Introduction to Magnetic Resonance Imaging

Fall 2016, Tuesday/Thursday 2nd period (9:30-10:45)

Course number: PHYS 4510 / 6510
Instructor: Qun Zhao, Dept. Physics & Astronomy & Bioimaging Research Center
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Office hour: Wed. 3:30-4:30 or by appointment

I. Course Objective:
To provide basic knowledge to understand modern methods of Magnetic Resonance Imaging (MRI) physics and to apply the knowledge to solve problems in biological and biomedical fields.

II. Course Goals: Lectures will provide an introductory treatment of current magnetic resonance imaging physics and methods for living systems. Current new development will be discussed, including but not limited to functional brain imaging, tracking of stem cells, MR spectroscopic imaging, etc. In addition, a lab component will be taught using the state-of-the-art GE 3 Tesla magnet and/or a Varian 7T small animal magnet, located at the BioImaging Research Center on UGA campus. Students will have opportunities to gain hands-on experiences and understanding of the whole MR system, operation of the imaging instrumentation, performing MR data acquisition and data analysis.


Topic of Lectures
1. Introduction to MRI
2. Concepts of magnetic resonance
3. MRI system and Instrumentation
4. Relaxation and contrast
5. MR signal generation & detection
6. Imaging gradients
7. Fourier imaging
8. RF pulses and echoes
9. Imaging in multiple dimensions
10. Image reconstruction: sampling and aliasing
11. Rapid imaging pulse sequences
12. Dynamic Contrast-enhanced MRI
13. functional MRI and brain imaging
14. Spectroscopic Imaging
15. Diffusion Imaging

Grading: Class grades will be based on results from class attendance (10%), graded homework/tests/laboratory work (60%), and a final exam (30%).

Note: No makeup for the final exam will be scheduled.

A if AS >= 90
A- if 90 > AS >= 87
B+ if 87 > AS >= 85
B if 85 > AS >= 80
B- if 80 > AS >= 77
C+ if 77 > AS >= 75
C if 75 > AS >= 70
C- if 70 > AS >= 67
D if 67 > AS >= 60
F if 60 > AS

Additional requirement for 6510 students (counted into homework assignments)
Graduate students who sign up the 6510 will be assigned additional readings (published papers on MRI), and give presentations during the course.

University honor code and academic honesty policy
UGA student honor code: “I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others”. All students are responsible for knowing the University’s policy on academic honesty. All assignments submitted in this course must be your own unless you have received my permission to collaborate and have properly acknowledged receiving assistance. It is the responsibility of the instructor and the TA to uphold the University’s academic honesty policy and report my belief of dishonesty to the Office of the Vice President for Instruction.