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
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.
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.