

Abstract for an Invited Paper
for the MAR06 Meeting of
The American Physical Society

Non-equilibrium one-dimensional Bose gases¹

DAVID WEISS, Penn State

I will describe the preparation and time evolution of arrays of trapped one-dimensional Bose gases with highly non-equilibrium momentum distributions. We observe negligible thermalization, in both the strong and intermediate coupling regimes, even after each atom has undergone thousands of collisions. These experiments can be understood as quantum mechanical versions of Newton's cradle, with hundreds of particles simply exchanging specific momentum values. The absence of thermalization demonstrates nearly integrable dynamics, which is a theoretical rarity and an experimental first for many-body systems with many degrees of freedom. By allowing tunnelling among the tubes, we can continuously change the collisions from one-dimensional to three-dimensional. We have thus been able to study the onset of thermalization in a many-body system.

¹This work was supported by the N.S.F., and performed in collaboration with Toshiya Kinoshita and Trevor Wenger.