Fermionic superfluidity with positive scattering length

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Superfluidity in an ultracold Fermi gas is usually associated with either a negative scattering length, or the presence of a two-body bound state. We show that none of these ingredients is necessary to achieve superfluidity. Using a narrow Feshbach resonance with strong repulsive background interactions, the effective interactions can be repulsive for small energies and attractive for energies around the Fermi energy, similar to the effective interactions between electrons in a metallic superconductor. This can result in BCS-type superfluidity while the scattering length is positive (see Figure 1).

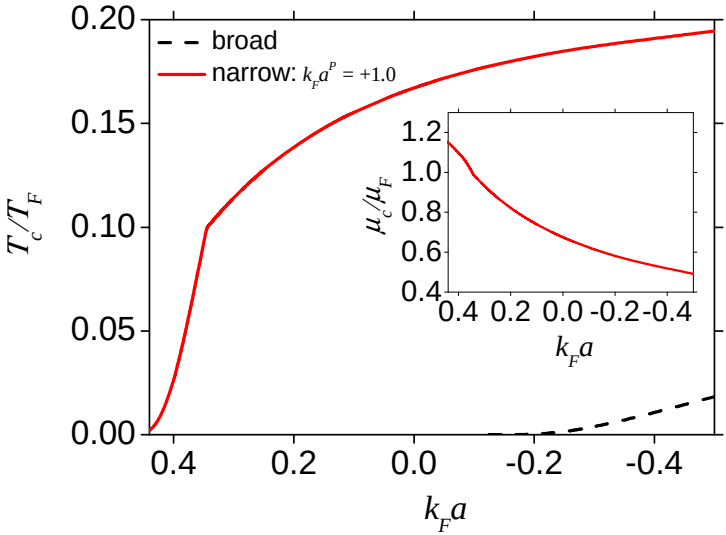

Figure 1: *Critical temperature T_c in the BCS limit, for small negative and positive scattering length $k_F a$, in the case of a narrow Feshbach resonance with strong repulsive background interactions (solid line), and of a broad resonance (dashed line). Inset: chemical potential μ_c at T_c for identical parameters.*