by collecting light signals from two different sides of the sample. This way allows to raise the reliability of nanoparticle detection with the assumption that the origin of the experimental errors in two methods is different.
In contrast to conventional light sheet microscopes, which are based on the fluorescence detection, our device is based on elastic scattering detection. It allows to increase markedly the sensitivity of nanoparticles detection. We will present the schemes of the developed microscopes and demonstrate theirs possibilities on example of nanoparticles of different origins (polystyrene nanoparticles, gold nanoparticles, exosomes, liposomes etc). We will present also the scheme of the developed by us special microscope for ultrahigh sensitive detection of individual optical spectra of single nanoparticles. The examples of measured spectra will be presented.

10:00-10:30 **Th16A(A)-3** (invited)

FRET in Single Donor-Acceptor Pair Attached to a Macromolecule Can Serve As a Tool for Studying Conformational Dynamics of the Macromolecule

Igor Osad'ko

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Proteins, DNA-molecules and other macromolecules, being in natural media, are able to change their shape (conformation) in time scale of minutes or milliseconds. Investigation of such conformational dynamics of macromolecules is important task. Luminescence of donor-acceptor (D-A) pairs attached to these macromolecules can be effective tool for investigation of conformational dynamics of the macromolecule. The most important feature of D-A pair is energy transfer of electronic energy of the donor molecule to the acceptor molecule. Efficiency of energy transfer is described by simple equation $E(R_{DA}) = I_A(R_{DA})/[I_A(R_{DA}) + I_D(R_{DA})]$ where I_D and I_A are intensities of D- and A-molecules. Since energy transfer depends on the distance R_{DA} between D- and A-molecule we can find information concerning R_{DA} by measuring efficiency $E(R_{DA})$.
Luminescence of D- and A- molecules separated by few nanometers and excited via absorption band of D-molecule is described by the Förster theory proposed more than seventy years ago for mixture of D- and A-molecules. However, application of the Förster theory (Förster Resonance Energy Transfer or FRET) for single D-A pair creates a number of new questions. These questions could not emerge when we deal with mixture of D- and A-molecules. In particular role of triplet states existing in D- and A-molecules can be reconsidered if we deal with single D-A pair. New aspects that emerge in FRET of single D-A pair are discussed in this talk. RFBR grant #17-02-00652 is acknowledged

10:30-11:00 **Th16A(A)-4** (invited)

Entanglement of a Nanowire System Interacting with Laser Field

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We discuss the entanglement in a ballistic quantum wire with Rashba spin-orbit interaction in the presence of both strong and weak magnetic fields and for different initial states of the system. Our results show that there is a strong relationship between the spin-orbit interaction and the entanglement sudden death and sudden birth. This allows new knobs to control the strength and the component of entanglement in the nanowire system.

[1] R. I. Mohamed, Ahmed Farouk, A. H. Homid, O. H. El-Kalaawy, Abdel-Haleem Abdel-Aty, M. Abdel-Aty and S. Ghose, Scientific Reports (2018) 8:10484 | DOI:10.1038/s41598-018-28607-3

11:00-11:10 **Th16A(A)-5** (sponsor)

Confocal Raman microspectrometers from SOL instruments for quantum dot analysis

Sergei Shashkov

SOL instruments, Minsk, Belarus

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A sponsored talk.

Fundamentals of quantum measurements – Hall B

09:00-11:10 Chairman: L. Mista

09:00-09:30 **Th16A(B)-1** (invited)

Fundamental limitations for measurements in quantum many-body systems

Thomas Barthel[1], Jianfeng Lu[2]

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Dynamical measurement schemes are an important tool for the investigation of quantum many-body systems, especially in the age of quantum simulation. Here, we address the question whether generic measurements can be implemented efficiently if we have access to a certain set of experimentally realizable measurements and can extend it through time evolution. For the latter, two scenarios are considered (a) evolution according to unitary circuits and (b) evolution due to Hamiltonians that we can control in a time-dependent fashion. We find that the time needed to realize a certain measurement to a predefined accuracy scales in general exponentially with the system size – posing a fundamental limitation. The argument is based on the construction of ε-packings for manifolds of observables with identical spectra and a comparison of their cardinalities to those of ε-coverings for quantum circuits and unitary time-evolution operators. The former is related to the study of Grassmann manifolds. The results show that it is a question of clever design to allow for the measurement of observables of interest through efficient dynamical schemes and a suitable encoding of models in quantum simulation protocols.

[1] T. Barthel and J. Lu, Phys. Rev. Lett. 121, 080406 (2018)