CONFERENCIA

Quantum size-effects in atomic chains and molecular wires revealed by their electronic conductances

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The ability to measure electronic conductance of single atoms and molecules is one of the most fascinating advances in physics and chemistry [1]. In my talk I will consider short linear chains of single-atom or molecular devices, manifesting quantum size-effects. Theoretically, one of the simplest examples of a quantum size-effect is the particle-in-a-box problem. When a particle bounces off two potential wells, the energy spectrum is quantized and the gaps scale with the box's length. I will demonstrate how this effect manifests itself in the conductance of linear oligoacenes, molecular chains whose basic unit is a benzene ring. Deeper understanding of quantum size-effects involves two limits: the infinite limit, represented by the band-structure, and the single unit (atom). For linear oligoacenes, I show that their specific band-structure implies unexpected incommensurate oscillations of the gap with length [2]. In the second part of the talk I will consider chains of magnetic atoms, which display so called Kondo effect when adsorbed on the surface of a metal [3]. Size effects in these chains offer a new perspective on the emergent heavy-fermion physics.

References:

[1] F. Evers et al.,arXiv:1906.10449 [cond-mat.mes-hall] (2019)

[2] T. Yelin, R. Korytár et al., Nature Materials, doi:10.1038/nmat4552 (2016)

[3] M. Moro-Lagares, R. Korytár, Nature Communications, 10:2211 (2019)

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