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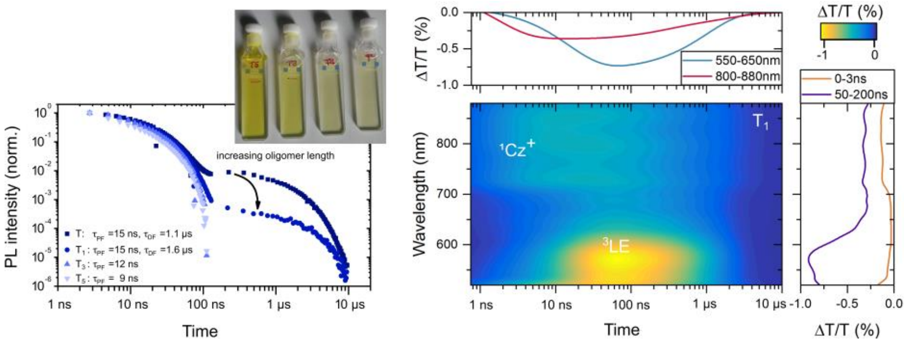
Master Thesis
Time-Resolved Optical Characterization of OLED Emitters



Example results from time-resolved optical characterization of novel OLED emitters.

Research Field
Experimental

Studies
Electrical Engineering
Physics

Start
From now on

Motivation

Organic light emitting diodes (OLEDs) are of great interest due to their applications in displays, from flat and bending smartphone displays through to large-area television screens. In the current generation of devices, most of the light-emitting molecules used in these displays are organometallic complexes containing rare earths such as iridium. However, the scarcity and high-cost of the rare earths and their low reliability in the blue region of the visible spectrum motivate the continued search for alternative materials. In the recent years, a new class of molecules with great potential for application in OLEDs was discovered. These materials possess a unique photophysical property that make them very attractive for efficient OLED devices; namely thermally activated delayed fluorescence (TADF). The details of the TADF process in candidate molecules is key to the efficiency of these emitters in OLEDs, and can be studied by time-resolved optical spectroscopy. The goal of this master's work is to perform time-resolved optical spectroscopy on new candidate TADF materials, and to develop rate-equation models that describe the observations and predict the efficiency of the candidate materials in OLED applications.

Techniques

The successful candidate will be trained in the following experimental techniques.

i) Steady-state absorption and photoluminescence (PL) spectroscopy (also as a function of temperature with cryogenic cooling). Modelling and assignment of electronic transitions.
ii) PL quantum yield. Quantitative determination of the efficiency of an emitter molecule.
iii) Time-resolved PL. Use of a gated ICCD camera to collect PL dynamics on the nano- to microsecond time range.
iv) Transient absorption. Investigation of intermediate excited-state populations and rate equation modelling.

Prerequisites

Prerequisite for the work is pleasure and skill in independent experimental work, team spirit as well as interest in new topics and approaches. Basic knowledge in the field of optical spectroscopy is advantageous but not essential.

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