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Workshop: Concepts of pulsed nuclear magnetic resonance spectroscopy

Nuclear Magnetic Resonance (NMR) is one of the most outstanding cases, where innovations of methods established the basis for one of the most powerful spectroscopy techniques with manifold applications comprising physics, chemistry, biology and medicine. Despite these different fields of application one can nevertheless find a common core that describes the basic NMR concept: Interacting nuclear spin ensembles are manipulated in a coherent way according to basic laws of quantum mechanics. In this workshop this fundamental concept will be elaborated using selected examples of NMR spectroscopy.

Tentative topics:

- NMR and quantum mechanics
    - Introduction
    - Phenomenological NMR: classical movement of a magnetic moment
    - Spin-1/2 and quantum mechanics of a two level system
    - Operator formalism
    - Density operator and Liouville formalism of pulsed NMR
- Application of Liouville formalism to pulsed NMR
    - The Free Induction Decay (FID)
    - Spin echo and the concept of phase cycling
    - Effective spin-1/2 formalism: the case of Nuclear Quadrupole Resonance (NQR)
    - Interacting spins
- Option: Technical issues
    - Signal-to-Noise Ratio of NMR
    - NMR coils and probes
    - Elements of a pulsed NMR spectrometer
    - Quadrature detection of NMR