Photon counting statistics in NV centers

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Abstract

We model and experimentally benchmark the full counting statistics of photons emitted by a single nitrogen vacancy center in diamond within the context of a quantum jump formalism. This formulation allows for the study of fluorescence under non-resonant laser excitation and resonant micro-wave (MW) control. We build a phenomenological framework which relates the relevant physical parameters with the detected photon counts. Furthermore, we can investigate the time correlations of the emitted photons and elaborate detection protocols to optimize the energy and time resources while maximizing the system sensitivity of magnetic-field measurements.

References

[1] Jensen, K., Acosta, V. M., Jarmola, A., and Budker, D., "Light narrowing of magnetic resonances in ensembles of nitrogen-vacancy centers in diamond," Phys. Rev. B 87, 014115 (Jan 2013)
[2] Cook, R. J., "Photon number statistics in resonance fluorescence," Phys. Rev. A 23, 1243–1250 (Mar 1981).

Figures

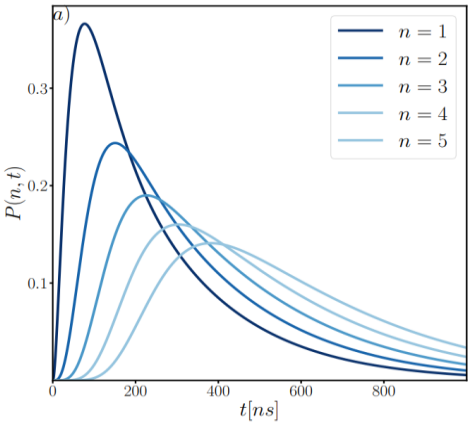

Figure 1: Probability P(n,t) of emitting n photons by an NV excited by a green laser as a function of time.

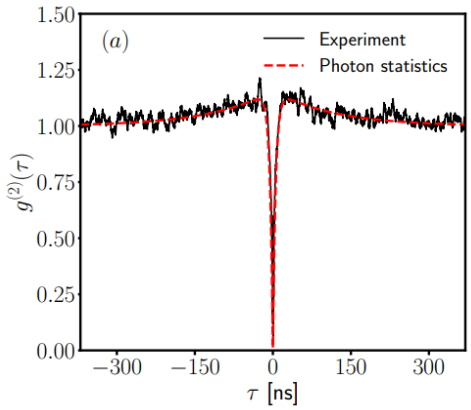

Figure 2: Measured autocorrelation function (black) for an NV centre and the photon statistics prediction (red).