

ICTS Statistical Physics and Condensed Matter Seminar

Title : Berry phase effects in electron hydrodynamics

Speaker : Subroto Mukerjee (Indian Institute of Science, Bengaluru)

Date : Wednesday, 21 January 2026

Time : 11:30 AM (IST)

Abstract : In conventional metals, the momentum of flowing electrons is not conserved in the bulk because they scatter off impurities and phonons. However, in ultraclean systems such as very high mobility graphene and other two-dimensional materials, it is possible for the flow of electrons to be hydrodynamic with momentum conservation in the bulk. This behaviour in conjunction with Berry phase effects arising from band structure can give rise to novel dissipationless vortical transport coefficients. These coefficients relate the stress tensor of the fluid to applied gradients in the electrostatic potential and temperature. Conversely, they also relate charge and heat currents to gradients in the velocity field of the fluid via Onsager relations. In this talk, I will derive expressions for the vortical coefficients within a semiclassical approximation. The most important ingredient in the derivation will be the anomalous velocity of electron wavepackets arising from the Berry curvature generated by the Bloch states. I will also discuss the importance of subtracting diamagnetic currents to obtain the vortical coefficients. The talk will be pedagogical in nature and mainly on the blackboard with a sufficient amount of emphasis placed on technical details.

Venue : Emmy Noether Seminar Room

Zoom Link: <https://icts-res-in.zoom.us/j/98956582748?pwd=O0oeOHse09J5A9yHoZYzvEh1PDOMLE.1>

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