Abstract:

The ground-state properties of *f*-electron compounds are characterized by strong interactions which lead to a plethora of exotic states. In this thesis we focused on compounds crystallizing in the tetragonal Ho_nCoGa_{3n+2}–type structure. Several new compounds have been synthesized from In-flux; particularly enigmatic are Ce_3TIn_{11} (*T* = Pd, Pt). These compounds possess two inequivalent Ce-sites and reveal coexistence of antiferromagnetic order and heavy fermion superconductivity at ambient pressure. This coexistence can be explained in the framework of two-Kondo ion lattice model, assuming one Ce-site being completely Kondo screened with the 4*f*-electron behaving itinerant and participating in superconductivity while the second Ce-site retains its local character giving rise to magnetic order via the RKKY interaction. The influence of crystal electric field on the magnetic ground state has been investigated on the Kondo compound Ce_2RhIn_8 by means of neutron experiments. U_2RhIn_8 and $URhIn_5$ behave like transition-metal antiferromagnets, contrary to Ce(4*f*)-counterparts. The 5*f*-states are entirely hybridized and Kondo interactions play no role. Neither does it in the investigated RE_2CoIn_8 (*RE* = Pr, Nd, Dy) compounds which exhibit strong localized 4*f*-electron behavior. Here, the influence of strong spin-orbit coupling on the RKKY interaction gives rise to an extraordinary magnetic phase diagram in Dy_2CoIn_8.