Seminarankündigung

Dienstag, 31. Januar 2017
16:15 Uhr

ZNN, Seminarraum EG 0.001

"Single solid-state quantum emitters for plasmonics"

Plasmonics offers the opportunity of tailoring the interaction of light with single quantum emitters. However, the strong field localization of plasmons requires spatial fabrication accuracy far beyond what is required for other nanophotonic technologies. We demonstrate a solution to this critical problem by controlled positioning of plasmonic nanoantennas with an accuracy of 11 nm next to single self-assembled GaAs semiconductor quantum dots. These dots do not suffer from blinking or bleaching or from random orientation of the transition dipole moment as colloidal nanocrystals do. Our method introduces flexible fabrication of arbitrary nanostructures coupled to single-photon sources in a controllable and scalable fashion.

We also demonstrate efficient coupling of excitons in near-surface GaAs quantum dots (QDs) to surface-plasmon polaritons. We observe distinct changes in the photoluminescence of the emitters as the distance between the QDs and the gold interface decreases. Based on an electric point-dipole model, we identify the surface plasmon launching rates for different QD-surface distances. While in conventional far-field experiments only a few percent of the emitted photons can be collected due to the high refractive index semiconductor substrate, already for distances around 30 nm the plasmon launching-rate becomes comparable to the emission rate into bulk photon modes, thus much larger than the photon collection rate. For even smaller distances, the degrading optical properties of the emitter counterweight the increasing coupling efficiency to plasmonic modes.

Finally, we will present a hybrid approach combining a dielectric and a plasmonic waveguide to optimize coupling of a quantum dot to a propagating plasmonic mode.

Prof. Markus Lippitz
Universität Bayreuth
Germany