Advanced biomedical imaging methods and instrumentation

PHYS-719

Dr. Mor Mishkovsky

Dr. Nathalie Just

On Site Course

- Fridays 12 September – 19 December 2023 at 13:15.
- On site room CH F1 542
- Contact details:
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Outline

- Main goal - to give solid introduction into approaches, methods, and instrumentation used in biomedical research.
- Major focus is on Magnetic Resonance Imaging (MRI) and related methods.
- Three blocks:
  - Basic principles (lectures 1 - 4)
  - Imaging methods (lectures 5 – 8)
  - Spectroscopy and metabolic imaging (lectures 9 – 13).

Part 1 – introduction

- **Lecture 1:** Basis of NMR

  Dr. Mor Mishkovsky (LIFMET, EPFL)
- **Lecture 2:** Echo formation and Image Contrast

  Prof. Ileana Jelescu (CHUV)
- **Lecture 3:** Basics of MRI, methods and sequences

  Dr. Antoine Lutti (LREN-DNC-CHUV)
- **Lecture 4:** Overview of MR hardware

  Dr. Daniel Wenz (CIBM-AIT)

Part 2 – Imaging

- **Lecture 5:** Cardiovascular MRI

  Dr. Ruud van Heeswijk (CHUV)

- **Lecture 6:** Basics of Diffusion Tensor Imaging

  Dr. Yohan van de Looij (CIBM-AIT, HES-SO)

- **Mid-semester break**

- **Lecture 7:** fMRI: functional Magnetic Resonance Imaging

  Dr. Nathalie Just (EPFL LIFMET)

- **Lecture 8:** Quantitative MRI

  Prof. Jessica Bastiaansen (Bern)

Part 3 – Spectroscopy

- **Lecture 9:** High resolution spectroscopy

  Dr. Hikari Yoshihara (ETH)
- **Lecture 10:** Magnetic resonance spectroscopy, protons and beyond

  Dr. Lijing Xin (CIBM-AIT, EPFL)
- **Lecture 11:** Dynamic Nuclear Polarization (DNP) MR

  Dr. Mor Mishkovsky (LIFMET, EPFL)
- **Lecture 12:** Metabolic modeling

  Dr. Joao Duartes (Lund University)
- **Lecture 13:** low field MRI

  Dr. Jean-Noël Hyacinthe (LIFMET, EPFL)
- **Lecture 14:** TBA

Conditions for credit

- > 80 % presence in lectures.
- Exam: Term paper
- Exercises: Individual preparation of the term paper and literature review.

Term paper

- Choice of topic related to MR imaging / spectroscopy (better close to your thesis topic).
- Send an e-mail to Mor Mishkovsky (mor.mishkovsky@epfl.ch) and Nathalie Just (Nathalie.just@epfl.ch) including the subject and a short description.
- Proposal deadline: November 5, 2025
- Format :Review article.
- Length : 20 – 30 pages including figures (word document, standard font size, 1.5-line space)
- Submission deadline: Friday, January 16, 2026