Ground state depletion imaging of HeLa cells using nanodiamonds

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Key Words: NV centre, diamond, ground state depletion, cells

1. Introduction
Microscopy has become an indispensable tool for non-invasive biological study. In this context, fluorescent markers have been used to investigate biological samples by embedding or attaching fluorescent nanoparticles into cells. Typical confocal microscopes are constrained in their resolution by the diffraction limit. Nitrogen vacancy (NV) centres in diamond have been widely investigated due to their excellent optical properties [1]. It has recently been shown that NV centres can be used for superresolution techniques, including wide-field localisation [2], Stimulated Emission Depletion (STED) microscopy [3] and Ground State Depletion (GSD) [4]. Here, we propose embedding nanodiamonds containing NV centres into HeLa cells and imaging the cells with GSD.

2. Experimental details
We check the location of the nanodiamonds in the cell by staining the outside of the HeLa cell with a dye. By performing widefield scans of the cell with nanodiamonds at different z-positions, we can determine whether nanodiamonds are inside or outside the cell. Based on GSD, the fluorescence of the NV centre is effectively switched off by optically shelving the electron of the NV centre into a long lived state, inhibiting the fluorescence in the presence of a probe beam. Combining a donut beam with the inhibition beam, the fluorescence is only emitted from the area determined by the local minimum of the inhibition beam. We will show the superresolved imaging of NV centres in nanodiamonds that are embedded into HeLa cells.

3. References

4. Acknowledgements
This work was supported by the Australian Research Council Laureate Fellowship project (FL100100099).