Structural information of biological macromolecules using a single quantum sensor | 12GS	**Start Date:** August 1st 2016
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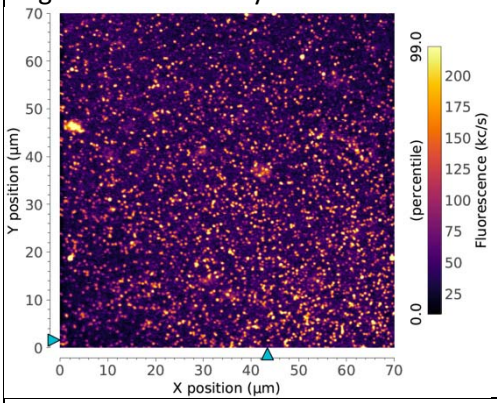
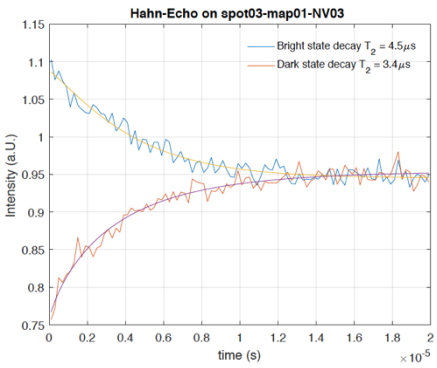
Abstract: Bringing quantum measurements and sensing to applications in life science is one of the objectives of IQST. In this project we plan to use NV-centers in diamond together with spin labels attached to various defined positions of macromolecules in order to measure distances within the biological complexes. In particular we will focus on RNA polymerase II, the sole enzyme in eukayrotes responsible for making mRNA, an essential step within the central dogma of molecular biology.

NV-centers in diamond are excellent sources for quantum sensing, due to their extremely long coherence time even at room temperature [1]. Recently it has been shown that in combination with EPR probes, NV-centers in diamond are capable of detecting a single spin on a single protein molecule [2]. Here we are planning to extend this technique to measure not only one spin, but also to record the coupling between two spins in a double electron-electron resonance (DEER) experiment at the single molecule level. As in ensemble EPR the distance between the spins can be inferred from the coupling strength of the spins, and thus lends itself to obtain quantitative structural information.

Moreover, we plan to employ techniques developed for super-resolution optical microscopy, namely point accumulation for imaging in nanoscale topography (PAINT) in order to overcome the low photostability of current EPR probes. EPR probes attached to medium affinity binders, e.g. nanobodies can be used to exchange spins on a single protein, while still operating with the same NV-center.

Figure 1: Preliminary Results: Left: Exemplary confocal scan of NV centers in thin diamond sheet.





Right: Hahn Echo experiment on individual NV center.

Recent results:	**Publications:**
• *Established single-molecule setup* • *First realized ODMR measurements of NV centers* • *Analysis of depth of implanted NV centers.*	