Πανεπιστήμιο Κύπρου

The Department of Physics at the University of Cyprus
is organizing a seminar on

Wednesday, 20 of April 2016, time 2:00 p.m.

Room B228, Building 13, New Campus

Speaker:

Dr. Pablo M. Perez-Piskunow
Department of Quantum Nanoscience, TU Delft

"Introduction to Majorana fermions, a realization in condensed matter physics"

The interest in Majorana fermions reemerged in the past decades, after the discovery of neutrino oscillations [1,3] and a theoretical proposal for realizing Majorana bound states at the ends of a Kitaev chain [2]. In this Colloquium, we are going to talk about Majorana fermions in condensed matter. The particle was proposed in the 30's by Ettore Majorana, who disappeared before telling us how to detect a particle with no charge, zero energy, and furthermore, a particle that is its own antiparticle.

The quest for this elusive particle attracts much attention in many fields of physics. The high-energy community uses huge underground laboratories in an attempt to detect the majorana neutrinos. Mesoscopic physicists try to build tiny devices that combine major discoveries of physics in the past decades: extremely low temperatures, superconductors, nanowires and topological transitions are among the ingredients to make the majorana quasiparticle [4,5,6].

We will jump from superconductors to nanowires, in order to describe the most simple toy model for Majorana fermions, the Kitaev chain. This model can be simulated with Kwant [7], a python package for mesoscopic simulations, and many of the physics used in this talk is explained in an online course of Topology in Condensed Matter [8].

[1] E. Majorana, Nuovo Cimento 14, 171 (1937)
[2] A. Y. Kitaev. Physics-Uspekhi, 44:131, (2001)
[3] F. Wilczek, Nature Physics 5, 614 (2009)
[4] Qi & Zhang, Rev. Mod. Phys. 83, 1057 (2011) MF physics
[5] Qi et al, PRL 102, 187001 (2009) p-wave TSC
[6] M. Leijnse & K. Flensberg, Semicond. Sci. Technol. 27, 124003 (2012) nice review
[7] C. W. Groth, et al., New J. Phys. 16, 063065 (2014). (http://kwant-project.org/)
[8] EdX Course, Topology in Condensed Matter (http://tiny.cc/topocm)

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