

# The TIMESTEP Research Apprenticeship Program

*Research Opportunities for Sophomores Majoring in Physics and Astronomy at UArizona*

PI: Gurtina Besla, Co-I: Ewan Douglas, Program Manager: Rebecca Lipson

The TIMESTEP Research Apprenticeship Program is an academic year program that offers participating students a paid opportunity (\$15/hr) to build technical and professional skills that are transferable to both research positions and internships in industry. The program was piloted in Fall 2022 with 7 students and will continue in Fall 2023 with 10 students.

Students spend two semesters working with a faculty mentor and graduate students in a UArizona Astronomy or Physics research lab, gaining hands-on experiences in lab skills and/or computing. The program aims to engage students who are marginalized in Astronomy and Physics, reaching them within their first two years of study with the aim of increasing retention of a more diverse student pool.

The program is managed by TIMESTEP PI G. Besla and Program Manager, Rebecca Lipson. In addition, a team of 2 graduate student coordinators also monitor student progress. This program is funded by UArizona RII.

The Apprenticeship focuses on two specific skill areas: Computation and Hardware/Software. Participating UArizona research labs focus in areas similar to a participating TIMESTEP employer or that enable the development of skills that are mapped to a participating TIMESTEP employer.

The program is designed to provide all students with a set of CORE Skills and a set of ADDITIONAL Skills that are dependent on the project (see table below). These skills are not embedded within the standard Physics/Astronomy Curriculum. TIMESTEP runs workshops (1-2/month) to enable students to learn the CORE skillsets. The ADDITIONAL Skills are taught by the Research Group PI.

<b>CORE Skills (completed by all interns)</b>	<b>ADDITIONAL Skills (project-dependent)</b>
<i>Reading scientific papers</i>	<i>Networking (SSH)</i>
<i>Literature review &amp; NASA Astrophysics Data System</i>	<i>Creating block diagrams</i>
<i>Linux Command Line</i>	<i>UA High Performance Computing (HPC)</i>
<i>Python</i>	<i>Computer vision (image processing-eg. OpenCV and some Scikit image processing features)</i>
<i>Version control-Git, GitHub, Git Client</i>	<i>Databases, SQL</i>
<i>Overleaf- LaTeX</i>	<i>Drafting (r/t Solidworks, CAD)</i>
<i>Debugging (e.g. Reading error messages/Stack overflow)</i>	<i>Basic optics</i>
<i>Visualizing data (Matplotlib)</i>	<i>Soldering</i>
<i>FORGE playshops in core identity and resilience</i>	<i>3D printing</i>
<i>SECD Professional Communication online module</i>	<i>Circuit design</i>
<i>RezBaz Computational Training program</i>	<i>Bayesian inference</i>
	<i>Machine learning (e.g. PyTorch)</i>
	<i>Microwave electronics and RF testing</i>
	<i>Digital signal processing</i>

## Outcomes from the 2022-2023 Pilot TIMESTEP Research Apprenticeship Program

7 undergraduates participated (29% First Generation, 29% Female, 57% BIPOC)

2 Faculty Groups participated: Dr. Tim Eifler (computing) and Dr. Ewan Douglas (hardware)

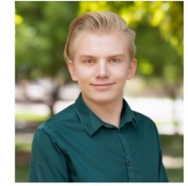
2022-23  
TIMESTEP  
Research  
Apprenticeship  
Students



Abinash Das  
Astronomy/Physics



Chance Lawrence  
Astronomy / Physics /  
Statistics & Data Science



Jonah Lotz  
Astronomy/Physics  
Minor: Computer Science



Jonathan Moreland  
Physics  
Minor: Astronomy



Neha Joshi  
Astronomy  
Minor: Computer Science



Shambhavi Srivastava  
Astronomy / Mathematics



Utkarsh Upadhyay  
Astronomy / Computer Science

- 100% of the students reported that they would highly recommend the program to peers and offered to speak about the program to others.
- 6 of the TIMESTEP apprenticeship students were accepted into the Internship program (program B). One student who was accepted had also applied to an internship out of state and chose to accept that position instead.
- TIMESTEP partnered with UArizona Forge to run 2 workshops for Apprenticeship students on the topics of core identity and resilience and with UArizona CATalyst Studios to offer students a hands-on soldering workshop (see images below)
- Students self-reported substantial increases in their experience in reading scientific papers, Linux command line, Python, version control (Git and GitHub), image processing, soldering, and machine learning/AI
- Every student who landed a summer position (6/7 students) reported that the skills they learned through the apprenticeship program and the support they received through the TIMESTEP program in general made it possible for them to get their summer position.



**Left:** Thirteen Arizona undergrads in physics and astronomy spent the afternoon learning how to solder in a workshop offered by TIMESTEP and held at UA's CATalyst Studios. Soley Hyman (UA Astronomy grad student) provided students with a chance to learn and practice soldering while building Light Sound devices that convert light to sound. These devices will be used in outreach efforts during solar eclipses with people who are blind/low vision. Many attendees are participating in TIMESTEP's Apprenticeship and/or Internship Programs. The TIMESTEP Research Apprenticeship Program is able to offer students skill-building workshops like this one to better prepare students for research and internships.

Students reported high satisfaction with the program, as evidenced by the following testimonials:

*"I learned so much about astronomical computing that I ended up switching majors"*

*“When I heard about the apprenticeship, I immediately got interested since the program aims to give practical experience to the astro majors and prepare them for industry level internships.”*

*“The TIMESTEP Apprenticeship has been a wonderful experience for me. It has helped me expand my knowledge and skills in both industry work and research. I feel much more prepared to tackle internships, jobs, and research projects than I did before this apprenticeship. The advisors and faculty genuinely care about us and want us to succeed.”*

### **The 2023-2024 TIMESTEP Research Apprenticeship Program**

10 Interns have been selected out of 21 student applicants. All are rising Astronomy and Physics sophomores.

#### **Demographics of Applicants: (21 total)**

24% Hispanic, 48% Asian, 28% White

29% Female

24% PELL Recipient; 39% Eligible for Federal Work Study

#### **Demographics of Accepted Students: (10 total)**

10% Hispanic, 50% Asian, 40% White

40% Female

10% PELL Recipient, 30% Eligible for Federal Work Study

Participating Faculty Research Groups for the 2023-2024 program include:

- Computing Research in Astrophysics
  - Dr. Tim Eifler (Astronomy) – taking on 3 students
  - Dr. Eduardo Rozo (Physics) – taking on 2 students
- Hardware & Software in Astrophysics
  - Dr. Ewan Douglas (Astronomy) – taking on 3 students
  - Dr. Dan Marrone (Astronomy) – taking on 2 students