

Advanced Master Lab Course

rules, regulations, and advice

GOOD SCIENTIFIC PRACTICE

There will be a lecture on good scientific practice which is mandatory to attend. The Freie Universität and all of its members (this includes you!) are committed to follow good scientific practice. You find a translation of the rules of the Freie Universität in the “Useful Downloads” section on Blackboard. It describes the rules as well as the actions that will be taken in case of scientific misconduct.

EXAMPLES OF SCIENTIFIC MISCONDUCT

- Invented data or results
- Concealment of data or of results
- Purposely modified data or results
- Deliberate false statements
- Faking one's own work (e.g. adoption of someone else's data)
- Sugarcoating experimental procedures and results
- Concealment of problems and error sources
- No error discussion
- Adopting the ideas or results of other people without properly citing the sources (see Plagiarism)
- Not or not correctly citing sources
- Citing only non-permanent sources

PLAGIARISM

This course – just like the scientific community in general -- **has zero-tolerance policy towards plagiarism**. Plagiarism is defined as **any copying without attribution**.

For example: using paragraphs of the text found online, copying three sentences from a previous report, reproducing from a textbook, or getting a figure from a colleague, copying a few sentences from Wikipedia for a pre-experiment report.

Any kind of plagiarism, either in pre-experiment or final reports will result in **failing the experiment**.

Even if you did not know what plagiarism is! This experiment **must be repeated the next semester**.

Repeated plagiarism will result in **failing the course**. Or worse. All cases of plagiarism will be referred to course administrators and taken extremely seriously.

GENERAL INFORMATION

The course is designed to give a glimpse into life of an experimentalist: you will carry out the measurements, analyse data and sources of errors, collaborate, prepare reports, and give presentations.

The experiments take place during the semester on Wednesdays and for particular experiments in the first two weeks of the semester break. The seminar is on Tuesday, participation in it is mandatory. The course website is [here](#). There, you find the list of the experiments, contact information for tutor of each experiments, the schedule of the experiments that you are assigned to.

During the course, each group of two or three students will carry out at 8 dates 7 experiments from different areas of physics, write reports on these experiments, and present the results of one of these experiments in front of the peers during the seminar. For the experiment were you give the seminar talk we reserve two dates, so that on the 2nd date you can come, reinsure what you have learned, take

photographs and finalize the talk and slides. At the end of this day you should present your talk to the tutor.

AT THE BEGINNING OF THE CLASS

To take part in the class, you must attend the general meeting/safety lecture and the lecture on scientific integrity. Both will be offered only once, typically during the second and fourth week of the semester.

If you did not attend that meeting, **for any reason**, you will not be able to take the part in the course for legal reasons. Before the start of the experiments, groups of two or three students will be formed and assigned to various experiments. You must register in [Blackboard](#) using the tab "Registration", where you can make suggestions for group mates and preferred experiments. We will try to satisfy your suggestions in forming the groups, choosing partners, and assigning the experiments. However, beware that assignment of partners/experiment is a semi-random process. The schedule for all of the experiments will be posted online shortly after the first safety instruction.

BEFORE THE EXPERIMENT – PRE-EXPERIMENT REPORTS

To prepare for the experiment, consult the detailed descriptions found at

<https://wiki.physik.fu-berlin.de/fp/doku.php>

as well as any other literature.

Two days before the experiment, send an email with the **written introduction to the experiment** (pre-experiment report) to the tutor for that experiment.

The **written introduction** should

- concisely describe the fundamental physics of the experiment
- contain a schematic draft of the experimental setup and the guidelines for the execution of the experiment.
- Do not exceed five pages in length, normally two pages are enough.

One day before the experiment, you will have a preliminary discussion (**Webex**) with the tutor of the experiment. The discussion will be based on the pre-experiment report. Each student within a group should take actively part in this preparation process. Be prepared to answer the questions regarding the background of the experiment, related physics, and equipment involved.

The tutor WILL reject students **without sufficient written introductory part and knowledge of the basic ideas of the experiment**; he/she can reject them also **in case they come too late**. A compensatory appointment can be agreed upon discussion with the tutor and organizer responsible for the course. See the **To-Do-List** for more information!

DURING THE EXPERIMENT

The experiment begins usually at 9:00 - 10:00 h. The tutor will ask questions, discuss with the students the experiment, and instruct the students in operating the experimental equipment. The students are allowed to use it only after approval of the tutor. The tutor will not perform the experiment! During the execution of the experiment the students should prepare clearly arranged data sheets which have to be attached to the final report.

The protocol should in principle be finished at the day of the experiment. It is worth pointing out that it is not the intention of the advanced lab course to force students to work on unfinished protocols at home for several days after the end of the experiment. The biggest part of the report should be completed during the preparation process so that it should be clear, e.g., which quantities are going

to be measured and how they should be presented. After the end of the experiment the tutor attests the proper execution of the experiment by **grading on Blackboard**. This grading is mandatory. To request a grading, you must acknowledge this first step of the experiment in [Blackboard](#) via an assignment using the tab "Advanced Lab Course Experiments".

AFTER THE EXPERIMENT

Each group should prepare an experimental report (final report) describing the scientific basics, methods, the results and conclusions of each experiment (Think of the report as a mini-scientific paper on the topic of your experiment). The final report (**<15 pages in length**) should contain:

- the name of the experiment, dates, and the names of the participants.
- a short description of the relevant questions and an explanation of the subjects of the experiment as well as the physical quantities to be measured. It should be originally drafted by the students. It should include answers to open questions from the script.
- the experimental data (mind the units!) as well as the description of the evaluation procedure and used formulas. It should be possible to follow the procedure that leads to the final results. Original graphics and diagrams have to be included.
- a discussion of the error sources (systematic, random) affecting the results of the measurements.
- a summary of the results as a separate section. Here a discussion of the measurements and of the involved physical quantities can be included along with possible critiques concerning the experiment.
- **One sentence contribution statement** stating which participant did what part of the work (e.g. wrote parts of the experiment, analysed the data, plotted some figures, etc)

The final reports have to be handed in to the tutor within two weeks after the end of the experiment.

Reports handed in later than two weeks after the experiment without proper justification will be considered insufficient. See the **To-Do-List** for more information! Even in that case they have to be submitted to the tutors. Each group can prepare one common protocol, provided that each of the students contributes to and fully understands it. Separate reports are also welcome. Note: In case one of the students in a group is not able to work on the protocol, the partner has to finish it alone. You must submit the report in [Blackboard](#) via an assignment using the tab "Advanced Lab Course Experiments".

The tutor is expected to correct the reports within seven days. In case of any deficiencies, the report will be returned **once** for corrections and amendments. No more than seven days can be allowed for that. Thereafter, the tutor will make a final discussion with the group and the report is certified as finished by the tutor if all the corrections are adequately made. The certification will only be given if the experiment has been well executed and the report is of quality and fully understandable (our criterion: the final report should read at least as a reasonable-quality scientific publication in specialized journal). You must acknowledge the final discussion in [Blackboard](#) using the tab "Advanced Lab Course Experiments".

Note: If **four weeks** after the experiment the report has not been finished and approved without proper justification, the experiment will be considered unsuccessful. In this case the students will have to carry out a different experiment, upon agreement with course organizers. See the **To-Do-List** for more information!

SEMINAR PRESENTATION

Each group will prepare a presentation about one of the experiments that they carried out. For this experiment there will be a second appointment, so that you have plenty of time to reinsure what you have learned. You must acknowledge giving the presentation in [Blackboard](#) using the tab "Advanced Lab Course Seminars".

During the presentation, all students should contribute equally. The presentation time is 30 min for 2-student groups or < 45 min for 3-student groups. The presentation should be rehearsed **TWICE** – once with the tutor of the experiment, at the day of the 2nd appointment, and once – with course instructors (Fumagalli or Püttner) **one week before the presentation**. These rehearsals will give the group a chance to improve their presentation; they will not be graded. **Students are responsible for setting up the rehearsal**. An adequate seminar presentation is necessary to pass the course. Some advice regarding presentations:

- Arrive > 5 min before the class starts, test your laptop connection!
- Target an audience of your peers, Master students, who are not experts in your topic
- Start with a clear and easy-to follow “*Introduction*” section. The question you should answer there: what will you tell the audience and why should the audience care?
- During the introduction, you do not need to show many long formulas and especially include formula derivations. One-two key formulas should be enough!
- In the second part of the talk, “*Experiment*”, you should clearly explain the experimental setup, methodologies
- At the end of the talk, in “*Conclusion*” section, discuss problems of the experiments, main conclusions, and possible applications.
- Always label each axis of each graph!
- Use simple fonts (Arial) and font big enough (>20pt) to be seen from the back row. Do not read from the slides. Do not use excessive colors/italics/bold/fonts. Do not have more than two graphs per slide.
- If you use any graph/illustration/reference that is not made by you, reference them -- otherwise, it is plagiarism!

PASSING THE COURSE

To pass the course, you need to do ALL of the following:

- complete 7 experiments
- Submit an experimental report for each experiment, go through tutors’ corrections, and obtain tutor’s grading of the assignments in Blackboard certifying report acceptance
- Present one talk at the seminar about one of the experiments at a satisfactory level
- Be present at most of the other seminars (75 %).

The final certificate of the advanced lab course as a whole will be provided by the course organizer, typically at the end of the semester. Alternative experiments for not approved ones have to be carried out within the same semester. If the advanced lab course is not successfully completed, please contact the organizer for a possible partial approval.

SUGGESTIONS...

...are welcome!

Last updated: Paul Fumagalli, October 2023