From Single molecule to molecular devices: Manipulation and excitation at the nanoscale

Abstract:

One of the most challenging Graal in nanoscience resides in our ability to design, control, and operate functionalized devices at the nanoscale. While various techniques are used to reach this goal, several drawbacks remain difficult to tackle. During this talk, after a quick overview of the actual state of the art, I will firstly present some recent findings that allow to perform and run a 2D device made of single atom quantum dots\(^1\). This very versatile atomic structure offers the possibility to be reversibly switched to an ON and OFF state, mimicking the well-known transistor function. I will also address our abilities to control the manipulation and formation of molecular dyads to study charge transfer processes at the nanoscale. We have shown recently that non-bonding FeTPP homodimers adsorbed on a semi-insulating CaF\(_2\)/Si(100) layer can be used as a studying platform to investigate charge transfer at the nanoscale\(^2\). In particular, we could demonstrate that the dynamics of the excitation position can rule the charge transfer efficiency that mainly follows anti-Kasha rule.

\(^1\) An ON/OFF two-dimensional molecular switching device based on anisotropic interactions of dangling bonds on Si(100):H at low temperature (9K), M. Yengui, E. Duverger, P. Sonnet and D. Riedel, Nature Communication, 8, 2211 (2017). DOI 10.1038/s41467-017-02377-4