Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

First-principles simulations of Graphene/Transition-metal-Dichalcogenides/Graphene Field-Effect Transistor[1] XIANGGUO LI, YUNPENG WANG, X. -G ZHANG, HAI-PING CHENG, Univ of Florida - Gainesville — A prototype field-effect transistor (FET) with fascinating properties can be made by assembling graphene and two-dimensional insulating crystals into three-dimensional stacks with atomic layer precision. Transition metal dichalcogenides (TMDCs) such as WS_2, MoS_2 are good candidates for the atomically thin barrier between two layers of graphene in the vertical FET due to their sizable bandgaps. We investigate the electronic properties of the Graphene/TMDCs/Graphene sandwich structure using first-principles method. We find that the effective tunnel barrier height of the TMDC layers in contact with the graphene electrodes has a layer dependence and can be modulated by a gate voltage. Consequently a very high ON/OFF ratio can be achieved with appropriate number of TMDC layers and a suitable range of the gate voltage. The spin-orbit coupling in TMDC layers is also layer dependent but unaffected by the gate voltage. These properties can be important in future nanoelectronic device designs.

[1]DOE/BES-DE-FG02-02ER45995; NERSC

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Date submitted: 06 Nov 2015 Electronic form version 1.4