PHYS8500 MRI Physics and Applications

Lecture: Tue/Thur, 2nd period 9:35-10:50pm, Physics 327, Fall 2021

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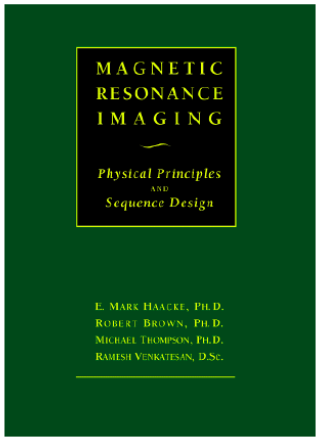
Office hours: Tue 2-3pm or by appointment

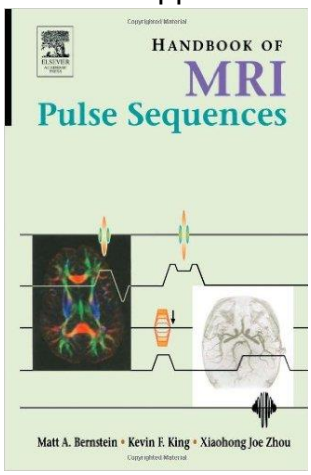
Course Objective: To provide students with basic knowledge to understand and apply modern methods of Magnetic Resonance imaging (MRI) to solve research problems.

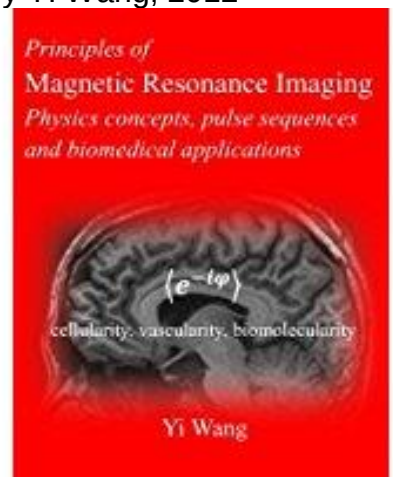
Course Goals:
This course presents a new imaging technology for biophysics and medical physics. It is based on the principles of nuclear magnetic resonance to obtain microscopic chemical and physical information about molecules in living bodies (human or animals). This course will also cover applications such as functional brain imaging, contrast-enhanced cancer imaging, and molecular imaging. In addition, *a lab component will be taught using a state-of-the-art 7 Tesla and a 3 Tesla scanner (located at the BioImaging Research Center on UGA campus) so students will have opportunities to gain hands-on experiences of MRI images acquisition*.

Reference books

1. Magnetic resonance imaging: Physical Principles and Sequence Design, by E.M. Haacke, R.W. Brown, M.R. Thompson, and R. Venkatesan, John Wiley & Sons, Inc. 1999
2. Handbook of MRI Pulse Sequences, by M. Bernstein, K, King, and X. Zhou, 2004
3. Principles of Magnetic Resonance Imaging: Physics Concepts, Pulse Sequences, and Biomedical Applications, by Y. Wang, 2012







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. Image reconstruction: sampling and aliasing
7. One-dimensional imaging: RF pulses and echoes
8. Imaging in multiple dimensions
9. Signal, contrast, and noise
10. Rapid imaging pulse sequences
11. Parallel Imaging and array of coils
12. Contrast-enhanced imaging using paramagnetic nanoparticles
13. functional MRI
14. Diffusion Imaging

Laboratory

MRI labs will be scheduled (TBD) and taught at 110, BioImaging Research Center, Coverdell Center

Student Presentation

Students will be assigned readings (published papers on MRI) and give presentations during the course.

Grading: Class grades will be based on results from graded homework (40%), presentation (30%), and a final exam/project (30%).

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**