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

Seminar

Unconventional quantum oscillations in the two-dimensional electron gas at complex oxide interfaces unravelled in high magnetic fields

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Two-dimensional electron gas (2DEG) has been discovered at the surface and interface of many perovskite transition metal oxides. The well-known and most widely studied oxides-based 2DEG exists at the interface between $LaAlO_3$ (LAO) and $SrTiO_3$ (STO). At this interface, the coexistence of multiple intriguing phenomena (e.g., giant magnetoresistance, spin-orbit interaction, magnetism, and 2D superconductivity) makes it promising for many applications, including spintronics and quantum computing. However, despite many investigations in the past decade, its calculated electronic band structure has only been partially verified. To experimentally examine the electronic band properties of LAO/STO as well as other oxides-based 2DEG, I measured the Shubnikov-de Haas effect (quantum oscillations in magnetoresistance) in LAO/STO, LAO/$KTaO_3$ (KTO), and EuO/KTO in the extreme environment of high magnetic fields (up to 60 Tesla) and low temperatures (down to 0.1 K).

In this seminar, I will talk about techniques I used to measure the Shubnikov-de Haas effect in both high continuous and pulsed magnetic fields. Furthermore, by presenting a detailed analysis of unconventional quantum oscillations in LAO/STO and EuO/KTO, I will highlight the peculiarity of the electronic band structure of oxides-based 2DEG, one of the plausible candidates for next-generation electronics, spintronics, and quantum computing/information.

Tuesday, Mar 28th 2023

4:00 PM (Tea / Coffee 3.45 PM)

Auditorium, TIFR-H