APCTP SEMINAR

Measurement of Electronic Thermal Conductance in Low Dimensional Materials with Nonlocal Noise Thermometry

Prof. Philip Kim

Harvard University

May 30th (Mon.) 16:00

302, Science Building 3, POSTECH & Online via ZOOM

In low-dimensional systems, the combination of reduced dimensionality, strong interactions, and topology has led to a growing number of many-body quantum phenomena. Thermal transport, which is sensitive to all energy-carrying degrees of freedom, provides a discriminating probe of emergent excitations in quantum materials. However, thermal transport measurements in low dimensions are dominated by the phonon contribution of the lattice. An experimental approach to isolate the electronic thermal conductance is needed. In this presentation, I will discuss how the measurement of nonlocal voltage fluctuations in a multiterminal device can reveal the electronic heat transported across a mesoscopic bridge made of low-dimensional materials. By using graphene as a noise thermometer, we demonstrate quantitative electronic thermal conductance measurements of graphene and carbon nanotubes up to 70K, achieving a precision of ~1% of the thermal conductance quantum at 5K. Employing linear and nonlinear thermal transport, we observe signatures of long-range interaction-mediated energy transport in 1D, in agreement with a theoretical model.

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■ **Contact information**

- Host: Gil-Ho Lee (lghman@postech.ac.kr)
- Office: Research Support Team (ra@apctp.org)

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