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# Seminar über Quanten-, Atom- und Neutronenphysik (QUANTUM)

June 2, 2022 at 2 p.m. c.t.  
Lorentz-Raum 05-127

Prof. Dr. Peter Krüger  
PTB Berlin

## **Measuring small magnetic fields and how that is useful**

Magnetic fields are ubiquitous in nature and since a long time also in technology. Yet, there are many open questions, needs for research and emerging new applications. Standards need to be set or refined, and more accurate calibrations are required by industrial adopters of new technologies. A particular challenge and opportunity arise at the lowest end of the spectrum of magnetic fields. With demonstrated measurement sensitivities beyond the femtotesla (per root Hertz) scale, the neuronal activities of the brain following a peripheral nerve stimulus become detectable in a single trial, for example. While even the foundations of physics can be tested at the frontier of lowest metrological noise floors, a current trend is to make magnetic field measurement and imaging viable in application contexts beyond quantum physics laboratories. Here, we will discuss such developments in terms of sensor developments, measurement environments and key use cases. We will focus on atomic gas-based probes of DC and slowly varying magnetic fields. With trapped ultracold gases, high resolution field mapping can be achieved with relevance to material developments such as indium tin oxide replacements for next-generation touch screens and solar panels. On the other hand, cells containing thermal atomic vapours can provide highest field sensitivities as part of optically pumped magnetometers with use in clinical neurology or current-density imaging in electric vehicle batteries.

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