Reviews for submissions to the USD Journal of Undergraduate Physics Research

title of paper reviewed: High Resolution Laser Spectroscopy of Rb

May 6, 2013

Abstract

Please proofread the enclosed manuscript. The author will be helped by your comments; please write with this in mind. Return the marked up copy and send a .tex, .dvi, or .pdf copy of the answers to the questions below in an email to Dr. Severn.

1 General Questions

1. Did you find any physics errors or mathematical errors? Was the logical underpinning of the arguments and explanation strong or weak? This is really of first importance.
   Only one: Equation 2 should be $F = I \pm J$. The logical underpinning is strong as well, though I think crossover resonance could use more explanation. The explanation of why it occurs is still lacking.

2. Did the writer adequately explain how the experiment works, both at the advanced, modern physics level, and at the more basic and practical classical physics level?
   Yes, the writer made clear the physics pertaining to this experiment.

3. Is the manuscript complete? That is, does it describe all of the prescribed experiments and results?
   Yes, the manuscript is complete omitting the small remainder of the results/conclusion still missing.

4. Did the abstract tell directly and concisely about what done and what were the results?
   Yes, it definitely does.

5. Did the author help provide a sense of background interest in the experiments? Was it clear why the experiments provide useful scientific knowledge? Did the author explicitly describe the organization of the paper, and did the author stick with it?
   Somewhat, somewhat, and yes. The importance of this information and background interest is simply left at “this stuff earns people Nobel Prizes and is important in Quantum.” Further interest could be developed, but does not impact the physics of the experiment.

6. Were the attempted experiments clearly described?
   Yes, the experiments are clearly described.
7. Were their results adequately explained?
   No. There is no explanation of how there are 6 peaks in the results considering I see 5. Additionally, the method/calculations determining chamber temperature are not presented in the results.

8. Is it clear that author has revised the submitted draft and has proofread it for errors?
   Yes. There were only a few errors that I noticed: there is a latex error in the reference to a figure in the last paragraph of section II, you say 'hald' instead of 'half' in the first paragraph on page 2, and in section IVA, 'has' is spelled 'as'.

9. Were the 3 rules for formatting mathematical prose scrupulously followed?
   The Good Samaritan rule was not strictly followed, but, in my opinion, none of the offenses are an issue as this rule seems to be somewhat excessive, at least in this situation. The other two rules were scrupulously followed. While some pesky people might somehow have an issue with equation 5, I believe it is perfectly well done, especially due to the alignment.

10. Does the format of the submission (section numbering, format of references, etc.) conform to AIP standards? (By the way, if the manuscript isn’t suitably ‘LATEX’ ed’, then there is an issue to note here).
    There is an issue with a reference (already mentioned) at the beginning of the paper, but after that there are no latex issues and I believe the format conforms to AIP standards.

2 Short responses to be made at the discretion of the reviewer

• Was there anything you wished to know more about which if added could improve the paper (or anything which should be left out)?
  Provide more of an explanation of crossover resonance and why it exists. The last sentence in the results section suggests that crossover peaks are always the most prominent, but an explanation of why is lacking in the paper. Either reword the sentence to say that we know it is true, or, preferably, explain why it is true somewhere.

• Any general comments about the paper?
  In the introduction, the author says that the hyperfine structure are the smallest quantum energy gaps, but they are not. In section II, you say you are trying to determined the chamber temperature, the number of dips, and the hyperfine spacing. Then you say two experiments will be conducted to determine the spectrum of Rb and the other to determine the doppler-free spectrum. Instead, say the two experiments will be conducted to produce the data. I think it is more appropriate to say you are trying to determine the three items you initially mentioned using the results of the two experiments. In the last sentence of IIIB, will it actually improve the reliability of the data or just the resolution? Is the data unreliable currently? In the first paragraph of IIIC, I think reducing the Doppler-shift improves precision, not accuracy. Your results should already be accurate. It should not change the position of the Doppler-shifted peak, which is what improved accuracy would do if data were inaccurate.