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Quasiparticles and order parameter near quantum phase transition MIRON AMUSIA, Racah Institute of Physics, ALFRED MSEZANE, CTSPS, Clark Atlanta University, VASILY SHAGINYAN, St. Petersburg Nuclear Physics Institute, Russia — We have shown that the Landau paradigm based upon both the quasiparticle concept and the notion of the order parameter is valid and can be used to explain the anomalous behavior of the heavy fermion metals near quantum critical points. The understanding of this phenomenon has been problematic largely because of the absence of theoretical guidance. Exploiting this paradigm and the fermion condensation quantum phase transition, we investigate the anomalous behavior of the heavy electron liquid near its critical point at different temperatures and applied magnetic fields. We show that this anomalous behavior is universal and can be used to capture the essential aspects of recent experiments on the heavy-fermion metals at low temperatures. In contrast with the conventional Landau quasiparticles, the effective mass of the quasiparticles in question strongly depends on the temperature and the applied magnetic field, while the order parameter is destroyed at any finite temperature. We have demonstrated that this unusual behavior of both the order parameter and the quasiparticles is determined by the fermion condensation quantum phase transition which allows the existence of the quasiparticles down to the lowest temperatures. In that case we obtain a unique possibility to control the essence of the HF metals by magnetic fields in a wide range of temperatures.

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