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Towards quantum many-body physics with Sr in optical lattices STEPAN SNIGIREV, ANDR HEINZ, ANNIE JIHYUN PARK, STEPHAN WISSENBERG, Max-Planck-Institut fur Quantenoptik, Hans-Kopfermann-Strae 1, 85784 Garching, Germany, JEAN DALIBARD, Laboratoire Kastler Brossel, College de France, ENS-PSL Research University, CNRS, UPMC-Sorbonne Universits, 11 place Marcelin Berthelot, 75005 Paris, IMMANUEL BLOCH, SEBASTIAN BLATT, Max-Planck-Institut fur Quantenoptik, Hans-Kopfermann-Strae 1, 85784 Garching, Germany — The widespread use of ultracold fermionic strontium atoms in optical lattices for precision measurements has led to the availability of many advanced tools and techniques for these atoms. With the recent realization of degenerate gases of all Sr isotopes and the development of fermionic quantum gas microscopes for alkali atoms, a new frontier has opened for quantum simulations and quantum information processing with fermionic ^{87}Sr. Many applications in quantum state engineering and quantum simulation require internal-state-dependent control of the atomic motion. In the Sr atom, there exist so-called tuneout wavelengths, where only one of the clock states is trapped and the other state can move freely. Because of the (in principle) exact cancellation of the other states polarizability at the tuneout wavelengths, it should be possible to realize spin-dependent lattices with high fidelity. Here, we propose a system to realize such internal-state-dependent control of the atomic motion and report on the construction of a new experiment towards quantum simulations with Sr in optical lattices.

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