



Frequently Asked Questions (FAQs) for MS and Ph.D. students interested in Joining the Ballantyne Group in the School of Physics¹

Purpose

Graduate students have many questions and concerns on their minds when choosing which groups to join for their master's or Ph.D. research. This frequently asked questions (FAQ) document is aimed at addressing those questions for students interested in my group. Please note that this document is *not* meant to be a contract or agreement but should hopefully provide helpful information for prospective students as they consider their options. Feel free to contact me to further discuss any of these points or to discuss potential research projects.

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FAQS

- *How did you get into science?*

I was always a kid who was interested in science, especially space stuff, but I never really thought of it as a career until I was a teenager and watched a PBS show called “The Astronomers” which followed a group of professional astronomers as they travel to telescopes, consider data and try to understand some aspect of the Universe. I realized then that someone can actually do this as a job, and I loved the idea of spending my time figuring out how galaxies, stars, etc. worked. After that, I decided I wanted to be an astronomer/astrophysicist and I never looked back.

- *Where did you get your degrees/research training and what is your scientific background?*

I did my undergrad at the University of Victoria in Canada where I majored in ‘Physics & Astronomy’. The main reason I went there was that it had a Co-op program in the Physics Department so I was able to work full-time for four semesters throughout my degree. I did work terms at the Dominion Radio

¹ Document based on the FAQ provided by Prof. Andrew McShan in the School of Chemistry and Biochemistry.

Astrophysical Observatory, the United Kingdom Infrared Telescope (located in Hawaii), and at the Canadian Institute for Theoretical Astrophysics. Because of this program I was able to get 16 months of research experience before grad school, and I was exposed to radio astronomy, IR astronomy, and a wide range of theoretical topics. From this experience I knew that I wanted to focus more on theory in grad school, but still stay connected to data. After a 1-year MS program at the University of Toronto, I was awarded a Commonwealth Fellowship to do my Ph.D. at the Institute of Astronomy at the University of Cambridge. I arrived in the UK not long after the launch of the *Chandra* and *XMM-Newton* telescopes, and the field of high-energy/X-ray astronomy was undergoing a resurgence. I therefore completed my Ph.D. with Prof. Andy Fabian on modeling the X-ray spectra of active galactic nuclei (AGNs).

Following my Ph.D. I held postdoctoral fellowships at the Canadian Institute for Theoretical Astrophysics and The University of Arizona. During that time, I expanded my research interests in high-energy astrophysics to include accreting neutron stars and the evolution of AGNs. My work often involves comparing computer-based models with published data from X-ray, radio and/or infrared telescopes. All these directions are guided by my underlying research philosophy of using any necessary tool or technique, unlimited by wavelength range or physical process, to make progress in understanding the relevant physics.

- *How long have you been at Georgia Tech?*

I am one of the founding faculty members of the Center for Relativistic Astrophysics and started at Georgia Tech in August 2008.

- *Are you taking students right now?*

Maybe. I do not currently have funding for another student. This may change by the end of the current semester, so please come and speak with me if you are interested in my research.

- *What kind of students do you look for?*

I don't have a specific checklist when considering new students. I feel strongly that I should be able to adapt my mentoring so that any motivated, passionate student can succeed.

- *Would you be interested in co-advising?*

Most students are not co-advised, but I have co-advised in the past when the situation made sense. This is something that usually unfolds organically due to an existing collaboration and is hard to just set up from the start. That said, I'm open to the possibility, so I'm willing to listen to a proposal to be a co-advisor.

- *What projects are going on in the group currently?*

Currently projects going on are (as of Fall 2023):

- Investigating the interaction between neutron star X-ray bursts and the surrounding accretion disk.
- The X-ray reflection signatures of supermassive black hole binaries
- Observational properties of dual AGNs evolving via dynamical friction

- *Are there any specific courses that students in your group take?*

Graduate students in my group typically take:

- PHYS 7125 – Introduction to Relativity
- PHYS 7127 – Cosmology & Galaxies
- PHYS 7129 – High Energy Astrophysics
- PHYS 8803 – Radiative Processes

- *Do you tend to give your students projects or have them select their own?*

Graduate student funding through grants to professors is tied to specific projects and deliverables. Therefore, most graduate students work on professor-assigned projects. As students get more experience, they may be able to come up with projects on their own, which I would support as long as it doesn't go too far away from the main thesis project.

- *How many group members do you currently have, and what type of student are they?*

I am currently working with 2 Ph.D. students plus 3 undergraduate students. Of the 5 group members, 4 are women. All current and alumni group members are listed on my website, <http://ballantyne.gatech.edu/>. Please reach out to any of these people to ask them questions about the group and my mentoring style.

- *What kind of techniques/skills will I learn during my time in the group?*

Students in my group develop strong programming skills and often have to use the local computer cluster resources available at Georgia Tech. I do not have strong opinions about what language students should program in, but I encourage python as it has broad applicability both within and outside of academia. Depending on the project, students may also gain experience in data analysis and model fitting techniques. As mentioned above, I am always open to learning new skills and techniques if they are the best tools for solving the problem we are working on. So, if we need to use a new simulation code, or if an AI/ML tool is the right approach, then we would work on learning that skill.

- *What kind of mentoring style do you have?*

I have a fairly 'hands-off' mentoring style, in the sense that I expect students to take ownership of their projects and be responsible for their progress. I do not sit with students for an hour or so helping debug code (for example). I expect students to write their papers (with my feedback and edits, but I do not write the drafts). However, 'hands-off' doesn't mean ignored, as I am deeply invested in the progress of the student and their project and will work hard to help the student be successful.

My view is that I am not smarter than my students, I'm not more insightful, but I do have more experience. So, I'm more likely to know what approaches may work best, what problems are more commonly encountered, or how to fix certain issues. My goal is to use my experience to help guide students through the stumbling-blocks of doing research so that, at graduation, students have the experience and skills to be independent scientists (even if that is not their chosen career path).

- *How often do you meet with your students?*

For a student that is just starting out, I typically start with 2 meetings a week, and then this drops down to 1 weekly meeting as the student becomes more comfortable with the project. However, I sometimes increase this back to 2 if I think it would be better for the student, or if there is a particularly urgent issue that needs to be addressed. I vastly prefer in-person meetings for discussions, rather than discussions

over email or Slack, so I also encourage students to drop by my office whenever they need to. I will also drop by the student office if I have an idea or a question.

- *What are your expectations for hours in the office?*

I do not keep track of the hours a student works either at home or at the office, but I think a 40 hour work week is reasonable, including time taken for classes or TA duties, if applicable. What I am interested in is progress on the research project. Each week during my meeting with a student we set goals for what should be accomplished in the next week. We work to make these goals reasonable, and I expect that progress is made towards those goals. Now, of course, things happen, life can get in the way --- there are exams, people get sick, somethings are harder to accomplish then expected. All this is fine and understandable, but I do want to see that the effort is there to solve problems and move the project forward.

In addition, I'm a strong believer in students maintaining a reasonable amount of work-life balance. I do not expect students to work weekends unless absolutely necessary, or respond to emails after normal working hours. I also encourage students to take time to pursue other interests and hobbies, and have some form of a social life. I think that students who can find a degree of balance between their academic and non-academic lives are more likely to thrive in graduate school.

- *How many papers will I be expected to publish?*

We definitely want to publish, but I don't place a quota on students (i.e., I don't say 'you must publish x number of papers to graduate'). Hopefully, the thesis project is designed so that several papers will naturally result, but the number will depend on how the project unfolds. My previous Ph.D. students all published ≥ 4 first author papers during their degree.

- *How is the group structured? How do you envision collaboration between students?*

My group has always been quite small, so graduate students work most closely with me, and maybe with an undergraduate researcher if one is needed. I strongly support students working in the office alongside fellow graduate students so that they can learn from one another. Even if students are working on different projects from different groups there is always something that can be learned from just talking through problems together. If a collaboration results from such interactions, I would be thrilled.

- *Is there funding currently available for me? Will I have to TA?*

Physics Ph.D. students often TA during their 1st 2 years in the program. Right now, I do not have funding for a student beyond that point. I also strongly encourage students to apply for graduate fellowships so they do not have to rely on their advisor for funding.

- *Will I be able to attend scientific conferences?*

Attending conferences to present research is an important activity in the growth of any young scientist. As my students obtain results, I work with them to identify relevant conferences and will help with submitting abstracts, designing posters, etc. A common conference my students attend is the High-Energy Astrophysics Division (HEAD) meetings of the American Astronomical Society, as well as smaller, more topical meetings that are focused on the student's research area. I help students with identifying ways to pay for conference trips and will write letters of support for funding requests.

- *How do you help students achieve their career goals?*

I encourage students to complete an Individual Development Plan (IDP), update it annually, and discuss it with me. I encourage students to try internships during their Ph.D. studies if they are interested in exploring different industries. I help identify courses and programs at Georgia Tech that may be helpful in preparing students for their post-graduation path. I ask students about their career goals and will make sure that they are obtaining what they need from me in order to accomplish those goals.

- *Where do students go after they graduate your group?*

Of the three Ph.D. students who have graduated from my group, one is a Patent Agent in Atlanta, one works as a Software Engineer for the Aerospace Corporation, and one is a Postdoc at the Institut d'Astrophysique de Paris.

- *Will I be able to partake in an internship if I want to?*

Yes, I do not have a problem with students taking an internship over the summer to explore their career options. I think internships are most appropriate after 3 full years in the Ph.D. program and the student has been admitted to candidacy.

- *Can I see the office space?*

Absolutely. Please send me an email and we can make it part of our meeting.

- *Are there group meetings or journal clubs?*

Since my group is quite small and the different students work on quite different areas, I tend not to have group meetings, but focus on our one-on-one meetings. The CRA has weekly journal club-like talks ("Cosmic Coffee") that all students should attend. Also, all students should present at Cosmic Coffee at least once a year, beginning in their 2nd year.

- *What are your views and your group's views on DEI?*

I'm very supportive of DEI efforts in the School of Physics, at Georgia Tech and science, in general. When I was Associate Chair for Graduate Studies in the School of Physics (from 2017-2022), I made several changes to our program and recruiting strategies to increase the diversity of the graduate student body. I have been a member of the School's DEI Committee for the last 3 years, and I have acted as one of the School's Ombuds. My group has frequently included students who are under-represented in science (women, LGBTQIA+ members) and has never experienced any tension between students.

- *How often do students take time off for vacation?*

I encourage students to take a reasonable amount of vacation time, usually occurring between semesters. All I ask is that students discuss with me the planned vacation well in advance (and before any tickets are purchased) so that any necessary accommodations can be made.