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Semiconductor-nanoplasmonic hybrid systems

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Date and Time: **Tuesday, May 10, 2016, 17:00**

Location: **Karl-Franzens-Universität Graz**
Institute of Physics, Universitätsplatz 5,
Lecture Room 05.01, ground level

16:30 - Meet-the-speaker-tea
Library Experimental Physics, Institute of Physics,
Room 122, 1st floor

Host: U. Hohenester

Abstract

Plasmonic nanostructures have gained much interest in recent years due to their capability of nano-focusing and guiding light in sub-wavelength dimensions, accompanied by pronounced electric field enhancements up to ~ 10^3 x, which are beneficial for enhancing non-linear optical effects as well spontaneous emission of close-by quantum emitters [1].

In this talk, I will introduce our work on studying the interaction between lithographically defined plasmonic bowtie nanoantennas or slot-waveguides with proximal low-dimensional semiconductor quantum materials. In the first part of my talk, I will report on the linear and non-linear optical properties of bowtie nanoantennas fabricated on semiconducting GaAs substrates [2] and show first results of Purcell-enhanced spontaneous emission rates from monolithically integrated, near-surface InAs/AlGaAs quantum dots [3].

In the second part of the talk, I will present studies on atomically-thin layered semiconductors, such as MoS_2 and $MoSe_2$ and their integration into functional devices. I will show that the second-order non-linear response from MoS_2 bilayers can be switched on and off by applying vertical dc-electric fields in SiO_2/Al_2O_3-capacitor structure [4,5]. Furthermore, we test the capabilities of coupling the spontaneous emission of monolayer $MoSe_2$ to the guided modes of nanoplasmonic slot-waveguides. We observe first evidence for waveguiding, paving the way towards a true nanoscale 2D crystal light source [6].

In general, the aim of our group is to combine low-dimensional semiconductor quantum emitters with deterministically fabricated nanoscale optical hardware for on-chip integrated nanophotonic applications.

[1] J. Schuller et al. Nature Materials 9, 193 (2010)
[2] M. Kaniber et al. Scientific Reports 6, 23203 (2016)
K. Schraml et al. Phys. Rev. B 90, 035435 (2014)
[3] A. A. Lyamkina et al. arXiv:1603.07093 (2016)
[4] J. Klein et al. Nano Letters 16, 1554 (2016)
[5] J. Klein et al. in preparation (2016)
[6] M. Blauth et al. in preparation (2016)

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