Courses in English
Course Description

Department 06 Applied Sciences and Mechatronics
Course title Quantum Sensing
Hours per week (SWS) 4
Number of ECTS credits 6 CP

Course objective
The course focuses on a comprehensive overview in the field of Quantum Sensing with special emphasis on solid state implementations of q-bits and gain an improved understanding of approaches to prepare quantum states in artificial atoms. The course presents selected examples of sensors working at the limit of the quantum mechanical ground state like sensors for motion, radiation or magnetic fields. Participants improve their physical understanding of quantum non demolition detection schemes in solid state systems. Another focus lies on the physical origin of decoherence processes and practical measures to minimize them. The skills to read, understand and critically evaluate articles focussing on quantum sensing is trained with special focus on high impact journals like nature or science and review articles.

Prerequisites
Quantum Physics 1

Recommended reading
Selected scientific articles provided during the course, R. Waser, Nanoelectronics and Information Technology: Materials, Processes, Devices, Wiley-VCH.

Teaching methods
lecture, exercise session, seminar

Assessment methods
written exam, seminar

Language of instruction
English

Name of lecturer
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Link
http://www.fb06.fh-muenchen.de/fk/modulbeschreibungen.php?id=1915

Course content
Applied superconductivity
Practical realization of the quantum metrological triangle (I (Millikan => SET), V (Josephson), U (Quantum Hall) )
Quantum realization of the Kelvin (Quantum sensing of noise, Single Electron Transistor), the Kilogram => Planck constant and the Second => atomic clock and applications (GPS)
Quantum sensors for single magnetic moments
Quantum ground state of mechanical vibration
Qbit realisations with emphasis on solid state implementations
Basic quantum computation realisation:
phase Qbit, Flux Qbit, Transmon, Finnmon, Rabi osszilation, quantum readout scheme.
Sensors based on Spintronics
NV centre in diamond => sensing application (Data storage, biology, spintronics)

Remarks