A correlated Anderson insulator on the honeycomb lattice
LUFENG ZHANG, Beijing Normal Univ, CHIA-CHEH CHANG, University of California, Davis, HSIAU-CHANG HUNG, The University of Texas at Austin, TIANXING MA, Beijing Normal Univ, RICHARD T. SCALLETAR, University of California, Davis — We study the effect of disorder on the semimetal – Mott insulator transition in the half-filled repulsive Hubbard model on a honeycomb lattice, a system that features vanishing density of states at the Fermi level. Using the determinant quantum Monte Carlo method, we characterize various phases in terms of the bulk-limit antiferromagnetic (AF) order parameter, compressibility, and temperature-dependent DC conductivity. In the clean limit, our data are consistent with previous results showing a single quantum critical point separating the semi-metallic and AF Mott insulating phases. With the presence of randomness, a non-magnetic disordered insulating phase emerges. Inside this disordered insulator phase, there is a crossover from a gapless Anderson-like insulator to a gapped Mott-like insulator.