

# Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart  
Max-Planck-Institut für Festkörperforschung  
Max-Planck-Institut für Intelligente Systeme

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Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

Gastgeber: Prof. Tilman Pfau, Universität Stuttgart, Telefon: 0711 - 685-68025

## Atomic magnetometry for biomedical and fundamental research

**Antoine Weis**

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### Abstract

I will review our research in the field of atomic magnetometry. Our sensors are based on 30 mm diameter cells with paraffin-coated walls containing room temperature spin-polarized Cs vapor. Laser detected magnetic resonance (LDMR) is used to measure the vapor's Larmor precession frequency that is proportional to the field amplitude. LDMR is implemented using a phase-locked feedback loop (PLL) that locks the magnetic resonance driving magnetic field to the Larmor frequency, yielding a shot noise limited magnetic field sensitivity of 10-20 fT/Hz<sup>1/2</sup>.

We have deployed a 25 sensor array of such sensors for recording the dynamics of human magneto-cardiographic field maps and apply it currently for the imaging of magnetic nanoparticles. We also deploy an array of similar sensors in high vacuum near a 100 kV electrode for monitoring and controlling the spatio-temporal variations of a 1  $\mu$ T field in an experimental search for a permanent neutron electric dipole moment at the Paul Scherrer Institute.

Current work focuses on the development of vector magnetometers and the exploration of magnetically silent magnetometers based on amplitude-, frequency-, or polarization-modulated laser light as well as on high accuracy vector magnetometers measuring the free induction decay of atomic orientation and/or alignment following pulsed excitation.

I will report on the current status and prospects of these experiments.