

Abstract Submitted
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The BCS-BEC crossover in density in GaAs heterostructures for bilayers of electrons and holes with mismatched densities DAVID NEILSON, PIERBIAGIO PIERI, GIANCARLO STRINATI, University of Camerino — We have investigated excitonic superfluidity in electron-hole bilayers in GaAs at low temperatures. We analyze the crossover from the BCS limit of overlapping pairs (high carrier density) to the BEC limit of non-overlapping tightly-bound pairs (low carrier density) by independently varying the densities of the electrons and holes. The different electron and hole effective masses in GaAs causes the phase diagram to depend strongly on the direction of the density imbalance. We can identify the crossover region between the BCS and BEC regimes in the phase diagram, and we find the richest variety of phases in this crossover region. We propose detection of a jump in the electron and hole chemical potentials across zero-density imbalance as the criterion for the occurrence of superfluidity. We make a comment on the relation of our results to density and mass imbalances in ultracold Fermi atoms.

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