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Phases of correlated spinless fermions on the honeycomb lattice MARTIN HOHENADLER, University of Würzburg, MARIA DAGHOFER, IFW Dresden — We use exact diagonalization and cluster perturbation theory to address the role of strong interactions and quantum fluctuations for spinless fermions on the honeycomb lattice. We find quantum fluctuations to be very pronounced both at weak and strong interactions. A weak second-neighbor Coulomb repulsion V_2 induces a tendency toward an interaction-generated quantum anomalous Hall phase, as borne out in mean-field theory. However, quantum fluctuations prevent the formation of a stable quantum Hall phase before the onset of the charge-modulated phase predicted at large V_2 by mean-field theory. Consequently, the system undergoes a direct transition from the semimetal to the charge-modulated phase. For the latter, charge fluctuations also play a key role. While the phase, which is related to pinball liquids, is stabilized by the repulsion V_2, the energy of its low-lying charge excitations scales with the kinetic energy t, as in a band insulator.

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