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Finite-temperature hydrodynamics for a 1D Bose gas and its application to breathing-mode oscillations in position and momentum spaces. KAREN KHERUNTSYAN, University of Queensland, Brisbane, Australia, ISABELLE BOUCHOULE, Institut d'Optique, Palaiseau, France — We develop a finite-temperature hydrodynamic approach for harmonically trapped 1D Bose gases and use it to describe the phenomenon of frequency quasi-doubling in the breathing-mode oscillation of the momentum distribution of the gas. The quasi-doubling here refers to the frequency of oscillation relative to the oscillations of the real-space density distribution, invoked by a sudden confinement quench. For problems with known initial (equilibrium) momentum distributions, our approach extends the utility of the hydrodynamic theory to describe the finite-temperature non-equilibrium dynamics not only in position space, but also in momentum space. The approach leads to insightful analytic results in both the weakly-interacting quasi-condensate and strongly-interacting Tonks-Girardeau (TG) regimes. It allows us to discern the contribution of the hydrodynamic velocity field and that of thermal excitations, hence explaining the mechanism behind the phenomenon of frequency quasi-doubling and its disappearance: We find that, at any finite temperature, this is governed by the quench strength, rather than by, e.g., a naively conjectured regime-crossover from the ideal Bose gas to the quasi-condensate (or TG) regime.

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