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Design and synthesis of organic dyes as a tool for biological and photonic

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Dye chemistry is a widely studied topic nowadays. Especially light-emitting dyes are important class of molecules for various applications such as bio-imaging, organic light-emitting diodes (OLEDs) and sensors. However, specific design of those dyes needs to be addressed depending on the targeted application. For instance, multivalent molecules (that possess two or more units of interest) and water solubility are keys to design bio-imaging agents. In particular, the design and synthesis of organic dyes that can emit in the near-infrared (NIR) is of great interest in the diagnostic and theragnostic areas. To address other application such as those related to organic electronics including organic photovoltaics and OLEDs, those molecules can by chemically redesigned with the idea of fulfilling the requirements of those application.

In this talk, I will show how, by designing the structure of some target molecules, we can apply those dyes to the selected applications. From small organic dyes to macromolecules, going through lanthanides complexes, we can target applications such as bio-imaging and opto-electronic devices. More specifically, I will discuss about multivalent molecules1 (for lectine detection) and lanthanides complexes for bio-imaging in the NIR region2,3. In the last part of my talk, I will present the latest data on the development of dyes for Epsilon-Near-Zero (ENZ)4 photonic applications. ENZ films are special in this sense that they possess a real part of the dielectric constant that is lower than 1. Such properties can be of importance since it can reduce the fluorescence lifetime of a dye that is at proximity of the ENZ film. Here, I designed and synthetized polymethine dyes and biradical dyes to obtain ENZ properties trying to specifically organize those molecules in their neat film.

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