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PHYS-3702-101

Intermediate laboratory- Photons and Nucleons

Spring 2023, Call number: #8131

6 **Instructor:** Dr. Julie Roche (rochej@ohio.edu)

7 **Office hours:** Mo, Tu and Wed 9:00 am to noon¹. To book an appointment in person in
8 my office or over video-conferencing, use Bookings ([this link](#))

9 **Class time and location:** Mo & Wd, 2:00 to 3:50 pm, in Edwards Accelerator Lab #208.

10 **Class web site:** Blackboard ([this link](#))

11

12 All information in this syllabus are subject to change, mainly because it is the first time I
13 am teaching this laboratory course. I will announce changes to the syllabus in class and by
14 email. You are responsible for keeping up to date with the changes.

15 I care about your success in this class. Let me know if something in this syllabus makes it
16 difficult for you to learn. We will find a solution to maximize your training. For example,

17 I will gladly help you with any assignment before the official due date. Similarly, if you
18 cannot make a deadline for a "good" but not university valid excuse, come and talk to me.

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¹If these do not work for you, email me to find a time that does work.

1 Goals and learning outcomes of the class

The two goals of this laboratory class are to develop your practical skills and reinforce Modern Physics concepts. At the end of this class, you will be able to:

- Construct arguments and identify trends based on experimentally controlled observations.
- Discuss the instrumentation used in an experimental investigation, including any systematic errors or biases that these might introduce.
- Work together in small groups to design and construct an experiment.
- Maintain laboratory notebooks of sufficient quality for beginning graduate-level research.
- Use a computer to do sophisticated data analysis, including uncertainty analysis using professional standards.
- Make written scientific arguments using several standard elements of technical communication.
- Use theoretical models to predict and understand measurement results.

2 Schedule

You will work on **five** different activities during this class: one introductory module and four experiments (noted lab 1, lab 2, ...). Table 1 gives a preliminary plan of the class and the date on which assignments are due. One lab will last two weeks: you should have time to perform your analysis during class meetings.

Your instructor will let you know which experiment you will perform on a specific lab one week ahead of the start of the lab. If you have not received the notification by that time, you must contact your instructor ASAP.

2.0.1 COVID-19, Flu and RSV

In this class, we will follow all the Health protocols and policies of Ohio University. Please refer to the “Be Safe Bobcats” website ([this link](#)) for more information. If OHIO asks you to stay home because of COVID-19, do so. If you are sick: we wish you to feel better soon. If you are asymptomatic: we hope you remain so. Let me know what is going on asap. Then, later on, when you are ready to get back to your studies, email to make up arrangements. I have masks to give you if you need one to attend class. There is a hand sanitizer at the entrance of the lab class: use it!

58 2.0.2 Attendance Policy

59 Attendance at all laboratory meetings is mandatory. If you have enough data for one lab,
60 take advantage of the remaining time to start writing your report; you should work in room
61 EDW 208. There will be no leaving the lab before 3:50 pm for any meeting (unless you have
62 the explicit agreement of the instructor).

63 Because of the structure of this class (round-robin), making up sessions is quite tricky.
64 However, make-up sessions will be arranged without any penalty if you present a university
65 valid excuse² for your absence. Excused absences include illness, death in the immediate
66 family, religious observance, jury duty, involvement in University-sponsored activities, and
67 isolation or quarantine because of sickness. **A student who misses four 90-minutes**
68 **class meetings without university valid excuses fails the class immediately.**

69

70 2.0.3 Participation

71 You are expected to be present, prepared, positive, thorough, kind, and respectful during lab
72 meetings. For example, this means that you work in a team to accomplish tasks, you treat
73 group members, staff, and the instructor professionally and respectfully, you are punctual,
74 and you exhibit proper respect for safety. Participation will be evaluated at each class
75 meeting.

76 3 Assignments

77 All assignments are due on Blackboard. Good-quality scans or photos of handwritten work
78 are acceptable for assignments other than reports, but typed work is preferred. The reports
79 that are not typed will not be graded.

80

81 You need to produce six different products for each lab: Answers to Preliminary Ques-
82 tions (APQ), 3 Lab notes, one analysis note, and one partial (or full) report. One group
83 member submits the lab notes or the analysis; the grades for those submissions apply to all
84 group members. You need to work on these together.

85 3.0.1 Late work policy

86 APQs and Lab notes received more than 24h after the deadline will not be graded and will
87 receive a zero. Likewise, analysis notes and reports received more than a week after the
88 deadline will not be graded and will receive a zero. Remember that a university's valid
89 excuse abolishes these deadlines. In this case, contact your instructor asap to discuss an
90 alternative schedule.

91 3.0.2 Group roles

92 For this class, you will be working in pairs. In turn, you will be the Recorder or the Operator.

²OHIO undergraduate catalog ([this link](#)), search for "Excused Absence"

Week	Date	In class activity	Assignment due on Blackboard
1	Jan 16	Martin Luther King Holiday	
	Jan 18	Introduction	
2	Jan 23		
	Jan 25	Lab 0	Analysis Tutorial
3	Jan 30 Feb 1		
4	Feb 6 Feb 8	Lab 1	APQ due at 8 am
5	Feb 13 Feb 15		
6	Feb 20 Feb 22	Lab 2	APQ due at 8 am Lab 1 report sections I and II due at 11:59 pm
7	Feb 27 Mar 1		
8	Mar 6	Writing workshop:	
	Mar 8	Lab 3	APQ due at 8 am
	Mar 13-17	Spring Break	
9	Mar 20 Mar 22		Lab 2 report section III due at 11:59 pm
10	Mar 27		
	Mar 29	Writing workshop:	
11	Apr 3 Apr 5	Lab 4	APQ due at 8 am Lab 3 report section IV due at 11:59 pm
12	Apr 10 Apr 12		
13	Apr 17	Writing workshop:	
	Apr 19	Lab 5	APQ due at 8 am
14	Apr 24 Apr 28		
Exam week	Apr 25		Full Report for lab 4 due at 12:30 pm

Table 1: Tentative schedule for the PHYS-3702 Spring 2023 sessions (last update 01-29)
 Lab notes are due in Blackboard at 11:59 pm after each Lab meeting, but for the last meeting of a specific lab. For example, for Lab 2, a journal entry is due on Blackboard on February 15, February 20, and February 22.

Report sections refer to the sections described in Appendix A.

Analysis notes (for labs 0 to 5) must be discussed with the instructor within a week of the last meeting for a given lab.

- 93 - On the first class meeting, the Recorder is the person listed first in the pair assignment
94 sent by the instructor, and the Recorder is the other person. Roles are switched during
95 the next meeting.
- 96 - The Recorder notes what the group does during the meeting time, records experi-
97 mental conditions and preliminary results and makes sure that the data are securely
98 saved. After each class meeting (but the last one for a given experiment), the Recorder
99 submits a Lab Notebook Entry on Blackboard on behalf of the group.
- 100 - The Operator interacts with the equipment, ensures all possible problems are ad-
101 dressed, suggests alternative approaches, and raises concerns with the suggested pro-
102 cedures, data quality, and preliminary results.

103 3.0.3 Lab report

104 Throughout the semester, we will work toward your writing of a full report for Lab 4. For
105 Labs 1 to 3, you will practice writing parts of reports, and we will discuss those practice
106 pieces during writing workshops. There will be no lab report writing for Lab 5. The report
107 formatting requirements should follow exactly the outline listed in Appendix A. We will
108 use the excellent "How to write a Lab report" section from Pomona University as our main
109 guide for writing reports. The Pomona document is available on Blackboard under the
110 "Writing tips" section.

111 I encourage you to learn to use the scientific word processor LATEX through Overleaf's
112 web interface. But you are welcome to use any word processor that works for you.

113 3.0.4 Lab notes

114 The role of a laboratory notebook is to provide yourself and your collaborators with a
115 complete record of your work, to keep all information in a central location, and to encourage
116 critical thinking on your work ³. Lab notes are due in Blackboard at 11:59 pm after each
117 Lab meeting, but for the last meeting of a specific lab. The Recorder will submit a Lab
118 note. The score for the Lab notes entry will apply to all members of the group. The entries
119 are evaluated on:

- 120 - Organization and Comprehensibility: How easy is it to follow your work?
- 121 - Completeness: Do you have enough detail to reconstruct your work? Do you describe
122 the steps of your data-taking or analysis?
- 123 - Reasonableness of data and explanations: Can you evaluate the quality of your data
124 or your analysis? Can you explain your data? Do you have a determination of the
125 errors in your results?
- 126 - What is your plan for the next lab meeting?

³I took these ideas from this pretty good [blog entry](#). This [article](#) also describes how to keep a good notebook.

127 **3.0.5 Answer To Preliminary Questions**

128 Before beginning a new experiment, students must submit answers to pre-lab questions
129 listed in the lab manual.

130 **3.0.6 Analysis note**

131 As a group, prepare a short report that answers the objectives for the lab. You do not need
132 to write a lot; answer the questions like homework questions. Your answers must be typed
133 and submitted to Blackboard before meeting with Roche or Abbas . Take an appointment
134 with me (Roche) or Mr. Abbas, that both students can attend. The Recorder for the last
135 lab meeting needs to present the Analysis and Results in less than 8 minutes. Both Students
136 will answer questions for about 8 minutes. If the analysis is satisfactory, your group gets full
137 credit (100%). If the analysis is not satisfactory, your group scores a 55%. Your group may
138 improve the analysis and come again to present it. For each additional try, your satisfactory
139 grade drops by 10%, and your non-satisfactory grade remains 55%. No Analysis Notes will
140 be evaluated more than a week after the last lab meeting.

141 If you are done early, it might be possible for a pair to present their Analysis note by the
142 end of the fourth lab session: ask me.

143 You must also submit an Analysis note for Lab 0: the analysis tutorial.
144

145 **3.0.7 Grading policy**

146 The overall grade will be based on many assignments. The weight for each component is as
147 follows:

	Auxillary assignments (APQ, lab notes)	25%
	Analysis notes	25%
148	Participation	25%
	Lab. reports (practice)	10%
	Full report for Lab 4	15%

149 After being rounded to the unit place, the overall numerical grade will be transformed into
150 a letter grade using the following table:

	A: 100-93%	A-: 92-90%
151	B+: 89-87 %	B: 86-83 % B-: 82-80%
	C+: 79-77 %	C: 76-73 % C-: 72-70%
	D+: 69-67 %	D: 66-63 % D-: 62-60%

152 **4 Other policies**

153 **4.1 Academic dishonesty and plagiarism**

154 The Ohio University Student Code of Conduct ([this link](#)) prohibits all forms of academic
155 dishonesty. These include cheating, plagiarism, forgery, furnishing false information to

156 the University, and alteration or misuse of University documents, records, or identification.
157 Suppose a student engages in course-related academic dishonesty. In that case, the student's
158 grade on the work in question or the overall grade course may be lowered by the instructor⁴.
159 For this course, it primarily means no fudging with the data or copying your presentation
160 from someone else. Data must be taken with partners, but you should write your report
161 individually.

162 4.2 Disability accommodation

163 Any student who feels s/he may need accommodation based on the impact of a disability
164 should contact me privately to discuss your specific needs and provide written documenta-
165 tion from Student Accessibility Services. If you are not yet registered as a student with a
166 disability, please get in touch with Student Accessibility Services at 740-593-2620 or visit
167 their website ([this link](#)).

168 4.3 Inclusivity

169 The best environment in which to learn physics is one that's inclusive and equitable. The
170 students, staff, and faculty of the Department of Physics and Astronomy are committed to
171 professional interactions, respecting and considering all its members' rich and diverse back-
172 grounds. We expect every member of our Department to encourage and support a culture
173 of equity for and inclusion of all social identities in all activities in which we participate and
174 uphold all Ohio University diversity policies. For more information about our culture of
175 inclusion and how to report issues and concerns, consult the Inclusion and Equity website
176 of the Physics and Astronomy Department ([this link](#)).

177 5 Feedback

178 I would appreciate feedback from the students on how the class is going. Talk to me, email
179 me, or drop an anonymous note in my mailbox. Specifically, this is the first time I am
180 teaching this class, so I need help polishing the documents I develop. You may gain up to
181 10% bonus points on your participation grade for a specific experiment.

182 6 Changes to the syllabus

183 1.0:

⁴Read more at The Office of Community Standards and Student Responsibility" web page ([this link](#))

184 Appendix A: PHYS3702 Report Formatting Require- 185 ments

186 Your report must conform to the following requirements. The document will be rejected and
187 not graded if these requirements are not respected. If you submit your report too close to
188 the deadline and your report is rejected because it doesn't respect the format requirement,
189 you might get a 0 for this assignment.

- 190 - Your report needs to follow exactly the table of content listed below.
- 191 - The experiment title, the author name, and the name of their partners need to appear
192 at the top of the first page in lines containing this information only.
- 193 - Your report needs to be between 2250 and 2750 words, about 5 pages of text. Each
194 section should be between 400 and 600 words. Show your word count.
- 195 - The tables and figures need to be included in the report after the conclusion section.
- 196 - You need to number the line of your report. In Latex, use the `linenumbers` command.
197 In Words, on the Layout tab, in the Page Setup group, click Line Numbers.
- 198 - The document should be written in single space. No more than six lines of text within
199 a vertical space of one inch. Margins, in all directions, must be at least an inch.
- 200 - Use one of the following typefaces identified below (i) Arial, Courier New, Palatino
201 Linotype at a font size between 10 and 12 points; (ii) Times New Roman at a font
202 size 11 or 12 points or (iii) Computer Modern family of fonts at a font size of 11 or
203 12 points. This document is written in the Lucida Computer Modern font at 12-point
204 size.

205 **Required table of content for the reports in PHYS3702:**

- 206 Abstract
- 207 I. Background Introduction
 - 208 I.A. Motivation
 - 209 I.B. Summary of experiment
- 210 II. Theory
- 211 III. Experimental Methods
 - 212 III.A. Description of apparatus
 - 213 III.B. Description of experimental procedure
 - 214 III.C. Description in plain English of the observed phenomena
 - 215 III.D. Description of sources of errors and how you minimize them
- 216 IV. Analysis and Results
 - 217 IV.A. Description of the data set
 - 218 IV.B. Method of Analysis
 - 219 IV.C. Presentation of results
 - 220 IV.D. Discussion of results
- 221 V. Conclusions

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V.A. Summary of results

V.B. Pertinence of results to the questions raised in the introduction

V.C. Further questions raised by this experiment. Suggestion for future work