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The physics of SU(4) alkaline-earth-atom-based Kondo lattice model at the Toulouse point SOLOMON F. DUKI, HONG LING, Rowan University — The study of ultracold alkaline-earth atoms has gained significant attention due largely to recent efforts to employ ultracold alkaline-earth atoms as a unique platform to explore quantum computing and many-body physics. For alkaline-earth atoms, there is an almost perfect decoupling of the nuclear spin from the electronic angular momentum in both the ground and the metastable states. This along with the existence of relatively high nuclear spin degrees of freedom makes the cold alkaline-earth atoms an excellent candidate that one can employ to study Kondo effects with higher SU(N) spin degrees of freedom. In this work, we focus on a mixture of two-component fermionic alkaline-earth atoms loaded in external optical lattice potentials and treat it as an cold atom implementation of SU(4) Kondo lattice model. We apply bosonization and canonical transformation to obtain an exactly solvable point (the so-called Toulouse point). We study the physics of the system at the Toulouse point by calculating various correlation functions in the parameter regimes that are experimentally accessible to cold atom experiments. This work is supported by the US National Science Foundation and the US Army Research Office.

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