Synthesis of Green-to-Red Fluorescent Materials

Number: MA/25/F4/0/011
Flagship: 4 - Environmental transitions
Faculty: PřF
Project leader: Kotora, Martin

The project focuses on the design and synthesis of novel chiral fluorescent materials that emit circularly polarized light in the green-to-red spectral range. These compounds will be based on small organic molecules containing carbon, nitrogen, and/or boron, incorporating quinolizinium or quinacridinium fluorophores and cyclic aza-bora functionalities. The molecular frameworks will feature either purely helical chirality or a combination of helical and planar chirality, in some cases conjugated with chiral [2.2]paracyclophane scaffolds. The use of environmentally benign elements aims to provide sustainable alternatives to existing emitters containing heavy metals, with potential applications in optoelectronics and advanced photonic technologies.

The project builds on preliminary and largely unpublished results from the participating laboratories. Previous work demonstrated that helical azonia salts can display strong yellow-to-red fluorescence, with emission properties tunable through modification of the helical core. In parallel, newly developed bora-cycles have been shown to emit green fluorescence, further supporting the feasibility of achieving a broad emission range. The research will pursue both racemic and enantioselective synthetic pathways to these molecules, followed by comprehensive characterization of their photophysical and chiroptical properties to guide the development of improved CPL-active emitters.

Collaboration between Charles University, the University of Geneva, and Heidelberg University will be supported through three mini-symposia hosted in Prague, Geneva, and Heidelberg, complemented by regular online meetings. These activities will facilitate knowledge exchange, interdisciplinary training, and the integration of PhD students and early-career researchers into an active European research network. By combining expertise in organic synthesis, materials chemistry, and advanced spectroscopy, the project will contribute to the development of innovative, sustainable light-emitting materials and strengthen long-term collaborative links between the partner institutions.