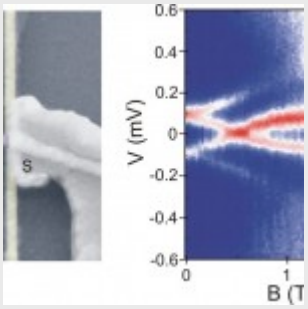
Spin Texture of Sub-Gap Andreev Levels in Semiconductor Quantum Dots Proximity-coupled to Superconductors

When: Friday, 27 November (2015), 12:00h
Place: Departamento de Física de la Materia Condensada, Facultad Ciencias, Module 3, Seminar Room (5th Floor).
Speaker: Eduardo J. H. Lee, SPSMS, CEA-INAC/UJF-Grenoble, France.



Abstract:

The combination of superconductors and low-dimensional semiconductors embodies a rich, yet largely unexplored physics. In this hybrid system, macroscopic properties enforced by superconductivity can be controlled through electrically tunable microscopic degrees of freedom, inherent to a relatively small number of confined electrons. Here we consider the prototypical case of a quantum dot (QD), defined in a semiconductor nanowire, strongly coupled to a superconductor (S) and weakly to a normal-metal (N) tunnel probe. In this system, the ground state can be either a spinsinglet or a spin doublet, depending on a competition between the superconductivity proximity effect, Coulomb interactions and Kondo correlations. In this talk, I will present experimental results unraveling magnetic properties of the lowest-energy, subgap states associated with elementary excitations between the singlet and double states (Andreev levels) [1]. In a magnetic field, the Zeeman splitting of these sub-gap states is revealed. The splitting can induce a quantum phase transition, manifested as a zero-bias conductance peak, from the singlet state to a spin-polarized ground state. Implications of the present work to current research on Majorana fermions will be discussed.

References

E. J. H. Lee, X. Jiang, M. Houzet, R. Aguado, C. M. Lieber and S.De Franceschi, Nature Nanotech. 9, 80, (2014).

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