Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Electrical energy harvesting from single-atomic-layer MoS_2 LEI WANG, Columbia University, WENZHUO WU, Georgia Institute of Technology, YILEI LI, TONY HEINZ, Columbia University, ZHONG LIN WANG, Georgia Institute of Technology, JAMES HONE, Columbia University — Monolayer MoS_2 is predicted to be strongly piezoelectric, an effect that disappears in the bulk due to the opposite orientations of adjacent atomic layers. We observe the first experimental study of the piezoelectric properties of two-dimensional (2D) MoS_2. We find that cyclic stretching and releasing of thin MoS_2 flakes with an odd number of atomic layers produces oscillating piezoelectric voltage and current outputs, while no output is observed for flakes with an even number of layers. In agreement with theoretical predictions, the output increases with decreasing thickness and reverses sign when the strain direction is rotated by 90 degrees. Transport measurements show a strong piezotronic effect in single layer MoS_2, but not in bilayer and bulk MoS_2. The coupling between piezoelectricity and semiconducting properties in 2D nanomaterials may enable applications in powering nanodevices, adaptive bio-probes and tunable/stretchable electronics/optoelectronics.

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Date submitted: 14 Nov 2014 Electronic form version 1.4