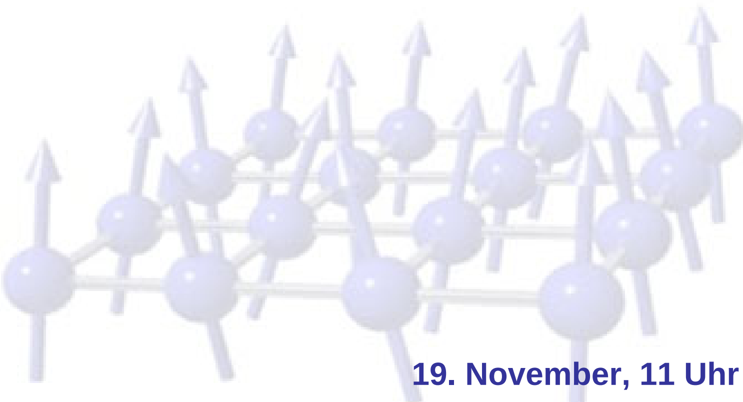
Dr. Jacob Taylor
(Massachusetts Institute of Technology (MIT))

High resolution magnetometry with solid-state spins

The detection of weak magnetic fields with high bandwidth and spatial resolution is an important problem in diverse areas from fundamental physics and material science to data storage and biomedical science. I will discuss a novel approach to magnetometry that makes use of recently developed techniques for coherent control of solid-state spin quantum bits (qubits). As a specific example, the use of spin qubits associated with Nitrogen-Vacancy (NV) centers in diamond allows for an unprecedented combination of ultra-high sensitivity and spatial resolution. This could enable sensing of sub-nano Tesla magnetic fields with resolution below 50 nanometers allowing the detection of a single proton within one second.
This interaction cannot only be utilized to create dipolar gases but also offers new possibilities for the coherent manipulation of quantum systems. In particular I will show how the strong state-dependent dipole moment, exhibited by Rydberg states, provides a new handle for the quantum control of trapped ions.



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Universität Ulm, Raum N 24/227
Albert-Einstein-Allee 11, 89081 Ulm

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