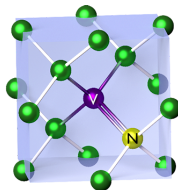
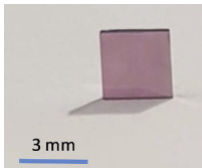


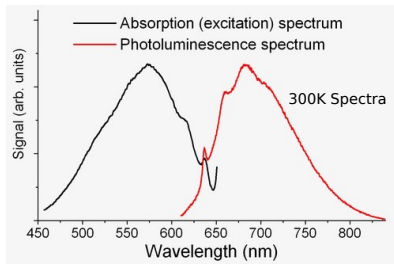
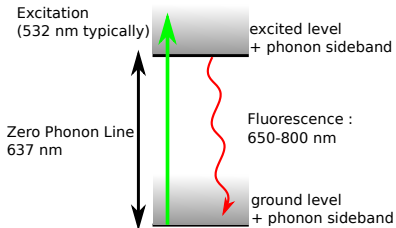
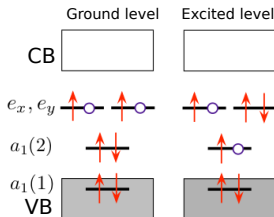
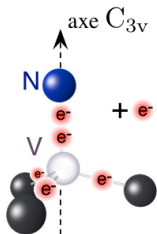
QICS small seminar : NV center brief overview

Clément Pellet-Mary
LPENS, ENS Paris

April 6, 2022

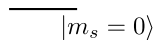
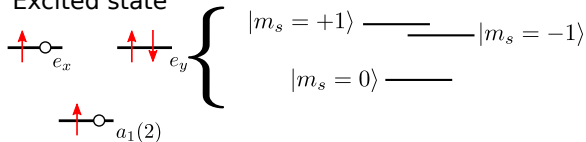


Optical properties of NV^- centers

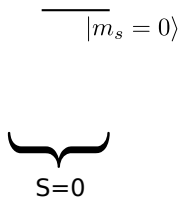
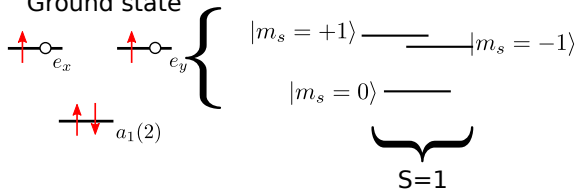


NV⁻ center electronic structure

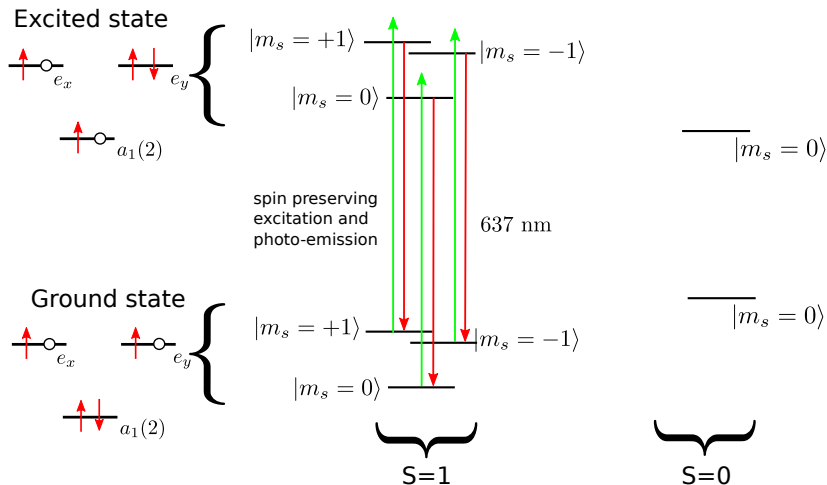
Excited state



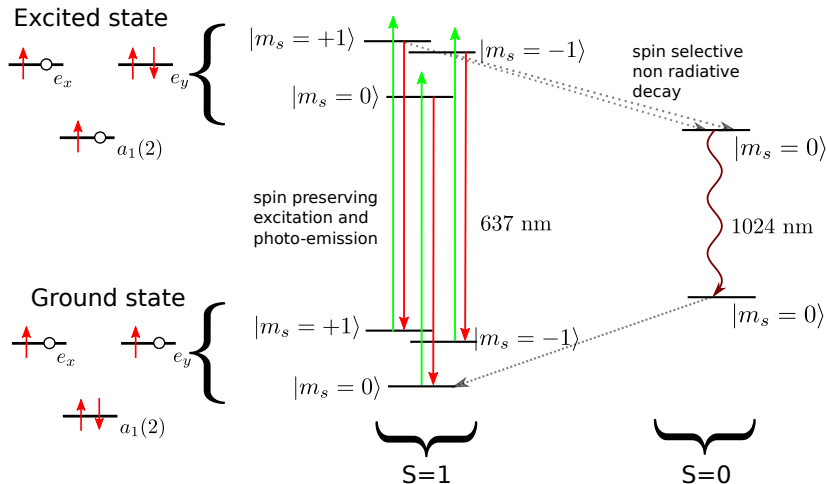
Ground state



NV⁻ center electronic structure

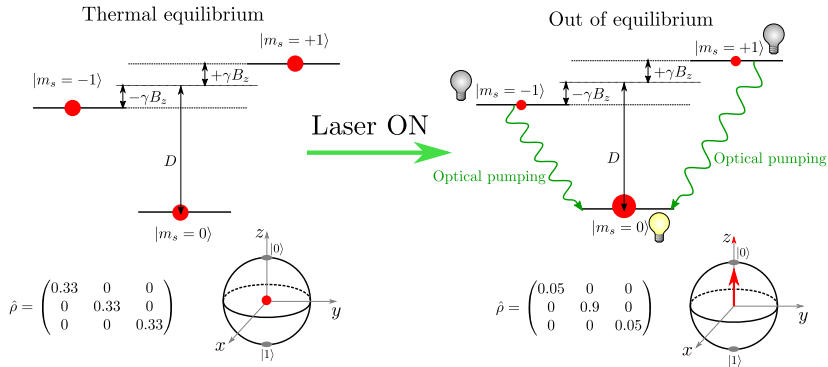


NV⁻ center electronic structure

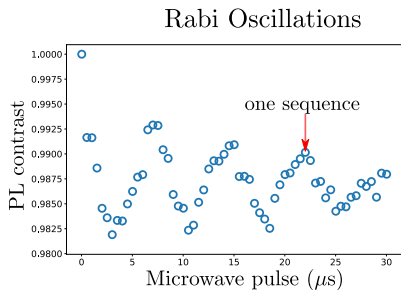
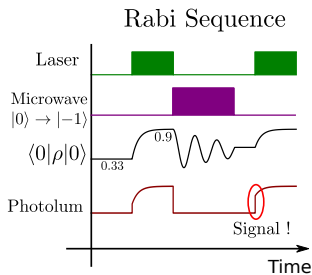
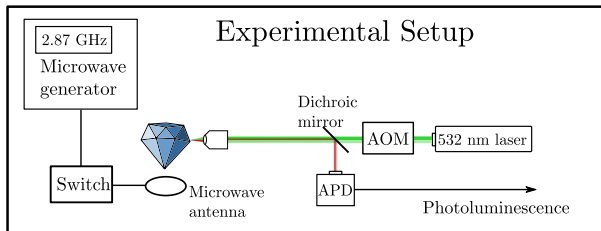


NV center spin sub-levels

$D = 2.87$ GHz (dipolar interaction between the two unpaired electrons)
 $\gamma B_z \approx 100$ MHz for usual magnetic fields
 $k_B T = 6.28$ THz at 300 K



Practical example : Rabi oscillations



Some NV successes

■ Quantum memory :

Room-Temperature Quantum Bit Memory Exceeding One Second

P. C. Maurer, G. Kucsko, C. Latta, L. Jiang, N. Y. Yao, S. D. Bennett, F. Pastawski, D. Hunger, N. Chisholm, M. Markham, D. J. Twitchen, J. I. Cirac, and M. D. Lukin

■ Intrication :

Loophole-free Bell inequality violation using electron spins separated by 1.3 kilometres

B. Hensen^{1,2}, H. Bernien^{1,2}, A. E. Dréau^{1,2}, A. Reiserer^{1,2}, N. Kalb^{1,2}, M. S. Blok^{1,2}, J. Ruitenbergh^{1,2}, R. F. L. Vermeulen^{1,2}, R. N. Schouten^{1,2}, C. Abellán³, W. Amaya³, V. Pruneri^{3,4}, M. W. Mitchell^{3,4}, M. Markham⁵, D. J. Twitchen⁵, D. Elkouss¹, S. Wehner¹, T. H. Taminiau^{1,2} & R. Hanson^{1,2}

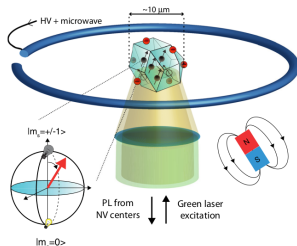
■ Quantum sensing (Magnetic field, Electric field, Temperature) :

Nuclear magnetic resonance detection and spectroscopy of single proteins using quantum logic

I. Lovchinsky A. O. Sushkov E. Urbach N. P. de Leon S. Choi K. De Greve R. Evans R. Gertner E. Bersin C. Müller L. McGuinness F. Jelezko R. L. Walsworth H. Park M. D. Lukin

Our work

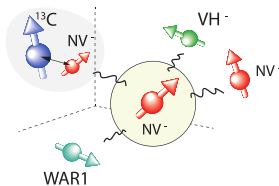
Micro-diamond levitation in a Paul trap



Coupling the spin levels to the mechanical degrees of freedom of the diamond

- Cooling of the diamond motion
- Alignment of the diamond

Probing dipolar interaction between spins in diamond



- "Dark" spin spectroscopy
- Thermalization dynamics of the spins