Control of a qubit by means of a Classical field: The Driven Jaynes-Cummings model

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The Jaynes-Cummings model (JCM) is one of the most important models in quantum optics. It sketches out the interaction of a two-level system (qubit) with a single mode of the quantized electromagnetic field (cavity field) in the so-called *rotating wave approximation* (RWA) [1,2]. We present a exatly-solvable modification of the JCM, where both the qubit and the quantized field are driven by an external classical field: the driven JCM (DJCM) [3,4] (Figure 1), and show that the classical driving field can be used as a control for the qubit. Particularly, it is shown that, by properly adjusting the external classical driving field, it is possiible to finely manipulate the atomic transitions of the qubit (see Figure 2), as well as the quantum properties of the cavity field. This, in turn, is of interest in many active areas of research encompassing basic science as well as applied physics. To mention a few, we can list the theory of quantum information and quantum communications, quantum optics, quantum control, quantum computation, etc (see for instance [5,6]).

References

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Figures

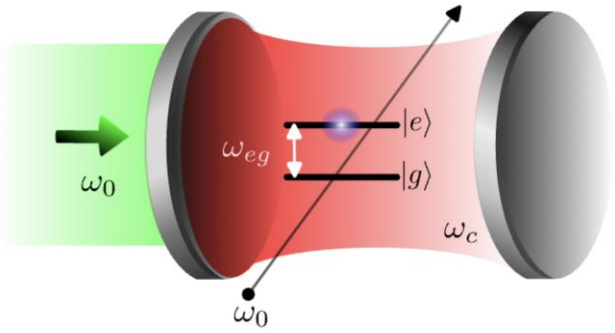

Figure 1: Schematic setup for the DJCM.

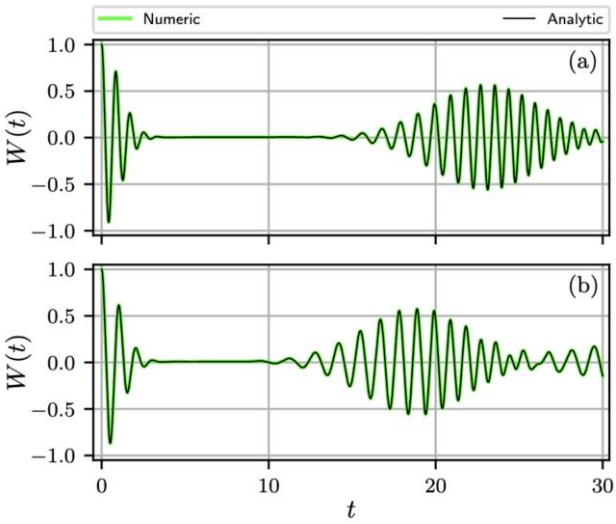

Figure 2: Atomic inversion W(t) corresponding to the DJCM (up) and the JCM (down).