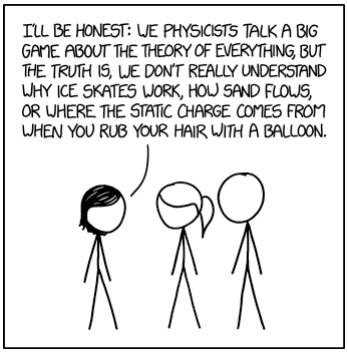
Advanced Master Lab Course

rules, regulations, and life advice



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GOOD SCIENTIFIC PRACTICE/PLAGIARISM

Science has to be done right: records must be kept, data have to be analyzed properly, and every source must be cited! There will be a mandatory lecture on the rules of **good scientific practice**. There is a translation of the rules rules of the Freie Universität posted on *Blackboard*.

One big violation of the rules of good scientific practice is plagiarism. Plagiarism is defined as **any copying without attribution**. For example: using paragraphs of a text found online, copying three sentences from a previous report, reproducing from a textbook, or getting a figure from a colleague without giving them credit, copying a few sentences from Wikipedia for a pre-experiment report. Any kind of plagiarism, either in pre-experiment or final reports may result in failing the course. Or worse! Even if that happens only once! Even if you did not know what plagiarism is! All cases of plagiarism will be referred to course administrators and taken extremely seriously. **This course – just like the scientific community in general -- has a zero-tolerance policy towards plagiarism.**

More examples of plagiarism or scientific misconduct:

- Invented data or results
- Concealment of data or results
- Purposely modified data or results
- Deliberate false statements
- Adopting the ideas or results of other people without properly citing the sources
- Concealment of problems and error sources
- Faking one's own work (e.g. adoption of someone else's data)
- Not or not correctly citing sources

GENERAL INFORMATION

During the course, each group of two or three students will carry out 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. The course is designed to give a glimpse into the life of an experimentalist: you will carry out the measurements, analyze data and sources of errors, collaborate, prepare reports, and give presentations.

The experiments take place on Wednesdays during the semester and, for particular experiments, in the first two weeks of the semester break. The seminar is on Tuesdays; participation is mandatory.

The course website is here. There, you find the list of the experiments, contact information for the tutor of each experiment, and the schedule of the experiments that you are assigned to.

AT THE BEGINNING OF THE CLASS

You must register in *Blackboard* using the tab "Registration", where you can make suggestions for group mates, preferred experiments, and your boundary conditions. To take part in the class, you must attend the general meeting/safety lecture, which will be offered only once, typically during the second week of the semester. If you did not attend that meeting for any reason, you will not be able to take part in the course for legal reasons. There will also be a lecture on scientific integrity and how to avoid being accused of plagiarism and a lecture on error analysis.

The experiments will start on the week after the safety lecture. Before the start of the experiments, groups of two or three students will be formed and assigned to various experiments. We will try to satisfy your suggestions in forming the groups, choosing partners, and assigning the experiments. However, beware that we will not be able to satisfy all of the requests. The schedule for all of the experiments will be posted online after the first safety meeting.

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 a **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. It should contain a schematic draft of the experimental setup and the guidelines for the execution of the experiment. It should 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 an active 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 a sufficient written introduction to the experiment 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 a discussion with the organizer responsible for the course.

DURING THE EXPERIMENT

The experiment usually begins at 9:00 - 10:00 by scheduling with a tutor. The tutor instructs the students in operating the experimental equipment. The students are allowed to use it only after the approval of the tutor. 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 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 supervisor attests to the proper execution of the experiment by **signing the participation paper** (mandatory!).

AFTER THE EXPERIMENT

Each group should prepare an experimental report (final report) describing the scientific basics, methods, 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 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). Tutors will not accept reports without such a statement.

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 not be accepted. 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: each group member should contribute a significant fraction (>25%) to each report (see "contribution statement").

The supervisor 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. Finally, 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)

Note: If **four weeks** after the experiment the report has not been finished and approved, the experiment will be considered unsuccessful. In this case, the students will have to carry out a different experiment, upon agreement with course organizers.

SEMINAR PRESENTATION

Each group will prepare a presentation about one of the experiments that they carried out. 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 least two weeks before the presentation**, and once – with course instructors (Bolotin or Püttner) **at least one week before the presentation**. These rehearsals will give group a chance to improve their presentation; they will not be graded. Students are responsible for setting up the rehearsal; no presentation without a rehearsal will be allowed :(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: 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 "*Conclusions*" section, discuss problems of the experiments, main conclusions, and possible applications.
- Always labels each axis of each graph!
- Use simple fonts (Arial) with big enough size (>20 pt) 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 signature certifying report acceptance
- Present one talk at the seminar about one of the experiments at a satisfactory level
- Be present at most (75%) of the other seminars

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 possible partial approval.

SUGGESTIONS…

…are welcome!

PRESENTATION BINGO

To keep you entertained during the presentations….

Last updated: Kirill Bolotin, April 2024