SYSM 2: Single Molecule Spectroscopy of Nanoobjects II

Zeit: Donnerstag 14:00–16:00 Raum: VMP 8 HS

Hauptvortrag SYSM 2.1 Do 14:00 VMP 8 HS

Single Emitters Coupled to Optical Nano-Antennas — Tim H. Taminiau[1], Fernando D. Stefani[1], Alberto Gonzalez-Curto[1], and •Niek F. van Hulst[1,2] — [1]ICFO - the Institute of Photonic Sciences, Mediterranean Technology Park, 08860 Castelldefels (Barcelona), Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Spain

We show how both excitation and emission of individual molecules is controlled by coupling to resonant optical nano-antennas. In these studies the single molecule approach is particularly effective as both position and orientation of the single absorber/emitter are well-defined. As a single absorber the molecule probes the local antenna field and here we show optical fields spatially localized within 25 nm at 514 nm wavelength for an 80 nm long Al resonant monopole antenna. Next the enhancement of the radiative and excitation rates is treated, particularly how the angular emission of the coupled system is highly directed. Clearly the dominant antenna mode determines the angular emission and arbitrary control over the main direction of emission is obtained, regardless of the orientation of the emitter. Finally a nano-Yagi-Uda antenna is discussed affording enhanced rates, strong unidirectional emission and, in reciprocity, efficient nano-focusing. The directivity is even more increased by the presence of a dielectric substrate, making such antennas a promising candidate for compact easy-to-address planar sensors at the single molecule level.

Hauptvortrag SYSM 2.2 Do 14:40 VMP 8 HS

Tracking of transport dynamics in living cells — •Ralf Bausinger[2], Christian Jüngst[1], and Andreas Zumbusch[1] — [1]Department Chemie, Universität Konstanz — [2]Department Physik, Universität Konstanz

During the last decade, ultrasensitive microscopy has become one of the most important tools in biophysics. In this talk, two different microscopy techniques and their biophysical application will be presented. With fluorescence excitation, sensitivities down to the single molecule detection limit can be achieved. As an example of single molecule sensitive microscopy in live cells, single particle tracking of individual nanocarriers will be shown. Polyethyleneimine (PEI) based gene carriers are among the most efficient synthetic vectors for the delivery of DNA into the cell nucleus. We use highly sensitive fluorescence microscopy and single particle tracking methods for the investigation of the particles' paths from the plasma membrane to the nucleus. Active actin polymerization around the particle supports its cell entry and Rab protein accumulation initiates the fast vesicular transport on microtubules. It will be shown how trajectories of this bidirectional transport process are segmented by a numerical algorithm separating different modes of motion. Diffusion analysis of these segments then allows to retrieve the distribution of the intracellular transport velocities. In the final part of the talk we will present new data on the modulation of the intracellular transport behaviour of single particles depending on their enzymatic functionalization.

Hauptvortrag SYSM 2.3 Do 15:20 VMP 8 HS

Photoswitching microscopy with subdiffraction optical resolution — •Markus Sauer, Mike Heilemann, and Sebastian van de Linde — Applied Laser Physics and Laser Spectroscopy, Bielefeld University, Universitaetsstr. 25, 33615 Bielefeld, Germany

We introduce a general approach for multicolor subdiffraction-resolution fluorescence imaging based on photoswitching of standard organic fluorophores. Photoswitching of ordinary fluorophores such as ATTO520, ATTO565, ATTO655, ATTO680, or ATTO700, i.e. the reversible transition from a fluorescent to a nonfluorescent state in aqueous buffers exploits the formation of long-lived triplet radical anions through reaction with reducing agents such as ß-mercaptoethylamine and repopulation of the singlet ground state by reaction with molecular oxygen. Thus, the lifetime the different fluorophores reside in the fluorescent state can be easily adjusted by the excitation intensity and the concentration of the reducing agent. We demonstrate the potential of multicolor photoswitching microscopy with subdiffraction-resolution on cytoskeletal networks and molecular quantification of proteins in the inner mitochondrial membrane with ˜ 20 nm optical resolution.