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Non-equilibrium dynamics in driven Bose-Einstein condensates
LEI FENG, LOGAN W. CLARK, LI-CHUNG HA, CHENG CHIN, University of Chicago — We report recent progress on the study of non-equilibrium dynamics in Bose-Einstein condensates using the shaken optical lattice or optically controlled Feshbach resonances. In the shaken lattice at sufficient shaking amplitude we observe a quantum phase transition from ordinary condensates to pseudo-spinor 1/2 condensates containing discrete domains with effective ferromagnetic interactions. We study the temporal and spatial Kibble-Zurek scaling laws for the dependence of this domain structure on the quench rate across the transition. Furthermore, we observe long-range density correlations within the ferromagnetic condensate. With optically controlled Feshbach resonances we demonstrate control of the interaction strength between atoms at timescales as short as ten nanoseconds and length scales smaller than the condensate. We find that making interactions attractive within only one region of the gas induces localized collapse of the condensate.

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