

NMR and MRI

Your primary goals for this lab are:

- (1) To understand how to measure T2 using spin echo techniques via the A=90 degree and single B=180 degree pulse sequence.
- (2) To understand how to measure T2 using spin echo techniques via the A=90 degree and multiple B=180 degree pulse sequence.
- (3) To understand how to measure T1 using pulse techniques via the A=180 degree and single B= 90 degree pulse sequence. {Why can't we apply multiple B pulses?}
- (4) To measure T1 and T2 for mineral oil using the three techniques above.
- (5) To measure T1 and T2 for the protons in water versus the concentration of copper sulfate ions in the solution.
- (6) To understand how spin echo NMR is used to do MRI.

Day One: First, learn about the apparatus, and then learn how to prepare specific spin states and to use them to measure the characteristic decay times by doing items 1 through 4 above.

Day Two: Measure T1 and T2 for the protons in water as a function of the concentration of copper sulfate ions in solution (item 5 above).

Day Three: In addition to finishing things that you did not finish on day 1 and day 2, do something creative on the third day. If you have ideas, please run them by me. If you do not, ask me for some.

In your lab report:

Explain how spin echo NMR works.
Explain the simple physics that governs T1 and T2.
Explain how spin echo NMR is used to do MRI.

Analyze your data.
Plot T1 and T2 versus the logarithm of the copper sulfate concentration.
How do your measured T1 and T2 values behave?
Can you explain why?