Recent developments in heavy-fermion quantum criticality

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Quantum criticality in heavy fermion compounds has been a topic of great interest for more than a decade [1]. In the vicinity of a quantum critical point, heavy fermion materials display qualitative departures from the standard Landau Fermi liquid behavior of conventional metals over a wide temperature range.

The quantum critical behavior of some heavy fermion materials may be understood using a space-time generalization of classical criticality, often called "Hertz-Millis" theory [2, 3]. For other materials a new framework, evoking the critical breakdown of Kondo screening at the quantum critical point [4–8], appears to be required. The experimental hallmark of the latter is the presence of an additional energy scale T^* at the quantum critical point [9–11] which separates the phase diagram into a region of entangled quasiparticles with large Fermi volume and one with disentangled quasiparticles and small Fermi volume. In some systems these two energy scales can be separated from each other either by chemical [12, 13] or by hydrostatic pressure [14]. Such separation may lead to non-Fermi liquid behavior arising not from a single quantum critical point but from a finite zero-temperature region of the magnetic field- or pressure-tuned phase diagram [12]. Global phase diagrams [12, 15, 16] have been suggested to rationalize these different kinds of quantum critical behavior.

These recent developments will be discussed in the talk.

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