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Invited Speaker

Electron, spin and thermal transport at the nanoscale in molecular devices: a journey through recent results.

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I will review recent results on electron, spin and thermal transport at the nanoscale in molecular self-assembled monolayers (SAMs) and ultra-thin films. These results were mainly obtained by conductive-AFM (in air or UHV) and SThM (scanning thermal microscope) experiments and supported by ab-initio calculations. I will review and discuss:

• the transport properties of polyoxometalates (POMs), which are nano-scaled molecular oxides endowed with a remarkable structural diversity and outstanding magnetic and/or redox properties [1-3].

• the properties of Prussian blue analogs (PBAs) and related cyanide bridged systems, which are coordination networks with unique optical, magnetic, conducting and electrochemical properties [4].

• molecular switches (triggered by light or chemical stimuli) self-assembled on metal and ferromagnetic electrodes with the purpose, in the later case, to develop multifunctional molecular spintronics devices [5-8].

• the thermoelectric properties of organic films and SAMs to assess the role of molecular structures, molecule/electrode interfaces and quantum interferences [9-11].

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[2] *Charge transport through redox active* $[H_7P_8W_{48}O_{184}]^{33-}$ *polyoxometalates self- assembled onto gold surfaces and gold nanodots.* Dalla Francesca, K.; Lenfant, S.; Laurans, M.; Volatron, F.; Izzet, G.; Humblot, V.; Methivier, C.; Guerin, D.; Proust, A.; Vuillaume, D. **Nanoscale** *2019*, 11, 1863-1878..

[3] *Covalent Grafting of Polyoxometalate Hybrids onto Flat Silicon/Silicon Oxide: Insights from POMs Layers on Oxides*. Laurans, M.; Trinh, K.; Dalla Francesca, K.; Izzet, G.; Alves, S.; Derat, E.; Humblot, V.; Pluchery, O.; Vuillaume, D.; Lenfant, S.; Volatron, F. Proust, A. **ACS Appl. Mater. Interfaces** *2020*, 12, 48109-48123.

[4] *Long-range electron transport in Prussian blue analog nanocrystals.* Bonnet, R.; Lenfant, S.; Mazerat, S.; Mallah, T.; Vuillaume, D. **Nanoscale** *2020*, 12, 20374-20385.

[5] *Conductance switching at the nanoscale of diarylethene derivative self-assembled monolayers on* $La_{0.7}Sr_{0.3}MnO_3$. Thomas, L.; Guerin, D.; Quinard, B.; Jacquet, E.; Mattana, R.; Seneor, P.; Vuillaume, D.; Mélin, T.; Lenfant, S. **Nanoscale** *2020*, 12, 8268-8276.

[6] *Conductance switching of azobenzene-based self-assembled monolayers on cobalt probed by UHV conductive-AFM.* Thomas, L.; Arbouch, I.; Guerin, D.; Wallart, X.; Van Dyck, C.; Melin, T.; Cornil, J.; Vuillaume, D.; Lenfant, S. **Nanoscale** *2021*, 13, 6977-6990.

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[8] *Electrical Molecular Switch Addressed by Chemical Stimuli.* Audi, H.; Viero, Y.; Alwhaibi, N.; Chen, Z.; Iazykov, M.; Heynderickx, A.; Xiao, F.; Guerin, D.; Krzeminski, C.; Grace, I. M.; Lambert, C.J.; Siri, O., Vuillaume, D.; Lenfant, S.; Klein, H. **Nanoscale** 2020, 22, 10127–10139.

[9] *Thermal conductivity of benzothieno- benzothiophene derivatives at the nanoscale.* Gueye, M.; Vercouter, A.; Jouclas, R.; Guerin, D.; Lemaur, V.; Schweicher, G.; Lenfant, S.; Antidormi, A.; Geerts, Y.; Melis, C.; Cornil, J.; Vuillaume, D. **Nanoscale** *2021*, 13, 3800-3807.

[10] *Correlation between nanoscale thermal and electrical conductivity in PEDOT:OTf thin films*. K. Kondratenko, D. Guérin, D. Deresmes, A. Carella, S. Lenfant and D. Vuillaume, in preparation.

[11] *Exploring thermoelectric properties of organometallic molecular junctions*. V. Delmas, S. Rigaut, V. Diaz-Cabanes, C. van Dyck, D. Vuillaume, E. Scheer, J. Cornil, and K. Costuas, in preparation.