Title of the thesis: Luminescent hybrid Metal-Organic Frameworks (MOFs) containing Quantum Dots (QDs)

Supervisor: Federico Cisnetti (50%)
Laboratory: ICCF - UMR 6296
University: UCA
Email and Phone: federico.cisnetti@uca.fr, +33473407110
Possible co-supervisor: Damien Boyer (50%),
Laboratory: ICCF - UMR 6296
University: SIGMA Clermont

Summary:
MOFs are self-assembled solids with a porous crystalline structure based on metal ions and organic ligands. They have been the subject of numerous studies in various fields of application: catalysis, medical imaging, gas storage or biological sensors. MOFs have a high porosity and their physicochemical properties can be tuned by varying the nature of the metal ions and the organic ligands.

Among the various synthetic possibilities, we will prioritize robust and simple approaches. In terms of chemical structure, buildings blocks containing NHC (N-heterocyclic carbene) (pre)ligands complexed or not with non-precious metals (for example copper) and / or which can be assembled by click chemistry approaches will be considered.

Within this thesis project, we will also aim to explore complex MOF-type constructs containing cadmium-free semiconductor nanocrystals (QDs), recently developed in the host team. QDs generally have a diameter of less than 10 nm and have remarkable optical properties which are tunable depending on their size. However, a major drawback of the latter remains their stability towards the external environment.

The original structure of the MOF designed within the framework of this thesis subject could play either a protective role for QDs in order to improve their stability, or an active role by participating in the optical properties of the hybrid material.

This thesis subject is aimed at students who have acquired, in master or engineering school a multidisciplinary training and wish to improve their skills in organic and inorganic molecular synthesis, in (nano)materials development and in a wide range of spectroscopic and physico-chemical characterization techniques.