Emory University
Graduate Program in Physics

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 – April	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 pursed 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 13-week rotations with two different potential PhD Advisors between the beginning of October and middle of April. Students are free to start earlier if they have already identified one potential PhD Advisor. The goal for the rotation is for both the student and prospective advisor to evaluate the match.

Rotation Report – At the end of each rotation, students will be required to write a short 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. The overall format of the report should contain:

- Title, Name, Date, and Rotation Advisor
- Abstract ($\leq$ 250 words)
- Body of text (~1500 words, roughly 5 pages double-spaced at 12 point font not including any figures or references as necessary)
- References

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 – August	Begin research project with chosen PhD Advisor, including intense reading of literature in chosen field of research as preparation for Qualifier proposal
Early September	Give oral research presentation to entire department
November 15th	Submit Research & Literature Report

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 begin their PhD research under the direction of their chosen dissertation advisor. As part of the training for doing PhD level research, students will write an in-depth literature and research summary of their chosen PhD area (due by November 15th), and give a presentation of their research progress to the physics faculty and students in a 10-min APS-style talk in early September.

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 by November 15th of the second year. 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 final revised report should be submitted to the Director of Graduate Studies no later than November 15th. 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 (3) 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 10 minute APS-style 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 2 credit hours of PHYS 599R Research both semesters of their first year. The Director of Graduate Studies will be the instructor of record on OPUS, but evaluation will be done by the Rotation Advisors. The Director of Graduate Studies will consult with both faculty members that were rotation advisors for the student and ask them to evaluate 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. PHYS 599R Research is graded Satisfactory (S) / Unsatisfactory (U), where an S indicates that the student is progressing satisfactorily towards the PhD. For the Research Rotations this means identifying an Advisor willing to take the student on for the PhD. A grade of U will be assigned to students who do not adequately complete the Research Rotation or identify an Advisor will to take them on. A grade of Unsatisfactory (U) in PHYS 599R Research will automatically place the student on probation, regardless of the number of credit hours taken. Two consecutive semesters on probation is sufficient to terminate a student from the PhD program. Students who are unable to identify a PhD Advisor from the Rotations may be given the opportunity to try a third rotation with another faculty member during the month of May. If a student does not identify a PhD Advisor during the summer another U will be given in 599R Research terminating them from the program.

During the Fall semester of their second year, students will register for PHYS 598 Research Summary, a graded course. 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.