# Ando Lab (a.k.a. Topological Matter Laboratory Cologne)

## Physics Institute II, University of Cologne

# Lab Manual (public version)

## Contents




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# Introduction

In my lab, I hope to foster an environment of scientific excellence and personal development, where we have fun doing curiosity-driven science. I would like all the lab members to be happy and productive in their lab life. This manual was written to help achieve these goals by providing guidance to the current lab members, as well as to give general introduction to prospective members.
- Yoichi Ando

This manual is inspired by similar ones that are publicly available, such as:
https://github.com/alylab/labmanual
http://jpeelle.net/peellelab_manual.pdf
https://github.com/memobc/memolab-manual?tab=readme-ov-file

Some of the contents which resonate in my lab are reproduced from them.

# Lab Ethics and Philosophy

- Be proactive to push the envelope of scientific knowledge and personal excellence.
- Work independently when you can, ask for help when you need it.
- Be willing to share your knowledge.
- Communicate openly and respectfully with other members of the lab.
- Always mindful about your self-dignity. That means, don't go dirty when you are not watched.
- Academia may feel different from other types of jobs, but it is still a job. You should treat your job with the same respect that you would treat a job at any other place.
- If you have an issue with another lab member that cannot be solved by talking with them about it, please talk with me.
- Communicate honestly, even when it's difficult.

# Role of the PI

- Have a vision of where the lab is going.
- Raise the budget, make sure the positions of the lab members are secure.
- Support the lab members in their career development, including writing letters of recommendation, introductions to other scientists, conference travel, and promoting their works.
- Support the lab members in their personal growth by giving flexibility in experiments, working hours, and environment.
- Make the time to meet with the lab members regularly and talk about science.

- Make sure to publish good papers as the results of the hard work of the lab members.
- Make sure that the lab as a whole is making progress towards the scientific goals.
- Make corrections in the scientific directions, if necessary.

## Basic Rules

- Security in the lab is of utmost priority. Strictly follow the security rules.
- Notify me if you will be taking the day off from work, either due to illness or vacation.
- Keep in mind that master students, PhD students, and postdocs are paid partly to perform teaching duties, irrespective of their funding sources.
- After using a work bench, be sure to clean it and make it even cleaner than it was before your use.
- Scientific members (master students, PhD students, postdocs, and permanent scientists) must attend the scientific group meeting on Monday morning.
- Administrative and technical members, postdocs, and PhD students should attend the information meeting on Monday afternoon.
- Scientific members are strongly suggested to join the bi-weekly journal club.
- All the lab members are expected to attend the Institute Seminar on Wednesday.
- A PhD student will be assigned a postdoc who will supervise the experiments. A student/postdoc pair will regularly have PhD project meetings with me (typically 90 minutes).
- A master or bachelor student will have a PhD student or a postdoc to supervise them.
- Before a master student joins our lab, they must have a mandatory meeting with me to check if the necessary conditions are met and to fill in this form: https://physik.uni-koeln.de/fileadmin/Downloads/modulhandbuch/master/Compulsory_Meeting.pdf

## General Points to Keep in Mind

- Scientific members are encouraged to attend the annual DPG meeting to present a poster or to give a talk. For students, their travel costs will be supported by the Heraeus Foundation.
- PhD students may attend one conference/workshop per year held outside of Germany, if they have results to present.
- Being able to give good talks is an important skill not only in the field of science but also in the industry, and I want you to obtain this skill in my lab. Use your journal club talk, institute seminar, oral presentation at a meeting/conference, and colloquium as the opportunities to obtain this skill and ask others for advice in the preparation stage.

# Expectations for Postdocs

I expect postdocs to move towards being more PI-like, including conceiving experiments, writing papers, giving talks, and cultivating an independent research program (while still supporting the lab's research), in addition to the skills expected for PhD students written below.

# Expectations for students

## Generally-expected competence and attitude

1. A good team player
2. Logical thinking
3. Open-minded
4. Can handle criticism in a positive way and use criticism to improve oneself
5. Possess good English writing/speaking skills

## Bachelor students

**Research Work**

- Take responsibility for the proper progress and completion of the project
- Execute a prescribed research program by following the instruction
- Work safely, carefully, cleanly, and precisely
- Keep notes on their experiments and recipes
- Consult the supervisor on a regular basis
- Study literature as suggested by the supervisor
- The thesis work including writing should be done in 12 weeks. (This means the student should register their thesis on the first day of the work. If the student strongly wishes, it can be extended by a few months as an exception, under the agreement with the supervisor.)

**Desirable Level of Performance**

- Extend the existing knowledge, data, or methods available in the group
- Propose ways to improve the project
- Can understand and apply relevant theory to the data at the level of textbooks

## Master students

**Research Work**

- Manage the project semi-independently and try to be involved in related projects
- Take initiative to modify the research plan or suggest an alternative approach, if necessary

- Work safely, carefully, cleanly, and precisely
- Keep notes on their experiments and recipes
- Study literature as suggested by the supervisor, but also explore literature on their own initiative
- Have well-balanced critical attitude towards own results, literature, and specialists
- The master research including thesis writing, which as a whole consists of three modules (Introductory Projects I and II + Master Thesis), should be done in 12 months.

**Desirable Level of Performance**

- Produce new methods, data, or understanding not previously available in the group
- Demonstrate original ideas
- Can understand and apply relevant theory to the data at the level of review articles

## PhD students

**Research Work**

- Manage the project independently and be involved in related projects
- Actively modify the research plan or suggest an alternative approach to achieve the goal
- Work safely, carefully, cleanly, and precisely
- Keep notes on their experiments and recipes
- Independently find and study relevant literature
- Have well-balanced critical attitude towards own results, literature, and specialists
- Students should aim at finishing their thesis work including writing in 3 - 4 years.

**Desirable Level of Performance**

- Produce new methods, data, or understanding that are publishable in high-impact journals
- Demonstrate original ideas and prove their validity/usefulness
- Can understand and apply relevant theory to the data at the forefront of developments

## Bachelor/Master Thesis

Thesis should be free of scientific errors and fulfills the general requirements for scientific literature. It should be written in good English without grammatical errors.

Before writing the thesis, the table of contents (TOC) should be shown to me for approval. The thesis should be written by the student with limited corrections by supervisor. Insightful discussions and interpretations of the data or methods, as well as suggestions for future experiments, should be the heart of the thesis. There is no minimum length. As long as the thesis describes and discusses the experiment in a comprehensive and well-understandable manner, shorter the better.

## PhD Thesis

A PhD student should publish/submit three papers before writing the PhD thesis, unless there are special circumstances to grant an exception.

A standard PhD thesis from our lab consists of an abstract, an overarching introduction, presentation of published/submitted papers (each paper is preceded by a comprehensive explanation of its significance in the context of the dissertation and the specific contributions made by the student), a concluding overarching discussion, and references. The thesis must demonstrate the ability of the author to argue scientifically. For more formal details, see § 7 of https://mathnat.uni-koeln.de/sites/dekanat/official/Formulare/Promotionen/2020_PO_MNF-UzK_engl.pdf

## Colloquium

The following should be given in a good balance: Background, objective, experimental procedure, obtained data, analysis and critical discussion of the data, conclusion. The length of the presentation should be 20 minutes for PhD and master thesis, and 15 minutes for bachelor thesis. Consult your supervisor well in advance to discuss the contents and to give a trial talk, if necessary.

In the Q&A, deal with questions efficiently and comfortably; interact well with questioners; try to offer new insights during discussions. It is important to directly answer the question; don't try to deflect the question.