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

# Seminar

## Tomographic imaging of superconducting order using particle-hole interference in STM

## Archisman Panigrahi

### MIT, MA

Topological superconductors featuring a non-trivial phase winding and broken time-reversal symmetry are an important area of ongoing research. While real-space imaging near atomic impurities with scanning tunnelling microscopy (STM) had major success in revealing nodes of the superconducting gap function, notably in cuprates, accessing its phase winding remains difficult. In this talk, I will describe how STM can in fact access this phase information by utilising a pair of atomic impurities as beam-splitters, which generate a Young-type interference pattern in the tunnelling conductance. By analysing how the real-space interference patterns of Bogoliubov quasiparticles respond to the controlled rotation of impurity configurations, we develop superconducting order parameter tomography (SOPT), a technique that reconstructs the momentum space structure of the gap function, including its phase winding. This real-space tomography provides a broadly applicable route to identifying unconventional and topological superconductivity featuring non-BCS pairing. Finally, I will present an alternating approach, demonstrating that bands with broken time reversal symmetry host non-zero chiral three-spin correlations. This ground state chirality can be detected with spin-sensitive STM, and can serve as another probe of topological superconductivity.

***Thursday, Jan 8th 2026***

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

***Seminar Hall, TIFRH***