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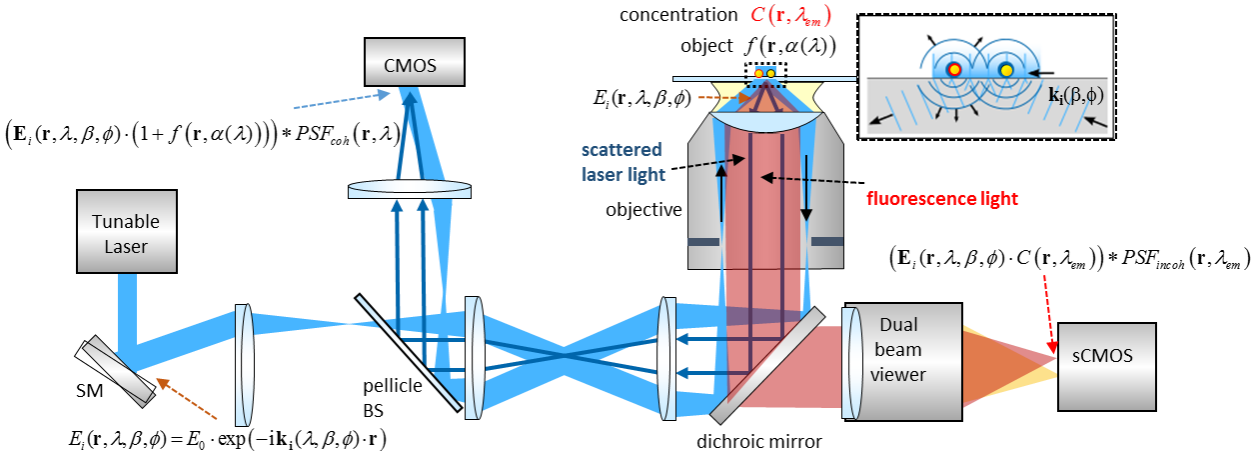
Open PhD or Post-Doc Position

Rotating Coherent Scattering Microscopy using absorption phase delays

Background: ROCS is a novel optical microscopy concept, where objects are illuminated coherently with rotating laser beams and images are generated from back-scattered coherent light. By exploiting defined multiple interferences and speckles, k-spectral shifting from oblique illumination and angular integration of many coherent images [1] within milliseconds, a spatial resolution of nearly 120nm can be achieved, at a temporal resolution of ≥ 100 Hz and with excellent image contrast. Our novel, rotating coherently scattered (ROCS) technique used in TIR-dark-field mode allows to acquire thousands of images without loss in image quality (e.g. fluorophore bleaching), without image reconstruction, is hence used to observe highly dynamic processes in life-sciences.



Schematic of a ROCS imaging system: Partially coherent images from back-scattered laser light are combined by rotation in the azimuthal angle ϕ change with the incident k-vector, which can be controlled by the the laser wavelength λ and the polar angle β of incidence. Fluorophores delay the phase of the backscattered laser light and emit fluorescence light at the same time for object identification and control.

Project: In a project funded by the DFG (PhD/PostDoc salary of 65%/100% E13) we first want to reach a new imaging record with 120 nm spatial and 100 Hz temporal resolution. Second, we want to distinguish specifically marked structures in the image through specific absorption and phase retardation of the scattered laser light by the reference wave in brightfield mode - first at nanometer-sized particles and then at cellular structures and living cells.

We are seeking a motivated candidate with a strong background in optics and microscopy. The candidate should setup a new multi-laser ROCS system, perform advanced experiments & theory & computer simulations to better understand partially coherent interferences/speckles and image formation of correlated and uncorrelated photons propagating through complex media.

We are a young and motivated team with a strong background in microscopy, in optical trapping & tracking and in biophysics. We are looking forward to answering your questions!

*[1] Ruh,…, Rohrbach, "Superior contrast and resolution by image formation in rotating coherent scattering (ROCS) microscopy," Optica **5**, 1371-1381 (2018).*