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State preparation and non-equilibrium dynamics in bilayer Bose-Hubbard systems STEPHAN LANGER, ANDREW J. DALEY, Department of Physics and Astronomy, University of Pittsburgh — We study the ground states and non-equilibrium dynamics of ultra-cold Bose gases in bilayer optical lattice systems with separately tunable interlayer coupling, energy offset between the layers and repulsive interactions. The case of two coupled one-dimensional chains is treated in a numerically exact manner using the adaptive time-dependent density matrix renormalization group which allows us to study the change of offset and interlayer coupling in real time. We identify parameter regimes where the ground state of the coupled system in the limit of small interlayer coupling consists of a Mott insulator in one layer and a superfluid state in the other layer can serve as an entropy reservoir. We then investigate time-dependent dynamics in this system, studying entropy transfer between layers as we change the layer offset energy and coupling strength. In addition to applications as a preparation scheme for fully interacting Mott-insulator states, feasible with available experimental techniques, the investigated protocols could be easily adapted to also allow for a controlled preparation of highly excited states.

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