

CRN: 45314

**Nuclear Magnetic Resonance (Phy5450)**

Fall, 2020

**Y. Xia**

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**Classes:** Tue & Thu, 1:00-2:47pm, online**Office Hours:** Tue & Thu, online or in person, by appointment**Main References:**Callaghan, PT: "Principles of Nuclear Magnetic Resonance Microscopy", paperback  
Oxford University Press (1994; ISBN-13: 978-0198539971)Keeler, J: "Understanding NMR Spectroscopy", 2<sup>nd</sup> ed paperback  
Wiley (2010; ISBN-13: 978-0470746080)Xia class notes (They will be provided to you as your personal copy. Do not share, upload,  
distribute them with anyone or to anywhere.)**Homework:** Six, 5% each**Lab Reports:**

Two, 5% each

**Test:** One, 20%**Final Exam:**

One, 40%

**Course Outline:**

Ch 1 Introduction

Ch 2 Classical description of NMR

**HW1 (Ch 1-2)**

Ch 3 Quantum mechanics description of NMR

Ch 4 Nuclear interactions

**HW2 (Ch 3-4)**

Ch 5 Instrumentation

Ch 6 NMR experimental

Ch 7 Spin manipulations by pulse sequences

**HW3 (Ch 5-7)****Test (Ch 1-7)**

Ch 8 Simple 1D spectroscopy

Ch 9 Advanced topics in spectroscopy

Ch 10 2D NMR spectroscopy

**HW4 (Ch 8-10)**Ch 11 Effect of the field gradient and **k**-space imaging

Ch 12 Spatial mapping in MRI

Ch 13 MRI instrumentation and experimental

**HW5 (Ch 11-13)**

Ch 14 Image contrasts in MRI

Ch 15 Quantitative MRI

Ch 16 Reading the binary data

**HW6 (Ch 14-16)****NMR Lab visits: (1) Spectroscopy, (2) Imaging****Final Exam (All Ch, more on Ch 8-16)****Notes:**

- Due to the covid-19 pandemic, all classes will be online, at the same time/day slots that have been reserved for the in-person classes. The office hours will be either online or in person, by appointment. You are welcome to email me.
- The links to the classes will be emailed to you before the individual classes (zoom or meet).
- HW is due by the end of one week after the chapters are completed. No later HWs.
- There will be no make-up test or exam. A grade of zero will be given without an official note from your doctor on the day of the test/exam.
- **In the past**, the test and the final exam were both closed books. You could bring with you one page of notes (letter-size), some blank papers, a stapler and a calculator. The time and format for this year's test and exam will be announced at a later time.
- **In the past**, we typically had several lab sessions (two classes for NMR spectroscopy and two classes for MRI, at the end of the semester). We would do some experiments together using either the sample of your choice or the lab sample. You would write a lab report for your experiment (one report for spectroscopy, one report for imaging). The lab sessions in this semester will depend upon the situation of the pandemic, and will be announced at a later time.