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Skolkovo Institute of Science and Technology

Energy Colloquium

Nonlinear Polariton Phenomena in Semiconductor Photonic Structures

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20 December 2016, 16:00

Skolkovo Innovation Center

Technopark, Building 3, Room 402

ABSTRACT:

When light propagates through an optically active semiconductor material hybridization of the optical and electronic excitations (photons and excitons) may occur. Such strong exciton-photon coupling leads to the formation of novel quasi-particles, so-called polaritons. Two photons colliding in free space do not interact: light beams just pass through each other with no effect on their propagation paths. By contrast the exciton component in the polariton wave function leads to giant repulsive interactions between the two colliding quasi-particles, which enable control of light by light at ultrafast speeds. This is potentially useful for applications in all-optical signal processing. The strong polariton nonlinearity also results in many-body phenomena ranging from superfluid-like behavior of light, Bose-Einstein condensation to soliton physics and to the study of inter-particle interactions in photonic analogs of important physical systems such as photonic topological insulators or optical analogs of quantum Hall systems. In my talk I will present polariton platforms based on the variety of optically active materials such as GaAs and atom thin van der Waals heterostructures of transition metal dichalcogenides ($MoSe_2$, MoS_2). The novel physics of a family of ultra-low-power polariton solitons, quasi-continuum generation and Cerenkov-like scattering will be reviewed.

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Colloquium schedule and information on how to get to the colloquium can be found at *http://www.skoltech.ru/en/energy-colloquium/*