

Abstract Submitted
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BCS-BEC crossover on the two dimensional honeycomb lattice¹

ERHAI ZHAO, ARUN PARAMEKANTI, Department of Physics, University of Toronto — We study the attractive Hubbard model on a honeycomb lattice. At half-filling, we find a quantum critical point (QCP) separating a weakly interacting semimetal with massless Dirac fermions from a strong coupling s-wave superconducting state. Away from half-filling, this model exhibits a BCS-BEC crossover in the vicinity of this QCP. Studying this model using ultracold atoms in an optical lattice could shed light on quantum phase transitions and BCS-BEC crossovers in electronic models. We present results for the evolution of several observables through the BCS-BEC crossover at zero temperature – the Fermi surface, the superfluid density and the collective sound and Leggett modes. We also suggest a method to observe the Leggett mode in an optical lattice.

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