Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Theory and Experiment of Scanning Thermoelectric Microscopy with Atomic Resolution EUI-SUP LEE, KAIST, SANGHEE CHO, HO-KI LYEO, Korea Research Institute of Standards and Science, YONG-HYUN KIM, KAIST — Heat, a measure of entropy, is largely perceived to be diffusive and transported incoherently by charge carriers and lattice vibrations in a material, which is hard to be spatially localized. Heat transport is therefore considered a challenging means of the local imaging of a material and its electronic states. However, Cho *et al.* [1] reported a series of striking wavefunction images of epitaxial graphene by measuring thermoelectric voltages with a heat-based scanning probe microscopy. Here we present how the thermoelectric signal is related to the atomic-scale wavefunctions and what the role of the temperature is at such a length scale. An exact expression of local thermoelectric voltage is deduced, and a computer-based thermoelectric imaging simulation method with first-principles wavefunction calculations is developed and performed on pristine and defective graphene. From this analysis, we find that coherent electron and heat transport through a point-like contact produces an atomic Seebeck effect. We will also discuss the connection between Seebeck coefficient and thermal properties of a material, such as electronic heat capacity and quantum of thermal conductance, by introducing the statistically defined Fermi temperature [2]. [1] S. Cho, S. D. Kang, W. Kim, E.-S. Lee, S.-J. Woo, K.-J. Kong, I. Kim, H.-D. Kim, T. Zhang, J. A. Stroscio, Y.-H. Kim, and H.-K. Lyeo, arXiv:1305.2845, Nature Mater. **12**, 913 (2013). [2] E.-S. Lee, S. Cho, H.-K. Lyeo, and Y.-H. Kim, arXiv:1307.3742, *submitted* (2013).

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Date submitted: 15 Nov 2013 Electronic form version 1.4