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Implosions in Bose-Einstein condensates quenched to large negative scattering lengths ELI HALPERIN, MICHAEL VAN DE GRAAFF, XIN XIE, JOHN BOHN, JUN YE, ERIC CORNELL, JILA, National Institute of Standards and Technology, and the University of Colorado, Department of Physics, Boulder, Colorado 80309, USA — While much work has been done in understanding the stability and collapse of Bose-Einstein condensates in the presence of weak attractive interactions, comparatively little progress has been made in understanding the transient excitations of a highly unstable Bose gas as it collapses. We explore this less understood strongly attractive regime through a set of implosion experiments in a a harmonically trapped Bose-Einstein condensate with a weak perturbing lattice potential. The lattice induces density modulations that seed implosions which would otherwise be seeded by quantum fluctuations in the absence of the lattice. We theoretically describe the time dynamics of these density modulations in the unstable regime by decomposing into the Bogoliubov modes of the system. We give analytic formulae for of collapse dynamics for Gaussian and sinusoidal perturbations in 1D and 3D which we compare to simulations of the Gross-Pitaevskii equation. By quenching from positive to negative scattering length, we use this model to amplify our well understood density modulations in a positive scattering length gas and get an experimental signature of these seeded fluctuations which can be used as a bridge for understanding the effects of intrinsic quantum fluctuations.

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