

**ATOMIC SPECTROSCOPY**

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***Watch the two videos on this experiment, Atomic Physics: Part 1 and Part 2.***

Student's Name \_\_\_\_\_

Partner's Name \_\_\_\_\_

**Pre-lab Discussion Questions and Staff Sign Off**

It is your responsibility to discuss and answer the questions for this lab with a professor or GSI before the first day of your scheduled laboratory period for the Pre-Lab Questions and on the 3<sup>rd</sup> & 5<sup>th</sup> day of this experiment the answer the Mid-Lab Questions. This signed sheet must be included as the first page of your report. Without it you will lose 1/3 of a letter grade for Pre-Lab and or Mid-Lab. You should be prepared to do and discuss at least the following items before you come to lab. If you find it difficult to find the proper texts and articles to refresh your memory, you may find it useful to watch some of the online videos, which are designed specifically to help you in this experiment. They are titled Energy Levels, Transitions, Light Sources and Detectors, Optical Instruments, Atomic Physics. For the pre-lab, be prepared to do the following:

1. Draw an energy level diagram for hydrogen. Show the transitions which produce the Balmer series. What is the formula that gives the wavelengths of these lines for the simple Bohr hydrogen atom? How do the Bohr model and energy level derivation differ from the better quantum mechanical methods?
2. Draw an energy level diagram for helium. Show the transitions which produce the red and yellow lines. Note the differences between the energy level structures and splittings for hydrogen and helium.
3. Draw an energy level diagram illustrating the Zeeman effect in the red line of helium. When a 1 tesla magnetic field is applied to helium, what happens to levels and transitions that produce the red line of helium?
4. Draw a sketch of the diffraction grating spectrometer showing the placing of the optical elements and the path and focussing of the light as it goes from the source through the spectrometer and to the film or photomultiplier. Explain how the grating functions. Calculate a representative value for the resolving power.
5. Draw a sketch of the Fabry-Perot interferometer showing the placing of the optical elements and the path of the light as it goes from the source through the interferometer and through the telescope. Calculate the resolving power. Why is it necessary to use the interferometer instead of the grating when observing the Zeeman Effect?

Staff Signature \_\_\_\_\_ Date \_\_\_\_\_

Completed on the *first* day of lab? (circle) Yes / No

**Mid-lab Questions and Staff Sign Off**

On **day 3** of this lab, you should have successfully produced a photograph and a strip-chart plot of the Balmer-series lines, and made an estimate of the Rydberg constant. Show them to a GSI and ask for a signature.

Staff Signature \_\_\_\_\_ Date \_\_\_\_\_

Completed on the *third* day of lab? (circle) Yes / No

On **day 5** of this lab, you should have successfully observed the Zeeman splittings of the helium lines and estimated a value for the Bohr magneton. Demonstrate this to an instructor and ask for a signature.

Staff Signature \_\_\_\_\_ Date \_\_\_\_\_

Completed on the *fifth* day of lab? (circle) Yes / No

**INCLUDE THESE SHEETS AS THE FIRST PAGES OF YOUR REPORT**

**Physics 111 Advanced Lab****Student Evaluation of Experiment**

Now that you have completed this experiment, we would appreciate your comments. Please take a few moments to answer the questions below, and feel free to add any other comments. Since you have just finished the experiment it is *your* critique that will be the most helpful. Your thoughts and suggestions will help to change the lab and improve the experiments.

Please be as specific as possible, using both sides of the paper as needed, and turn this in with your report. Thank you!

Experiment name: \_\_\_\_\_

Date: \_\_\_\_\_

How was the write-up for this experiment? How could it be improved?

How easily did you get started with the experiment? What sources of information were most/least helpful in getting started? Were the reprints appropriate? Did the Pre-lab discussion help? Did you need to go outside the course materials for assistance? What additional materials could you have used?

What did you like and/or dislike about the experiment?

Would you recommend this lab to fellow student? Why or why not?

What advice would you give to a friend just starting this experiment?

If the course materials were available over the Internet (WWW, FTP, etc), would you (a) have access to them and (b) would you prefer to use them this way?

Please circle the abbreviations of the other labs you have done. ATM BRA BMC COM CO2 GMA HAL HOL JOS LIF LLS MNO MOT MUO NLD NMR RUT SHE OPT OTZ XRA	Overall quality of this experiment? 1      2      3      4      5 Poor                      Average Good
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**Thank you from the 111-Lab Staff**