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Universal Relations of Ultracold Fermi Gases with Arbitrary Spin-Orbit Coupling JIANWEN JIE, Renmin Univ of China, RAN QI, PENG ZHANG, Renmin University of China — We derive the universal relations for an ultracold two-component Fermi gas with spin-orbit coupling (SOC)Weconsider the system with ans-wave short-rage interspecies interaction, and ignore the SOC-inducedmodification for the value of the scattering length. Using the first-quantized approach developedby S. Tan (Phys. Rev. Lett.107, 145302 (2011)), we obtain the short-range and high-momentum expansions for the one-body real-space correlation function and momentum distribution function, respectively. For our system these functions are 2 dimension matrix in the pseudo-spin basis. We find thatthe leading-order ($1/_{k4}$) behavior of the diagonal elements of the momentum distribution function are not modified by the SOC. However, the SOC can significantly modifythe behavior of the non-diagonal elementsof the momentum distribution functionin the large-klimit. In the absence of the SOC, the leading order of these elements isO(1/k6)When SOC appears, it can induce a term on the order of $1/_{k5}$. We further derive theadiabatic relation and the energy functional. Our results show the SOC can induce a new term inthe energy functional, which simply describe the contribution from the SOC to the total energy.The form of the adiabatic relation for our system is not modified by the SOC.

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