Hybrid quantum sensor for physiological magnetic fields | 11AGS	Start date:
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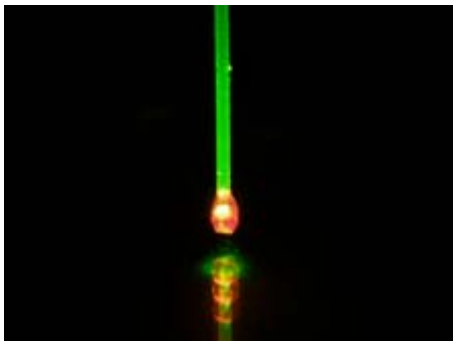

Abstract:
Highly sensitive magnetic field measurements nowadays relies on utilizing well-controlled quantum systems. The main players in the field are vapor-cell, SQUID and NV-diamond based sensors, where each of them has its own advantages and disadvantages. While vapor-cells and SQUIDS reach superior sensitivities (<ft) to NV-based sensors (<pT), they have a standoff distance and related spatial resolutions (mm-cm), which are up to 6 orders of magnitude larger than for NV-based sensors (nm) if operation under ambient conditions is required. Despite their lack of spatial resolution both, SQUID and vapor cell sensors have been applied to non-invasive magnetoencephalographic and magnetocardiographic diagnostics. As magnetic field amplitudes in these applications are small and even tinier at large distances, such fields will be obscured by background magnetic field fluctuations and thus proper magnetic shielding is required. On the other hand, a highly sensitive reference probe, in this case the atomic vapor, can be used to remove background fields from the signal of the small scale in situ probe, which is the NV center in this case. This project aims at combining the individual strengths of both sensor systems into symbiotic hybrid sensing devices.

Recent results:

- full demagnetization and compensation of the mu-metal shielding for the magnetometer
- installation of a calibrated coil for alternative sensitivity estimations
- selected as a talk for the OPM workshop in Fribourg (CH), 20.08.-23.08.2017
- application from a student who worked at the PSI at the nEDM experiment
- wrote a grant proposal for an unshielded magnetometer

Publications:

[1] **A rubidium Mx-magnetometer for measurements on solid state spins**, Daniel Arnold, Steven Siegel, Emily Grisanti, Jörg Wrachtrup, and Ilja Gerhardt, Review of Scientific Instruments, **88**, 2, (2017)
[2] F. Ziem, H. Fedder, J. Wrachtrup, in preparation