Project 4.23. Molecular photophysics of functional organic systems

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Background:
There are two PhD topics to choose from:

(A) Excited state spin dynamics in molecules with donor-acceptor structure.
Molecular excited state dynamics are of fundamental importance for such processes as charge separation, magnetoreception or photosynthesis, where they provide bases for transformation of physical signals into chemically or biologically relevant information. An area of particular interest includes interconversions of highly polar singlet and triplet states which are recently more and more exploited in new generation organic light emitting devices (OLED).

(B) White luminescence of organic molecule as a function of its structure
White light emitting materials are of considerable practical importance and they are usually obtained by combining and balancing luminescence from two or more different substances. A more future-oriented approach for white light generation, used in white fluorophores developed in our Group, is to combine emission from a locally excited state with that of a product of an adiabatic process, e.g. excited state electron or proton transfer, originating from a single substance/molecule.

Aim:
(Topic A) The goal of the project is to study molecular structure and geometry effects on the spin dynamics and intersystem crossing in excited states formed in photoinduced electron transfer in selected organic molecules. This is an experimental study, the molecules to be investigated are synthesised in our Group, and their photophysics are studied in a state-of-the-art well-equipped spectroscopic laboratory (steady-state and time-resolved spectrofluorimetry, time-resolved (ns-ms) absorption spectrophotometry, temperature-dependent measurements).

(Topic B) The proposed PhD dissertation will be focused on experimental studies of photophysics of such molecules, and in particular on the exploration of the effects of structural factors on radiationless processes reducing the quantum yield of white emission, as well as will attempt to reduce the efficiency of these processes. This is an experimental work and the molecules are synthesised in our chemical laboratory and are studied in a state-of-the-art, well-equipped optical spectroscopic laboratory (steady-state and time-resolved spectrofluorimetry, time-resolved (ns-ms) absorption spectrophotometry, temperature-dependent measurements).

Requirements:
- knowledge of the basics of fluorescence spectroscopy,
- knowledge of the basics of radiation physics and optics,
- knowledge of the basics of organic chemistry,
- knowledge of the basics of quantum-chemical computations,
- openness and readiness to intensively expand knowledge in the above mentioned areas,
- passion for experimental work,
- working knowledge of English,