TIMESTEP

Graduate School Application Overview- Astronomy and Physics Majors

Dr. Gurtina Besla, Professor of Astronomy
Dr. Weigang Wang, Professor of Physics
Wednesday, October 14th, 5-6:30 pm
Steward, N305

Please complete this survey first !

UROC Research Programs

Priority deadline is November 15

Undergraduate Timeline
Two years

Additional Perks

Prestigious national program

10 units of credit

$5,000 first summer stipend

Fee waivers for grad school apps

Presentation at a national conference

Sophomore Year

Envision: Application, Decision, Research Design Course (Spring Semester)

First Summer

UROC Research Experience at U of A

Junior Year

Practice: Dive deep into graduate school research and preparation.

Second Summer

Research Experience Elsewhere

Senior Year

Launch: Graduate Preparation Course, application, acceptances

AAS CSMA Launches Micro-Grants Program

Neelab Yousafzai
American Astronomical Society (AAS)

More information
& application:

Administrator: Dr. Carlos J. Vargas
CSMAgrant@aas.org

Photo credit: American Institute of Physics

The **AAS Committee on the Status of Minorities in Astronomy (CSMA)** was awarded a $15,000 **AIP Diversity Action Fund Award** to establish the CSMA Micro-Grants Program. This program sponsors Black, Indigenous, People of Color (BIPOC), and other students who are suffering from the effects of financial scarcity. Yearly through 2023, the program will offer 10 one-time grants of at least $500 each to support BIPOC undergraduates to pay graduate school application fees, GRE testing fees, virtual conference registrations, or to purchase textbooks and research supplies. The 2023 Micro-Grants Program applications are open as of 28 August and will close on 13 October (11:59 pm ET).

TIMESTEP

International Scholar Forum

Wednesday, October 21 at 5:00-6:30 pm in PAS 236

This forum will allow undergraduate students to network, share resources, and get support from a representative of U of A's International Student Services and a panel of graduate students from physics, astronomy, and planetary sciences. We will focus on student visas, CPT/OPT, and graduate school choices.

This is a valuable opportunity for seniors to discuss graduate school plans with international students who are currently pursuing a PhD at the U of A.

Use this code to submit your questions and topic suggestions in advance.

ATTENTION SENIORS!!!!
Sign Up for our Graduate School Application Workshops

For astronomy, physics, planetary sciences majors/minors

Sign up here to schedule 1:1 meetings with UA faculty members for feedback on your documents for your grad school applications. Get your materials- personal/research statements- for grad school reviewed by professors and get personalized advice on which schools might be a good fit for you. Students must sign up in advance for workshops by the end of the day October 23rd.

Sign up here

TIMESTEP

How it works:

We aim to match each student with two reviewers, based on the availability of reviewers. You will receive templates for your documents in advance (find resources on the timestep website (Resources for Students → Academic & Career Planning → Graduating Seniors).

For the meetings, you must have rough drafts ready as Google docs of your CV + personal and/or research statements. 1:1 meetings will happen during our regular TIMESTEP sessions below or by appointment

- Wed, October 28- 5:00 - 6:30 pm- In person, Steward N305
- Wed, November 4- 5:00 - 6:30 pm- In person, PAS 236
- By appointment the week of October 26
- By appointment the week of November 2

What is graduate school?

- “School” for undergraduates after they graduate → Classes for the first two years.
- An institution where you will “learn” → to do research, to work with a mentor on a research problem, be a teaching assistant and see how to teach
- You will specialize - from a general area you find a specific niche to focus on
- Learning to present work - to folks within your subfield and broadly.
- Learn how to write - papers, proposals

Why do you want to go to graduate school?

- Do research !!
- Understand how things work
- Make a contribution to a field that I love
- Make that knowledge more accessible globally !
- Develop new ideas/products/research directions
- Get some letters PhD!
- Get the tools to teach and help others enter this field that i love
- *spite* show yourself and others that you can do this.
- Open doors for future experiences that require a phd [this shouldn't be the #1)
- Interdisciplinary work

Components of the applications

- Transcripts
- GRE/PGRE (not all schools require)
- CV
- Letters of Reference
- Research Statement

1. Grades/Transcripts

- 3.0 minimum GPA cut off
- Upper division physics classes matter, as well as gradient of improvement
- Often you’re asked for the textbooks used in your classes.
- Letter writers can explain poor grade performance and gradient of improvement (it is ok to ask advisors if they can do so)

GREs

- Cases where optional, not required? See Link Here
- 40th percentile and above you're fine, maybe even 30th percentile

CV (curriculum vitae, Latin meaning “course of life”)

- See templates on the TIMESTEP website
- What should you stress: List of Research experience, outreach/DEI activities + short blurb, focus on products of research (research notes, presentations etc).
- List any graduate level classes (it’s not required!)
- Add two or three sentences about each research project, including the **research product/outcome** of your project.
- List Conferences attended and Talks/Posters presented
- List Leadership roles in even non-scientific activities
- List Professional activities including sports if they occupied a lot of your time (e.g. varsity)

Example CV: Jay Motka (UA Astro/Physics major, Class of 23)

RESEARCH EXPERIENCE

Numerical Simulations of Charged Black Holes

Relativity Group, Department of Physics, The University of Arizona — August 2022 - May 2023

Project: Simulating a Charged Black Hole in Extremal Limit on Charge using Numerical Relativity Simulations
Undergraduate Thesis Link: https://repository.arizona.edu/handle/10150/668671

Advisor: Dr. Vasileios Paschalidis

Goal: To simulate black holes that are closer to the extremal limit on charge than has ever been accomplished before, which will help understand conditions around such black holes and lead to a path for possible theoretical tests of the weak cosmic censorship hypothesis.

Results: Calculated initial conditions for the simulations of charged back holes that can achieve the extremal limit on charge using analytical techniques. This work is published as an undergraduate Honors thesis.

Connecting Cosmological Simulations to Observables in the Infrared

SÍGAME Group, Steward Observatory, The University of Arizona — January 2020 - September 2021

Project: Creating Spectral Cubes and Moment Maps from the Output of a Python Module Named SÍGAME
Project Link for Moment0 Maps: https://github.com/jaymotka/moment0_maps

Advisor: Dr. Karen P. Olsen

Goal: To create data visualization tools that correlate with the underlying physics of the simulated galaxies, which can be cross-checked with observations to better understand galaxy formation and evolution.

Results: Created algorithms to generate spectral cubes, moment maps, and line ratio maps from simulated 3D galaxy datacubes, which are output of SÍGAME. My code is submitted to SÍGAME main branch published on GitHub. This work is published in a co-authored paper in The Astrophysical Journal (Olsen et al. 2021).

Letters of Reference

- Who to ask -- someone who lays out in detail what you've actually done in research or can speak to/give context for your grades
  - Who can speak to what you have done relative to the opportunities you have had.
  - Who can speak to how well you will do in the future.
  - Sometimes you can have 4 letter writers
  - If something is emphasized in your personal statement (e.g. a research project) they should be providing a letter.
  - Want people who can speak to your undergraduate experience (not highschool). Avoid family as letter writers
  - If you ask a graduate student make sure their advisor co-signs the letter.

Letters of Reference

- When to ask:
  - Earlier the better!
  - Will need to send your letter writers a copy of your CV and personal statement
  - Ask if the person can write you a “strong letter”/”strong and detailed letter”
- How to organize information for your letter writers (spreadsheets/google docs; See here) and what other information to provide so they write a specific letter (see here)
- Build relationships early !

  Office Hours, Research, Clubs/Activities

Reference Letters - What info to provide your letter writer

<u>To request a letter of reference for graduate school</u>

save your answers as a .docx file (named “LastName_year_gradLOR”). Send this file and your current CV (as a pdf named “LastName_year_CV) to Prof. **<u>at least two weeks</u>** before your letter is due, and then remind Prof. by email 3-5 days before the due date.

1. If you have taken classes with me, list them and include your grade and what year you took the course.
2. When (month/year) did you start working in my group, and who did you work most closely with?
3. In 5-10 sentences explain your project in my group. What were you working on, why was it important, and what did you learn?
4. If you have worked somewhere else since leaving my group, what have you been doing? Why is it cool and important?
5. Why do you want to go to graduate school? What is your long-term career goal?
6. Describe why you think you will be a successful graduate student, and how your work in group shows these traits.
7. Describe 1-2 situations from your time in my group that highlight what you like most about doing research, and why.
8. What do you consider the biggest weakness in your application, and why? Is there anything about your application that you would like to me to explain in my letter?
9. What do you consider your greatest strengths, and why?
10. Is there anything personal or sensitive that you want me to exclude from your letter?

Research / Personal Statement

- Advice from UA Astro Grads
- What to emphasize:
  - **why do you want to go to graduate school???**
  - Committee is Looking for your fit within their department - e.g. in terms of the area of physics/astronomy in which you are interested. Be broad. No one will hold you to it if you get in.
  - Just because you worked in one are as an undergrad doesn’t mean you have to do work that as a graduate student

What to emphasize: Academic Performance

- If you took Graduate level classes - explain why did you take this?
- Can explain a lower GPA
- Covid19 Impact

What to emphasize: Discuss Research Experience

- What have you done
- What got you excited?
- Emphasize *skills* gained / What did you learn?
- Illustrate understanding of the bigger picture science goals - WHY does your project MATTER?

What Emphasize: Institution and Legibility

- Address institutional specific details - **why are you applying to this specific school**
  - Look at departmental website and research areas/personnel
  - You can email people at various school to see if they are taking on students
- Make sure the statement comes across as professional (header/footer, **SPELL CHECK**)
- Utilize paragraphs. Emphasize **one main point per** paragraph (e.g. talk about a strength you have - organized/multitask, ambitious, capable of doing research at a graduate level, can code, are a problem solver, good communicator/speaker/team member, are a leader etc)

Costs: UofA Astronomy/Physics: $90 application fee.

- Fee waivers are possible. Look at the department website. Contact the department directly (usually director of graduate studies) even if it isn't listed on their website.
- **UofA Grad Application Waiver**: if you are a member of these sponsored programs.
- **UofA Astronomy** - Please email Hannah Potter (hpotter@arizona.edu) for information about need-based fee waivers.
- **UofA Physics** - To inquire about need-based application fee waiver, contact the Dr. Erich Varnes (Director of Graduate Studies) with evidence such as previously received need-based federal grants (for example Pell grants).
- **OSTEM scholarships** ($750; NOV 3rd 2026 deadline): https://www.queerinai.com/grad-app-aid (they have an application review program)

Semiconductor Science and Technology
New Physics MS and Accelerated Master's Program (AMP)

<u>Earning both a Bachelor’s and a Master’s degree in 5 years (30 units required for the Master’s degree)</u>

- During Year-1 to Year-3 students take regular undergraduate coursework (~90 units).
- Students apply to the AMP program by the end of Year-3 (GPA 3.3 requirement).
- In Year-4, AMP students may take up to 12 units of graduate coursework which may apply toward both the Bachelor’s and the Master’s degrees.
- In Year-5, students take remaining 18 units of graduate coursework

Semiconductor Science and Technology Courses

Objectives:

1. knowledge and essential skills in semiconductor processing (down to 2nm node).
2. Emerging semiconductor technologies such nonvolatile memory, 2D devices and quantum computing.

Core courses

- PHYS 560A Condensed Matter Physics (3)
- PHYS 565 Quantum Materials and Devices (3)
- PHYS 567 Quantum Materials and Devices Lab (3)
- PHYS 695A Current Problems in Physics (1)

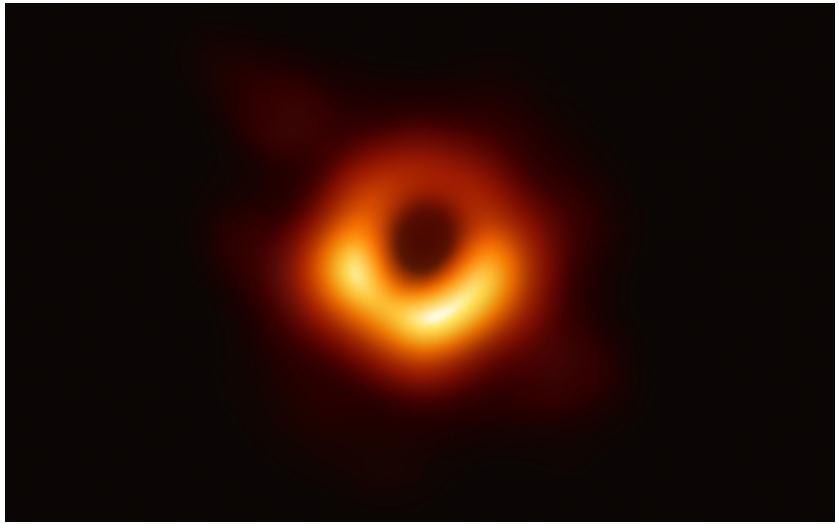
PHYS 544 Topics in Experimental Physics – Vacuum Techniques (3)

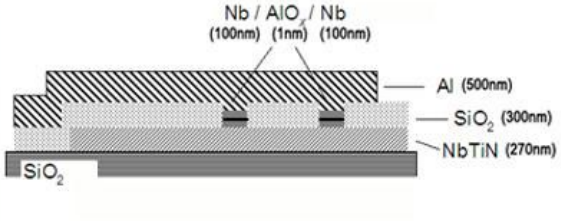
- MSE/ECE 546 Semiconductor Processing (3)
- MSE/ECE 547 Semiconductor Processing Lab (2)
- MSE/ECE 580 Advanced Materials Characterization (3)

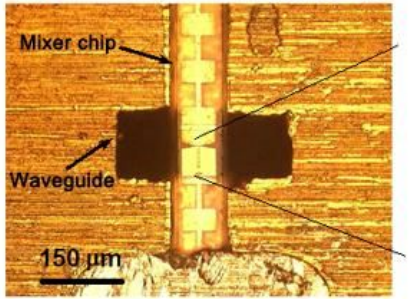
Elective courses

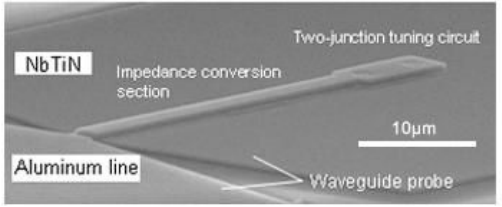
- PHYS 561 Physics of Semiconductors (3)
- ECE 507 Digital VLSI System Design (3)
- MSE/ECE 554 Electronic Packaging Principles (3)
- PHYS 560B Condensed Matter Physics II (3)
- PHYS 570A Quantum Mechanics(3)
- PHYS 599 Independent Study (3-6)
- and many more…

Example of what you will be leaning: Superconducting tunnel junctions





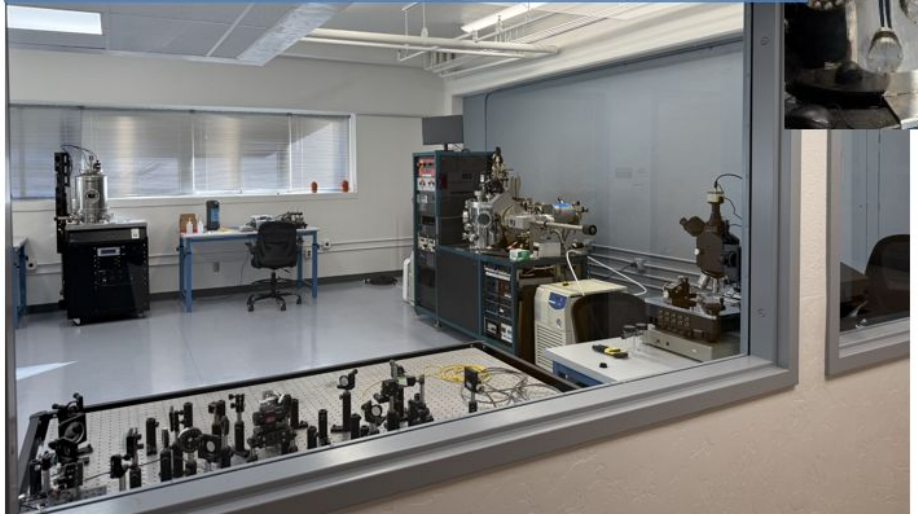


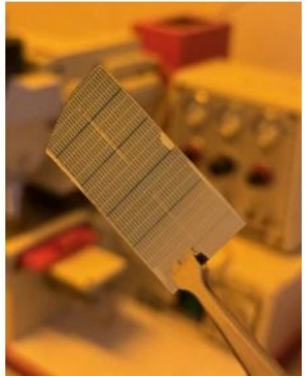


DOI: 10.1109/TASC.2007.898594

Future Advanced Semiconductor Technology Laboratory (FASTLab)

- End-to-End Semiconductor Fabrication (CNC to Functional Devices)
- Multiscale Materials & Device Characterization
- Advanced Quantum Device Research (Josephson Junctions & 2D Systems)





Still want to do a Ph.D. eventually? Why MS degree?

- MS degree in just 1 more year through the AMP.
- 30 units of regular MS can potentially be completed in 1-1.5Y.
- Improve GPA: many MS courses might be “easier” than traditional upper-division theory courses such as 331 and 371.
- Gain substantial research experience by spending 1-2 years embedded in a research group, with a high likelihood of co-authorship on peer-reviewed publications or conference papers.
- Demonstrate advanced preparation for Ph.D. programs by completing graduate-level courses such as PHYS 570A and 515A, enabled by the M.S. program’s flexible core requirements.
- Strengthen your CV with teaching experience – all MS students have Instructional Assistant positions.

Limited Incentives Available

- Tuition Scholarship ($3k -$12k)
- Graduate College Fellowships ($2.5k-$5k)
- Graduate Access Fellowship ($4k, need-based)
- Other fellowships
- **Paid Instructional Assistant Positions for all MS students ($500–$1,200/month)**
- **Application Fee Waivers**

Applying To Non-US Schools

Canada (astro/physics): Similar expectations and timelines.

Toronto Astro and Physics - Dec 12

Chile: Similar expectations, but different timelines.

La Serena (astro): Applications open mid-july, and close Sep 1.

Start date in March. (only need 2 ref letters)

Australia : Similar expectations and timelines

Australia National University - deadlines Nov 15 (Note: they ask for copies of publications or thesis papers - substantial research)

U. Sydney Physics - again substantial research (paper etc)

Applying To Non-US Schools

UK: Master's not needed. Deadlines vary. Typically apply to a specific group

Surrey (astro) - Apply to specific groups, listed in January. Interviews are conducted.

Durham (astro)- Application Deadline is Dec 15th. Likely need a publication. 2 letters. Apply to specific groups as listed here.

Oxford, Cambridge - likely need Masters, Publication

Applying To Non-US Schools

Most European countries:

Deadlines vary - Late October, Early November

Direct entry to PhD typically **requires a Masters or equivalent** (e.g. substantial honors thesis project).

Typically apply to **a specific research group** (look for project lists - denmark, spain, germany, netherlands, etc)

There is often an interview process (January). **Practice Presenting your research!**

These are paid positions

Germany IMPRS program deadline: Nov 1/Oct 30

Masters programs have later deadlines (e.g. Jan 31).

These are typically unpaid (but it is substantially cheaper than in the US)

but some German Master's programs cover fees.

Applying to Non-US schools.

East/South Asia

Japan: NAOJ Deadlines : Oct 8 - Nov 6 Application Guidelines (often unfunded) [Contact Dr. Eiichi Egami]

India: Integrated PhD programme - 6 years max. Paid positions (reasonable).
Entrance exam required (varies per institution), December-Mid Feb - if pass minimum then invited to apply.
Then Interview stage (March -June). Programs focus on course work.
But once you're in, you are well-supported (funding for publications, support from the institute)
National Centre for Radio Astrophysics (NCRA)
Tata Institute for Fundamental Research (TIFR)
International Center for Theoretical Sciences (ICTS)

China: contact Dr. Xiaohui Fan

South Korea: contact Dr. Serena Kim

If you are planning to apply to East/South Asian Graduate Schools please indicate this in the final survey.

PhD in Germany: Example Heidelberg IMPRS

From Christian Burt (Graduated Astronomy 2024):

It is best to have the mindset that you're not submitting an application to a panel that searches for certain traits at a graduate department like in the US, but you're submitting an application t**o specific individuals that are deciding if they want to employ you.** My application to IMPRS-HD was completely different from the applications I sent to US institutions.

Masters In Europe: Example Padua, Italy

From Alessandro Bressini (Graduated Astronomy, 2024):

I've found that Arizona has prepared me very well for Padua. Simply discussing the things done in class (like the PHYS 305, ASTR 302, ASTR 400A/B final projects) will let the reader know the extent of your studies. The statement for Padua was only one page long, so I crammed a lot of information about my research experiences, precepting intro physics, and what my aspirations are as well as how Padua can help me achieve those goals. No reference letter needed.

If you are going to study internationally, do as much research about the program as possible, be active in getting things done, talk with as many people as you can, and <u>be prepared to struggle.</u> Once the dust settles, it's absolutely worth it.

Interviews

- “Why do you want to do a PhD”?
- “Why do you want to come to XX Institution?”
- “What attracted you to astrophysics in particular?”
- “Can you give an example of a moment where you struggled in a research project, lab or similar? How did you approach the challenge and overcome it?”
- They may also show you a plot or similar to discuss, just to see how you approach problem solving.

TOEFL

If you have a Degree from a US institution you generally do not need this - but double check each institution. For U of A you do not need TOEFL if you are a UofA student.

Final Survey!

Join us on LinkedIn!

Request to join the group

Helpful Resources for Students

- GradSchoolShopper magazine from AIP
- UA Physics Department- Graduate Application Procedure & Forms
- UA Graduate Program in Astronomy and Astrophysics
- TIMESTEP resources