Warsaw Doctoral School in Natural and Biomedical Sciences and the Institute of Organic Chemistry PAS cordially invites you to **Spotlight talk:**

Interfering electron waves in single-molecule junctions

given by

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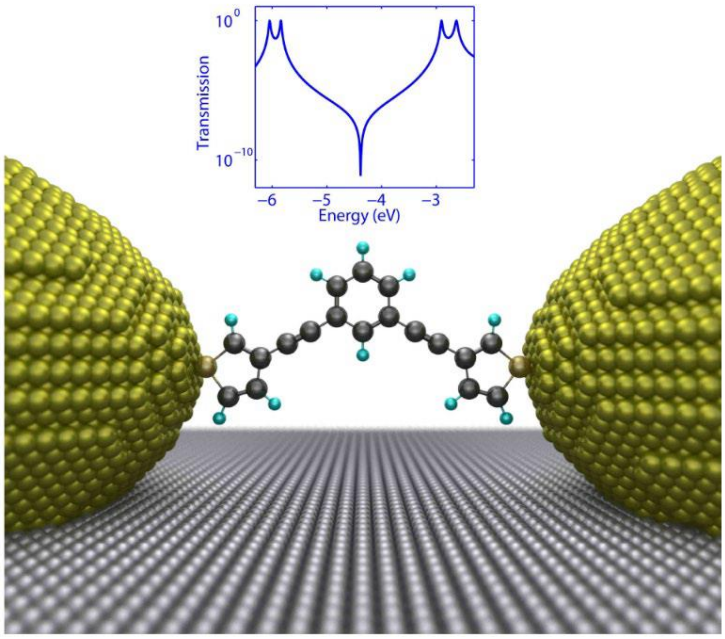
April 26, 2024 (Friday) – 10 a.m.

aula IOC/ICP PAS, Warsaw, Kasprzaka 44/52

Agenda: Single-molecule junctions enable the study of a broad range of quantum-transport phenomena even at room temperature [1]. These quantum features are related to molecular orbital and spin degrees of freedom and are characterized by various energy scales that can be chemically and physically tuned. To study the rich variety of quantum transport processes that emerges from the competion between these energy scales, we have developed several techniques to create solid-state, single-molecule devices [2] in which molecules are deposited from solution. These include mechanical controlled break junctions, molecular transistors made by a self-breaking electromigration technique, and room-temperature stable molecular transistors by electroburning of few-layer graphene.



In this talk, I will discuss quantum interference phenomena in single-molecule junctions. Interestingly, these quantum effects can be observed at room temperature in ambient and can lead to conductance changes of orders of magnitude. A simple example is charge transport across a benzene ring: the para-para connection leads to constructive interference, while the para-meta connection leads to destructive interference with a dramatically lower probability for electrons to cross the molecule and thus a lower conductance. These quantum transport effetcs are a general feature of a large variety of molecules and I will show how they can be controlled by the electric fields of a gate [3] and by mechanical strain in 'double-decker' molecules (π-stacked OPE's [4], paracyclophanes [5], porphyrin cyclophanes [6]).

[1] M.L. Perrin, E. Burzurí and H.S.J. van der Zant, *Chem. Soc. Rev.*, **2015**, *44*, pp. 902-919.
[2] P. Gehring, J.M. Thijssen and H.S.J. van der Zant, *Nature Reviews Physics*, **2019**, *1*, pp. 381-396.
[3] M. Koole, J.M. Thijssen, H. Valkenier, J.C. Hummelen and H.S.J. van der Zant, *Nano Letters*, **2015**, *15*, pp. 5569-5573.
[4] R. Frisenda, V.E.A.C. Janssen, F.C. Grozema, H.S.J. van der Zant and N. Renaud, *Nature Chemistry*, **2016**, *8*, pp. 1099–1104.
[5] K. Reznikova *et al.*, *J. Am. Chem. Soc.*, **2021**, *143*, pp. 13944 – 13951.
[6] W.M. Schosser *et al.*, *Nanoscale*, **2022**, *14*, pp. 984 − 992.

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