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Dynamics of atoms in bilayer optical lattices, and adiabatic state preparation ANDREW DALEY, Univ of Pittsburgh and Univ of Strathclyde, STEPHAN LANGER, Univ of Pittsburgh — We study theoretically the dynamics of ultracold quantum gases trapped in optical lattices consisting of two layers (which can each either be one-dimensional or two-dimensional). Considering both bosons and fermions, we propose schemes for adiabatic state preparation of low-entropy states, making use of a separately tunable interlayer coupling, energy offset between the layers and repulsive interactions. In this context it is possible, for example, to use one layer as an entropy reservoir, which can be used to remove entropy from the other layer, before being decoupled from it. For the case of two coupled one-dimensional layers, we calculate the time-dependent dynamics exactly using the time-dependent density matrix renormalization group techniques. This allows us to identify parameter regimes where entropy transfer between layers occurs, and the emergence of characteristic many-body correlations in the low-entropy layer can be observed. This process is especially effective when the desired state in the low-entropy layer is gapped, and these states can be used as a starting point also for other adiabatic preparation protocols, including the realisation of metastable excited states.

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