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Dissipation Fermionizes a One-Dimensional Gas of Bosonic Molecules DOMINIK M. BAUER, NIELS SYASSEN, MATTHIAS LETTNER, THOMAS VOLZ, DANIEL DIETZE, JUAN J. GARCIA-RIPOLL, IGNACIO CIRAC, GERHARD REMPE, STEPHAN DÜRR, Max-Planck-Institute for Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching, Germany — Here we report on our latest results about ultracold molecules in optical lattices. First, we show how dissipation creates a Tonks gas of molecules. If a gas of bosons is confined to 1D, the interaction between particles can become so important that the strongly correlated regime is reached. This is called a Tonks-Girardeau gas. In the limit of infinite interaction strength, one cannot find two bosons at the same position. Previous studies of the Tonks gas relied on elastic interactions. Second, we observe large-amplitude Rabi oscillations between an atomic and a molecular state near a Feshbach resonance (1). The frequency and amplitude of the oscillations are well described by a two-level model. The observed density dependence of the oscillation frequency agrees well with the theoretical prediction. We confirm that the state produced after a half-cycle contains exactly one molecule at each lattice site. In addition, we show that for energies in a gap of the lattice band structure, the molecules cannot dissociate.
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