Chez Pierre

Presents ...

Wednesday, November 4, 2015
11:00am
MIT Room 4-331

Special Wednesday 11:00am

Chez Pierre Seminar

Ramón Aguado

Instituto de Ciencia de Materiales de Madrid (ICMM), Consejo Superior de Investigaciones Científicas (CSIC), Spain.

” Majorana bound states from exceptional points in non-topological superconductors“

Recent experimental efforts towards the detection of Majorana bound states have focused on creating the conditions for topological superconductivity. In this talk, I will discuss an alternative route, which achieves zero-energy Majorana bound states when a topologically trivial superconductor is strongly coupled to a helical normal region. Such a junction can be experimentally realised by e.g. proximitizing a finite section of a nanowire with spin-orbit coupling, and combining electrostatic depletion and a Zeeman field to drive the non-proximitized portion into a helical phase.

Majorana zero modes emerge in these junctions without fine-tuning as a result of charge-conjugation symmetry, and can be ultimately linked to the existence of `exceptional points' (EPs) in parameter space (non-hermitian degeneracies extensively studied in photonics [1-3], but seldom discussed in electronic systems), where two quasibound Andreev levels bifurcate into two quasibound Majorana zero modes. After the EP, one of the latter becomes non-decaying and fully localised as the junction approaches perfect Andreev reflection. As I will show, these Majoranas generated through EPs exhibit the full range of properties associated to conventional closed-system Majorana bound states, while not requiring topological superconductivity [4].

[1]*The physics of exceptional points*, W. D. Heiss, J. Phys. A 45, 444016 (2012).
[2]*Spawning rings of exceptional points out of Dirac cones,* Bo Zhen et al, Nature 525, 354 (2015)
[3]*Topologically protected defect states in open photonic systems with non-hermitian charge-conjugation and parity-time symmetry,* Simon Malzard, Charles Poli, Henning Schomerus, arXiv:1508.03985.
[4]*Majorana bound states from exceptional points in non-topological superconductors,* P. San-Jose, J. Cayao, E. Prada and R. Aguado, arXiv: 1409.7306.