Spin Susceptibility and Strong Coupling Effects in an Ultracold Fermi Gas

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We investigate magnetic properties and effects of strong pairing fluctuations in the BCS (Bardeen-Cooper-Schrieffer)-BEC (Bose-Einstein condensation) crossover regime of an ultracold Fermi gas. Using an extended T-matrix theory[1], we calculate spin susceptibility χ above the superfluid phase transition temperature T_c. In the crossover region, we show that the formation of preformed Cooper pairs naturally leads to a non-monotonic temperature dependence of χ, which is similar to the so-called spin-gap phenomenon observed in the under-doped regime of high-T_c cuprates[2]. From this temperature dependence, we determine the spin-gap temperature as the temperature at which χ takes a maximum value, in the whole BCS-BEC crossover region. Since the spin susceptibility is sensitive to the formation of singlet Cooper pairs, our results would be useful in considering the temperature region where pairing fluctuations are important in the BCS-BEC crossover regime of an ultracold Fermi gas.

1. T. Kashimura, R. Watanabe, and Y. Ohashi, Phys. Rev. A **86** 043622 (2012).
2. Y. Yoshinari, H. Yasuoka, Y. Ueda, K. Koga, and K. Kosuge, J. Phys. Soc. Jpn. **59**, 3698 (1990).

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