AKB 23 Photo-Biophysics

Time: Thursday 16:15–17:15 Room: ZEU 255

AKB 23.1 Thu 16:15 ZEU 255

Living Optical Fibers in the Vertebrate Retina — •Jochen Guck[1], Kristian Franze[1], Stefan Schinkinger[1], Jens Grosche[2], Ortrud Uckermann[2], Kort Travis[1], Detlev Schild[3], and Andreas Reichenbach[2] — [1]Insitute for Soft Matter Physics, Universität Leipzig — [2]Paul-Flechsig Institute for Brain Research, Universität Leipzig — [3]Department of Neurophysiology and Cellular Biophysics, Universität Göttingen

The retina of the vertebrate eye is inverted with respect to optical function. Light must pass through a significant thickness of scattering tissue before reaching the light-sensitive photoreceptor cells. We have investigated the retina as a phase object and could show that the retina contains optical fibers that guide light from the vitreous body through the scattering layers to the photoreceptor cells. These optical fibers are identified as Müller cells, which are radial glial cells spanning the entire thickness of the retina. For this we measured the transmission and scattering properties of Müller cells both in their natural matrix, applying confocal microscopy to eye-cup preparations and retinal whole-mounts, and as isolated cells, using a modified dual-beam laser trap. This finding ascribes a new function to glial cells and presents the inverted retina as an optical fiber phase-plate.

AKB 23.2 Thu 16:30 ZEU 255

Interactions of Biological Cells with Coherent Light — •Kort Travis and Jochen Guck — Universität Leipzig, Fakultät für Physik und Geowissenschaften, Abteilung Physik der weichen Materie; Linnéstrasse 5, 04103 Leipzig, Germany

Understanding near-field interactions of coherent infrared light with biological cells is critically important for modern optical manipulation and trapping applications, such as the optical stretcher or the optical tweezers. With respect to classical scattering theory, considerations of refractive index and size classify cells in the "anomalous diffraction" regime. Although there is significant published work applying numerical techniques such as the finite difference time domain (FDTD) technique to analyze these electrodynamic interactions, the use of higher order, more analytic techniques such as Mie theory, has been quite limited. In the present discussion, the system transfer operator (T-matrix) formalism is used to evaluate general features of optical fields in and around cells. Specifically, the discussion will cover: electrodynamic characteristics of all objects in this optical size range; effects of surface deviations from ideal shape; effects of the inclusion of large organelles such as the nucleus and mitochondria; and finally, effects associated with local inhomogeneities in the refractive index. Key points in the analytical discussion are illustrated with examples from numerical simulation and from experimental results.

AKB 23.3 Thu 16:45 ZEU 255

Single Molecule Spectroscopy of Light Harvesting Complexes — •Sebastian Mackowski, Stephan Wörmke, Christoph Jung, Andreas Zumbusch, Moritz Ehrl, and Christoph Bräuchle — Department Chemie, Ludwig-Maximilians Universität München, Butenandtstrasse 11, 81377 München, Germany

Light harvesting complexes are ideal candidates for studying the interactions between proteins and chromophores. One of the least known is peridinin-chlorophyll-protein (PCP) complex - a photosynthetic molecule composed of a barrel of hydrophobic protein, which shields two subunits each comprising of a single chlorophyll molecule dressed by four peridinin molecules, which are responsible for the light harvesting in the blue-green spectral range. Here we report on single molecule spectroscopy measurements of different types of light harvesting molecules. The experiments carried out at room temperature show that the wild type PCP complexes are quite unstable and they bleach out within several seconds. On the other hand, in order to observe ultranarrow zero-phonon-line emission of this complex at cryogenic temperatures we combined the recently developed vibronic excitation scheme with a solid immersion lens. In this way, the significant increase of the effective numerical aperture of collection optics enables us to monitor time- and energy scales of spectral jumps characteristic for single chromophore fluorescence. Detailed analysis of these spectral fluctuations should provide unique information about the interaction between the protein and the chlorophyll, and should shed light onto the energy landscape of this protein complex.

AKB 23.4 Thu 17:00 ZEU 255

Evaluation of a Possible Pathway for Ubiquinone Shutteling in the Photosynthetic Unit of the Purple Bacteria Rhodospirillum rubrum — •Andrew Aird[1], Carsten Tietz[1], Jörg Wrachtrup[1], and Klaus Schulten[2] — [1]3. Physikalisches Institut, Universität Stuttgart — [2]Theoretical and Computational Biophysics Group, University of Illinois at Urbana-Champaign

The core complex of the photosynthetic unit of the purple bacteria *Rhodospirillum rubrum* plays a cruical role in the conversion of light into chemical energy. In the reaction center a Quinone molecule functions as electron carrier to transport the electrons, created in the first step of photosynthesis, from the inside of the core complex to the Cytochrome bc_1-complex. The exact pathway of the Quinone molecule is still unknown. Molecular Dynamics Simulations of the shutteling of the Quinone molecule were performed to see if the molecule is able to diffuse through the closed LH1 ring.