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Symmetry Broken States of Dirac Fermions in Graphene with A Partially Filled High Landau Level HAO WANG, D.N. SHENG, Department of Physics and Astronomy, California State University Northridge, F.D.M. HALDANE, Department of Physics, Princeton University — We report on numerical study of symmetry broken states of the Dirac electrons in partially filled N=3 Landau level (LL) in graphene. At half-filling, the static density-density correlation function displays sharp peaks at nonzero wavevectors. Finite-size scaling shows that the peak value grows with electron number and diverges in the thermodynamic limit, indicating an instability toward a charge density wave. A weak disorder potential plays the role of selecting a symmetry broken stripe phase as the ground state from the nearly degenerated low-energy manifold. Such a quantum phase is experimentally observable through transport measurements. Associated with the special wavefunctions of the Dirac LL, both stripe and bubble phases become possible candidates for the ground state at lower filling numbers in the N=3 LL. We have also studied the ground state evolution and quantum phase transitions of the 2D electron gas at half-filled N=1 LL under an additional repulsive three-body interaction.

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