Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Graphene Frequency Multipliers[1] HAN WANG, DANIEL NEZICH, JING KONG, TOMAS PALACIOS, Massachusetts Institute of Technology — In this paper we demonstrate a new application for graphene: full-wave signal rectification and frequency doubling. Due to its ambipolar transport properties, graphene field-effect transistors (GFET) show a "V"-shaped transfer characteristic about the minimum conduction point. Frequency doubling can be realized with a single GFET by biasing the gate to the minimum conduction point and superimposing a sinusoidal input signal to the gate. Electrons and holes will conduct in alternative half cycles to produce an output signal at the drain, whose fundamental frequency is twice that of the input. Sub-linear IV characteristics of the GFET near minimum conduction point help improve the spectrum purity of the output signal. In our experiments, for an input frequency of 10 KHz, the output signal showed excellent spectrum purity (94% of RF power at 20 KHz) in the absence of any filtering elements. Given the extremely high electron mobility in graphene (>100,000 cm^2/Vs at room-temperature), such ambipolar devices have the potential to operate at very high frequencies and allow the fabrication of new THz sources and sensors, as well as high speed transmitters and receivers.

[1]This work is partially supported by Interconnect Focus Center (IFC) and Microsystems Technology Laboratories MIT.

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Date submitted: 20 Nov 2008 Electronic form version 1.4