



Universität Göttingen • Fakultät für Physik  
Advanced Lab Course



## Advanced Lab Course (Master-Fortgeschrittenenpraktikum I/II)

# Introductory Meeting & Safety Briefing

Winter Term 2023/24

Tim-Oliver Husser

Institute for Astrophysics and Geophysics

(Slides mostly by Thomas Kurz)

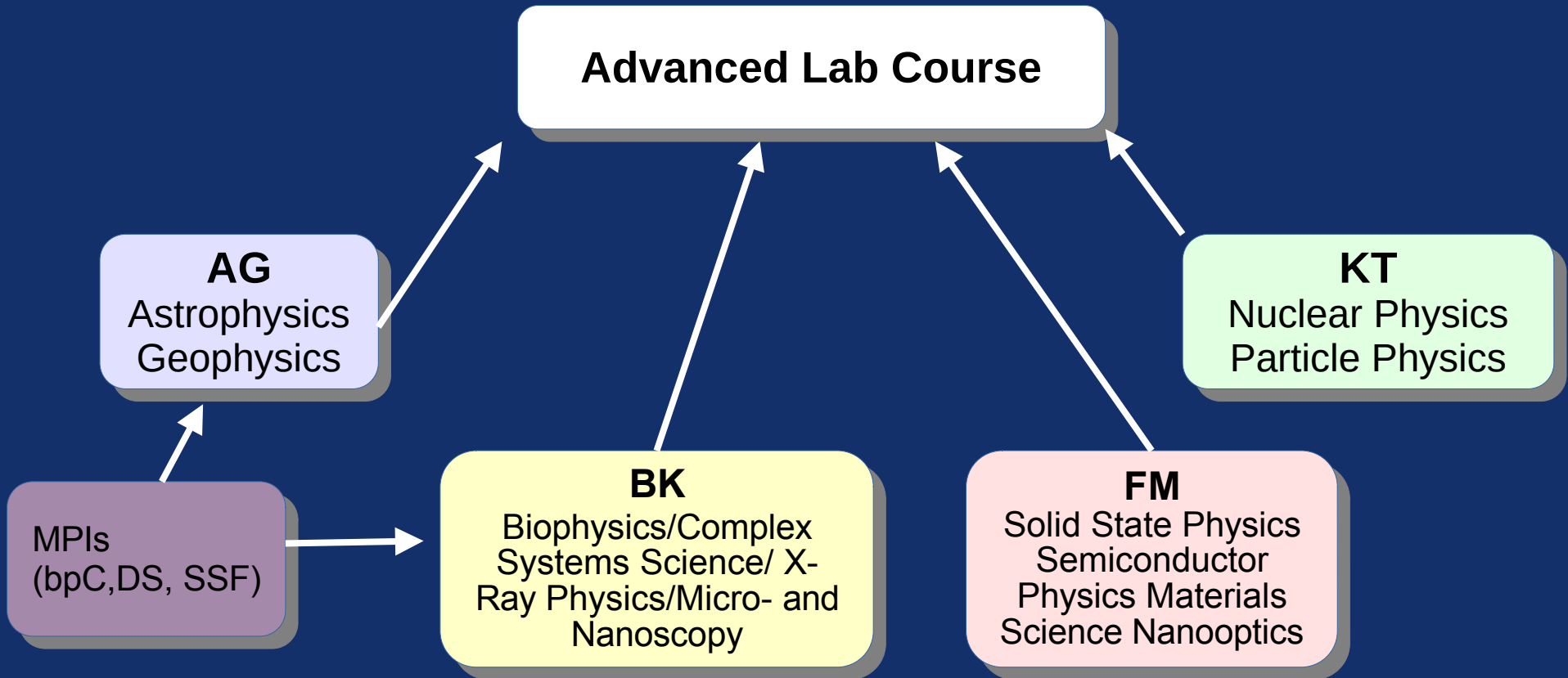
[thusser@uni-goettingen.de](mailto:thusser@uni-goettingen.de)  
[@thusser](https://www.instagram.com/thusser)



# General Information

- ALC has two parts (1 and 2) either part can be conducted in summer or winter term
- Part 1: module M.Phy.1401 is a required course, usually completed in the first semester of the Master program
- Part 2: module M.Phy.1402 is an elective course, usually completed in the second semester of the Master program

Part 2 can be substituted by certain other courses (Internship, Electronics Lab)





# General Information

- per Part/Module: 4 Labs – 6 hours/week (SWS) – 6 CP
- Experiments usually done by teams of two
- Web page:

<https://advanced-lab-course.physik.uni-goettingen.de>

provides ...

- all information on organization of the ALC
- online schedule and assignment of Labs
- abstracts/descriptions of the experiments offered
- instructions



# General Information

- contact persons/persons in charge
  - questions on experiments, appointments
    - **Tutors**
  - Questions on the oral exam
    - **Examiners**
  - questions and constructive critics concerning the organization of the ALC
    - **Organizer**



# Registration

- Registration for exam via FlexNow:
  - M.Phy.1401.Ex: Advanced Lab Course I - Experiments
  - M.Phy.1402.Ex: Advanced Lab Course II - Experiments
- Examination date\*:  
March 31, 2024

**Please register (or cancel) in time.**

**Registration after the deadline is not possible!**

\* This is a formal date. You should have conducted your Labs by then but it is **not required** that oral examination is already taken



# Registration

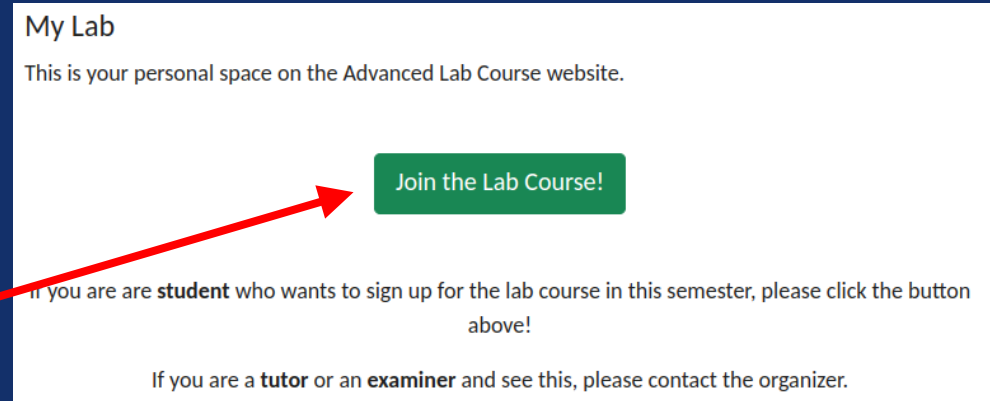
- Register on ALC website  
<https://advanced-lab-course.physik.uni-goettingen.de>



Physik  
um



NEWS DOWNLOADS CONTACT MY LAB



**Account will only be activated AFTER safety briefing (see later)!**



# Remember

StudIP  $\neq$  FlexNow  $\neq$  ALC website

**Register on ALL THREE!**





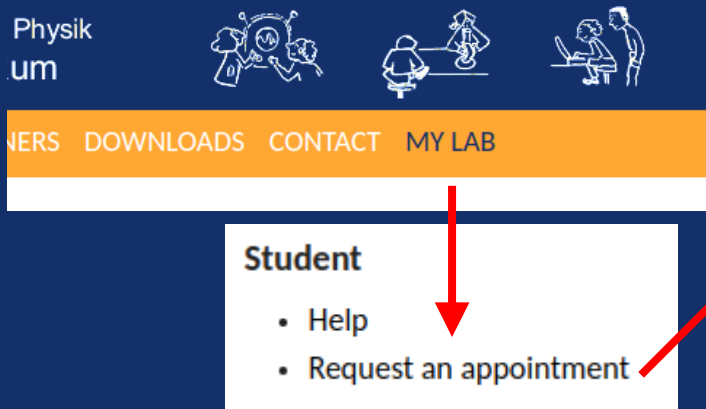
# Course of actions

- sign in for Labs online or make appointments directly with the tutor. This is possible during the whole semester.
- download the **instructions** (login required)
- **contact the tutor** at least one week in advance (mandatory). The tutor will give hints for preparation and additional literature, if available
- **prepare** yourself thoroughly (theory)
- conduct the experiment. In general, Labs take place on **Wednesdays, 09:00-17:00**
- write the report (submission **deadline: 2 weeks** after the Lab)



# Lab assignments

- are self-organized, usually 'first come, first served'
- Login required, need to have joined for current semester
- use request form to sign in for a lab



Experiment: AG.CCD - Astronomical CCD Calibrations and Observations

Date:

Lab partner:

(Lab partner 2):

Comment:

You will be contacted when the appointment is created (or denied).



# Lab assignments

- Alternatively you can send an **email to the tutor**. Has to be done for appointments outside of lecture period.
- When the appointment is created, you can see it on your **MyLab** page:

| Upcoming labs  |                        |                         |
|----------------|------------------------|-------------------------|
| Date           | Experiment             | Students                |
| Sept. 30, 2022 | <a href="#">AG.CCD</a> | A. Student , B. Student |

- Now you should contact the tutor for information about the lab and start preparing for it.



# Lab assignments

- **Teams of three** are possible, but should remain an exception please ask the tutor or the organizer
- you can **fail** a lab
  - in case of absence without reason
  - if you are ill-prepared
  - If your report is not accepted
- in case of **failure**:
  - make a new appointment with the tutor (same experiment) or take another lab



# Instructions, Preparations and experimental work

- download the **instructions** (login required)
- in case that the online instructions are (still) missing or an English version is not yet available but needed:
  - ask the tutor for assistance
- **Preparation:**
  - work out the required theory
  - read recommended references
  - answer questions that are posed in the instructions
  - the description of the relevant theory is (the first) part of your Lab report



# Experimental work

- location of the Lab: see ALC web site or ask the tutor
- please show up on time
- starts with a discussion of the experiment and explanations by the tutor, possibly including special safety instructions, **this is the opportunity to ask questions and clarify things!**
- Presence of the tutor required in case of possibility of personal safety hazard operation of expensive equipment
- in case of uncertainty or doubt:
  - Do not hesitate to ask
  - try common sense



# Lab protocol / notes

- **document** the course of your experimental work.  
Note down
  - all relevant data
  - instrument settings
  - experimental steps and procedures
- tables of measured values:  
hand-written record, or electronic spreadsheet, attach a printout to your report
- the Lab protocol is an **important part** of your report



# Lab report

- For each Lab a **written report** has to be submitted (= practice of scientific writing)
- reports are returned to you after being accepted
- every student has to **submit their own report**, prepared independently and formulated with their own words, except for
  - the Lab protocol
  - figures and calculations used in the analysis of the results (team work)





# Lab report

- Length: **≈10 pages of text** (without figures and the protocol)
- structure:
  - 1) cover sheet and a Lab record sheet
  - 2) abstract, summarizing the goal of the experiment (~ 0.5-1 page)
  - 3) theory part (concise, ~ 3-4 pages) answers to questions, if required
  - 4) description of experimental procedure (related to protocol)
  - 5) Analysis and interpretation of results, including error analysis and discussion (~5-6 pages)
  - 6) Lab protocol (original or scan)



# Lab report

- Formal requirements:
  - created with word-processing software LaTeX, Libreoffice, Word ... (templates available for download), Font size  $\geq 10$  pt
  - no handwritten report will be accepted
  - please use the standard cover sheet, attach Lab record paper sheets should be firmly stapled together
  - **submission via ALC website as PDF**



# Lab report

- requirements with regard to form and content:
  - text clearly structured and logically presented (with sections, subtitles)
  - concise and focused presentation
  - please observe orthography and punctuation
  - figures and diagrams of appropriate size and scaling, well-readable axis labels and legends
  - numbered equations
  - numerical values rounded according to precision of measurement
  - use of SI units, unless otherwise stated




# Lab report

- Language of the report: English or German (upon tutor's consent)
- Submission deadline: 2 weeks after the Lab (extension is possible if approved by the tutor)



# Lab record

- Can be used for tracking your labs.
- But **not required** anymore!
- Done via ALC website now.



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Faculty of Physics  
University of Göttingen

### Lab record

Please attach a copy of this form to each submitted report.  
Keep the documents safe. They are needed for admission to the oral examination.  
Please fill in required information with print letters. Shaded areas are reserved for tutors/examiners

**A. Personal Information**

|                      |
|----------------------|
| family name          |
| first name           |
| matriculation number |
| email                |

**B. Lab**

|                            |                     |
|----------------------------|---------------------|
| acronym-name of Lab        | conducted on (date) |
| name(s) of team partner(s) |                     |
| name of tutor              | name of examiner    |

**C. Report**

|           |                                        |                                                                                  |                    |
|-----------|----------------------------------------|----------------------------------------------------------------------------------|--------------------|
| version 1 | date of submission of original version | <input type="checkbox"/> accepted on <input type="checkbox"/> returned on (date) | signature of tutor |
| version 2 | date of submission of first revision   | <input type="checkbox"/> accepted on <input type="checkbox"/> returned on (date) | signature of tutor |
| version 3 | date of submission of second revision  | <input type="checkbox"/> accepted on <input type="checkbox"/> returned on (date) | signature of tutor |

**D. Statement of acceptance**

|                 |                   |                       |
|-----------------|-------------------|-----------------------|
| Report accepted | date of signature | signature of examiner |
|-----------------|-------------------|-----------------------|

Version 10/15



# Life of a report

| Pending reports |            |            |          |
|-----------------|------------|------------|----------|
| Lab date        | Experiment | Student    | Tutor(s) |
| April 10, 2023  | AG.CCD     | A. Student | A. Tutor |

| Finished reports |        |            |         |
|------------------|--------|------------|---------|
| Date             | Lab    | Accepted   | Exam    |
| June 22, 2022    | AG.DEN | 31/07/2022 | Pending |
| May 11, 2022     | AG.CCD | 31/07/2022 | Pending |
| May 25, 2022     | AG.DMH | 31/07/2022 | Pending |
| May 27, 2022     | AG.MWH | 31/07/2022 | Pending |

[Add exam](#)

Experiment: AG.CCD - Astronomical CCD Calibrations and Observations

Date: June 1, 2022

Report:

[Upload report](#)

Report goes through the stages:

- Pending
- Finished



# Crediting of external courses

- only possible for elective module M.Phys.1402
- **Substitution by another module:**  
Internship, Electronics Lab
- **crediting of other accomplishments**  
Lab courses abroad, Summer schools (CERN, DESY,...) other experimental courses or practicals



# Crediting of external courses

- requirements:
  - the external course is not credited against other modules or substituted for other courses
  - informal certification of a habilitated member of the faculty is needed with assessments (grade) of the achievement (should be submitted before the examination date)
  - written document (e.g., a report) on the course work





# Oral examination

- requirement for admission to the examination (“**Prüfungsvorleistung**”):
  - Successful completion of **four labs per module**, which can be checked on the ALC website at any time
- For part 2 the number of Labs can be smaller when external courses are taken into account
- after having fulfilled the requirements, print out and fill in an **Examination Form**




# Examination form

fill in

personal  
information

Labs conducted

external  
courses, if  
applicable

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Göttingen

Advanced Lab Course  
Faculty of Physics  
University of Göttingen

### Examination Form

Please check boxes that apply and fill in required information with print letters! Please print out double-sided

**A. Semester**  
 Summer semester 20\_\_  Winter semester 20\_\_/\_/\_\_\_

**B. Module**  
 Part I (required course), Module M.Phys.1401  Part II (elective course) Module M.Phys.1402

**C. Personal Information**

|                      |
|----------------------|
| family name          |
| first name           |
| matriculation number |
| email                |

**D. Labs conducted**  
Please attach a Lab record with signed statement of acceptance for each entry

|   | Acronym-name of lab | Date conducted | name of tutor |
|---|---------------------|----------------|---------------|
| 1 |                     |                |               |
| 2 |                     |                |               |
| 3 |                     |                |               |
| 4 |                     |                |               |

**E. External credits** (module M.Phys.1402 only, attach certificate)

|                       |                           |
|-----------------------|---------------------------|
| description of course | equivalent number of Labs |
|-----------------------|---------------------------|

**F. Statement of admission** (to be filled in by the Lab organizer)  
It is confirmed that all requirements for admission to the examination are fulfilled.

|                                      |                                                                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| signature of the organizer (T. Kurz) | <input type="checkbox"/> first<br><input type="checkbox"/> second (repeat)<br><input type="checkbox"/> third (repeat)<br>examination |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|

**G. Oral examination** (to be filled in by the examiner/observer)  
Please observe the statement above before entering the examination.

|           |                  |       |  |                       |  |  |
|-----------|------------------|-------|--|-----------------------|--|--|
| Examiner: | name of examiner |       |  | signature of examiner |  |  |
| Observer: | name of observer |       |  | signature of observer |  |  |
| Date:     |                  | Time: |  | Grade:                |  |  |

record of examination:

Version 10/18

not required  
anymore!

examination  
protocol, to  
be filled by  
the examiner



# Organizing the oral exam

- choose a person from the list of examiners (on the website) who is entitled to carry out the final exam
- **get in touch** with this person early to get her/his approval
- after having obtained admission, find a suitable examination date with the examiner and define with her/him the possible subjects of the exam
- typically, these will center around the Labs you have conducted, and contents of external courses if applicable



# Organizing the oral exam

- Please register exam on ALC website!

| Finished reports |        |            |         |
|------------------|--------|------------|---------|
| Date             | Lab    | Accepted   | Exam    |
| June 22, 2022    | AG.DEN | 31/07/2022 | Pending |
| May 11, 2022     | AG.CCD | 31/07/2022 | Pending |
| May 25, 2022     | AG.DMH | 31/07/2022 | Pending |
| May 27, 2022     | AG.MWH | 31/07/2022 | Pending |

[Add exam](#)

Date:

Examiner:

Labs:

- AG.DEN - The Curious Case of Dark Energy**  
Lab date: 22/06/2022  
Student(s): A. Student  
Tutor: Advanced Tutor  
Accepted: 31/07/2022  
Report: 2022/19-AG.DEN-Student.pdf
- AG.CCD - Astronomical CCD Calibrations and Observations**  
Lab date: 11/05/2022  
Student(s): A. Student  
Tutor: Advanced Tutor  
Accepted: 31/07/2022  
Report: 2022/20-AG.CCD-Student.pdf
- AG.DMH - Numerical Analysis and Data Visualisation for Dark Matter Halos**  
Lab date: 25/05/2022  
Student(s): A. Student  
Tutor: Advanced Tutor  
Accepted: 31/07/2022  
Report: 2022/21-AG.DMH-Student.pdf
- AG.MWH - The Microwave Sky**  
Lab date: 27/05/2022  
Student(s): A. Student  
Tutor: Advanced Tutor  
Accepted: 31/07/2022  
Report: 2022/22-AG.MWH-Student.pdf

[Add exam](#)



# Organizing the oral exam

Register the exam on FlexNow!

- M.Phy.1401.Mp: Fortgeschrittenenpraktikum I
- M.Phy.1402.Mp: Fortgeschrittenenpraktikum II



# Taking the oral exam

- date, time and location as appointed with the examiner
- duration: **30 minutes**
- language: German or English
- examiner has access to your reports on the ALC website, so please make sure that you uploaded them and created an exam!
- bring with you the **examination form**
- the signed examination form should be sent to the organizer immediately (usually done by examiner)



# Evaluation and Feedback

- Evaluation requests will be sent out after every finished lab.
- Constructive critics and ideas for improvement are welcome any time!
- Please report any possible errors, misprints etc in instructions or on the web site to the person in charge



# Safety briefing follows...

- Safety guidelines can also be downloaded from the ALC web site
- Please acknowledge that you have taken part in the safety briefing and and that you have taken notice of the safety advices by signing and returning the confirmation form
- **Without this signature you may not take part in the Advanced Lab Course!**
- For some Labs you may obtain additional specific safety instructions related to the specific hazards.





# General precautions

- **do not work alone** in a possibly hazardous environment
- when personal hazards exist during parts of the experimentation, **the presence of the tutor is required**
- the use of **protective measures or equipment** is mandatory (e.g. protective wear, shields or safety goggles)
- inform yourself on **first-aid measures**: first-aid box, first-aid post, next doctor



# Fire protection

- fire alarm system: in case of alarm
  - **leave the building immediately** (next escape way)
  - go to the meeting point outside the building
- if you discover a fire:
  - activate fire alarm box, push emergency stop
  - call 112, leave building
- small fires: use fire extinguisher
- **self protection has absolute priority**
- do **not** use elevators in case of fire



# Radiation protection

- radiation control areas and restricted areas may only be entered by persons whose **exposition to radiation is monitored** (by dosimeter)
- For work with radioactive substances, the students will be **instructed by the tutor**, who is responsible for proper handling and shielding
- **Pregnant women** are not allowed to conduct an experiment involving radioactive samples



# Electrical equipment

- In case of an accident with electricity:
  - push emergency stop immediately
  - do not touch anything or anybody beforehand!
- Persons affected have to be brought to the **emergency room** of the University clinic (UMG)
- prevention: do not use extension leads on the floor
- if you are uncertain or doubtful about the electrical wiring of an experiment: **please ask the tutor before switching it on!**
- This pertains in particular to experiments involving high voltages



# Working with gases/liquid nitrogen

- Liquid nitrogen may only be transported or refilled under **supervision of the tutor**
- Never handle liquid nitrogen without **protective eye shield and gloves**
- Never handle liquid nitrogen in a closed room without **sufficient air circulation**
- In particular: **liquid nitrogen vessels must not be accompanied when transported in an elevator**



# Working with chemicals

- ... is restricted to dedicated **chemical labs**
- work under the laboratory hood, if possible
- **be informed** about the potential hazards and health risks of the substances you are using
- wear **protective equipment** (gloves, glasses)
- take care of **proper disposal**
- label all vessels/flasks according to their contents
- clean and return the hardware you have used
- analogous procedures apply for biological material



Next...

# Laser Safety Briefing