光子学报 2011, 40(6) 944-948 DOI: 10.3788/gzxb20114006.0944 ISSN: 1004-4213 CN: 61-1235/O4



论文

# 运动双原子与腔场作用模型中原子布居的演化

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**摘要:**

为了找出原子运动对原子布居演化的影响,通过建立两原子在一光学谐振腔中运动的模型,用量子力学分析原子具有不同速度时两原子布居数演化.研究结果表明,当光学腔中光场处于相干态,而原子处于运动中时,两原子的能级布居演化与光学腔场模结构相关联.假如初始时刻原子的位置固定在腔中某一位置,两原子的布居演化在少光子数呈现出周期性,多光子数时表现出崩塌和回复现象|假如初始时刻两原子在光学腔相干态光场中处于运动状态,则两原子的布居数随时间的变化将呈现出周期性.通过设定两原子以不同运动速度沿谐振腔轴向运动,得到原子布居数以不同周期演化,演化周期为两原子与场耦合系数变化周期的最小公倍数.在光场平均光子数增多时,原子布居数振荡将加快.演化程度与两原子初始态有关.在光场平均光子数较少时,两运动原子的布居数演化显得规则有序.因而,通过适当的选择两原子的速度和初始光场,就能对两原子的布局数演化的程度和周期进行控制.

**关键词:** 量子光学 Tavis-Cummings模型 原子布居数反转 相干态 原子运动

## Population Inversion of Two Moving Atoms in a Cavity

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Abstract:

In order to find out the effect of atomic motion on the population inversion of two atoms,the atomic states were analyzed by the method of quantum mechanics.It was found that the population inversion of two atoms was related to the field mode structure in an optical resonant cavity when the atoms were moving and the optical field was in coherent state.When two atoms in the cavity were fixed at initial time,the evolvement of population inversion of two atoms was periodic in the case of a small average photo number,and there were collapses and revivals of atomic inversion in the case of a large average photo number.The evolvement of population inversion of two atoms became well-regulated orderly under the coherent cavity field when atoms were in motion at initial time.The population inversion of two atoms will evolve in different periods when the two atoms move in axial direction at different velocity.The period of population inversion is the lease common multiple of periods of coupling coefficients between two atoms and field.When there are more average photon number in the cavity,the oscillation of population inversion will be faster.So it is possible to control the population inversion by properly choosing the velocity of atoms and the initial field.

Keywords: Quantum optics Tavis-Cummings model Atomic population inversion Coherent state Atomic motion

**收稿日期** 2010-12-14 **修回日期** 2011-03-31 **网络版发布日期** 2011-06-25

DOI: 10.3788/gzxb20114006.0944

**基金项目**:

贵州省科技厅科学技术基金（No.J[2008]2052）资助

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