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Quantum dynamics of dynamically unstable, integrable few-mode systems RANCHU MATHEW, University of Maryland, EITE TIESINGA, University of Maryland and National Institute of Standards and Technology — Recently, quenches in isolated ultra-cold atomic quantum systems have become a subject of intense study. We consider quantum few-mode systems that are integrable in their classical mean-field limit and become dynamically unstable after a quench of a system parameter. Specifically, we study the cases of a Bose-Einstein condensate (BEC) in a double-well potential and of an antiferromagnetic $F = 1$ spinor BEC constrained to a single spatial mode. First, we study the time dynamics of a coherent state after the quench within the truncated Wigner approximation and find that due to phase-space mixing the systems relax to a steady state. Using action-angle formalism and guided by insights from the related pendulum system, we obtain analytical expressions for the time evolution of expectation values of observables and their long-time values. We also study the full quantum dynamics of the systems. Comparing their results with the TWA results, we find agreement in the long-time expectation value of the observables. The relaxation time scales, however, are different.

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