Departamento de
Física de la
Materia Condensada
Universidad Zaragoza

SEMINARIOS 2018

Aitor Mugarza

Institut Català de Nanociència i Nanotecnologia

"Electron confinement on surfaces studied by scanning tunneling spectroscopy"

At the nanoscale electron scattering leads to well-known quantum effects such as quasiparticle interference and electron confinement. These were elegantly demonstrated with real-space visualization in the pioneering scanning tunnelling spectroscopy experiments using quantum resonators on metallic surfaces. Here, resonators of different geometry and chemical nature were artificially fabricated by moving atoms one by one, and later used as quantum laboratories for quantitative studies of scattering parameters, and for the exploration of more exotic phenomena such as the quantum mirage and invisibility.

Here I focus on the study of electron scattering from monoatomic steps, which are intrinsic defects present on any surface. Different cases will be presented to illustrate the role of various material properties on electron scattering. First, the model case of confinement of a spin-degenerated, two dimensional nearly-free electron gas will be introduced by using 1D quantum resonators fabricated with parallel steps on the Ag(111) noble metal surface. In a second case, the role of spin-orbit coupling will be studied, by measuring electron confinement on step resonators built on a $BiAg_2$ surface alloy, material with record-high Rashba interaction. Finally, the scattering of exchange-split Ni surface states from the edges of graphene nanoislands will be discussed. In summary, the three cases will illustrate how quantum resonators can be used to study: i) the role of coherence in quantum resonator arrays; ii) the role of step composition and atomic structure on the scattering amplitude; iii) novel spin-flip mechanisms related to the spin-orbit entanglement; iii) spin-dependent scattering that can give rise to efficient spin-filtering effects.

Aitor Mugarza obtuvo la licenciatura y el doctorado en Ciencias Físicas, en 1997 y 2002 respectivamente, en la Universidad del País Vasco (EHU-UPV). Después de realizar una estancia postdoctoral en Lawrence Berkeley National Laboratory, en 2007 se incorporó como investigador senior en el grupo Atomic Manipulation and Spectroscopy (AMS) del Institut Català de Nanociència i Nanotecnologia (ICN2). En 2013 fue nombrado líder del grupo AMS, y desde el 2015 es profesor de investigación ICREA. Cuenta con más de 60 publicaciones y 40 charlas invitadas en el campo de sistemas electrónicos de baja dimensionalidad e intercaras híbridas. Su actividad científica actual está enfocada en síntesis de materiales bidimensionales nanoestructurados, la manipulación de carga y espín en estos materiales a nivel atómico, y fenómenos de dispersión electrónica en grafeno y materiales con fuerte interacción espín-órbita.

25 de Mayo (viernes)

Con la colaboración de:

Facultad de Ciencias
Universidad Zaragoza

LUGAR: SALÓN DE ACTOS DEL EDIFICIO DE GEOLÓGICAS

HORA: 12:30