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Thermal Conductivity Measurements in Sub-micron Graphene Crystals SERAP YIGEN, VAHID TAYARI, JAMES PORTER, JOSHUA O. ISLAND, A. R. CHAMPAGNE, Department of Physics, Concordia University, Montreal, QC, Canada — Heat conductivity measurements in graphene using optical spectroscopy have been limited to micron-scale devices, and mostly room temperature and uncontrolled charge densities. We present an electron transport method to measure thermal conductivity, κ, in sub-micron suspended graphene, over a broad range of temperature (50K - 350K), and as a function of charge density. We study suspended two-point graphene devices whose length ranges from 350 nm up to 1.2 micron. We show that the there can be good thermalization of electrons and acoustic phonons in these devices. This enables us to use electron resistivity as a thermometer for electrons or phonons. Our devices are in the near-diffusive regime, permitting Joule heating of the samples and modelling heat transport using a heat equation. We measure an increase of two orders of magnitude in κ over the studied temperature range and crystal lengths. κ is dominated by the electronic heat conductivity in sub-micron devices, and phononic heat conductivity in longer devices. In short devices, we can tune κ by more than a factor of two with charge density, opening the possibility of creating room temperature heat transistors.

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