

Abstract: We study the dynamic behavior of Bose-Einstein condensates with two- and three-atom interactions in optical lattices with analytical and numerical methods. It is found that the steady-state relative population appears tuning-fork bifurcation when the system parameters are changed to certain critical values. In particular, the existence of three-body interaction not only transforms the bifurcation point of the system but also affects greatly on the macroscopic quantum self-trapping behaviors associated with the critically stable steady-state solution. In addition, we also investigated the influence of the initial conditions, three-body interaction, and the energy bias on the macroscopic quantum self-trapping. Finally, by applying the periodic modulation on the energy bias, we observed that the relative population oscillation exhibits a process from order to chaos, via a series of period-doubling bifurcations.

Keywords: Bose Einstein condensate; dynamic phase transition; quantum entanglement effects.