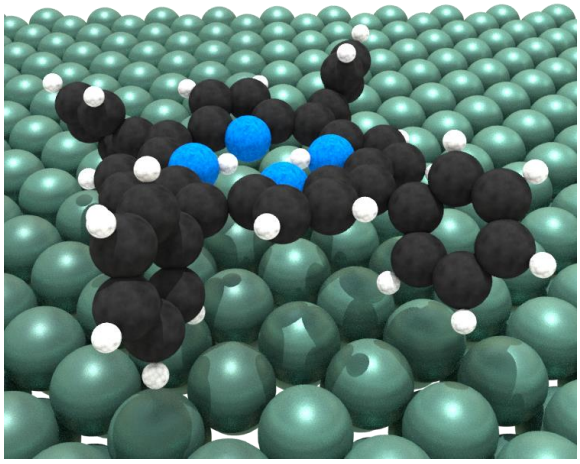
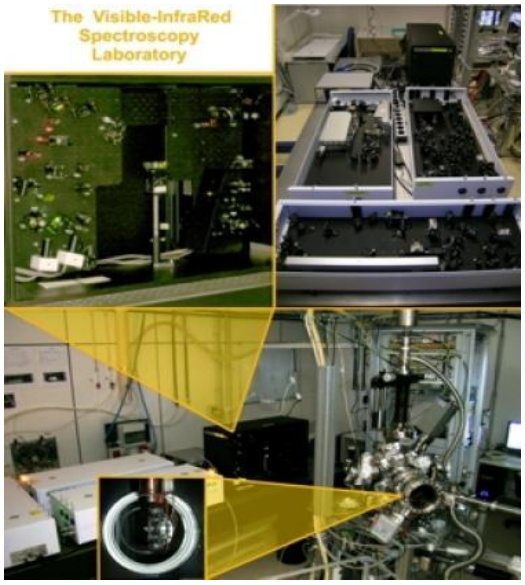
Biomimetic materials at near ambient pressure





Nature performs catalytic reactions for the synthesis of energy vectors and organic compounds by exploiting nano-sized or single-atom photosystem and enzymatic catalytic centers, where metals (Mn, Cu, Ni, Fe…) are supported by C, S, or N linkers. Light harvesting and funneling to electronic devices, storage, or reaction centers for chemical conversion is one of the biggest challenges to face in the view of a renewable and clean energy scenario. Technologically speaking, this translates in the search for optimal materials (in terms of low cost, high efficiency and sustainability) based on a detailed and thorough understanding of the involved physical processes in the framework of a bottom up approach. Charge transfer related to exciton dissociation (electron-hole separation), charge transport, delivery of energy to nano-engineered chemical reaction centers, and electron injection at the electrodes are indeed the rate limiting and crucial processes.

Here we propose to investigate self-assembled metallorganic monolayers and other biomimetic model materials *in situ* and *operando* by means of IR-Vis SFG vibronic spectroscopy and synchrotron radiation-based spectroscopies. Bonding of the reactants at nanostructured surfaces and with the single metal atom catalytic centers of an organic framework under biomimetic reaction conditions have already been characterized by means of this approach. Gas-solid and liquid-solid interfaces will be investigated, both under catalytic and electro-catalytic conditions.

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