武汉物数所理论交叉学术交流系列报告

(第一一三期)

Localization at the Edge of 2D Topological Insulator by Kondo Impurities

Prof. Boris Altshuler

Columbia University, New York, USA

2015年01月14日(周三) 上午10:30-12:00

频标楼4楼报告厅

About the speaker:

Research areas: Condensed Matter Physics of electrons in metals, Semiconductors and Superconductors, Quantum transport in disordered systems, Quantum devices, Quantum computation.

Awards: 1993 Hewlett-Packard Europhysics Prize (Agilent Prize); 1993 Edmund Stoner Award of IoP; 1998 Humboldt Research Award.; 2003 Oliver Buckley Prize of American Physical Society.

Professional Societies: 1993 Fellow of the American Physical Society; 1996 Member of the American Academy of Arts and Sciences; 2002 Member of the National Academy of Sciences.

Abstract: **Recent interest to the topological insulators [1] is inspired by the fact that their boundaries host gapless electronic excitations, which are extended and make the system conductive even in the presence of a potential disorder. 1D edge of a 2D topological insulator is predicted to have perfect conductance ($2e^2/h$): right and left moving electrons carry opposite spins and potential disorder cannot flip spins and thus causes neither back-scattering nor the usual 1D localization.**

What if there are localized spins coupled to the edge electrons? It turns out that the conductivity is still perfect provided that this coupling conserves the z-projection of the total spin of the impurities and electrons. Magnetic anisotropy violates this conservation and causes the backscattering even at $T=0$, i.e. an arbitrary small density of the spins with arbitrary weak anisotropy of the coupling leads to Anderson localization of the edge states in long enough samples [3]. The conclusion follows from the mapping of the electron-spin coupling to the well-studied problem [2] of disordered Luttinger liquid.

1. M.Z. Hasan and C.L. Kane, Rev. Mod. Phys. 82, 3045 (2010).
2. T.Giamarchi and H.J.Schulz, Phys. Rev. B 37, 325 (1988).
3. B.L.Altshuler, I.L.Aleiner, V.I. Yudson Phys. Rev. Lett 111, 086401 (2013)

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