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Superfluid transition temperature and its zero density limit extrapolation in a unitary atomic Fermi gas on a lattice[1] QIJIN CHEN, Zhejiang University — The superfluid transition temperature T_c of a unitary Fermi gas has been of great interest. One way to study T_c in a 3D continuum is to study fermions on a lattice at finite densities and then extrapolate to the zero density limit, as has been done in quantum Monte Carlo (QMC) simulation studies. For this extrapolation to work, it is essential to probe the densities in the asympotic regime. In this talk, we study fermions on a three-dimensional isotropic lattice with an attractive on-site interaction as a function of density n, from half filling down to 5.0×10^{-7} per unit cell, using a pairing fluctuation theory. As n decreases towards $n = 0$, T_c/E_F increases to the leading order linearly in $n^{1/3}$, and reaches the zero density limit $T_c/E_F = 0.256$, consistent with that calculated directly in the continuum for a contact potential. Inclusion of the particle-hole channel reduces T_c/E_F to 0.217, in agreement with experiment. However, except for very low n, T_c/E_F exhibits significant higher order nonlinear dependence on $n^{1/3}$. The densities accessed by QMC studies are still not low enough to be in the asymptotic regime. References: Q.J. Chen, arXiv:1109.5327; arXiv:1109.2307; Q.J. Chen et al, PRL 81, 4708(1998); PRB 59, 7083(1999).

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