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Probing Interaction-Induced Ferromagnetism in Optical Superlattices[1] JAVIER VON STECHER, JILA and Department of Physics, University of Colorado, Boulder, Colorado, EUGENE DEMLER, MIKAHIL LUKIN , Physics Department, Harvard University, Cambridge-MA, 20138., ANA MARIA REY, JILA and Department of Physics, University of Colorado, Boulder, Colorado — We analyze how to use ultracold fermionic atoms loaded in optical superlattices for a controllable preparation and detection of interaction-induced ferromagnetism. First, we discuss how to experimentally achieve Nagaoka ferromagnetism in an array of isolated plaquettes (four lattice sites arranged in a square). Next, we allow for weak interplaquette tunneling and analyze the occurrence of itinerant ferromagnetism. Since ferromagnetism is unstable in the presence of weak interplaquette couplings, we propose to mediate long-range ferromagnetic correlations via double-exchange processes by exciting atoms to an excited vibrational band. We calculate the phase diagram of the two-band plaquette array and discuss conditions for the stability and robustness of the ferromagnetic phases in this system. Experimental implementations of the proposed schemes are discussed.

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