

Quantum algorithms for improved sensing

J. Wrachtrup

Institute for Quantum Science and Technology, University of Stuttgart, Germany
wrachtrup@physik.uni-stuttgart.de

The accuracy of measurements is limited by quantum mechanics. Ingenious demonstrations, like measuring gravitational fields or time have explored accuracy limits and reached fundamental obstructions. Yet, precision measurements so far are restricted to macroscale and dedicated environments. In the talk I will discuss spin quantum sensors comprising a single electron spin plus a nuclear spin quantum register. With such a system we measure a variety of quantities including electric and magnetic fields, temperature, and force. We use nuclear spins to enhance the measurement accuracy of the electron spin e.g. via quantum error correction or as ancillary quantum bits as memory or for quantum Fourier transformation [1-3]. I will present a variety of applications ranging from quantum simulations to imaging of cellular structures.

References

- [1] N. Aslam et al. *Science* 0.1126/science.aam8697 (2017)
- [2] L. Schlipf et al. *Science Advances* 3:e1701116 (2017) DOI: 10.1126/sciadv.1701116
- [3] F. F. de Oliveira, et al. *Nat. Commun.* 8, 15409 doi: 10.1038/ncomms15409 (2017)