Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Emergence of an effective thermal correlation length in the course of prethermalization REMI GEIGER, MAXIMILIAN KUHNERT, TIM LANGEN, MICHAEL GRING, BERNHARD RAUER, Atominstitut, TU Wien (Vienna University of Technology), TAKUYA KITAGAWA, EUGENE DEMLER, Harvard University, DAVID ADU-SMITH, JOERG SCHMIEDMAYER, Atominstitut, TU Wien (Vienna University of Technology) — Understanding non-equilibrium processes in many-body quantum systems is an important unsolved problem in many areas of physics. Here, we study the relaxation dynamics of a coherently split one-dimensional Bose gas by measuring the full probability distribution functions of matter-wave interference. After splitting, the system rapidly relaxes to a thermal-like quasi-steady state retaining partial information about the initial conditions. We observe this state to be independent on the initial temperature before splitting and associate the relaxation dynamics with prethermalization. Observing the system on different length scales allows us to probe the dynamics of excitations on different energy scales, revealing two distinct length-scale dependent regimes of relaxation. We measure the crossover length-scale separating these two regimes and identify it with the prethermalized phase-correlation length of the system. Our work provides a direct vizualization of prethermalization and multimode dynamics in a one-dimensional many-body quantum system.

Remi Geiger
Atominstitut, TU Wien (Vienna University of Technology)

Date submitted: 09 Nov 2012 Electronic form version 1.4