Invitation to a John van Geuns Foundation lecture by

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Weak and Strong Coupling: Potential for Controlling Energetics and Relaxation in Molecular Based Systems

Tuesday 9 November 2023, D1.116, 10am



Coupling of the transition dipole moment of an organic chromophore can create new photophysical relaxation pathways and/or change the energetics of the excited states. I will give a selection of examples using three different coupling scenarios. The first scenario deals with weak exciton coupling, which enables energy transfer between chromophores. I will discuss how the energy transfer, commonly referred to as FRET, can be used as a multiplicity converter. The second scenario deals with strong exciton coupling, which results in new delocalized states with distinctly different energies than the uncoupled chromophore (so-called J-aggregates). I will start by showing that such systems can not only be used to red shift the absorption, but the delocalized nature results in a breakdown of the so-called energy gap law, giving a surprisingly high emission quantum yield in the NIR region of the electromagnetic spectrum. I will then continue with highlighting the benefit of strong exciton coupling for decreasing energy losses for triplet sensitizers. The third and last scenario deals with strong light-matter coupling. Here the molecular transition dipole moment is strongly coupled to the electromagnetic field inside an optical cavity, producing so-called polaritonic states. This phenomenon opens a plethora of options for manipulating the properties of molecules, with a broad range of applications in physics, chemistry, and materials science. In this presentation, I will discuss on the possibility to modify energetic driving forces and to efficiently harvest the excitation energy in planar heterojunctions by utilizing the delocalized nature of hybrid light-matter states.

If you wish to meet with Prof. Börjesson on November 8 or 9, please contact Tomáš Šolomek, t.solomek@uva.nl

References

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***Strong exciton coupling*:**
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***Strong exciton-photon coupling*:**
Bhuyan, Mony, Kotov, Castellanos, Gómez Rivas, Shegai and Börjesson "*The rise and current status of polaritonic photochemistry and photophysics*" *Chem. Rev.* **2023**, *123*, 10877.

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Mony, Climent, Petersen, Moth-Poulsen, Feist and Börjesson "*Photoisomerization Efficiency of a Solar Thermal Fuel in the Strong Coupling Regime*" *Adv. Funct. Mater.* **2021**, *31*, 2010737.

Wang, Hertzog and Börjesson "*Polariton-assisted excitation energy channeling in organic heterojunctions*" *Nature Comm.* **2021**, 12, 1874.

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