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Graphene thermal transport studies via radio-frequency, cross-correlated Johnson noise thermometry JESSE CROSSNO, XIAOMENG LIU, KE WANG, ACHIM HARZHEIM, Harvard University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, THOMAS OHKI, KIN CHUNG FONG, Raytheon BBN Technologies, PHILIP KIM, Harvard University — The electronic temperature of a dissipative, mesoscale device can be determined by monitoring the Johnson noise power emitted over a wide frequency range. Using radiometry techniques, we have developed a high-frequency, wide bandwidth, cross-correlation Johnson noise thermometer operating from room temperature to cryogenic levels that is compatible with strong magnetic fields. Precisions ranging from 2 to 25 mK are demonstrated over the temperature range of 3 to 300 K with 1 second of integration time. This non-invasive thermometer has enabled us to perform sensitive electronic thermal transport studies in boron nitride encapsulated monolayer graphene over two orders of magnitude in temperature. This versatile technique also enables precision Fano factor measurements as well as studies of correlated noise phenomena, such as those found in layered Van der Waals heterostructures.

Jesse Crossno
Harvard University

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