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Thermodynamics of interacting cold atomic Fermi gases with spin-orbit coupling[1] SCOTT JENSEN, YORAM ALHASSID, CHRISTOPHER GILBRETH, Center for Theoretical Physics, Yale University — New physics is suggested with the prediction of novel phases in cold atom systems when a synthetic spin-orbit coupling is introduced. In particular, recent studies show that a new type of Bose-Einstein condensate, termed Rashbon-BEC, is formed when a generalized Rashba spin-orbit term is present [1]. The Rashbon-BEC phase can be obtained by tuning the spin-orbit coupling strength even in the case of finite negative scattering length. This stands in contrast to the BCS-BEC crossover in the absence of spin-orbit coupling where a negative scattering length is associated with BCS physics, and its divergence signals the crossover. In our work we apply finite-temperature quantum Monte Carlo methods to a spherical Rashba spin-orbit coupled two-species Fermi gas with contact s-wave interaction in three dimensions. We will discuss the phase diagram for this system, and its crossover behavior from BCS to Rashbon-BEC.
[1] See for example in J. P. Vyasanakere, S. Zhang and V. B. Shenoy, Phys. Rev. B 84, 14512 (2011).

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