Theory of Modern NMR Methods

Schedule:

This course teaches the basic principles of liquid phase nuclear magnetic resonance spectroscopy and the theoretical foundations of modern applications. Modern NMR methods are excellent for atomic-resolution structural analysis of biologically active molecules and biopolymers and for studying their interactions.

Physical foundations of the NMR phenomenon. Chemical shift and spin-spin coupling. The pulse-Fourier principle. Description of experiments using vector and product-operator models. Magnetization trajectories. Understanding the basic experiments using density matrix method or product operators.

Building blocks of impulse NMR experiments:

RF pulses, gradient pulses, selective pulses, phase programs, spin-echo, polarization transfer. Two-dimensional (2D-NMR) structural investigation methods: COSY, TOCSY, NOESY, HSQC, HMQC, HMBC. Spin-lock methods: ROESY and TOCSY. Liquid-phase relaxation phenomena: spin-spin, spin-lattice relaxation and nuclear-Overhauser effect (NOE), chemical exchange phenomenon. Design of pulse programs for experiments in Bruker topspin system. NMR applications of the mathematical program MATLAB.

References:

J. N. S. Evans, Biomolecular NMR Spectroscopy, Oxford University Press, 1995,
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