Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Thermal transports in two-dimensional materials. XIANGFAN XU, Center for Phononics and Thermal Energy Science, School of Physics Science and Engineering, Tongji University, BAOWEN LI, Department of Mechanical Engineering, University of Colorado Boulder — As atomically thick two-dimensional (2D) materials, Graphene and Boron nitride (BN) exhibits extraordinary optical and mechanical properties, and extremely high thermal conductivity. Being very stable nanometer-thick membrane that can be suspended between two leads, graphene and BN provide a perfect test platform for studying thermal transport in 2D systems. Here, we report experimental measurements of thermal conduction in suspended single layer graphene and few-layer BN. a) We found that thermal conductivity in single layer graphene increases with sample length (L) and remains length-dependent with logL at T= 300K even for lengths much larger than the averaged phonon mean free path, providing experimental evidence of the Breakdown of Fourier's law in thermal conduction. b) We observed a thickness-dependent thermal conductivity in bilayer suspended h-BN with the room temperature value reaching as high as 484 W/(mK), exceeding that in bulk h-BN. These results are the consequence of the two-dimensional nature of phonons and provide fundamental understanding into thermal transports in two-dimensional materials.

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Date submitted: 09 Nov 2016 Electronic form version 1.4