Magnetic ordering and superconductivity in Ce-Pd-In Kondo lattices*

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The Ce–Pd–In system comprises several ternary phases crystallizing with different crystal structure types, including a few prototype ones. Some of these materials have been characterized for their physical properties and reported to exhibit a variety of nontrivial phenomena, which are predominantly governed by hybridization of cerium 4*f*-electronic states with conduction band states. The intensively studied compounds CePdIn and $CePd_2In$ were found antiferromagnetic (AFM) Kondo lattices with heavy-fermion (HF) ground states, resulting from competing Kondo and RKKY interactions with similar energy scales. Dense Kondo effect, yet of considerably weaker magnitude, was evidenced also for AFM phases $Ce_8Pd_{24}In$, $CePd_3In_2$, $CePd_2In_4$, $Ce_6Pd_{12}In_5$ and non-stoichiometric Ce_2Pd_2In, as well as for ferromagnetic indide $Ce_{11}Pd_4In_9$. In contrast, hardly any hint at Kondo screening interactions was revealed for ferromagnetic $CePdIn_2$ and paramagnetic $Ce_4Pd_{10}In_{21}$. Most interestingly, the compound Ce_2PdIn_8 was discovered to exhibit unconventional HF superconductivity driven by magnetic fluctuations. In this material, the nodal superconductivity emerges in the proximity of AFM quantum critical point instability that manifests itself in the form of distinct non-Fermi liquid (NFL) features observed in the normal-state transport and thermodynamic properties. Similar NFL behavior was recently found in Ce_3PdIn_{11} and $Ce_5Pd_2In_{19}$, which form with crystal structures closely related to that of Ce_2PdIn_8, yet bearing multiple sites for Ce atoms in their crystallographic unit cells. Most remarkably, the former compound was established to exhibit at ambient pressure HF superconductivity that coexists with complex long-range AFM ordering. In our review of the physical properties of the Ce–Pd–In ternaries we shall supplement the literature data with our own hitherto unpublished results obtained on single crystals of a few selected materials.

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