Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Quantum Spin Hall phase in multilayer graphene[1] NOEL GARCIA, JOSE LUIS LADO, JOAQUIN FERNANDEZ-ROSSIER, International Iberian Nanotechnology Laboratory (INL), THEORY OF NANOSTRUCTURES TEAM — We address the question of whether multilayer graphene systems are Quantum Spin Hall (QSH) insulators. Since interlayer coupling coples p_z orbitals to s orbitals of different layers and Spin-Orbit (SO) couples p_z orbitals with p_x and p_y of opposite spins, new spins mixing channels appear in the multilayer scenario that were not present in the monolayer. These new spin-mixing channels cast a doubt on the validity of the spin-conserving Kane-Mele model for multilayers and motivates our choice of a four orbital tight-binding model in the Slater-Koster approximation with intrinsic Spin-Orbit interaction. To completely determine if the QSH phase is present we calculate for different number of layers both the Z_2 invariant for different stackings (only for inversion symmetric systems), and the density of states at the edge of semi-infinite graphene ribbon with armchair termination. We find that systems with even number of layers are normal insulators while systems with odd number of layers are QSH insulators, regardless of the stacking.

[1]We acknowledge financial support by Marie-Curie-ITN 607904-SPINOGRAPH

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Date submitted: 13 Nov 2014 Electronic form version 1.4