The Beauty of Chirality & Excitons in Soft Matter Thin Films

Lecture by Prof. Manuela Schiek

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Organic semiconductors are mechanically soft and chemically tunability but strong in their interactions with light, eventually showing a quasi-metallic response. Chemical modifications target the molecular packing, tuning the structure-correlated excitonic thin film properties. Upon structural mirror symmetry breaking, the chiral matter absorbs left and right handed circular polarized light to a different extent. Prototypical chiral small molecular model compounds are obtained via a smart ex-chiral pool synthesis strategy. Their circular dichroic response can be greatly amplified in supra-molecular aggregated thin films due their excitonic coupling. Implementing such photoactive layers in conventional bulk-heterojunction diodes, the devices show a handedness-dependent light to photocurrent conversion without the need for additional polarization manipulating optical elements. Moreover soft matter promises a seamless match with biological tissue. Bionic photosensor are able to stimulate neuronal model cells via a photo-capacitive mechanism upon pulsed illumination. This provides a roadmap to minimal invasive implantable neuro-stimulating platforms for vision restoration.

Manuela Schiek *graduated at the University of Oldenburg in Chemistry in 2004 and completed her PhD thesis on "Organic Molecular Nanotechnology" in 2007. The thesis was awarded the Albert Weller Prize for providing a complete route starting from synthesis to frequency doubling organic nanofibers. Manuela then moved to the Engineering Campus of the University of Southern Denmark in Sonderborg. In 2012 she returned to Germany with a Fellowship at the Institute of Advanced Studies in Delmenhorst and was appointed a Junior-Professorship in Experimental Solid State Physics at the University in Oldenburg in 2013. With her special curiosity for excitonic circular dichroism she explores functional interfaces between light, life and nanoscopic soft matter.*

