Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Negative refractive index electron 'optics', pseudospintronics and chiral tunneling in graphene pn junction – beating the Landauer switching limit?[1] REDWAN SAJJAD, University of Virginia, CHENYUN PAN, AZAD NAEEMI, Georgia Institute of Technology, AVIK GHOSH, University of Virginia — We use atomistic quantum kinetic calculations to demonstrate how graphene PN junctions can switch with high ON currents, low OFF currents, steep gate transfer characteristics and unipolar rectification. The physics of such unconventional switching relies on (a) field-engineering with patterned gates to create a *transmission gap,* by sequential filtering of all propagating modes, and (b) using tilted junctions to suppress Klein tunneling under appropriate gate biasing, making that transmission gap *gate tunable.* The doping ratio of the junction dictates the energy range over which the tilt angle exceeds the critical angle for transmission, generating thereby a gate tunable transmission gap that enables switching at voltages less than the Landauer-Shannon thermal limit. The underlying physics involves a combination of 'electron optics' driven by Snell's law, negative index metamaterial with a PN junction, and pseudospin driven chiral tunneling, for which we also present experimental verification. [Sajjad et al, APL 99, 123101 (2011); Sajjad et al, PRB 86, 155412 (2012)].

[1]Authors acknowledge financial grant from NRI-INDEX

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Date submitted: 09 Nov 2012 Electronic form version 1.4