Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Collective many-body bounce in the breathing-mode oscillations of a finite-temperature Tonks-Girardeau gas. KAREN KHERUNTSYAN, YASAR ATAS, University of Queensland, ISABELLE BOUCHOULE, Institut d'Optique, DIMITRI GANGARDT, University of Birmingham — We analyse the breathing-mode oscillations of a harmonically quenched Tonks-Giradeau (TG) gas using an exact finite-temperature dynamical theory. We predict a striking collective manifestation of impenetrability—a collective many-body bounce effect. The effect, while being invisible in the evolution of the *in situ* density profile of the gas, can be revealed through a nontrivial periodic narrowing of its momentum distribution, taking place at twice the rate of the fundamental breathing-mode frequency of oscillations of the density profile. We identify physical regimes for observing the many-body bounce and construct the respective nonequilibrium phase diagram as a function of the quench strength and the initial equilibrium temperature of the gas. We also develop a finite-temperature hydrodynamic theory of the TG gas, wherein the many-body bounce is explained by an increased thermodynamic pressure during the isentropic compression cycle, which acts as a potential barrier for the particles to bounce off.

Karen Kheruntsyan
University of Queensland

Date submitted: 26 Jan 2017 Electronic form version 1.4