SFB/TRR 21 - Seminar

18. März 2016, Stuttgart

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(Universität Basel)

Imaging Electromagnetic Fields in Alkali Vapor Cells with sub-100 um Resolution

At the University of Basel, we have developed a technique for imaging microwave magnetic fields using alkali vapor cells, detecting microwaves through Rabi oscillations driven on atomic hyperfine transitions. This could prove transformative in the design, characterisation, and debugging of microwave devices (e.g. atom chips or ion traps), as there are currently no satisfactory established microwave imaging techniques. Our technique may also find applications in medical imaging. We have built a high resolution imaging system, whose 50x50x140 um3 spatial resolution, 1 uT/sqrt-Hz sensitivity, and 150 um approach distance are now sufficient for characterising a range of real world devices at fixed microwave frequencies.
Frequency tunability will be essential for wider applications, however we can only detect microwaves that are resonant with an atomic transition. Our solution is to use a large dc magnetic field to Zeeman shift the hyperfine ground state transitions to any desired frequency. In addition to high resolution images of 6.8 GHz microwave fields, I will present results from a proof-of-principle setup, where we have used a 0.8 T solenoid to detect microwaves from 2.3 to 26.4 GHz.

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