Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Tunneling spectroscopy of single- and double-layer graphene planar tunnel junctions CONOR PULS, NEAL STALEY, YING LIU, Department of Physics, Pennsylvania State University — It is of fundamental as well as technological concern if there exists an energy gap in single- and double-layer graphene devices. Single-layer graphene is thought to be gapless while double-layer graphene features an energy gap tunable by controlling the charge difference between the two layers. Previously, scanning tunneling microscopy and spectroscopy studies have been employed to examine energy spectra of graphene films. This approach produces local charge inhomogeneity at the probe tip that could significantly alter the local density of states (DOS) in graphene. Planar tunnel junctions provide a probe of the DOS that should not induce such an inhomogeneity in the charge carrier density. We fabricated planar tunnel junctions on single- and double-layer graphene using an ultrathin quartz filament as a shadow mask over mechanically exfoliated graphene as an alternative to lithographic procedures so as to avoid possible contamination in a wet lithography process. We have measured tunneling spectra for both weakly and strongly disordered samples. For single-layer graphene, we observed an unexpected gap. For double-layer graphene, we found a gap and other features in the tunnel spectra by changing the back gate and tunnel junction bias voltages independently - thereby tuning the charge difference between the top and bottom layer - as well as varying magnetic field and temperature.

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Date submitted: 27 Nov 2007 Electronic form version 1.4