271 Towards implementing colour centres for opto-electronic applications

J.R. Maze[1], A.Norambuena[1], H.Duarte[1], I. Alvizu[1], A.Dréau[2], C.Hepp[3],V.Waselowski[1], P. Spinicelli[2], J.-F.Roch[4], V.Jacques[2,4], T. Müller[5], J.N. Becker[3], B. Pingault[5], H. Sternschulte[6], D. Steinmüller-Nethl[6], S.Reyes[1], A. Gali[7], M.Atatüre[5], and C.Becher[3]

[1]Instituto de Física, Pontificia Universidad Catolica de Chile, Santiago, Chile

[2]Laboratoire de Photonique Quantique et Moléculaire, Ecole Normale Supérieure de Cachan, France, [3]Fachrichtung 7.2 (Experimentalphysik), Universität des Saarlandes, Saarbrücken, Germany, [4]Laboratoire Aimé Cotton, CNRS and Université Paris-Sud, Orsay, France, [5]Atomic, Mesoscopic and Optical Physics Group, Cavendish Laboratory, University of Cambridge, United Kingdom, [6]DiaCoating GmbH, Mitterweg 24, 6020 Innsbruck, Austria, [7]Dept. of Atomic Physics, Budapest University of Technology and Economics, Budapest, Hungary

email address corresponding author: jeromaze@gmail.com

Colour centres in solid are promising candidates for metrology and opto-electronic applications such as single photon generation for quantum information processing. Some of these centres present tuneable properties depending on their symmetry and immediate environment that makes them ideal for applications that requires a high level of control. As an example, the nitrogen vacancy centre in diamond contains a single electronic spin degree of freedom that can be readout on demand optically. This feature has allowed 30 nT/Hz sensitivity magnetometry [1].

Implementing such systems requires a deep understanding of their properties and how they interact with the environment intrinsic and external to the host matrix in which they are embedded. Here, we will show recent progress on using such systems for room temperature monitoring single nuclear spins [2] as shown in Figure 1. In addition, we will show recent advances on modelling the optical properties of such colour centres. Although some colour centres look similar in their composition, small changes on their atomic configuration lead to important changes in their optical spectra. A deep understanding on this feature is key for opto-electronic applications such as single photon generation. We will show how symmetry and external perturbations play an important role on radiative transitions [3].

Shaping the optical and electronic properties of colour centres in solids might impact a number of disciplines ranging from biology by enabling high sensitive room temperature sensors, to material science and energy saving applications by creating controllable molecule-based electronic switches.

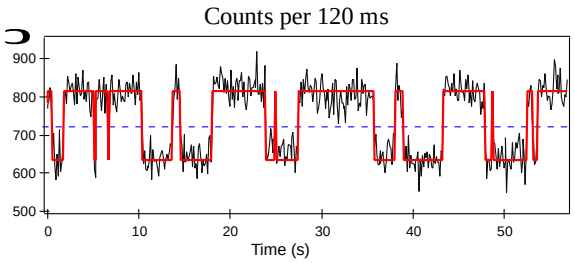

Fig.1. *(a) Observation of quantum jumps of a single nuclear spin through NV colour centre [1].*

We acknowledge grants Fondecyt Regular No 1141185. Conicyt Associative Investigation Program No. ACT1108.

References

[1] Maze et al, Nature **455**, 644 (2008).
[2] A. Dreau, P. Spinicelli, J.R. Maze, J-F. Roch, V. Jacques. Phys.Rev. Lett. **110**, 060502 (2013).
[3] C. Hepp, T. Müller, V. Waselowski, J.N. Becker, B. Pingault, H. Sternschuttle, D. Steinmüller-Nethl, A. Gali, J.R. Maze, M. Ateture, C. Becher, et al, Phys. Rev. Lett. **102**, 036405 (2014).