

Seminar

Universal quantized thermal conductance in graphene

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In condensed matter physics, last one decade, the graphene, a single carbon atomic layer, has emerged as an ideal platform to experimentally verify many theoretical predictions. One of those predictions are to see the quantum limit of electrical conductance as well as thermal conductance. Although the quantization of electrical conductance (in e^2/h) has been observed in graphene quantum Hall (QH) but the demonstration of quantization of thermal conductance in terms of its quantum limit ($\pi^2 k_B^2 / 3h T$) remains challenging due to the requirement of accurate measurement of very small temperature (T) change. The quantum limit of thermal conductance has been demonstrated recently in GaAs-AlGaAs heterostructures but its determination in graphene QH will open a new path to study the unique exotic phases near the Dirac point, which can be uniquely identified by the thermal conductance measurements. Motivated by this we have carried out the thermal conductance measurement in the integer QH regime of graphene by sensitive noise thermometry setup with an accuracy of $\sim 2\text{mK}$ temperature change. We have measured the thermal conductance for $\nu=1, 2$ and 6 plateaus and its values agree with the quantum limit of it by more than 90% accuracy. Our results also reveal that at low temperature (below 60mK) the thermal transport happens predominantly through the QH edge state whereas above 60mK electron-phonon coupling starts contributing to the thermal transport, which increases as $\sim T^4$. These thermal transport measurements in graphene QH will pave the way to investigate the flow of information for exotic systems like twisted bilayer graphene with magic angle or even denominator QH fractions in bilayer graphene.

Monday, Dec 10th 2018

4:00 PM (Tea/Coffee at 3:30 PM)

Auditorium, TIFR-H