocrystals are used as a core, activated by various rare-earth elements, and the shell is silicon dioxide, showed good spectral performance. They weretestedin a biomedical test aimed at photodynamic therapy (PDT), and the result can be assessed as quite encouraging at this stage of research.

Summing up the scientific significance of the work performed to date, we note that the undoubted merit of the qualified team performing work on this themeis their constant desire to conduct research in line with world trends in the development of Raman spectroscopy and microscopy. In the same vein, we see the research concept of the new project proposed by the authors within the framework of the ongoing theme. It implies two major blocks – (i) fundamental research on the little-studied problemof the physical nature of the abnormalpeak intensity antiStokes/Stokes ratio often observed in SERS spectra, and, (ii) two applied biomedical tasksusing Raman scattering and upconversion luminescence. This is NETOSis, and, above all, the search for its possible spectral markers, as well as protein-lipid interactions based on lipodiscs. The proposal of the theme leaders (Grigory Arzumanyan and Norbert Kucherka) on its extension and opening of the new "Biophotonics" project is, in our opinion, a harmonious and natural continuation of this research area.The program, from a scientific point of view, looks very ambitious and requires adequate funding.

Summarizing, I note that the project "Biophotonics", proposed in the frame of the extension of the theme, is very relevant, scientifically significant and deserves every support for its implementation in the FLNP JINR in the next three years.

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