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Quantum Sensing with Diamond Defects

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The electronic spins of single atomic defects in diamond can serve as magnetic sensors with exceptional sensitivity and nanoscale spatial resolution. So far, the nitrogen-vacancy (NV) center has been used for sensing external targets, partly due to its exceptional spin coherence under various experimental (including ambient) conditions. In this talk, I will discuss my postdoctoral work (Degen group; ETH Zurich) in creating an NV-NMR platform for molecular sensing. Our team developed fabrication and surface treatments for improving sensitivity while enabling highly generalizable molecular surface functionalization [1]. These techniques were subsequently used to detect conformational changes in few-molecule DNA samples. In parallel, we developed optimized diamond nanopillar structures for improving NV fluorescence collection, yielding a factor-of-three measurement speed-up [2]. I will conclude by outlining plans for my new lab to improve magnetic sensitivity further, enabling single-nuclear-spin detection within functionalized molecules and opening the door for structure elucidation or reaction monitoring on the single-molecule level.

[1] Abendroth et al., *Nano Letters* **22**, (2022).

[2] Zhu et al., *Nano Letters* **23**, (2023).

Keyword-1

quantum sensing

Keyword-2

quantum hardware

Keyword-3

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