Tracing the Kondo lattice in $YbRh_2Si_2$

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The quantum superpositions underlying entanglement are at the heart of the intricate interplay of localized spin states and itinerant electronic states that gives rise to the Kondo effect. In a Kondo lattice, this interplay gives rise to the emergence of charge carriers with enhanced effective masses, but the precise nature of the coherent Kondo state responsible for the generation of these heavy fermions remains highly debated. Here, we report on the phase diagram of $YbRh_2Si_2$ and discuss novel Scanning Tunneling Microscope results on a generic Kondo lattice system, $YbRh_2Si_2$, which trace the onset of this entanglement[1]. We find that the hybridization of conduction and 4f states results in a gap-like feature in the tunneling conductance at the Fermi energy. In addition, we reveal unambiguously the Kondo renormalized crystal-field excitations of the Yb3+ ions. Finally, we investigate how the STM signatures will change when exploring the different phases of $YbRh_2Si_2$ and the quantum critical point separating them.

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