



RUTGERS

Physics & Astronomy Grad Program Orientation

Based on notes from
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Welcome:	R Bartynski
Delta-P:	-
Placement Exams:	R Gilman
Orientation:	R Gilman



Context

- Rutgers Physics & Astronomy has ≈ 110 graduate student, plus ≈ 10 graduating in October.
- There are 23 entering students, 21 Ph.D. + 2 M.S.
- Ph.D. students are guaranteed support for 5 years, almost all Ph.D. students are supported during their time here by a combination of fellowships and/or grants (GAs) and/or TA positions.
- GA/TA appointments are different from fellowships - fellows are not considered employees but TAs/GAs are. (Different health insurance plans, parking.)

People You Will Work With

- Graduate Program Admin: Shirley Hinds
 - Most of the mechanics of doing things
- Your research mentor / adviser
- Graduate Program Director: Ron Gilman
 - signatures & advice
- TA assignments: Wim Kloet
 - lab assignments: Gabe Alba
- Ph.D. Qualifier Committee Chair: Saurabh Jha



Expectations

- You are now mature responsible adults!
- Learn to learn. Learn to self-direct.
- Be responsible in your TA assignments.
 - Understand what you are expected to do from the course lecturer or administrator.
 - Attend meetings.
 - Prepare for classes / labs.
 - If you have grading to do, get it back to the students in a reasonable time.
 - Attend DELTA-P and learn more - Thursday @ 5 PM - you might have received email from Prof. Chandra about this.

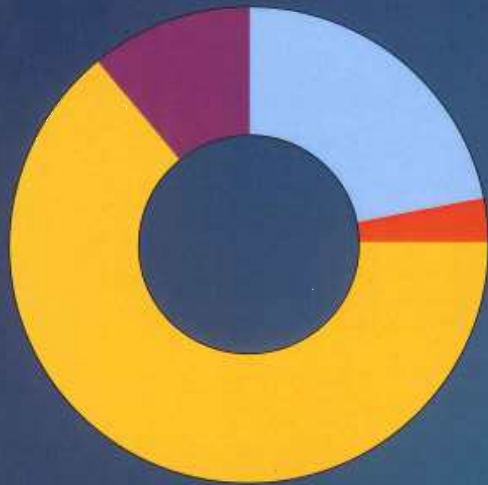


Expectations - Academics

- PhD students: get through required classes and qualifying process within about 2 years
 - Get into research in 2nd year
 - Get a degree in ≈ 6 years, depending...
 - Usually PhD students do not get an MS degree
- MS students: get through the classes and a more limited research project within 1 - 2 years so you get a degree
- And then you continue on to a successful career...

The Physicist's New Definition of Work...

Physics PhDs Who enter the workforce*



64%

GO INTO THE
PRIVATE SECTOR

22%

GO INTO THE
ACADEMIC SECTOR

Average Private Sector
Initial Salary



*Stats only include PhDs in potentially permanent positions (e.g. excluding postdoc positions and temporary academic appointments). Other areas of permanent employment include government and national labs.



Some Resources

- In general the graduate school has some resources to help students conference travel, fellowships for finishing students (Bevier), ...
 - Expect these to be severely limited
 - Gradfund!
- The department has the Van Dyck fund, which helps support graduate recruiting and grad student travel to summer schools and perhaps conferences
- National Science Foundation Fellowships: due Oct 27, 2017: <https://www.nsf.gov/pubs/2016/nsf16588/nsf16588.htm>



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Steps to Ph.D. Candidacy (about the same for MS Degree)

- Placement / Challenge exams
 - The placement / challenge exams are intended to see if you are ready for graduate classes or do not need them. Do not think of them as being like an old Ph.D. exam or class final. They are not on your transcript.
- Take and pass the core courses
 - Additional Challenge exams
- Qualifier: Find a mentor and prepare a topic
 - Prepare the paper
 - Give the oral presentation
 - Pass the oral exam - answer questions well
 - Each part of the qualifier is assessed separately



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MS with Thesis Requirements - Credits

- Credits: 30 (most courses are 3 credits)
 - Minimum 24 course credits (courses with grades).
 - Minimum 6 credits research (701, 702).
 - Up to 12 credits may be transferred from elsewhere, once 12 credits have been passed at Rutgers.
 - No more than 6 credits at advanced undergraduate level.
 - At least 18 credits in P&A and closely related fields.
 - It is not unusual for people to take courses in math, bio, CS...
 - No more than 9 credits with grades below B.
 - Note: “normal” course load is 3 courses = 9 credits/term for a full time student.



MS with Thesis Requirements - Thesis

- Thesis
 - The M.S. thesis and oral exam is roughly the same as that required for Ph.D. students to qualify for advancement to candidacy.
 - One difference is that that M.S. committee has 4 faculty members, while the Ph.D. qualifier committee has 3+1
 - If you are an M.S. student thinking of becoming a Ph.D. students, we should add a 4th member to your committee. Please tell me.



- Physics: theory or experiment in
 - condensed matter, including surface science
 - high energy
 - nuclear physics
 - biophysics
 - "Joint Ph.D. Program" with quantitative biology boot camp
 - <http://proteomics.rutgers.edu/?q=content/joint-phd-program>
 - mathematical physics
 - physics education research
- Astronomy Option



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Physics Ph.D. Requirements - Credits

- Credits: 72 (most courses are 3 credits)
 - No minimum course credits (courses with grades), but
 - Grade of B or better in (or place out of) core courses:
 - QM 501, 502
 - E&M 503, 504
 - CM 507
 - Stat Mech 611
 - + 4 advanced courses,
 - Minimum 24 credits research (701, 702).
 - Up to 24 credits may be transferred from elsewhere, once 12 credits have been passed at Rutgers.



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Physics Ph.D. Requirements - Courses

- 4 advanced courses...
 - Distribution requirement of at least 1 course in each of 2 non-PhD areas
 - A: 601 Solid State / 627 Surface Science
 - B: 605 Nuclear / 613 Particle
 - C: Astro
 - D: 617 General Relativity (out of area for everyone)
 - E: Biophysics
 - + 2 more advanced courses, in area or of interest
- Minimum 24 credits research (701, 702).
- Up to 24 credits may be transferred from elsewhere, once 12 credits have been passed at Rutgers.



Astronomy Ph.D. Requirements - Credits & Courses

- Credits: 72 (most courses are 3 credits)
 - No minimum course credits (courses with grades), but
 - Grade of B or better in (or place out of) core courses:
 - QM 501
 - E&M 503
 - CM 507
 - 514 radiative processes and (607 galaxies or 608 cosmology) to qualify
 - Other of 607 / 608 and 606 stars and 610 interstellar matter and 2 out-of-area courses to graduate
 - Minimum 24 credits research (701, 702).
 - Up to 24 credits may be transferred from elsewhere...



NJ Residency

- We encourage US citizens / residents to become NJ residents
 - Can be done after one year
 - Reduces tuition costs
 - Usually you do not pay tuition, but your adviser does, if you have a GA appointment. Less \$ for tuition → more \$ for other things: conferences, equipment, ...
 - Not necessarily easy



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Ph.D. Requirements - Credits

- With a normal course load of 9 credits per term, you can reach 72 credits after 4 years
 - After you finish courses, we can reduce your course load to limit tuition costs, while filling out forms to keep you in full time status in compliance with visa requirements, or from having to start paying back student loans.
 - Generally we want you to have more credits sooner so you cost the research grants less tuition later.
 - Credits indicate how many hours the course takes. A TA/GA appointment counts as 6 credits - but these credits do not count towards your degree - and takes 10 - 15 hours / week. 3 more credits make you a full time student. You need to register for the TA/GA appointment.



Research Topic

- Find an area of current research that interests you
- With aid of mentor explore in some depth
- Goal: demonstrate readiness to do research, not necessary to do original research
 - General understanding of field
 - Specific understanding of particular topic
 - Importance of topic and what research investigations are called for
 - Understand the underlying physics (and/or astronomy)
- A research project is not required for the qualifier
- The subject may or may not become your dissertation topic
- The mentor may or may not become your dissertation advisor



- High Energy Theory
 - Students without advanced preparation will probably not be ready
 - The HET group generally considers Quantum Field Theory courses as prerequisites
 - Students are advised to pick a non-HET topic for the qualifier
 - This will not preclude dissertation work in HET
 - Students should consult HET group for further advice



Mentor

- The mentor's role is to guide you in a project by suggesting a particular subtopic, suggesting references and papers to read, or basic topics (the stuff in textbooks) to be studied more in depth.
- The mentor should check on your progress and answer questions BUT he/she is not expected to be spending many hours a week trying to teach the material to you. You are expected to do most of the work on your own.
- The mentor has no obligation to take you on as his/her PhD student if you pass, and you have no obligation to choose your mentor as your dissertation adviser.



- The paper should be 10-12 pages in length (11 pt font, 4 lines per inch), e.g., Phys. Rev. style
- The paper should consist of at least three parts
 - Introduction: overview of the topic, general background, its importance, and the current problems
 - A more detailed discussion of a particular subtopic and how it helps the field
 - A final discussion on how to address the subtopic in order to advance the field. This might, but does not have to be, part of your dissertation
- All appropriate references and citations included



Presentation

- The presentation should be a professional-style presentation (probably PowerPoint or similar) lasting no more than 20 minutes
- It should cover the elements of your paper in the same manner as you would present at a conference
- Should not get into low-level details (avoid lots of equations, details of experimental apparatus, etc.)
- Should be clear to a non-specialist



Oral Exam

- The oral exam will test your understanding of the topic and the essential physics behind it. You should be prepared to answer questions about anything discussed in your paper. Questions might also include basic physics within your general area.
- Questioning may cover more basic topics and will be guided by the quality of responses to questioning. Poor answers may lead to questions about more basic material.
- For an experimental topic, you will be expected to have an understanding of how the detectors you discuss work.
[Example: If you talk about a scanning tunneling microscope, you would be expected to understand quantum mechanical tunneling.]



What do we expect from you?

- Based on your area of interest, seek out a mentor and notify Saurabh Jha and Ron Gilman of the mentor's name.
- The mentor will guide you in picking a particular topic, suggest reading materials, monitor your progress in learning the topic
- Submit a 1 paragraph paper to Saurabh Jha summarizing the topic you will be talking about - most 2nd year students turning these in now
- Presentation/exams usually will be scheduled for November.



What if I don't pass?

- You may be asked to repeat all or some of the exam. For example, you may be asked to repeat only the oral exam, without re-writing the paper or giving a new presentation.
- You will be given one chance to repeat the exam, which should be done before the end of the following semester.
- Even if you pass the exam, you cannot be advanced to candidacy until you have successfully gotten B's in the core courses or passed the appropriate challenge exam.
- Even if you pass the exam, you may be advised to try another area of research and/or another advisor.



What happens when I pass?

- The fun begins!
- Choose adviser and have first committee meeting within one year after passing the exam
- Register for research credits once admitted to candidacy. Minimum 24 required, 72 total (course + research)
- Advanced course requirement - 5 in total
 - 2 outside of research (at most 1 outside of physics and astronomy)
- Goal: complete dissertation research in 3-4 years (6 total).
 - Remember - no extra credit for extra time spent in grad school!
- Optional - apply for M.S. degree
 - 30 course credits; can transfer grad courses from other universities



Path to the Ph.D.

- The fun continues!
- Annual committee meetings
 - Written and oral presentations
 - Make sure you are on track
- Preparing for beyond the dissertation
 - Consider external fellowships
 - Give talks and posters at professional conferences
 - Learn about wealth of careers - attend seminars and colloquia, meet visitors, talk to advisors and colleagues outside of university research
- Stay in touch after graduating



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TA's

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- ~15 hours / week - contact me if it is taking more
 - DELTA-P



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Academic Integrity

- Don't cheat
- Cheating on tests → kicked out of program
- OK to quote people, with attribution
- PhD dissertations run through turnitin