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Dynamics of reduced dimension Bose gases in optical lattices

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We use deep optical lattices to tightly confine cold atoms in reduced dimensions. By applying shallower optical lattices in the weakly confined direction, we realize well-characterized one- and two- dimensional Bose-atom lattice gases. Transport dynamics is studied by observing motion of the atom cloud through the lattice. For a 1D quantum degenerate Bose gas, we report the observation of strongly damped dipole oscillations in a combined harmonic and optical lattice potential. Damping is significant for very shallow axial lattices (0.25 photon recoil energies), and increases dramatically with increasing lattice depth, such that the gas becomes nearly immobile for times an order of magnitude longer than the single-particle tunneling time. Surprisingly, we see no broadening of the atomic quasimomentum distribution after damped motion.