

Phys4052 Methods of Experimental Physics: II

Introduction: The second semester of the Phys4051/2 sequence consists of three components. In the first 4 weeks you will carry out several experiments. The bulk of the semester will be devoted to independent projects that will allow you to put into practice many of the skills that you have acquired over the last semester. Because these projects are such an important part of the Phys4052 course, some time in the first weeks will be spent on getting ready for them. The third component will be the lectures in which we will cover statistics, various topics in experimental physics and during which you will give presentations of your project to the rest of the class.

Prerequisite: Completion of Physics 4051.

Staff: The faculty members for this course are:
Shaul Hanany (Office: Physics 333, 626-8929)
Office hours: Friday 4:30 – 5:30 PM and by appointment
Jeremiah Mans (Office: Physics 377, 625-8994, jmans@physics.umn.edu)
Office hours: Wednesday 2:30 pm – 3:30 PM and by appointment

Technical assistance for the laboratory is provided by:
Kurt Wick: (Physics 69, 624-2831, wick@umn.edu)

The teaching assistants are:
Bryce Beverlin II: Sections 2 and 3
(Physics 46, 624-6305, beverlin@physics.umn.edu Office Hours: Tuesday 3:30 – 4:30 PM.)
Tanner Schulz: Sections 4 and 5.
(Physics 58, 626-5503, schulz@physics.umn.edu) Office Hours: Wednesday 7:00 - 8:00 AM or by appointment)

Please check our WEB page (<http://mxp.physics.umn.edu/>) and your E-mail on a regular basis, as it may be used for announcements.

Lectures: Three lectures are given per week: M, W, F, 11:15 - 12:05, in 133 Physics. The first several weeks of lectures will cover topics in data analysis. The remaining lectures will cover noise, detectors for electromagnetic waves across the spectrum, vacuum techniques and if time permits low-temperature techniques. Student presentations will also be made throughout the course. These are described in more detail below.

Lab Tours: Depending on popular demand and on availability, we may have tours of research laboratories in the building and perhaps some University facilities. The schedule will be posted at a later date.

Experiments: All students must complete and write reports on three experiments, which will be assigned from the following group: "Ball Dropper," "Noise," "Diffraction" and "Measurement of the Verdet Constant of Water" (See the lab manual chapters 1 through 6.) Students are expected to work in pairs for these experiments, but **each student must write his or her own separate report, including his or her analysis**. The experiments require knowledge of electronics, computer interfacing and programming, and statistical analysis. Much of this material was covered in 4051. The experiments this semester are different than before in that you are expected to work out much of the details of the experiment on your own. The report should include a brief introduction, sections on your data collection and analysis and a conclusion. All reports will be limited to maximum 10 pages, double spaced, 12 point font. Please see the accompanying handout on the web. The reports are due the first lab section of the following weeks: the first report will be due the week of February 4; the second lab will be due the week of February 11 and the third lab on February 27. No labs will be accepted after February 21.

Homework: Homework assignments will be handed out on in class. Students may work in groups on the homework but must write up individual solutions.

Project: The projects consist of the following components, which are explained in more detail below. On January 25 (Friday of the first week of the semester) you will be required to submit a **Letter of Intent**, consisting of a one-page description of your project. If we have questions about your letter we will meet with you for an **interview** during class time on January 30. On February 22, you will submit a 7 to 10 page **proposal** for your proposed project. You will start working on your project on February 25. Between February 29 and spring break, one participant in each project will give a short **oral presentation** in class. The other member of each group will give a presentation at the end of the semester. Starting with the second project week, you are expected to fill out a short **weekly progress report** on the web. On April 7, each *group* will hand in a **Midterm Project Report** explaining in detail what has been accomplished up to that point. Finally, on May 9, each *student* will hand in his or her **Final Project Report**.

Letter of Intent: On January 25 you will be required to submit a Letter of Intent, consisting of a one-page description of what type of project you plan to do. If you did not receive the material describing the various aspects of the project at the end of last semester, please see Shaul Hanany or Kurt Wick immediately.

Interviews: If necessary, instructors will meet with you on January 30 to discuss the feasibility of your project and your needs. Additional meetings will be arranged as needed.

Proposal: Once your LOI has been approved, each student will submit on February 22 a full research proposal for the experiment to be carried out later in the course. In order to ensure the success of these projects, we will lay considerable stress on the quality of the proposals. It will not be unusual for the proposal to be handed back for further work, particularly as it relates to the feasibility of the project, availability of equipment and supplies, proposed analysis of the data, and knowledge of literature in the field.

Poster

Session: The poster session will be held on Friday, May 9, and the physics faculty and students will be invited to attend.

**Weekly
Progress**

Reports: In order to track your progress, you must complete a weekly project report in which you will briefly indicate the work you have accomplished, along with any other relevant comments. These reports can be found on the class web page.

Oral Pre-

sentations: Two short (15 minutes) oral project presentations will be given by each group. The first presentation will be given in the first few weeks of the projects; you will need to explain briefly the theory and background of your project and what your group expects to accomplish in the next 8 weeks. The second presentation will be given in the final two weeks of the semester; the results from your project will be shown and explained.

Each student is required to give one of these presentations. Students may decide which partner will do the first presentation and which one the second.

These presentations will be given in Phys133 during scheduled class hours and will involve the use of computer generated presentation materials. PowerPoint or similar tools may be used and the presentation files must be submitted in ppt or pdf format at least 2 hours prior to the presentation..

Project

Web Page: Each group will design a web page, which will be hosted on our server, describing their project. A minimal web page must contain the abstract of your project report and pictures of your setup. It will count towards your final grade.

Reports: In addition to the reports for the experiments in the first four weeks, you will be writing two reports. The first report, the Midterm Report, is due on April 7 and covers all the aspects of your project except data analysis. Material from this report will be used for the final report, due May 9, which will be a complete paper on your project. Both reports should be presented in the format of a scientific paper in the style of *Physical Review* or *Physical Review Letters*. Please have a look at papers published in these journals to understand what is expected both in terms of scope and style. Please submit the report as if you submit a paper. All reports, including the reports for the experiments in the first 4 weeks, will be limited to maximum 10 pages, double spaced, 12 point font. Your final report must also be submitted in electronic form as a PDF file. You will prepare the experiment and make the measurements with your partner. You may also analyze the data together, however the reports should be prepared and submitted individually. For example, the parts of the report containing the description of the physics, the apparatus, the summary of the data and the conclusions should all be prepared individually.

Final Exam: There will be no final exam. Instead, homework will be handed out during the semester and will be graded.

Grades: 20% of the final grade will be based on the reports from experiments of the first four weeks and the short homework assignment and the final exam. 65% of the final grade will be based on your project, including letter of intent, proposal, progress report, mid-term report, oral presentations, final report and web page. The final report is due on the last day of class, May 9. The graded homework will weigh 15%.

Attendance

Policy: Attendance is mandatory for all classes at which student presentations are being given. Please be prepared to justify your absence. There is a penalty of 5% of your final grade per absence for unjustifiable absences.

Lab

Notebooks: You must enter a lab-by-lab record of your work and data acquired in a bound record book. Both students in a pair may use the same book so that all records are available to both.

Keys: Keys to your project rooms will be signed out to students during your first meeting with the instructors, otherwise, your U-Card give you access to the main lab (Room 65).

Schedule:

DATE	DEADLINES	DUE DATES	LECTURES
1/21/2008	MLK		
1/23/2008	First Day of Class		Data Analysis
1/25/2008	LOI		Data Analysis
1/28/2008			Data Analysis
1/30/2008	Interviews		No lecture (Interviews)
2/1/2008			Data Analysis
2/4/2008		First Lab Due	Data Analysis
2/6/2008			Shop Policies
2/8/2008			Data Analysis
2/11/2008		Second Lab Due	Photon detection and measurement
2/13/2008			Photon detection and measurement
2/15/2008			Photon detection and measurement
2/18/2008		Data Analysis HW Due	Photon detection and measurement
2/20/2008			Effective Presentations
2/22/2008	Proposal Due		Effective Presentations
2/25/2008	First Week of Projects		Effective Presentations
2/27/2008		Third Lab Due	Initial Student Presentation
2/29/2008			Initial Student Presentation
3/3/2008			Initial Student Presentation
3/5/2008		Photon HW Due	Initial Student Presentation
3/7/2008			Initial Student Presentation
3/10/2008			Initial Student Presentation
3/12/2008			Initial Student Presentation
3/14/2008			Initial Student Presentation
3/17/2008	Spring Break		
3/19/2008	Spring Break		
3/21/2008	Spring Break		
3/24/2008			Effective Scientific Writing
3/26/2008			Effective Scientific Writing
3/28/2008			Effective Scientific Writing
3/31/2008			Cryogenics
4/2/2008			Cryogenics
4/4/2008			Cryogenics
4/7/2008	Midterm Report		Cryogenics
4/9/2008			Vacuum Techniques
4/11/2008			Vacuum Techniques
4/14/2008		Cryogenics HW Due	Vacuum Techniques
4/16/2008			Vacuum Techniques
4/18/2008			Vacuum Techniques
4/21/2008			Final Student Presentation
4/23/2008			Final Student Presentation
4/25/2008			Final Student Presentation
4/28/2008		Vacuum HW Due	Final Student Presentation
4/30/2008			Final Student Presentation
5/2/2008			Final Student Presentation
5/5/2008			Final Student Presentation
5/7/2008			Final Student Presentation
5/9/2008	Final Report Due		Poster Session