Dipolar interactions in dense ensembles of Nitrogen-Vacancy centers

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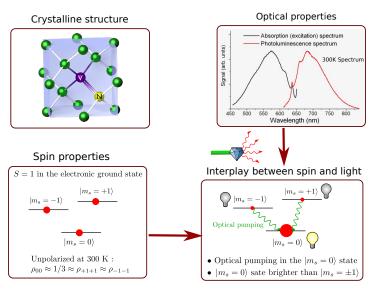




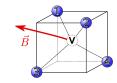




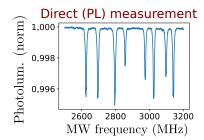
Preamble: the NV center

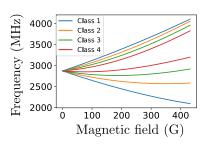


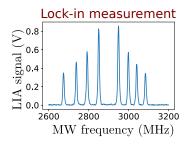
Preamble: the 4 classes of NV centers



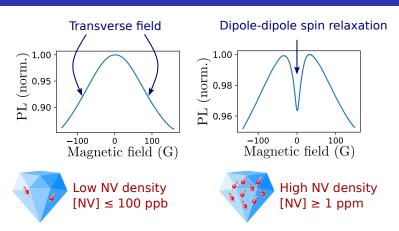
4 different projections of \vec{B} over the 4 possible NV axes \rightarrow 4 classes of resonances







Subject of this presentation



- Better understand the dipole-dipole interaction in dense NV ensembles
- · Exploit the PL feature for magnetometry

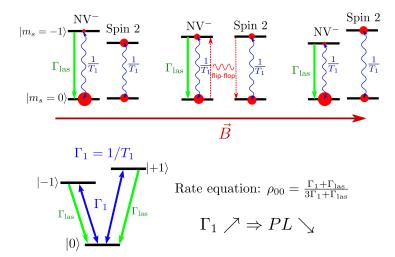


Outline

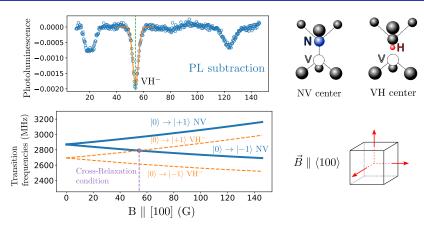
1 Cross-relaxation with NV centers

2 The NV-fluctuator model and experimental verification

Principle of cross-relaxation with NV centers



Example: Cross-relaxation between NV centers and VH⁻

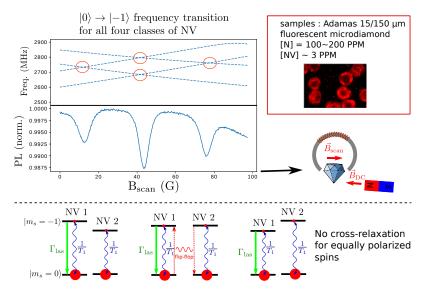


Optical detection of paramagnetic defects in diamond grown by chemical vapor deposition

C. Pellet-Mary, P. Huillery, M. Perdriat, A. Tallaire, and G. Hétet Phys. Rev. B **103**, L100411 – Published 24 March 2021

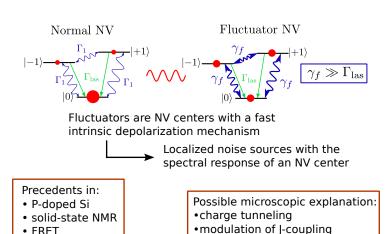


Cross-relaxation between NV centers and NV centers



Presentation of the fluctuator model

FRFT



Choi, Joonhee, et al. Physical review letters 118.9 (2017): 093601.

Predictions of the fluctuator model

- \blacksquare Γ_1 increases when classes overlap spectrally (increase in the resonant fluctuator density).
- The dipole induced depolarization has a stretched exponential profile:

$$ho_{00}(t) \propto \exp\left(-\sqrt{rac{t}{T_1}}
ight)$$

■ The Fluctuators spectral response is broadened by their decay rate γ_f (lifetime limit).