

Lifshitz transition with interactions in high magnetic fields: Application to CeIn₃

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The Néel ordered state of CeIn₃ is suppressed by a magnetic field of 61 T at ambient pressure. There is a second transition at ~ 45 T, which has been associated with a Lifshitz transition [1,2]. Skin depth measurements [2] indicate that the transition is discontinuous as $T \rightarrow 0$ and that the transition has a weak pressure dependence until it merges with the Néel transition. Motivated by this transition we study the effects of Landau quantization and interaction among carriers on a Lifshitz transition. The Landau quantization leads to quasi-one-dimensional behavior for the direction parallel to the field. Repulsive Coulomb interactions give rise to a gas of strongly coupled carriers [3]. The density correlation function is calculated for a special long-ranged potential [4]. It is concluded that in CeIn₃ (a) an electron pocket (and not a hole pocket) is being emptied as a function of field and (b) in the ground state the electron pocket is emptied in a discontinuous fashion. This discontinuity is gradually smeared by the temperature in agreement with skin depth experiments [2].

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