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Pairing states of a one-dimensional spin imbalanced Fermi gas accross a Feshbach resonance

ADRIAN FEIGUIN, University of Wyoming

A description of the BCS-BEC crossover in one dimension that properly accounts for the coexistence of fermions and bound pairs can be achieved in the framework of the Bose-Fermi resonance model, in which two fermions in an open channel couple resonantly to a diatomic molecule in the closed channel. In the case of a gas with spin imbalance, pairing correlations consistent with a phase of the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) type dominate a wide parameter range on the BCS side of the resonance. In the BEC regime, the FFLO correlations are suppressed, leading to a Bose-Fermi mixture consisting of a conventional bosonic superfluid in the molecular channel immersed into a gas of fermions that is either partially or fully polarized. I will present results of a comprehensive numerical study of this model using the density matrix renormalization group method, and determine the dependence of the critical polarization on filling and detuning. [F. Heidrich-Meisner, A.E. Feiguin, U. Schollwoeck, W.Z werger, Phys. Rev. A81, 023629 (2010)]