Abstract Submitted
for the CAL13 Meeting of
The American Physical Society

Quantum Shock Waves in Collisions of Ultracold Atomic Clouds[1]
SEBASTIANO PEOTTA, MASSIMILIANO DI VENTRA, University of California San Diego — Ultracold atomic gases represent an ideal toolbox to study quantum effects that are difficult to probe using other systems. Here, we use a time-dependent density matrix renormalization group approach to show that the collision of two interacting bosonic clouds in one dimension gives rise to shock waves with a concomitant local energy distribution typical of population inversion, i.e., an effective negative temperature. A classical hydrodynamic description compares well with the exact quantum dynamics only up to the gradient catastrophe time. Such a highly nonequilibrium local distribution, however, does not prevent the system from recovering its initial state after an oscillation period which is renormalized by the interaction. All these results can be tested experimentally.

[1]This work has been supported by DOE under Grant No. DE-FG02-05ER46204.

Sebastiano Peotta
University of California San Diego

Date submitted: 12 Sep 2013 Electronic form version 1.4