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Driving Correlated Quantum Fluctuations from a Bose-Einstein Condensate LIANG-YING CHIH, MURRAY HOLLAND, JILA, University of Colorado, Boulder — In a recent experiment that observed a Bose firework pattern by Clark et al. in Nature 551, 356 (2017), a Bose-Einstein condensate emitted high momentum atoms in jets when driven by a periodic modulation of the scattering length. This experiment demonstrated the capability to selectively amplify quantum fluctuations with a specific momentum that could be spectroscopically tuned. We use the generalized Hartree-Fock-Bogoliubov theory to quantify the initial quantum fluctuations in a stationary condensate, and then numerically simulate the resulting dynamics of the system when the scattering length is modulated. The classical external field that excites pairs of particles with the same energy but opposite momenta resembles the coherently driven nonlinearity in a parametric amplifier, and generates a squeezed matter-wave state in the quasiparticle mode on resonance with the modulation frequency. Since this is a highly coherent process with automatic phase matching, we observe monotonic growth in the pair correlation amplitude. We propose applying Ramsey interferometry to experimentally probe the pair correlations in a future experiment.

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