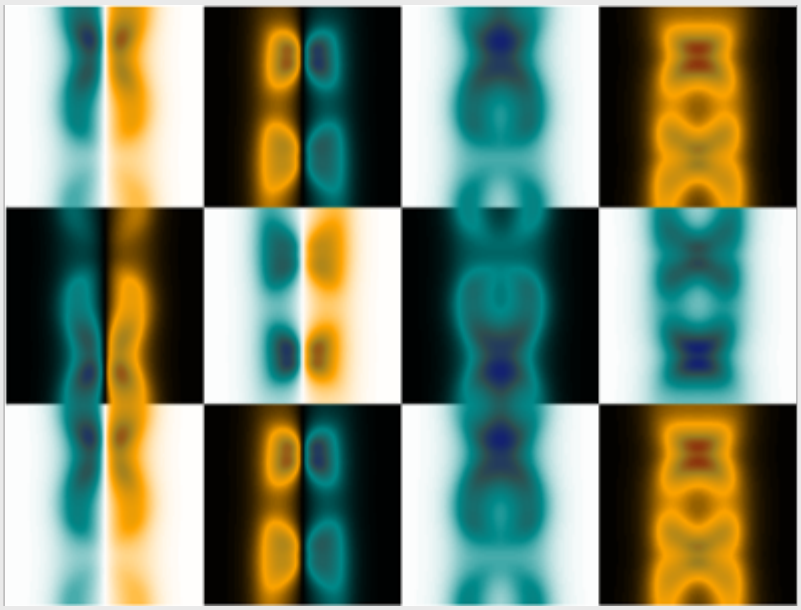
Reversible Thermal Diode and Energy Harvester with a Superconducting Quantum Interference Single-electron Transistor

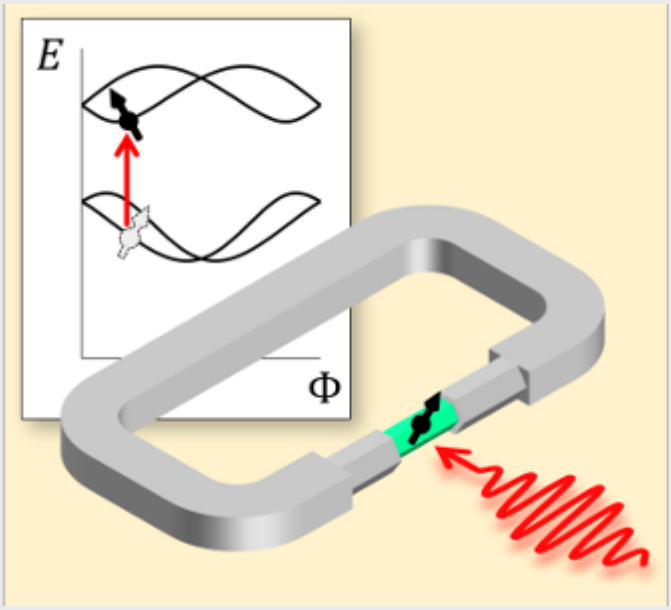


Articles: published in Applied Physics Letters by Rafael Sánchez, IFIMAC researcher and member of Department of Theoretical Condensed Matter Physics.

The density of states of proximitized normal nanowires interrupting superconducting rings can be tuned by the magnetic flux piercing the loop. Using these as the contacts of a single-electron transistor allows us to control the energetic mirror asymmetry of the conductor, thus introducing rectification properties. In particular, we show that the system works as a diode that rectifies both charge and heat currents and whose polarity can be reversed by the magnetic field and a gate voltage. We emphasize the role of dissipation at the island. The coupling to substrate phonons enhances the effect and furthermore introduces a channel for phase tunable conversion of heat exchanged with the environment into electrical current.

We thank discussions and comments from A. Levy Yeyati, C. Urbina, and F. Giazotto. This work was supported by the Spanish Ministerio de Economía, Industria y Competitividad (MINECO) via the Ramón y Cajal Program No. RYC-2016-20778 and the "María de Maeztu" Programme for Units of Excellence in R&D (No. MDM-2014-0377). We also acknowledge the Université Paris-Saclay international grants, the EU Erasmus program. [Full article]

Spin-Orbit Splitting of Andreev States Revealed by Microwave Spectroscopy



Article: published in Physical Review X by Sunghun Park, Alfredo Levy Yeyati, IFIMAC researcher and member of the Department of Theoretical Condensed Matter Physics.

We perform microwave spectroscopy of Andreev states in superconducting weak links tailored in an InAs-Al (core-full shell) epitaxially grown nanowire. The spectra present distinctive features with bundles of four lines crossing when the superconducting phase difference across the weak link is 0 or π. We interpret these features as arising from zero-field spin-split Andreev states. A simple analytical model, which takes into account the Rashba spin-orbit interaction in a nanowire containing several transverse subbands, explains these features and their evolution with magnetic field. Our results show that the spin degree of freedom is addressable in Josephson junctions and constitute a first step towards its manipulation. [Full article]

Synopsis: Putting a Spin on the Josephson Effect

Heavy, heavier, the softest - Heavy Electrons to Explore Correlated Quantum Matter

INC COLLOQUIUM – OFFICIAL ANNOUNCEMENT

Title: Heavy, heavier, the softest – Heavy Electrons to Explore Correlated Quantum Matter.

When: 10 December, 2018, 12h30

Where: Sala de Conferencias, Módulo 00, Faculty of Sciences, UAM.

Speaker: Silke Paschen, Vienna University of Technology, Austria.

Electronic correlations are a central theme in contemporary condensed matter physics – and hold promise for new functionality in quantum materials. In this talk I will show that heavy fermion compounds are ideal model systems to explore quantum phases and fluctuations driven by correlations. The effective mass of the conduction electron in a heavy fermion metal is not only ‘heavy’, but can become heavier and heavier on driving the system towards a quantum critical point, where the mass may ultimately diverge. At this point, a critical continuum of excitations leads to exotic properties not captured by the standard theory of metals, Fermi liquid theory. The associated accumulation of entropy makes the material extremely soft to the formation of new phases, including unconventional forms of superconductivity.