

Title: Polariton solitons in semiconductor microcavities and waveguides in the strong coupling regime.

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Abstract:

Recently hybrid light-matter particles (polaritons) formed due to strong exciton-photon coupling in semiconductor microcavities attracted much attention. Importantly polariton-polariton interaction enables giant optical nonlinearity which is 3-4 orders of magnitude stronger than that in the other weakly coupled systems. This feature makes polariton system very attractive for potential applications in all-optical signal processing. Strong interparticle interactions have already resulted in the observations of polariton condensation, polariton superfluid-like behavior and vortices. Very recently conservative polariton dark solitons and bright solitons in patterned microcavity wires were reported, which are simply described by nonlinear Schrodinger equation without inclusion losses and gain. In my lecture I focus on a different type of polariton solitons, which exist in a dissipative environment where losses are fully compensated by gain from external pump, which is important for scalability. I will also describe the stability of such linearly and circularly polarised solitons given by the strong spin anisotropy of polariton-polariton interactions. The second part of my talk will be devoted to the new types of polaritons formed in semiconductor waveguides, where light is confined by the total internal reflection at interfaces. Waveguide polaritons propagate at a speed of 50 $\mu\text{m}/\text{ps}$ about an order of magnitude faster than their counterparts in microcavities. I will present new experimental results on observation of dark spatial and bright temporal waveguide polariton solitons enabled by peculiar waveguide polariton dispersion and strong repulsive interactions. The richness of polariton soliton phenomena creates a platform for the development of future polaritonic devices performing optical digital processing.