Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Coherence lengths in attractively interacting Fermi gases with spin-orbit coupling YU YIXIANG, JINWU YE, Mississippi State Univ, WUMING LIU, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences — Extensive research has been lavished on the effects of spin-orbit couplings (SOCs) in attractively interacting Fermi systems in both neutral cold-atom systems and condensed-matter systems. Recently, it was suggested that a SOC drives a class of BCS to Bose-Einstein condensate (BEC) crossover that is different from the conventional one without a SOC. Here, we explore what are the most relevant physical quantities to describe such a BCS to BEC crossover and their experimental detections. We extend the concepts of the coherence length and ?Cooper-pair size? in the absence of SOC to Fermi systems with SOC. We investigate the dependence of chemical potential, coherence length, and Cooper-pair size on the SOC strength and the scattering length at three dimensions (3D) (the bound-state energy at 2D) for three attractively interacting Fermi gases with 3D Rashba, 3D Weyl, and 2D Rashba SOC, respectively. We show that only the coherence length can be used to characterize this BCS to BEC crossover. Furthermore, it is the only length which can be directly measured by radio-frequency dissociation spectra type of experiments. We stress crucial differences among the coherence length, Cooper-pair size, and the two-body bound-state size. Our results provide the fundamental and global picture of the BCS to BEC crossover and its experimental detections in various cold-atom and condensed-matter systems.

Yu Yixiang
Mississippi State Univ

Date submitted: 29 Dec 2014 Electronic form version 1.4