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Nonlinear dynamical phase diagram of ultra-cold atoms in periodic lattices WAKUN LAM, GIL SUMMY, MARIO BORUNDA, Oklahoma State Univ — We study the dynamics of ultra-cold bosonic gases in periodic deep optical potential by incorporating the nonlinear inter-site coupling into the discrete nonlinear SchrÖdinger equation (DNLSE). We numerically solve the DNLSE to analyze and compare the evolution of Gaussian wave packets reported in [Phys. Rev. Lett., 86, 11(2001)]. Our result corroborates the validity of the phase diagram calculated by the variational method within a certain range of parameters of the initial wave packets. We calculate the long-term evolution of solutions of DNLSE to generate a fine phase diagram to elaborate the transitions between different dynamic modes. We propose an experimental scheme to verify the phase diagram based on the Bose-Einstein condensates in optical lattices.

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