Non-linear dynamics of a double-well Bose-Einstein condensate-reservoirs system

ABSTRACT

We investigate the dynamics of a Bose–Einstein condensate (BEC) confined within a symmetric double-well trap out-coupled to reservoirs. Our model is based on the quantum Heisenberg–Langevin approach. Dissipation in the system is induced by the interaction of condensate bosons with the reservoir which determines the Markovian and non-Markovian operational dynamics. These distinct dynamics correspond directly to the choice of function used in the dissipation kernel of the quantum Langevin equation. The main focus of this work is to study non-Markovian dynamics of the system proliferated by the use of Ornstein–Uhlenbeck (OU) memory function. Comparison is made with the Markovian dynamics induced by the use of δ-memory-less function. We have calculated numerically the time evolution of population imbalance and tunneling current of the system and found dissipation destroys the regular pattern of the two-mode BEC phases. Comparison between dissipative models shows significant differences in their dynamics, particularly in the strongly interacting case.

Keyword: Double-well BEC; Dissipation; Ornstein–Uhlenbeck memory function; Non-Markovian