

**PHYSICAL COLLOQUIUM**  
**INVITATION**

---

Monday, 26.06.2017, 4.15 p.m., W2-1-148

speaks

**Prof. Dr. Gregor Witte**  
**Philipps University Marburg,**  
**Head of the Research Group Molecular Solids,**  
**Marburg, Germany**

about

**Template controlled growth of crystalline organic semiconductor films  
and hetero-structures with defined molecular orientation as model  
systems for exciton studies**

Despite the recent success of optoelectronic organic devices such as photovoltaic cells, the fundamental understanding of the involved photo-physical processes is still incomplete. This is mainly due to the complex microstructure of blends that are used in real devices and hamper precise microscopic interface studies. Polycyclic aromatic molecules such as oligoacenes are versatile building blocks which form crystalline films and can also be modified chemically, e.g. by fluorination which turns the p-type pentacene (PEN) into the n-type perfluoropentacene (PFP). Using template-controlled growth, crystalline acene films of defined molecular orientation and even selective polymorphs can be prepared. These allow for detailed excitonic studies of the various phases [1] while temperature dependent measurements indicate a notable strain at the interface with inorganic supports [2]. For the case of PFP on alkali halides, it is possible to grow hetero-epitaxial organic films, which allow for polarization and directional resolved optical measurements on individual crystalline molecular domains [3]. This enables in particular an experimental investigation of the correlation between molecular packing motifs and singlet-exciton fission processes. Using time- and polarization-resolved pump-probe experiments a pronounced exciton fission efficiency is only found along the b-axis where molecules are slip-stacked [4]. In the last part, structural and optical properties of molecular acceptor/donor hetero-systems are discussed at the examples of PEN/PFP and PEN/C<sub>60</sub>. Using the concept of templated film growth again allows for the realization of well defined molecular interfaces with different relative orientation. While this yields highly oriented PEN/PFP hetero-stacks either in standing or lying molecular orientation [5], evidence for the formation of Diels-Alder adducts between C<sub>60</sub> and pentacene is found [6]. Time resolved luminescence and linear absorption spectroscopy are performed to explore the energetics and dynamics of charge transfer excitons at the interfaces.

References:

- [1] I. Meyenburg et al. Phys. Chem. Chem. Phys. **18**, 3825-3831 (2016).
- [2] L. von Helden, T. Breuer and G. Witte, Appl. Phys. Lett. **110**, 141904 (2017).
- [3] T. Breuer and G. Witte, Phys. Rev. B **83**, 155428 (2011).
- [4] K. Kolata et al. ACS Nano **8**, 7377-7383 (2014).
- [5] T. Breuer and G. Witte, ACS Appl. Mater. & Interfaces **7**, 20485-20492 (2015).
- [6] T. Breuer, A. Karthäuser, G. Witte, Advanced Material Interfaces **3**, 1500452 (2016).

All interested persons are cordially invited.

Sgd. Prof. Manuela Schiek