TECHNISCHE UNIVERSITÄT CHEMNITZ

Institut für Physik
Physikalisches Kolloquium

Mittwoch, 19.06.2019, um 16:00 Uhr

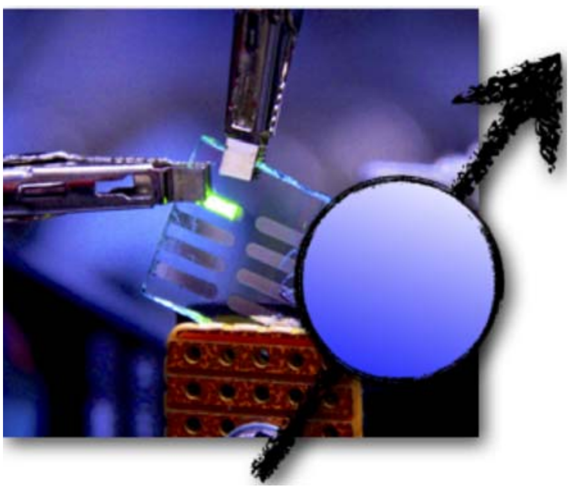
Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude,
Raum 2/N013

Dr. Andreas Sperlich

Universität Würzburg, Experimentelle Physik VI

Spin-Effects in Next-Generation Organic Light Emitting Diodes

Organic light emitting diodes (OLEDs) promise a bright future for display and lighting applications. Yet, further technological leaps will be necessary to enhance efficiency and lifetime, while lowering costs to make this technology viable. There are several fundamental challenges of the involved luminescing materials that need to be understood and addressed - all of them have to do with spin-dependent phenomena in OLEDs. The spins of injected charge carriers are generally uncorrelated. Prior to recombination, electrons and holes form an intermediate state with a ratio between singlet- and triplet spin configuration of 1:3. Assuming this simple statistic, the internal quantum efficiency of OLEDs is thus limited to 25%, as only the singlet state recombines radiatively. An intriguing approach to tackle this issue is the mechanism of thermally activated delayed fluorescence (TADF), where non-emissive triplet states are thermally upconverted to emissive singlet states. Although this upconversion is a spin-forbidden process that raised many questions, direct spin-sensitive studies on OLED devices are scarce in literature. Here, we apply a combination of time-resolved optical spectroscopy and spin-sensitive magnetic resonance methods based on electrical detection (EDMR), electroluminescence (ELDMR) and photoluminescence (PLDMR) to efficient TADF OLED devices. Our results show that, while the TADF emission of donor:acceptor based systems is identical for both electrically driven devices as well as for optically excited samples, the intermediate excited states and relaxation pathways differ substantially. While in both cases emission involves an interfacial triplet exciplex state, there are additionally molecular triplet excitons involved for optical excitation that don't play any role for electrical injection. This discrepancy highlights how imperative spin-sensitive methods are to understand TADF mechanisms and push the on-going TADF research forward.



Alle Zuhörer sind ab 15:45 zu Kaffee und Tee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:
Prof. Dr. Carsten Deibel, Tel. 0371 531 34878

www.tu-chemnitz.de/physik