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Bridging nanophotonics and plasmonics: Exploring Light-Matter interaction in hybrid plasmonic metal/semiconductor nanowires

Nanophotonics aims to diminish the size mismatch between electronics and photonics to enable optical on-chip applications including coherent light generation and optical data transfer on a nanometer scale. Promising photonic materials towards this goal are semiconductor nanowires and nanowire arrays which have led to nanophotonic device demonstrations including waveguides, light emitting diodes and lasers. However, the diameter of nanowire waveguides and laser cavities is fundamentally constrained by the diffraction limit of the guided photonic modes. Hybrid metal/semiconductor nanowires possess plasmonic modes which are concentrated in the vicinity of the metal/semiconductor interface allowing for a miniaturization below the optical diffraction limit. Hybrid plasmonic semiconductor nanowire structures are therefore promising building blocks for nanophotonic devices with deep sub-wavelength footprint. To improve the performance of hybrid plasmonic nanowire waveguides and lasers and to develop optimal design schemes for such hybrid nanostructures it is important to understand the light-matter interaction in these composite materials. In my talk I will report on recent advances in photonic and hybrid plasmonic nanowire research and address fundamental physics and technological aspects which are essential for the anticipated integration of hybrid plasmonic nanowires into next generation optoelectronic systems.

Biography

Hans-Peter Wagner is Associate Professor at the Physics Department at the University of Cincinnati. He received his PhD at the University of Regensburg/Germany in 1991. He has his expertise in fabricating hybrid plasmonic metal/organic semiconductor heterostructures and hybrid plasmonic nanowires using organic molecular beam deposition (OMBD). His main fields of interest are the linear and nonlinear optical properties of inorganic and organic semiconductor nanostructures and of hybrid plasmonic structures. His studies include experiments and theoretical modelling of the relaxation dynamics of coherent and incoherent excitons in semiconductor nanostructures, of photonic and plasmonic lasing as well as of second of harmonic generation and two-photon absorption. He has contributed to more than 140 reviewed journals and international conference papers.

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