Quantum trajectory approach to stochastically-induced quantum interference effects in coherently-driven two-level atoms

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abstract Stochastic perturbation of two-level atoms strongly driven by a coherent light field is analyzed by the quantum trajectory method. A new method is developed for calculating the resonance fluorescence spectra from numerical simulations. It is shown that in the case of dominant incoherent perturbation, the stochastic noise can unexpectedly create phase correlation between the neighboring atomic dressed states. This phase correlation is responsible for quantum interference between the related transitions resulting in anomalous modifications of the resonance fluorescence spectra.
\[ S(\omega) \text{ [arb. units]} \]

\[ \frac{\omega}{\Omega} \]

- **Numeric**
- **Analytic**
The graph shows the spectral density $S(\omega)$ in arbitrary units as a function of $\omega/\Omega$. Two lines are plotted: one labeled "Numeric" and the other "Analytic". The Numeric line appears to have sharper peaks compared to the Analytic line.
The graph shows the dependence of $S(\omega)$ on $\omega/\Omega$. The x-axis represents the normalized frequency $\omega/\Omega$ ranging from $-15$ to $15$, while the y-axis represents the signal $S(\omega)$ in arbitrary units, ranging from $0.01$ to $0.1$. There are two curves labeled "Numeric" and "Analytic" which demonstrate the comparison between numerical and analytic results.
The graph shows the dip width normalized by $\Omega$ as a function of $\Gamma/\Omega$. The curve represents $|s_-|/\Omega$ with a solid line, and $\gamma/\Omega$ with a dashed line.
\[ \Delta \phi [\text{rad}] \]

\[ \begin{array}{c}
0 \\
\pi/2 \\
\pi \\
3\pi/2 \\
2\pi \\
\end{array} \]

\[ \Omega t \]

\[ \begin{array}{c}
0 \\
200 \\
400 \\
600 \\
800 \\
1000 \\
\end{array} \]
\[ C_{\cos}(\tau) \]

\[ \frac{\Gamma}{\Omega} = 0.2 \]
\[ \frac{\Gamma}{\Omega} = 1.1 \]
\[ \frac{\Gamma}{\Omega} = 5 \]
\[ C_{\sin}(\tau) \]

\[ \frac{\Gamma}{\Omega} = 0.2 \]
\[ \frac{\Gamma}{\Omega} = 1.1 \]
\[ \frac{\Gamma}{\Omega} = 5 \]