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

Seminar

Field free Superconducting Diode Effect in noncollinear magnet superconductor heterostructures

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The superconducting diode effect (SDE) refers to non-reciprocal transport, where current flows without resistance in one direction but becomes resistive in the opposite direction. Such transport phenomena emerges when both inversion and time-reversal symmetries are broken, causing the critical current that drives the transition to the normal state to become direction-dependent. In this talk, I shall discuss a theoretical framework for realising a field-free SDE based on a two dimensional (2D) Shiba lattice featuring a conical spin texture. Using the real-space Bogoliubov– de Gennes (BdG) calculations, we illustrate that the conical spin configuration alone is sufficient to break the necessary inversion and time reversal symmetries, enabling nonreciprocal supercurrent flow without any external magnetic field, yielding diode efficiency exceeding 40%. Furthermore, we find that the efficiency of such a diode effect becomes strongly dependent on the direction of current flow, revealing a pronounced angular dependence that can be tuned by varying the pitches of the spin texture along the two spatial lattice directions. Our findings offer a pathway toward scalable, field-free superconducting components for non-dissipative electronics and quantum technologies.

Wednesday, Feb 4th 2026

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Auditorium, TIFRH