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Spin susceptibility and effects of fluctuating Cooper pairs in the BCS-BEC crossover regime of a superfluid Fermi gas[1] HIROYUKI TAJIMA, RYO HANAI, YOJI OHASHI, Keio University — We theoretically discuss the spin susceptibility χ and effects of strong-coupling corrections in the BCS-BEC crossover regime of an ultracold Fermi gas. Using an extended T-matrix approximation, we calculate χ over the entire BCS-BEC crossover region, showing that this magnetic quantity is very sensitive to pairing fluctuations in both the normal and the superfluid phase. In the normal state, it is suppressed by preformed singlet Cooper pairs near $T_{\rm c}$, being similar to the spin-gap phenomenon in high-$T_{\rm c}$ cuprates. Below $T_{\rm c}$, on the other hand, pairing fluctuations enhance χ, in the sense that the suppression of this quantity by the superfluid order is weakened due to partial dissociation of Cooper pairs. From these, we determine the region where pairing fluctuations strongly affect spin excitations in the phase diagram of a Fermi gas with respect to the temperature and the strength of a pairing interaction. We also compare our results with the recent experiments on a ^{6}Li Fermi gas. Our results indicate that the spin susceptibility is a useful observable in understanding strong-coupling properties of an ultracold Fermi gas in the BCS-BEC crossover region.

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