### M229: Advanced Topics in Magnetic Resonance Imaging

**Spring 2019: 4 Units**  
**Room:** 300 Medical Plaza, B500  
**Lectures:** Tue/Thu 10:00 AM – 11:50 AM  
https://mrrl.ucla.edu/pages/m229

**Instructors:** Holden Wu, PhD ([holdenwu@mednet.ucla.edu](mailto:holdenwu@mednet.ucla.edu))  
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**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. **April 2,** Tue  
   **Introduction** – Advanced MRI Techniques and Applications
2. **April 4,** Thu  
   **RF Pulse Design** – Adiabatic Pulses
3. **April 5,** Fri  
   **RF Pulse Design** – Excitation k-space / MATLAB Demo
   
   **[Homework 1]**
4. **April 11,** Thu  
   **Pulse Sequences** – SSFP / GRE / SPGR
5. **April 16,** Tue  
   **Pulse Sequences** – RARE & Bloch Simulation (MATLAB demo)
6. **April 18,** Thu  
   **Pulse Sequences** – Extended Phase Graphs and Simulation
   
   **[Homework 2]**
7. **April 23,** Tue  
   **Project Discussion**
8. **April 25,** Thu  
   **Fast Imaging** – EPI, PROPELLER
9. **April 30,** Tue  
   **Fast Imaging** – Non-Cartesian Sampling I
10. **May 2,** Thu  
    **Fast Imaging** – Non-Cartesian Sampling II
11. **May 7,** Tue  
    **Managing Motion in MRI**
12. **May 9,** Thu  
    **MR Temperature Mapping**
    
    **[ISMRM 5/11 – 5/17]**
13. **May 21,** Tue  
    **Image Reconstruction** – Partial k-space
14. **May 23,** Thu  
    **Image Reconstruction** – Parallel Imaging I
15. **May 28,** Tue  
    **Image Reconstruction** – Parallel Imaging II / k-t Reconstruction
16. **May 30,** Thu  
    **Image Reconstruction** – Compressed Sensing
17. **June 4,** Tue  
    **Advanced Application Topic** – Guest Lecturer: TBD
18. **June 6,** Thu  
    **Advanced Application Topic** – Guest Lecturer: TBD

   **[Final Project Presentation]**
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:

- Research papers as assigned