A correlated Anderson insulator on the honeycomb lattice
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— We study the effect of disorder on the semimetal – Mott
insulator transition in the half-filled repulsive Hubbard model on a honeycomb lat-
tice, 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 con-
sistent 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 insula-
tor phase, there is a crossover from a gapless Anderson-like insulator to a gapped
Mott-like insulator.

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