2004 Vol.41 No.4 pp.547-552 DOI:

Tunneling Dynamics Between Atomic and Molecular Bose-Einstein Condensates

CHEN Chang-Yong[1,2]

[1] Department of Physics, Loudi Teachers' College, Loudi 417000, China
[2] Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, the Chinese Academy of Sciences, Wuhan 430071, China
(Received: 2003-5-12; Revised: 2003-9-2)

Abstract: Tunneling dynamics of multi-atomic molecules between atomic and multi-atomic molecular Bose-Einstein condensates with Feshbach resonance is investigated. It is indicated that the tunneling in the two Bose-Einstein condensates depends on not only the inter-atomic-molecular nonlinear interactions and the initial number of atoms in these condensates, but also the tunneling coupling between the atomic condensate and the multi-atomic molecular condensate. It is discovered that besides oscillating tunneling current between the atomic condensate and the multi-atomic molecular condensate, the nonlinear multi-atomic molecular tunneling dynamics sustains a self-locked population imbalance: a macroscopic quantum self-trapping effect. The influence of de-coherence caused by non-condensate atoms on the tunneling dynamics is studied. It is shown that de-coherence suppresses the multi-atomic molecular tunneling. Moreover, the conception of the molecular Bose-Einstein condensate, which is different from the conventional single-atomic Bose-Einstein condensate, is specially emphasized in this paper.

PACS: 03.75.Fi, 74.50.+r, 05.30.Jp, 32.80.Pj
Key words: tunneling dynamics, an atomic (a molecular) Bose-Einstein condensate, Feshbach resonance, de-coherence

[Full text: PDF]

Close