In the heavy-fermion metal YbRh$_2$Si$_2$ a quantum critical point (QCP) has been established by driving a continuous antiferromagnetic (AF) phase transition from $T_N \approx 70$ mK at $B = 0$ to $T_N = 0$ via application of a tiny magnetic field $B_c (\perp c) \approx 60$ mT [1]. New results on the Hall effect [2], magnetic Grüneisen ratio [3] and thermoelectric power [4] support the conclusion drawn from earlier studies [5, 6] that this AF QCP coincides with a Kondo-breakdown QCP or Mott transition, selective to the Yb$^{3+}$-4f states. In a recent investigation, (positive and negative) chemical pressure was applied to YbRh$_2$Si$_2$ to explore the evolution of its B-T phase diagram under changes of the unit-cell volume: Clear signatures of the Kondo-breakdown QCP were observed within the magnetically ordered phase under volume compression (i.e., Co substitution for Rh) [7]. On the other hand, under slight volume expansion (doping with 2.5 at % Ir) the AF instability and the selective Mott transition were found to still coincide at $B_c (\perp c) \approx 40$ mT. For 6 at% Ir doping, however, AF order appears to be largely suppressed ($T_N < 20$ mK), while the Kondo-breakdown QCP remains virtually unchanged. For this composition, a new type of low-T spin-liquid phase shows up in a finite range of magnetic fields [7]. Further ongoing studies concerning the interplay between the selective Mott transition and incipient AF order in this material will be briefly reviewed.

In collaboration with:


2. S. Friedemann et al., to be published.
4. S. Hartmann et al., to be published.