



## Guest Lecture

### Title:

“Spin Qubits Using Donor Spins in Silicon”

**Speaker:** Prof. Dr. John Morton

**Address:** Quantum Spin Dynamics Group, UC London, UK

**Date:** Friday, 10<sup>th</sup> of April 2015

**Time:** 14:30

**Place:** Seminar Room CBEG02 (387, Photonics); Gußhausstraße 27

### Abstract:

Electron and nuclear spins of donors in silicon are exceptional candidates for representing quantum bits, with coherence times of up to 3 seconds for the electron spin [1], up to 3 minutes for the neutral donor nuclear spin [2], and 3 hours for the ionized donor nuclear spin [3]. Furthermore, single-shot readout of both the electron spin and nuclear spin have been demonstrated, with measurement fidelities of up to 99.8% [4]. I will first discuss how the Stark shift caused by DC electric fields can be a powerful control method to locally tune different donor spins in- and out- of resonance, and to coherently drive Z-rotations [5]. I will then show how optically-driven donor-bound exciton transitions can be used to electrically detect of the donor electron spin resonance and discuss how this could provide a fruitful route to single-spin measurement at higher temperatures, lower magnetic fields, and using more simple nanodevice structures [6]. Finally, I will examine strategies for scaling up to arrays of multiple coupled dopant spins qubits.

[1] G. Wolfowicz et al., Nature Nanotechnology 8 561 (2013)

[2] M. Stege et al., Science 336 6086 (2012)

[3] K Saeedi et al., Science 342 830 (2013)

[4] J.J. Pla et al., Nature 489 541 (2012); Nature 496 334 (2013)

[5] G. Wolfowicz et al., Phys Rev Lett 113 157601 (2014)

[6] C. C. Lo et al., Nature Materials doi:10.1038/nmat4250 (2015)