Research Rotations & the First Summer of Research

Research Rotations – Identifying a PhD Advisor

Timeline

September  
Meet with faculty and select two potential PhD Advisors

October 1st – April 30th  
Complete two mini-rotations with prospective PhD Advisors

Rationale

The goal of the research rotations is to expose students to different areas of research and potential advisors, prior to settling down into one particular area for their PhD research. The timeline was designed to give both the student and advisor sufficient time and interaction to determine if they would be a good match together, and to allow the student to gauge their interest in the subject area of research and determine if it is sufficient to sustain them for the duration of the dissertation.

From the student’s perspective, the rotation is an opportunity to learn about different research projects and approaches currently being pursued in the group, while interacting closely with the potential PhD advisor and their group members. They should use this time to determine the desirability of the prospective advisor as a dissertation mentor, as well as their aptitude and interest in the research methods used by the group.

From the faculty’s perspective, the rotation is an opportunity to interact closely with a student and thus, to gain an idea of the student’s abilities as a potential dissertation student researcher. The student’s performance (including aptitude, level of intellectual engagement and work ethic) in the rotation will be regarded as an indication of suitability for continued work in the faculty member’s group. The rotations also allow faculty an opportunity, outside of classes, to become familiar with students in the program.

During the rotation period it is expected that the student will learn in detail about at least one project in the group and read relevant research articles to see how the project fits into the literature. The student is also expected to get “hands on” experience in the research project. For example, in the laboratory of an experimental faculty member, the rotation is expected to involve the acquisition, analysis and interpretation of data, usually obtained with instrumentation that is the laboratory’s specialty. In the group of a theory faculty member, the rotation would likely involve work on an aspect of theory, or the development and application of a computational or simulation approach. The student is also expected to participate in the other activities associated with the laboratory, such as group meetings. In essence, the student is treated as a member of the group during the rotation period. This will allow the student to get a good feel for the particular research environment, and their potential future colleagues.
Requirements

Choosing potential PhD Advisors – During the month of September, students will meet individually with at least five (5) faculty members to discuss the particular research area. This would likely involve a tour of the lab or other relevant research facilities, as well as a discussion of the current research projects being conducted in the group. The student is encouraged to meet and talk with current group members to get an appreciation for their day-to-day activities as a PhD student.

Two such potential PhD Advisors will then be selected for rotations, in consultation and agreement with them. The proposed timeframe for each rotation will be determined in agreement with the student and both potential PhD Advisors. This timeframe will be communicated to the Director of Graduate Studies in writing, no later than September 30th. A sheet for the collection of signatures and outline of the rotations planned is provided to the student to facilitate this process.

Length of Rotations – Students shall complete two (2) rotations with two different potential PhD Advisors between October 1st and April 30th. Students must start their first rotation by no later than October 1st, but are of course free to start earlier if they have already identified one potential PhD Advisor.

Each rotation will last a minimum of 8 weeks, but will typically be longer as determined between the student and prospective advisor. The goal for the rotation is for both the student and prospective advisor to evaluate the match. Thus, the prospective advisor is free to extend the timeframe until they feel the evaluation process has been met, with the condition that both rotations be completed by April 30th.

For example, between October 1st and April 30th there are roughly 30 weeks (excluding Christmas holidays). Thus, there is plenty of time for students to evaluate two potential advisors and research groups extensively. The split can be anywhere from 15 weeks + 15 weeks or 22 weeks + 8 weeks. Students could even do three rotations if they are particularly undecided, or their interests change once they become exposed to more areas of research. Note that the choice of “minimum of 8 weeks” was designed to leave the maximum amount of flexibility to accommodate students differing interests, while ensuring that each student evaluates more than one prospective advisor. Thus, only two 8 week rotations (16 weeks total) is considered unacceptable performance and will be reflected in the student’s grade.

Rotation Report – At the end of each mini-rotation, students will be required to write a summary report describing what they have learned about some aspect of the research going on in the group. For example, picking one project and describing the basic goal of the project, a bit of the relevant literature, and how the research is carried out. This requirement enables the prospective PhD Advisor to evaluate the student’s ability to read and understand research literature, construct a coherent and logical scientific argument, and describe scientific ideas in their own words. It also allows the potential advisor to assess the student’s attention to detail and their ability to write. All these are elements needed for success in PhD level research.

The student should go through at least one round of feedback and revision on the written document by the advisor before submitting it to the Director of Graduate Studies. The reports will be due at the end of each individual rotation period, not both at the end of April. The overall format of the report should contain:
Additional requirements for the rotations are at the discretion of the rotation advisor. It is expected that the student will participate in the group meetings and journal clubs associated with this advisor (basically “join” the group). As part of their evaluation of the student, advisors are free to require presentations by the student at relevant group meetings, as well as other tasks such as sample preparation, data collection, analysis, calculations, coding, etc. The potential advisor is free to evaluate those skills they consider the most important to judging the student’s ability as a potential researcher in their group.

First Summer of Research – Getting up to Speed on PhD Research Literature

Timeline

May 10th – August 31st  
Begin research project with chosen PhD Advisor, including intense reading of literature in chosen field of research as preparation for Qualifier proposal

Early September  
Submit Research & Literature Report  
Give oral research presentation to entire department

Rationale

Now that the student has identified their PhD Advisor, they can begin their formal training and research in their chosen area of research. During the first summer, students undertake a 12-14 week research project under the direction of their chosen dissertation advisor, which culminates in a formal report, including an in-depth review of the literature, and give a presentation of their research progress to the physics faculty and students.

The principal goals over the summer are for the student to gain experience in how the research process is carried out in their specific area of PhD research in preparation for the Qualifier proposal. This in-depth education and training with guidance from the advisor will emphasize literature assimilation, and quasi-independent acquisition, analysis, and interpretation of methods and data. The student should spend a great deal of time reading and familiarizing themselves with the research literature in their chosen field of research. This is necessary to provide a strong foundation for developing their own independent research ideas in moving forward in the PhD. The written research report and oral presentation are designed to hone organization and communication skills that will benefit the preparation and presentation of the Qualifier proposal.

The oral presentations in early September offer an excellent opportunity for both the graduate faculty and graduate students to become better acquainted and to learn basic features of the research currently being performed in the Department. It also forms a nice introduction to
the department for new graduate students entering the program, and facilitates general
department cohesion.

Requirements

Research & Literature Report – A detailed research and literature report will be written by the
student at the end of the first summer of research. Since this project will form part of the
student’s PhD work, the written report should contain a strong description of the research
literature giving a detailed overview of the state of the field for their chosen PhD, and a progress
report on their research efforts to date. After feedback and revision with the PhD Advisor, a
copy of the report should be submitted to the Director of Graduate Studies no later than the end
of September. The student should not leave writing of the report to the last minute as the level of
detail required and time for revisions typically take approximately three weeks after the student
has completed a first draft. The report shall be a minimum of 10 pages (typed, doubled space;
not including illustrations, figures and tables), and be composed as follows:

- Title, Name, Date, and PhD Advisor
- Abstract (≤ 200 words)
- Introduction (≥ 3 pages)
  - The Introduction includes a clear statement of the goals of the project, the current
    literature context for the particular problem or issue to be addressed, and its
    significance. The relevant background literature for the project is described in
    sufficient detail for the reader to become informed of the main issues.
- Methods (≥ 2 pages)
  - The experimental and/or analysis techniques used should be briefly described and
    their sources cited. (If a new experimental method or technique is being reported,
    however, then this should be described in the Results section.)
- Results (≥ 3 pages)
  - The main results and their meaning should be reported in a logical fashion.
    Similar to research articles, all figures and tables should be described in the body of
    the text.
- Discussion (≥ 2 pages)
  - The interpretation of the data and associated analysis should be described and
    explained, as well as the meaning and significance of the results with respect to
    existing literature. Future experiments or approaches should be suggested. (The
    Results & Discussion sections may be combined if the logical flow of the
    arguments are more clear in this fashion, but it should not be used as a way of
    reducing the amount of discussion and interpretation of results.)
- Conclusions
  - The main conclusion(s) and their significance should be briefly summarized.
- References
  - Sufficient publications should be referenced and cited to demonstrate that the
    student has developed working knowledge of the current state of their chosen PhD
research area. It is assumed that the student has a reasonable understanding of the content of these references.

Oral Presentation – The oral research presentation will be a 25 minute talk followed by a 5 minute question period given to the department faculty and students. The presentation will summarize the student’s research progress over the summer, describing their project, results to date, the relevant literature, and its significance. The date of the presentations will be set by the Director of Graduate Studies, to be held in early September, typically the Wednesday or Thursday after the Labor Day holiday.

Grading

For the rotation sequence, students will register for PHYS 598R Rotation in the Spring semester of their first year. The Director of Graduate Studies will be the instructor of record on OPUS, who will determine a letter grade at the end of the Spring semester representing the two rotations together. The Director of Graduate Studies will consult with both faculty members that were rotation advisors for the student and ask them to assign a grade for the student’s rotation with them that reflects the student’s participation in research and group activities, their performance in the written report, and any other evaluation of skills the rotation advisor considered important to their success in a PhD program. The letter grade for the rotations will be determined as a weighted average of these two grades, weighted by the length of time spent by the student in each rotation.

For the first summer of research, students will register a second time for PHYS 598R Rotation in the Fall semester of their second year. The chosen PhD Advisor will be the instructor of record on OPUS, who will determine a letter grade at the end of the fall semester that reflects the student’s performance in research. This evaluation of the student’s progress on the research project will be based on the following factors: quality of the student’s work, conscientiousness and degree of time and intellectual commitment, trainability, and sophistication in the level of approach to the project. Note that these evaluation factors are distinct from any emphasis on the significance, importance or publishability of the results obtained. The student’s level of understanding of the material will be gauged by their written research and literature report and their oral presentation to the department.