Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Unusual quantum Hall Ferromagnetism in Bilayer Graphene
BARLAS YAFIS, University of Texas at Austin, RENE COTE, Université de Sherbrooke, ALLAN MACDONALD, University of Texas at Austin — Bilayer graphene has eight nearly degenerate Landau levels at the Dirac point compared to the four nearly degenerate levels which occur in an isolated layer. The additional degeneracy is associated with the degeneracy of $n = 0$ and $n = 1$ orbital Landau level states in the bilayer case and adds a Landau level pseudospin degree of freedom to the spin and valley pseudospins present in the single layer case. We predict broken symmetry states which lift the associated degeneracies with a Hunds rule which orders spin first, then valley, and finally the Landau-level pseudospin. It follows that the Landau level pseudospin orders at all odd total filling factors. We find unusual collective modes which are not gapped even though the system has uniaxial anisotropy, and a $q^{3/2}$ dispersion at small q because the divergence of the pseudospin magnetization produces charges with long-range Coulomb interactions. Because of the charge carried by these collective modes, they are dipole active. We predict unusual intra-Landau-level contributions to the cyclotron resonance signal. We will also discuss unusual properties of the Skyrmions spin-textures of these quantum Hall ferromagnets.

Yafis Barlas
University of Texas at Austin

Date submitted: 13 Dec 2007 Electronic form version 1.4