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Thermalization in 1D, 2D, and 3D Spin-Dependent Lattices

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— Spin- and species-dependent optical lattices have potential applications for both cooling and thermometry in experiments with strongly correlated phases. However, these schemes presume that gases experiencing drastically different potentials remain in thermal equilibrium. We will present thermalization measurements for two co-trapped species, one that is lattice-bound and another that is confined harmonically. We use ^{87}Rb atoms confined in a 1064 nm dipole trap combined with a spin-dependent lattice; appropriate tuning of the lattice wavelength, polarization, and magnetic field direction realize a lattice with potential depth proportional to $m_F g_F$. The m_F=0 state of ^{87}Rb therefore does not experience the lattice potential, while the m_F=-1 state can be strongly lattice bound. Modulation of the lattice is used to preferentially heat the m_F=-1 gas, and measurements of the subsequent return to thermal equilibrium are used to infer the thermalization rate. We will comment on the prospects for using this system for thermometry and also on technical issues such as heating and inelastic loss.

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