FLEET SEMINAR

Probing quantum phase transition and decoherence in topological insulators with universal conductance fluctuations

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ABSTRACT

Topological insulators are a new class of materials characterised by linear gapless surface states, which emerge in the bulk band gap due to non-trivial topology of the band structure. These boundary states are a lucrative candidate for emerging technologies, such as, (i) future low power electronics, and (ii) quantum computation due to the topological protection of the electronic states. However, several issues remain to be addressed for achieving successful integration of topological insulators in the above-mentioned technologies.

One of such issues is the fact that, the only way to switch off topological field effect transistors is to induce a topological phase transition, i.e. transforming topological insulator to a trivial insulator by breaking some fundamental symmetry of the system, such as time reversal symmetry or inversion symmetry. In the first part of my talk, I will present results from my PhD in IISc, India, on directly probing such topological phase transition in a 3D topological insulator $Bi_{1.6}Sb_{0.4}Te_2Se$ as a function of a magnetic field with universal conductance fluctuations [1]. I will also give updates on our recent work at Monash University where we are working on engineering topological phase transitions in van der Waals heterostructures of topological insulators.

Successful integration of topological insulators as elementary units in quantum qubits requires a comprehensive understanding of the dephasing mechanisms governing the surface carriers in these materials. In the second part of my talk, I would like to highlight the curious case of saturation of phase coherence in topological insulators and demonstrate our experimental investigations to understand its origin [2].

References

[1] Saurav Islam, Semonti Bhattacharyya, Hariharan Nhalil, Suja Elizabeth, and Arindam Ghosh, Physical Review B, 2018, 97, 241412 (R)

[2] Saurav Islam, Semonti Bhattacharyya, Hariharan Nhalil, Mitali Banerjee, Anthony Richardella, Abhinav Kandala, Diptiman Sen, Nitin Samarth, Suja Elizabeth, Arindam Ghosh, arXiv:1904.08517

BIO

Semonti Bhattacharyya completed her PhD in Physics in Indian Institute of Science, Bangalore. Broadly, her area of interest is experimental condensed matter Physics. Her thesis work mainly focuses on disorder dynamics and quantum transport in mesoscopic samples of topological insulators and magnetically doped topological insulators.

Presently, she is working as a Postdoctoral research fellow at School of Physics and Astronomy, Monash University, Melbourne. She has created a remote-controlled precise set up to fabricate van der Waals heterostructures of two-dimensional materials and she is studying topological phase transitions in van der Waals heterostructures of topological insulators.

DATE: Friday 24th May
TIME: 11:30-12:30
VENUE: G59, K15,
Old Main Building
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