Interaction and Disorder Effects Across BCS-BEC Crossover in Three- and Two-Dimensional Fermi Gases

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We investigate the effect of static impurities in three- and two-dimensional ultracold atomic Fermi gases. We incorporate disorder from impurities through fluctuations [1, 2] and study its effects on the BCS-BEC crossover. We analyze the effect of quenched disorder for various physical quantities such as chemical potential, pairing gap, density of states, spectral function, and ground-state energy. We extend our study further towards the experimentally viable quantities such as condensate fraction, sound velocity and Landau critical velocity. The results are presented as a function of binding energy (in 2D) and 3D scattering length (in 3D). We observe negligible effect of disorder in 2D for BCS Cooper pairs and considerable amount of depletion in the BEC regime but intriguingly the results also reveal that disorder effect is masked at the crossover region [2, 3, 4]

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