



Departamento de
Física de la
Materia Condensada
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The light at the end of the tunnel

The optical resonator between the tip and the sample of a Scanning Tunnelling Microscope (STM) supports plasmonic modes that can be excited by the injection of inelastic tunnel current through the cavity gap. Because these modes can be finely tuned thanks to the sub-angstrom resolution of STM, this technique can potentially offer radically new insights into the plasmonics of nanoscale objects at a much smaller scale than conventional techniques. Plasmonic tunnel electroluminescence spectra, however, contain information about the optical properties of the cavity, but also on the electronic structure of tip and sample. In this seminar I will show a completely experimental method to eliminate electronic structure factors from tunnel electroluminescence spectra, giving access for the first time to the true optical spectra of the resonators. Our results dispel the disagreement between the theoretically expected shifts in the plasmonic modes with tip-surface distance and the experimentally observed ones. Moreover, when extended to photon energies close to the applied bias voltages, our analysis also clarifies the general shape of the emission edge, shedding light on the controversial origin of the overbias emission, and allowing us to determine the electronic temperature of the junction. Finally, we will show how our method enables an equivalent to light absorption experiments of single molecules adsorbed on metal surfaces.

Roberto Otero obtained his PhD in 2002 from Universidad Autónoma de Madrid (UAM). After three years as Marie Curie Fellow in Aarhus University (Denmark), he obtained a Ramón y Cajal contract to move back to UAM, where he was promoted to “Profesor Titular” in 2020. He is also associated to IMDEA Nanoscience center and IFIMAC, both excellence centers distinguished with the Severo Ochoa and Maria de Maeztu mentions, respectively.

Con la colaboración de:



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22 Abril (viernes)

HORA: 12:30

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