

M229: Advanced Topics in Magnetic Resonance Imaging

Spring 2021: 4 Units

Lectures: Tue/Thu 10:00 AM – 11:50 AM

Zoom link TBD

<https://mrrl.ucla.edu/pages/m229>

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Office: Zoom link TBD

Course Description: This course will explore recent MRI developments that 1) have had high impact on the field, 2) involve novel pulse sequence design or image reconstruction, and/or 3) enable imaging of anatomy or function in a way that surpasses what is currently possible with any other modality. Simulations and programming exercises in MATLAB will provide hands-on experience for students. Students will propose and carry out a final project along current directions of advanced MRI research.

Prerequisites: This course is a follow-up to M219 (Principles and Applications of MRI) and is meant for students interested in pursuing research related to the development or translation of new MRI techniques.

Course Schedule:

- #1. Mar 30, Tue **Introduction** – Advanced MRI Techniques and Applications
- #2. April 1, Thu **Pulse Sequences** – Rapid GRE
- #3. April 6, Tue **Pulse Sequences** – RARE / Bloch Simulation MATLAB demo
- #4. April 8, Thu **Pulse Sequences** – Extended Phase Graphs (EPG) / MATLAB demo
- #5. April 13, Tue **RF Pulse Design** – Adiabatic Pulses
- #6. April 15, Thu **RF Pulse Design** – Excitation k-space I
- #7. April 20, Tue **RF Pulse Design** – Excitation k-space II / MATLAB Demo
- #8. April 22, Thu **Project Discussion**
- #9. April 27, Tue **Fast Imaging** – EPI, PROPELLER
- #10. April 29, Thu **Fast Imaging** – Non-Cartesian Sampling I
- #11. May 4, Tue **Fast Imaging** – Non-Cartesian Sampling II
- #12. May 6, Thu **Image Reconstruction** – Partial k-space
- #13. May 11, Tue **Managing Motion in MRI**
- #14. May 13, Thu **Image Reconstruction** – Parallel Imaging I
[ISMRM 5/15 – 5/20]
- #15. May 25, Tue **Image Reconstruction** – Parallel Imaging II / Coil Compression
- #16. May 27, Thu **Compressed Sensing / Artificial Intelligence**
- #17. June 1, Tue **Advanced Application Topic - TBD**
- #18. June 3, Thu **Advanced Application Topic - TBD**
[Final Project Presentation]
- #19. June 7-11, **Final Presentations**

Course Assignments:

- Reading book chapters and research papers
- Programming assignments x2 (MATLAB)
- Final project presentation (1 page abstract and 10+10 min oral presentation)

Grading Structure:

- Participation (10%), Homework (30%), Final Project (60%), Extra Points.

Reading List:

- Handbook of MRI Pulse Sequences. M. A. Bernstein, K. F. King, and X. J. Zhou. Elsevier Academic Press, 2004. ISBN-13: **978-0120928613**.
- Research papers as assigned