seminars

Wednesday 24th May 2017 12:00h

C/Faraday, 9
Conference Hall
Imdea Nanociencia
Ciudad Universitaria de Cantoblanco

Disordered Weyl semimetals: chiral super-universality, fate of Fermi arcs and bulk-boundary correspondence

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Weyl semimetal (WSM), besides manifesting chiral anomaly and Fermi arc surface states, exhibits a quantum-phase transition (QPT) into a diffusive metallic phase at strong disorder. The existence of this phase transition has been established in the case of the chemical potential disorder represented by charge impurities.
However, (1) other types of disorder are also inevitably present in the experimental samples, and (2) the fate of the Fermi arcs has not been studied at this QPT.
I will first discuss generic phase diagram of a minimal WSM with two nodal points in the presence of disorder. We show that emergent chiral symmetry plays a fundamental role in determining universality classes of the disorder-driven transitions in a WSM. Chiral symmetric disorders exhibit superuniversality – chiral superuniversality – the correlation-length exponent (v) and the dynamical critical exponent (z) are independent of the type of disorder as long as the chiral symmetry is preserved [1]. They are equal to v=1 and z=3/2 to the one-loop in the expansion either about lower critical dimension or about the critical disorder distribution, in agreement with our numerical results.
I will then discuss the fate of the Fermi arcs at the disorder tuned QPT, and show that with increasing strength of disorder the Fermi arcs systematically loose its sharpness. Furthermore, close to WSM-metal QPT they completely dissolve into the metallic bath of the bulk of the system [2].
This establishes a bulk-boundary correspondence across the QPT with experimental consequences observable in ARPES and STM.

[1] B. Roy, R.-J. Slager and V. Juricic, arXiv: 1610.08973.

[2] R.-J. Slager, V. Juricic, and B. Roy, arXiv: 1703.09706.

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