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

LEONID ISAEV, ANA MARIA REY, JILA, NIST & Department of Physics, University of Colorado at Boulder — We study quantum magnetism in strongly interacting fermionic alkaline-earth atoms (AEAs). Due to the decoupling of electronic and nuclear degrees of freedom, AEAs in two lowest electronic states ($^1S_0$ and $^3P_0$) obey an accurate $SU(N2I+1)$ symmetry in their two-body collisions (I is the nuclear spin). We consider a system that realizes the simplest $SU(2)$ case (for atoms prepared in two nuclear-spin states) in an optical lattice with two bands: one localized and one itinerant. For the fully filled narrow band (two atoms per lattice site) we demonstrate that an applied magnetic field provides an efficient control of the local ground state degeneracy due to mixing of spin and orbital two-body states. We derive an effective low-energy model that includes this magnetic-field effect as well as atomic interactions in the two optical lattice bands, and show that it exhibits a peculiar phenomenon of a magnetic field-induced Kondo effect, so far observed only in Coulomb blockaded quantum dots. We expect that our results can be tested with ultracold ^{173}Yb or ^{87}Sr atoms.

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Leonid Isaev
JILA, NIST & Dept of Physics, University of Colorado at Boulder

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