

Quantum dynamics of instability-induced pulsations of a Bose-Einstein condensate in an optical lattice

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We study the dynamics of a Bose-Einstein condensate in a one-dimensional optical lattice in the limit of weak atom-atom interactions, including an approximate model for quantum fluctuations. A pulsating dynamical instability in which atoms periodically collect together and subsequently disperse back into the initial homogeneous state may occur in the time evolution. We take into account the quantum fluctuations within the truncated Wigner approximation. We observe that the quasiperiodic behavior still persists for a single realization that represents a typical experimental outcome, but ensemble averages show various manifestations of quantum fluctuations. Quantum effects become more prominent when the effective interaction strength is increased.

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