Two-photon blockade improved by many two-level systems

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Both theoretical predictions and experimental results have demonstrated that in resonant systems, increasing the number of two-level systems (TLSs) confined within an optical cavity deteriorates the photon blockade. When many TLSs are present and the detunings are small, the nonlinearity of the system becomes too weak to sustain a strong photon blockade. Consequently, the first observation of two-photon blockade was achieved in an experiment with a single TLS trapped inside a cavity. However, the measured third-order correlation function in that setup has a value that is not far from unity, implying a non-negligible probability of detecting three or more photons.

In this work, we demonstrate that the third-order correlation function can be suppressed almost to zero by placing an ensemble of TLSs near one of the cavity mirrors. Using an analytical method based on a non-Hermitian Hamiltonian, we show that this remarkable enhancement of the two-photon blockade arises from destructive interference effects.

References

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