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Thermodynamic properties of two-component cold Fermi gases with bound states NAOYUKI SAKUMICHI, NORIO KAWAKAMI, Department of Physics, Kyoto University, Kyoto 606-8502, Japan, MASAHITO UEDA, Department of Physics, University of Tokyo, Tokyo 113-0033, Japan; ERATO Macroscopic Quantum Control Project, JST, Tokyo 113-8656, Japan — We address the thermodynamics of a two-component cold Fermi gas with short-range interaction. In the BEC region of the BCS-BEC crossover the fermionic particles form bosonic dimers as the two-particle bound states. We focus on the fermionic properties of the particles which constitute the dimers. To this end, we use the Lee-Yang quantum cluster expansion method, which enables us to expand the logarithm of the grand partition function in a power series of fugacity. By calculating the fourth-order contribution in fugacity we elucidate how the thermodynamic properties are affected by the quantum-statistical exchange effect between two fermionic particles that belong to different bosonic dimers. Furthermore, we extend the method to take into account the effect of the monomer-dimer and dimer-dimer scatterings and discuss the corresponding scattering length.

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