Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Magnetic excitations and spin-gap phenomenon in the BCS-BEC crossover regime of an ultracold Fermi gas[1] HIROYUKI TAJIMA, Keio University, TAKASHI KASHIMURA, Retired, RYO HANAI, Keio University, RYOTA WATANABE, Retired, YOJI OHASHI, Keio University — We investigate the uniform spin susceptibility χ and strong-coupling corrections in the BCS-BEC crossover regime of an ultracold Fermi gas. Within the framework of an extended T-matrix theory,[2] we show that χ exhibits non-monotonic temperature dependence in the normal state, and is suppressed near the superfluid phase transition temperature $T_{\rm c}$. This spin-gap phenomenon is found to be deeply related to the pseudogap phenomenon appearing in the single-particle density of states. To characterize this magnetic phenomenon, we introduce the spin-gap temperature $T_{\rm s}$ as the temperature at which χ takes a maximum value. Determining $T_{\rm s}$ in the entire BCS-BEC crossover region, we identify the spin-gap regime in the phase diagram of a Fermi gas with respect to the temperature and the strength of a pairing interaction. Since the spin-gap is crucial key phenomenon in high-$T_{\rm c}$ cuprates, our results would be useful for the study of this many-body phenomenon using ultracold Fermi gases, as well as in observing the pseudogap phenomenon through the spin-gap phenomenon.

[1]H. T. was supported by the Research Grant of Keio Leading-edge Laboratory of Science & Technology.
[2]T.Kashimura, R.Watanabe, and Y.Ohashi, Phys. Rev. A **86**, 043622 (2012).

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Date submitted: 13 Nov 2013 Electronic form version 1.4