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Multi-body interactions in few-body arrays of fermionic 87Sr AKIHISA GOBAN, ROSS HUTSON, G. EDWARD MARTI, SARA CAMPBELL, MICHAEL PERLIN, JOSE D'INCAO, Univ of Colorado - Boulder, PAUL JULIENNE, JQI, University of Maryland, NIST, ANA-MARIA REY, JUN YE, Univ of Colorado - Boulder, NIST — Ultracold Alkaline-earth (AE) atoms provide unique platforms for advancing atomic clocks, quantum information processing, and quantum simulation. There is particular interest in the use of fermionic AE(-like) atoms to perform quantum simulations of large-spin quantum magnetism, the Kondo effect, and high-energy lattice gauge theories. Multi-body interactions, which cannot be broken down into sums of pairwise interactions, hold the potential to create even more exotic states of quantum matter, but they are yet to be explored in fermionic AE atoms. Here, we use clock spectroscopy of ^{87}Sr to isolate arrays of few-body systems in a three-dimensional optical lattice and directly observe the onset of $SU(10)$-symmetric multi-body interactions in AE fermions. We observe effective three-body interactions in density-dependent shifts of the spectroscopic signal that are non-linear in the occupation number of the few-body system. We additionally measure three-body recombination rates as a function of particle density and occupation-number. Supported by the theory, these measurements suggest favorable energy and timescales of the interactions for their use in a ultracold atom quantum simulator.

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