北京大学量子材料科学中心

International Center for Quantum Materials, PKU

北京大学量子材料科学中心-巴西国际物理研究所量子信息和物质报告会

Scanning tunneling spectroscopy of Majorana zero modes in a Kitaev spin liquid

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The International Institute of Physics, in Natal, Brazil

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地点：北京大学物理楼，西563会议室

蔻享直播

Abstract

Frustrated magnets in two dimensions hold the promise of realizing some exotic quantum spin liquid phases in which fractional spin excitations obey non-Abelian statistics. A celebrated example in this context is the quantum spin liquid phase described by Kitaev's honeycomb model in a magnetic field. This phase is characterized by gapless chiral edge modes and a gapped bulk excitation spectrum containing Ising anyons, composed of Majorana zero modes (MZMs) bound to vortices of an emergent Z2 gauge field. In this talk I will describe characteristic signatures of MZMs in Kitaev spin liquids that should be seen in scanning tunneling spectroscopy (STS) experiments. The tunnel conductance is determined by the dynamical spin correlations of the spin liquid and by spin-anisotropic cotunneling form factors. Near a Z2 vortex, the tunnel conductance has a staircase voltage dependence, where conductance steps arise from MZMs and (at higher voltages) from additional vortex configurations. By scanning the probe tip position, one can detect the vortex locations. Our analysis suggests that it is possible to distinguish Z2 vortices in Kitaev spin liquids from trivial defects or magnetic impurities in polarized phases by combining the spatial, bias voltage and magnetic field dependence of the STS response.

About the speaker

Rodrigo Pereira is a research leader at the International Institute of Physics, in Natal, Brazil. He received his PhD from the University of British Columbia (Vancouver, Canada), was a postdoctoral researcher at the Kavli Institute of Theoretical Physics (Santa Barbara, USA) and an assistant professor at the University of Sao Paulo (Sao Carlos, Brazil). His research interests include dynamics of low-dimensional systems, quantum impurity models, quantum magnetism, and topological phases of matter.