



TECHNISCHE UNIVERSITÄT  
IN DER KULTURHAUPTSTADT EUROPAS  
CHEMNITZ

# Institut für Physik Physikalisches Kolloquium



**Mittwoch, 05.07.2023, um 11:15 Uhr**

Ort: Reichenhainer Str. 90;  
Zentrales Hörsaal- und Seminargebäude,  
Raum C10.013

**Prof. Dr. Julia Stähler**

Humboldt-Universität zu Berlin



**GAEDE-PREISTRÄGERIN 2016**

## **How hybrid excitons suppress charge separation: ultrafast, but delayed**

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Inorganic/organic hybrid systems offer great technological potential for novel solar cell design due to the combination of high charge carrier mobilities in the inorganic semiconductor with the chemical tuneability of organic chromophore absorption properties. While ZnO basically exhibits all necessary properties for a successful application in light-harvesting, it was clearly outpaced by TiO<sub>2</sub> in terms of charge separation efficiency. The physical origin of this deficiency is still under debate.

We use a combination of femtosecond time-resolved photoelectron spectroscopy with many-body *ab initio* calculations to demonstrate that optical excitation of the chromophore is followed by (1) ultrafast electron transfer into the ZnO bulk (350 fs), (2) electron relaxation, and (3) delayed (100 ps) recapture of the electrons at a 1 nm distance from the interface in (4) a strongly bound (0.7 eV) hybrid exciton state with a lifetime exceeding 5  $\mu$ s that is analysed by taking into account pump-probe delay-dependent photostationary population dynamics. Beyond the identification and quantification of all elementary steps leading to the suppression of charge separation at ZnO interfaces, our key finding, the substantially delayed hybrid exciton formation, opens up a sufficiently large time window for counter-measures with the potential to finally successfully implement ZnO in light-harvesting or optoelectronic devices without significant efficiency losses.

Alle Zuhörer sind ab 11:00 Uhr zum Kaffee vor dem Hörsaal eingeladen.



Informationen zum Vortrag erteilt:  
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