Quantum Physics

Two-level atom at finite temperature

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Properties of a two-level atom coupled to the quantized electromagnetic field at finite temperature are determined. The analysis is based on a new method (inspired by QED) of describing qubits, developed previously at zero temperature (Phys. Rev. A 76, 062106 (2007)). In this paper, we make a generalization to finite temperature by introducing the Matsubara formalism and the temperature propagators. We analyze the spectral properties of different types of propagators and we derive a direct connection between the temperature propagators and the real time propagators. To show the effectiveness of this method, we calculate the temperature dependence of the polarizability of a two-level atom in the lowest order of perturbation theory and we predict an unexpected sharpening of the resonance. The whole discussion is carried out without the rotating wave approximation.

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