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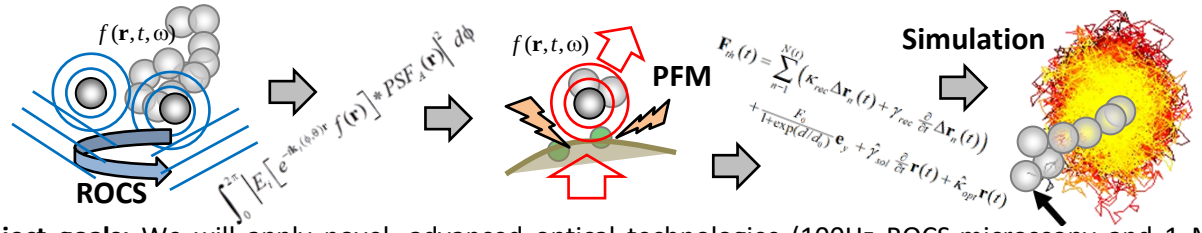
PhD or Post-Doc Position

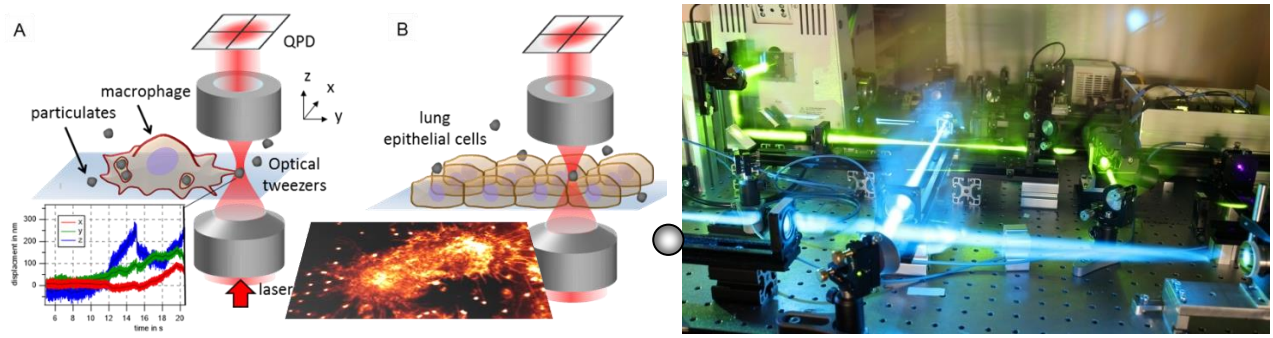
The diffusional interaction of particulate matter with lung cells Investigated with modern laser technologies

Background: Particulate matter (PM) are microscopic particles (0.1 – 10µm) suspended in the ambient air. Based on WHO studies, it is accepted that PM represents a serious health risk. The fine and ultrafine PM fraction penetrate deeper into the lungs, enter the alveoli and may pass into the blood system, hence depositing PM in all human organs. The important first stages of contact and uptake of ultrafine particles into lung cells could hardly be monitored and understood because of missing technology and concepts.



Project goals: We will apply novel, advanced optical technologies (100Hz ROCS-microscopy and 1 MHz Photonic Force Microscopy, PFM) and biophysical concepts (thermal noise changes) to analyze the biophysical mechanisms of the entry of ultrafine particulate matter into lung cells at the level of single cell reactions. We will characterize the multi-step diffusional behavior of particles approaching the cells, binding to it, and their entry into the cell. We apply Rotating Coherent Scattering (ROCS) microscopy and Photonic Force Microscopy on so far unexplored spatial and temporal scales. The project will be in scientific exchange with researchers from the University Hospital.

Work packages: Extension of Microscopes and stage (fluid gas flow chamber), Development of different cell models, Thermal noise tracking of particle engulfment, Characterization of uptake process by monitoring binding strength and friction, Imaging of PM-cell interactions by ROCS microscopy



Left: Optically trapped and non-trapped particles fluctuate nearby living cells. Trapped particles are moved toward the cell membrane and its positions fluctuations (3D trace) are recorded in 3D at 2 MHz temporal resolution via quadrant photo-diodes (QPDs). Bottom insets: microsecond nanometer position traces of the particles defined by thermal and cellular forces. Label-free ROCS-superresolution image of a macrophage with many 200 nm particles. Right: Photo of ROCS setup.

Qualifications and Requirements

We seek a motivated physicist/engineer with a strong background/interest in biophysics and microscopy / optical tweezers. The candidate should speak German fluently and should have an excellent MSc in physics or engineering, English language proficiency at level B2. The candidate (salary: PhD 3.5 yrs 66% E13, Post-Doc 2.5 yrs 100% E13) will design biophysical experiments including cell preparation, use super-resolution microscopy (ROCS), 3D thermal noise tracking, optical tweezing, advanced data analysis and computer modeling. The candidate will give lecture tutorials and will participate at several scientific conferences.