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Magnetic-field-tunable Kondo effect in alkaline-earth cold atoms[1]

LEONID ISAEV, ANA MARIA REY, JILA, NIST and Department of Physics, University of Colorado Boulder — We study quantum magnetism and emergent Kondo physics in strongly interacting fermionic alkaline-earth atoms in an optical lattice with two Bloch bands: one localized and one itinerant. For a fully filled narrow band (two atoms per lattice site) we demonstrate that an applied magnetic field provides an efficient control of the ground state degeneracy due to the field-induced crossing of singlet and triplet state of the localized atomic pairs. We exploit this singlet-triplet resonance, as well as magnetically tunable interactions of atoms in different electronic states via the recently-discovered inter-orbital Feshbach resonance, and demonstrate that the system exhibits a magnetic field-induced Kondo phase characterized by delocalization of local singlets and a large Fermi surface. We also determine the phase diagram of the system within an effective low-energy model that incorporates the above magnetic-field effect as well as atomic interactions in the two optical lattice bands. Our results can be tested with ultracold ^{173}Yb, and provide a model for the magnetic field-induced heavy-fermion state in filled skutterudites such as $PrOs_4Sb_{12}$.

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