CH-401

Advanced nuclear magnetic resonance

Emsley Lyndon

Cursus	Sem.	Type
Chemistry	BA6	Obl.
HES - CGC	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**2 weekly**
Lecture	2 weekly
Number of positions	

Summary

Principles of Magnetic Resonance Imaging (MRI) and applications to medical imaging. Principles of modern multi-dimensional NMR in liquids and solids. Structure determination of proteins & materials. Measurement of molecular dynamics. Principles of Hyperpolarization.

Content

- Projections of objects using magnetic field gradients.
- Image reconstruction by back-projection and by Fourier transformation.
- Contrast based on relaxation, diffusion, and contrast agents.
- Functional imaging.
- Imaging of flow and angiography.
- Advanced multi-dimensional correlation methods in magnetic resonance. Applications to protein strucutre determination and to determination of metabolism.
- Principles of multiple-pulse solid-state NMR. Applications to materials science.
- Principles of Nuclear Hyperpolarization and applications to imaging and spectroscopy.

Learning Prerequisites

Required courses

None

Recommended courses

Strcutural Analysis (CH-314)

Important concepts to start the course

Basic physical, organic, inorganic and biological chemistry

Learning Outcomes

By the end of the course, the student must be able to:

- Assess / Evaluate the meaning and limitations of MRI pictures
- Assess / Evaluate an approach to structure determination of molecules by NMR

- Design an NMR based approach to characterising materials
- Hypothesize how to produce hyperpolarized nuclear spins

Teaching methods

Lectures based on popular textbooks with ample addition of illustrations through recent applications and case studies. Regular excercise classes.

Assessment methods

Written Examination

Supervision

Assistants	Yes

Resources

Notes/Handbook

On Moodle

Moodle Link

- https://go.epfl.ch/CH-401