Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Magnetoresistance of Metal-Shunted Graphene Devices PAUL CAMPBELL, ADAM FRIEDMAN, F. KEITH PERKINS, JEREMY ROBINSON, US Naval Research Laboratory — Graphene, a single atomic layer of hexagonally arranged carbon atoms, presents the optimal platform to study magnetoresistance (MR) effects because of its temperature-independent mobility and linear band structure with zero band gap. Extraordinary magnetoresistance (EMR) can be realized in metal-shunted graphene devices. Here, due to the different magnetic-field-dependent resistances of the metallic shunt, graphene, and shunt-graphene interface, current flows easily through the shunt in zero and low magnetic field, while in high magnetic field, more current flows around the shunt and is redistributed in the graphene. Devices made from chemical vapor deposition (CVD) graphene grown on copper and transferred to a SiO_2/Si substrate with Ti/Au shunts display gate-tunable longitudinal MR of $\sim$600% at 12 T and also show promise for use as Hall sensors. Graphene magnetoresistance devices have many possible applications including magnetic field sensors and magnetic read-heads. In contrast with the many proposed electronic uses for graphene, which necessitate the creation of a band-gap, graphene magnetoresistance devices that exploit LMR or EMR provide a use for as-grown or deposited graphene.

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Date submitted: 16 Nov 2010 Electronic form version 1.4