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

Internal Seminar

Superfluid He-II Cavity Optomechanics for Sensing and Analogue Gravity applications

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Over the past decade, superconducting circuits have emerged as a versatile platform for coupling to various degrees of freedom, including qubits and mechanical resonators. This has led to a plethora of results with applications in quantum sensing and computing. In this talk, I will introduce a unique degree of freedom—the sound modes in superfluid He-II, which effectively act as a mechanical resonator. I will present the full characterisation of this system across different temperatures, along with results on its nonlinear dynamics and turbulence phenomena. Building on this, I will discuss our latest experiments on third sound modes/surface waves on a thin layer of superfluid He-II coupled to a microwave re-entrant cavity for analogue gravity studies. In this setup, the equations of motion naturally map onto an effective curved space-time metric, providing a controlled platform to simulate cosmological phenomena.

Friday, Apr 11th 2025

14:30 Hrs

Seminar Hall, TIFRH