The first experiments have already demonstrated the successful quantum key distribution from satellite to ground [1]. Today, the usage of small Cubesat modules is considered for laser communications and QKD [2,3]. Rapid growth in the number of small-size satellite for remote sensing and communications, thanks to the availability of low-cost satellites, provides impetus for high capacity laser communication in space. Quantum communication can enhance the overall performance of secure communication. Our concept of using the cubesat for quantum communication involves developing and creating a system of satellite-based laser communication for high-speed information transfer via optical channel protected with the quantum cryptography protocols. The laser modules for the transmitter and the receiver should have a capability of mounting onto ground, aerial and space mobile platforms. The receiver and the transmitter will be equipped with the necessary gear for organizing a complete optical communication channel for both classical high-speed communication and quantum key distribution. The final goal of the project is creating the laser channel between the satellite and the ground station with the transmitting terminal mounted as a payload onto a 6U Cubesat microsatellite and the receiver within the Earth's atmosphere. The communication channel organized in the following way should meet the following requirements:

- Ground-satellite communication distance 450-1200 km with at least 10 km within the atmosphere
- Laser pulse repetition rate 10-300 MHz
- Quantum key rate at least 1 kbit/s
- Quantum cryptography protocol: decoy state, BB84
- Maximum transmitter dimensions 100 mm x 100 mm x 300 mm
- Power consumption no more than 5-10 W; maximum power consumption during 10 min 15-25 W in one rotation
- Supply voltage 5 V
- Communication with controlling electronics via UART, SPI, I2C

[1] Sheng-Kai Liao, Wen-Qi Cai, Wei-Yue Liu et al, Nature 549, 43 (2017).

[2] S. Neumann, S. Joshi, M. Fink et al EPJ Quantum Technology 5, 4 (2018).

[3] E. Kerstel, A. Gardelein, M. Barthelemy et al, EPJ Quantum Technology 5, 6 (2018).

Tu14P-15 (poster)

Calculation of Fluorescence Excitation Spectra to Help Nanoscopy of a Dipole-dipole Coupled Pairs of Light Emitters

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This work is aimed at theoretical investigation of the spatial structure and spectra of light emitted by a single pair of emitters with dipole-dipole interaction for arbitrary geometries of excitation-detection configurations. It is realized to support the experiments with controlled positioning of pairs of quantum light emitters separated by distances smaller than the excitation/emission wavelength driven by a tunable cw laser. We investigate how the arrangement of the incident light against the spatial configuration of the pair can help reveal the strength of dipole-dipole interaction and the distance between the emitters for particular solid angles from which the fluorescence signal is collected for registration. We use the manyparticle quantum-kinetic formalism describing the interaction of optical radiation with an arbitrary number of particles based on the Bogolyubov-Born-Green-Kirkwood-Yvon (BBGKY) hierarchy of equations for reduced density matrices and correlation operators for quantized field and material subsystems. This method includes all possible collective interactions as internal components of the hierarchy. These interactions are expressed through the mean-field potentials and manyparticle correlation operators. We have obtained the two-particle density matrix operator for a coupled emitting pair and calculated the total fluorescence intensity of such a system as a function of laser frequency with respect to the observation and excitation angles. The model and calculation algorithm we developed are adjustable to the real experimental conditions [1]. The criteria for restoring the distance between the emitters and their spatial orientation in the sample from the shape of the measured spectral curve have been formulated. This method was developed to accompany measurements of the distances by means of statistical processing of blinking fluorescence and scanning electron spectroscopy. This study was supported by the Russian Science Foundation (project no. 17-72-20266).

[1] I.Y. Eremchev, N.A. Lozing, A.A. Baev, et al. Jetp Lett. 108(1), 30 (2018)

Tu14P-16 (poster)

Low-temperature study of PLE spectra of GeV centers in CVD diamonds

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In this paper we report the results of low temperature studies of photoluminescence excitation (PLE) spectra of Zero Phonon Line (ZPL) for small ensembles of GeV centers (down to single centers level) in CVD diamond. The diamond film was grown by Chemical Vapor Deposition method in a microwave plasma CVD reactor ARDIS-100 (2,45GHz) [1]. Synthesis conditions were as follows: reaction gas mixture H2/CH4/GeH4 in the ratio of 93,4/6/0,6 % respectively, total