CLOSED STACKS

ANALYTICAL INVESTIGATION OF THE EFFECT OF DIPOLE-DIPOLE INTERACTION ON DISPERSION SPECTRUM

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ABSTRAK

Penyelidikan dilakukan keatas spektrum penyerapan-penyerakan bagi dua atom dua paras yang dipacu oleh suatu medan kuat yang koheren dan mengalami lembapan dalam vakum normal. Dua kes telah diuji: Dalam keadaan resonan bersama interaksi dwi-kutub dan keadaan bukan resonan tanpa interaksi dwi-kutub.


ABSTRACT

A study is made of the absorption-dispersion spectra of two collective two-level atoms driven by a strong coherent field and damped by normal vacuum. Two cases are examined: on-resonance case with the inclusion of dipole-dipole interaction and off-resonance case without the inclusion of dipole-dipole interaction.

In the on-resonance case, we have solved analytically the master equation for the reduced atomic density operator for the coherently driven Dicke model interacting with a normal vacuum and used a symbolic manipulating software to obtain the absorption-dispersion spectra. We show that for large Rabi frequencies of the driving field (i.e. when the frequency of laser is tuned to the atomic transition frequency), the index of refraction can be enhanced at vanishing absorption. However, when the frequency of laser is not tuned to the atomic transition frequency, we do not find any large refractive index accompanied by vanishing absorption. We also find that the presence of the dipole-dipole interaction is essential for the Rabi side bands to split into doublets and also the existence for additional Rabi side bands. This confirms results obtained by Agarwal et al. (1981).

In the off-resonance case, the secular approximation technique for a system of two two-level atoms is used to calculate an analytical expression for the absorption-dispersion spectra. We show that, in the presence of detuning we do not find any large refractive index accompanied by vanishing absorption at the Rabi side bands. However, at the central frequency of the spectrum, we show that the dispersion is finite when absorption is zero. This is confirmed by numerical results.
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