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Quantum Spintronics

Multimodal Spin Based Sensors

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Scope

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Scope

- Motivation (SiC transistor (in place monitoring etc))
- Motivation2 : Microscope (As for diamond)

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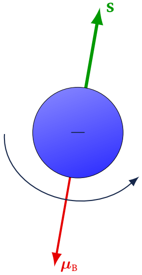
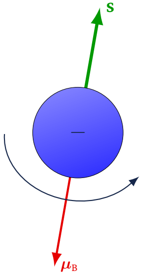
Spintronic Devices



spin - transport - electronics

Spintronic Devices



spin - transport - electronics

- Exploit spin in the same way electronics exploit charge

Background

$S = 1$ Magnetometry

$S = 1$ Magnetometry Summary

1. We can resolve **two frequencies** corresponding to the defect in the CW-ODMR spectra.
2. The ZFS parameters D and E are well known.
3. We can determine the magnitude using

$$\boxed{B = \frac{\sqrt{\frac{1}{3}\left(f_1^2 - f_1 f_2 + f_2^2 - D^2 - 3E^2\right)}}{g\mu_B}.}$$

4. We can determine the azimuthal angle using

$$\boxed{\theta = \frac{\cos^{-1}(\eta/D)}{2}.}$$

$S = 1$ Electrometry

$S = 1$ Electrometry Summary

1. We can resolve **two frequencies** corresponding to the defect in the CW-ODMR spectra.
2. The direction and magnitude of $\vec{B}$ and the ZFS parameters D and E are well known.
3. In general

$$\boxed{\Delta f_{\pm} = d_{\|} E_z \pm \left(F(\vec{B}, \vec{E}, \vec{\sigma}) - F(\vec{B}, 0, \vec{\sigma}) \right)}$$

4. With $\vec{B}$ parallel to the defect axis we have

$$\boxed{\theta = \tan^{-1}\left(\frac{\mathcal{E}_{\|}}{\mathcal{E}_{\perp}}\right), \quad \mathcal{E} = \sqrt{\mathcal{E}_{\perp}^2 + \mathcal{E}_{\|}}.}$$

Multimodality

$\vec{B}$ and T

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So what?

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Questions?