Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Webinar

Superconductivity and its interplay with magnetism in low dimensional quantum systems

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Superconductivity in low dimensional systems is very fragile and leads to a complex state of matter when subjected to pair breaking field, magnetic disorder, or when coupled to magnetic materials. One of the active fields of research in condensed matter physics is to engineer such a state of matter to realize novel superconductivity with different topological phases, called topological superconductivity (TCS). The emergence of such phase is associated with the appearance of so-called Majorana modes at the phase boundaries which has been proposed to provide a pathway for the next generation quantum computation. Despite intense research in the field, the physical realization of such a state of matter is still at a very elementary level and the emphasis on the fundamental research around the proposed model systems is much needed to be able to make use of the Majorana modes for the quantum computation. In this talk, I will present our latest work contributing to the fundamental understanding of the two model systems to realize TSC.

In the first part of the talk, I will show our investigation on the interaction between magnetic impurity (Fe) and an s-wave superconductor (TaO) and show that the exchange interaction between the impurity and Cooper pairs in a superconductor can be tailored by artificially building multi-impurity Kondo system. In the second part of the talk, I will show our study on the emergence of hybrid-superconductivity at the interface of the superconductor-semiconductor heterostructure. Here, we observe that the anisotropic properties of the semiconductor (black phosphorus) are inherited in the order parameter symmetry of the isotropic superconductor (Pb) at the interface. This result is important and often neglected in the device physics community that builds topological superconductors.

Monday, Sep 20th 2021

4:00 PM