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Pair Condensation in a Finite Trapped Fermi Gas

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— Cold atomic fermi gases are widely studied examples of strongly interacting quantum systems. Examples include $^{40}$K, $^6$Li and neutron matter. In the unitary regime, where the scattering length is very large compared to the mean inter-particle distance, they are nonperturbative and exhibit universal behavior. Moreover, they can be created in the lab, providing an excellent testing ground for theory. In this talk I will describe quantum Monte Carlo calculations we have been performing to study the signatures of pairing and the superfluid phase transition in finite-size systems. Using the Auxiliary Field Monte Carlo (AFMC) method, we study the pairing gap, condensate fraction, pair wavefunction and density profile as a function of temperature. Defining the onset of condensation $T_{\text{cond}}$ as the temperature when the condensate fraction crosses its (finite) noninteracting limit, we consider the question of whether pairing occurs prior to condensation in the unitary regime.

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