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Giant Excitonic Circular Dichroism and its Added Value in Organic Opto-Electronics

Speaker:

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ISAS Berlin, Lecture Hall (Room 2018) Schwarzschildstr. 8, 12489 Berlin

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Molecular excitonic chirality and the inherently connected differential absorption of circular polarized light (circular dichroism, CD) combined with semiconducting properties offers great potential for chiral opto-electronics. The chirality-rooted excitonic thin film properties can be targeted by chemical modifications of the molecular scaffold. Here, enantiomerically anilino squaraines with varying side chain functionalization are obtained via a convenient ex-chiral pool strategy. The resulting thin films are either micro crystalline or isotropic. In the former case we connect the local texture with the circular and linear optical anisotropies which arise from polymorph specific excitonic coupling.[1] For this we combine X-ray diffraction, polarized spectro-microscopy[2] and imaging Mueller matrix polarimetry. In case of extended homogeneous thin films, supra-molecular aggregation induced by thermal annealing can lead to a giant circular dichroism. By Mueller matrix polarimetry we verify that this CD is due to the nature of the molecular excitonic coupling and not caused by cholesteric ordering effects.[3] This is a door-opener for sizable optical manipulation of spin-states at ambient conditions for future chiral spintronic applications. For now, such thin films emerged to be well suited for the fabrication of bulk heterojunction photodiodes for sensing of circular polarized light without the need for additional optical elements.[4] We rationalize by transfer matrix optical simulations that the optical dissymmetry fully converts into a photocurrent dissymmetry providing a facile roadmap to slender integrated platforms for chiroptical imaging and sensing purposes.

[1] Zablocki, Hertel, Anhäuser, Puttreddy, Holstein, Arteaga, Balzer, Clever, Rissanen, Meerholz, Lützen, Schiek. Unpublished results.
[2] Balzer, Kollmann, Schulz, Schnakenburg, Lützen, M. Schmidtmann, Lienau, Silies, Schiek.
Cryst. Growth Des. **2017**, 17, 6455-6466.
[3] Schulz, Zablocki, Abdullaeva, Brück, Balzer, Lützen, Arteaga, Schiek. *Nat. Commun.* **2018**, 9, 2413.
[4] Schulz, Balzer, Scheunemann, Arteaga, Lützen, Meskers, Schiek. *Adv. Funct. Mater.* **2019**, 29, 1900684.