Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Interacting fermions on the honeycomb bilayer: From weak to strong coupling[1] OSKAR VAFEK, National High Magnetic Field Lab/FSU — Many-body instabilities of the half-filled honeycomb bilayer are studied using weak-coupling renormalization group (RG) as well as strong-coupling expansion [1,2]. For spinless fermions, there are 4 independent four-fermion contact couplings. Generally, we find runaway RG flows which we associate with ordering tendencies. The broken symmetry state is typically a gapped insulator with either broken inversion or broken time-reversal symmetry, with a quantized anomalous Hall effect. Additionally, a tight-binding model with nearest-neighbor hopping and nearest-neighbor repulsion is studied in weak and strong couplings and in each regime a gapped phase with inversion symmetry breaking is found. In the strong-coupling limit, the ground-state wave function is constructed for vanishing in-plane hopping but finite interplane hopping, which explicitly displays the broken inversion symmetry and a finite difference between the number of particles on the two layers. In the spin-1/2 case we use Fierz identities to show that there are 9 independent four-fermion contact couplings[2]. The 9 RG equations in this case reduce to the 3 found in Ref.[1] under the assumptions stated in Ref.[1]. They are further used to show that, just as in strong coupling, the most dominant weak-coupling instability of the repulsive Hubbard model (at half filling) is an antiferromagnet. [1] O. Vafek and K. Yang, PRB **81**, 041401 (2010). [2] O. Vafek, PRB **82**, 205106 (2010)

[1]NSF CAREER award Grant No. DMR-0955561

Oskar Vafek
National High Magnetic Field Lab/FSU

Date submitted: 16 Nov 2010 Electronic form version 1.4