

Physics 220, Spring 2009
Lab 13: Fluorine NMR

P. Smith and Z. Chen have published (in the March 2009 Journal of Amazing Investigations, volume 3, page 141) a report that fluorine gives an NMR signal consistent with the fluorine nucleus (^{19}F) having a magnetic moment $91 \pm 4\%$ as large as that of hydrogen (^1H). They have no information in their paper about the process of polarizing the fluorine nuclei compared to hydrogen (either as a function of current or as a function of time).

Your task is to confirm or refute their report on the magnetic moment of fluorine. If possible, improve their precision (i.e. make a measurement with a smaller error bar). You should also make some measurements to enable you to compare the process of polarizing fluorine compared to hydrogen, either as a function of current or as a function of time.

A draft of a complete scientific paper on this experiment is due in class on May 5 (counts for 20% of final paper grade); feedback on this paper will be returned by the end of the day May 6. The final version is due by 5 pm on May 12. The paper should include title, abstract, introduction, procedure, data, analysis, results, and acknowledgements and references (see other side of this sheet for acknowledgements and references format). Include graphs, diagrams, and tables as necessary.

The audience for the paper is people who have had physics at the level of this class, but who have not worked with the Earth's field NMR apparatus before. The paper should contain enough information so that this audience can understand your experiment and evaluate its validity, so you should say what you did and why, but you do NOT need to put step-by-step detail in of the sort that would be required for a person to perform the experiment using only your paper. Example: You can assume that they'd have access to the manual for step-by-step instructions, so simply saying "the electronics were tuned according to the instrument manual" is fine.

Acknowledgements

A statement of thanks to your lab partner(s) is appropriate here. Anyone else who gave you substantial help should also be acknowledged (this doesn't include me, unless I provided you with assistance beyond the normal teaching of the lab).

References

In giving references, put an endnote in the text when you cite a reference, like this [1]. Put all references in a list (arranged in order of citation) at the very end of the paper. Use the bibliographic form shown below (this is the form used by the *American Journal of Physics*). You should cite all books, articles, manuals, and Web sites from which you obtained information used in the lab. You do not need to cite the lab writeup I give you, but if you use any equipment manuals, you should cite those.

[1] A.N. Author, *How to Write an Interesting Book* (Bench Press, Springfield, Ohio, 2004), 1st ed., p. 1.

Bibliographic forms (Am J Phys style):

Books:

Eugene Hecht, *Optics* (Addison-Wesley, Reading, Mass., 1998), 3rd ed., p. 123.

Magazine or journal articles:

W.G. Rees and C. Viney, *American Journal of Physics* **56**, 434 (1988).

(the number in bold is the volume number, then comes the page number)

Web sites:

D. Slaven, *Dave's Relativity Page*, <http://tardis.svsu.edu/~slaven/relativity1.html>.

(Generally, the author, title, and URL of a page should be given. If no author is listed, just give the title and URL.)

Manuals and other unpublished reports:

PASCO Scientific, *Microwave Optics*, 1991.