PhD proposition

Name of the labs **: Institut Lumière et Matière, UCBL et CNRS, Institut de recherche sur la catalyse et l'environnement, UCBL, CNRS**

Groups : **Luminescence / Chimie durable: du fondamental à l'application (CDFA)**

Persons-in-charge : G. Ledoux (ILM) / S. Mishra (IRCELYON)

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Upconverting Core/shell nanoparticles as light harvesting material for photocatalysis

The aim of the PhD is to design multimaterials allowing the conversion of the solar photons which are not used by classical titania-based photocatalysts into useful ones. The idea is to use luminescent materials to convert visible and IR into UV photons *via* upconversion (UC).

Some teams, including ours, have tried this approach in the past few years and have indeed demonstrated that combining an upconverting material with titania leads to IR photocatalysis. However, since the process is highly non-linear (up to the 5^{th} order), the results were obtained under laser excitation and such a conversion has not been detected under a standard solar irradiation. Our project UPHocat aims at bypassing this non-linear bottleneck by modifying 2 key aspects of the process:

- combining the absorption of different wavelengths to significantly decrease the order of non-linearity of the UC process and making it compatible with the excitation density of the sun.

- replacing the radiative energy transfer to TiO_2 via an emission and absorption of UV photons by a more efficient process of non-radiative energy transfer (ET).

This project has been recently selected by the French research agency (ANR) and a PhD position is available in this frame.

The PhD student will have the possibility to work on three aspects of this project:

- To develop an experimental setup dedicated to the measure of transfer rates between different electronic system over a wide range of wavelength and times.
- To improve a simulation tool able to predict the energy migration between materials in a core (multiple) shell structure. The spectroscopic parameters of the model will be defined on the basis of the spectroscopic measurement (previous item).
- To develop chemical synthetic strategies to optimize those systems.

The project combines theoretical predictions, synthesis and performance analysis. It is thus interdisciplinary in nature and will be performed in close collaboration with the two teams at ILM and IRCELYON.

Candidate's profile: For this multidisciplinary natured project, we seek a candidate who has a master's degree in Chemistry or Physics with a good grade and some hand-on experiences in one or more of the fields of molecular engineering, materials science and luminescence. Interested candidates should send their CV and motivation letter to persons-in-charge G. Ledoux and S. Mishra.