

Title:

Structure and magnetic properties of metal tetraphenyl porphyrin single layers on Fe (001): a surface science investigation

Abstract:

One of the most fascinating class of organic molecules is porphyrins. Thanks to their open structure and the possibility of hosting a reactive metal ion at their center, these aromatic compounds are involved into several biological processes related, for instance, to oxygen transport in blood (heme group) or sunlight harvesting in plants (chlorophyll). Porphyrins can be artificially produced and used as, *e.g.*, chemical sensors or dye molecules in solar cells. Perspective applications in molecular electronics and spintronics are also foreseen: in this context, the engineering of ordered porphyrin layers and nanostructures is a prerequisite for the scalability and miniaturization of future devices.

In this talk, I will consider porphyrin growth on a prototypical magnetic and highly reactive metal substrate *i.e.*, iron. Crystalline substrates can promote the growth of ordered molecular overlayers in a well-controlled environment (vacuum) and by using specific growth techniques (molecular beam epitaxy); however, they can also strongly interact with the molecules. I will first propose and test a viable strategy to preserve the structural and electronic properties of porphyrins in contact with the substrate via the interposition of an ordered oxygen overlayer [1,2]. Moving from these results, I will then focus on the investigation of the magnetic activity of ordered monolayers of first-row transition metal porphyrins by means of spin-resolved photoemission spectroscopy [3]. Finally, I will take the occasion to present some recent results on the bottom-up realization of multilayer structures starting from these ordered layers, by exploiting the axial coordination of the porphyrin core with proper ligand molecules.

[1] Bussetti *et al.*, Appl. Surf. Sci. 390 (2016) 856

[2] Calloni *et al.*, Appl. Surf. Sci. 505 (2020) 144213

[3] Jagadeesh *et al.*, Appl. Phys. Lett. 115 (2019) 082404

Bio:

Alberto Calloni is an Associate Professor at the Department of Physics of Politecnico di Milano (Italy), where he participates in the research activities of the photoemission spectroscopy lab (VESI). He holds a Ph.D in Physics from Politecnico di Milano.

Since 2010, he works on the growth and photoemission spectroscopy characterization of ultra-thin films of metals and oxides, and on the study of hybrid interfaces with organic materials. Collaboration is acknowledged with the printed and molecular electronic group at the Italian Institute of Technology (IIT), the advanced line for overlayers, interface and surface analysis (Aloisa) at the Elettra synchrotron in Trieste, Italy, and the Prof. Kahn laboratory for molecular electronics in Princeton, USA, where he was also visiting professor.