



Astronomy Research Seminar: Student research and publication

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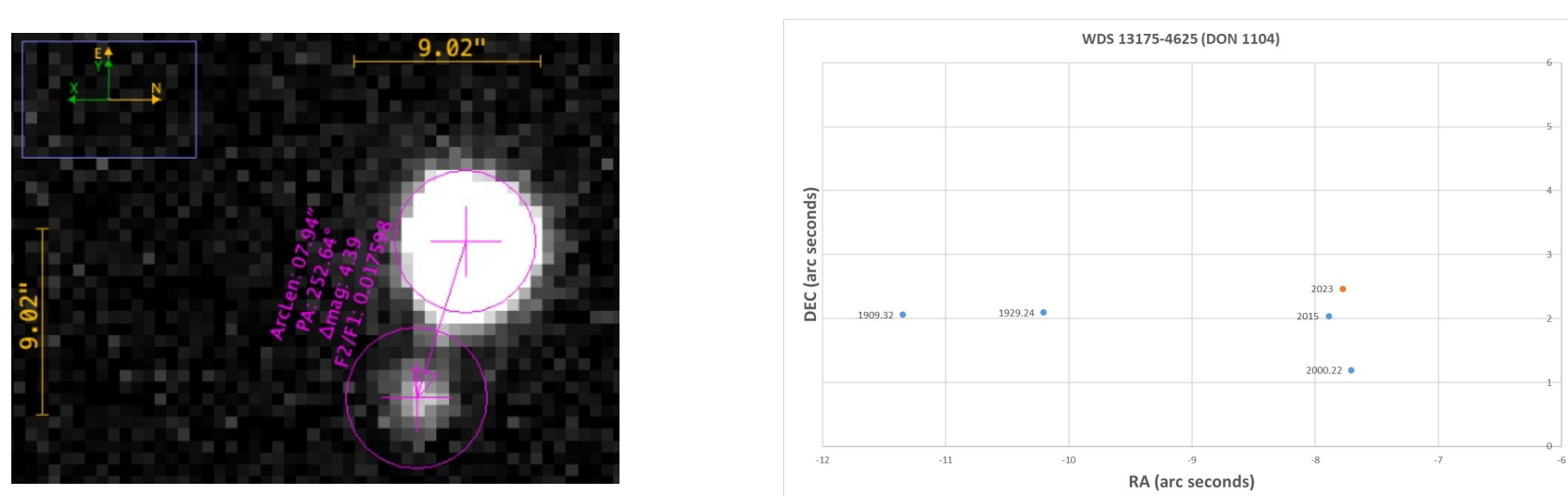
Expanding Access to Authentic Research Experiences for Undergraduates

A pilot program, funded by the National Science Foundation Partnerships in Astronomy & Astrophysics Research and Education (PAARE) program. The research experience for this Pilot Program is called the Astronomy Research Seminar. Students will select targets to study, learn how to use LCO telescopes, write a brief proposal for their target, make observations, and learn how to write a paper as part of their research process. This Seminar has been developed and successfully used in high school environments as part of LCO's Global Sky Partners program. **The seminar adapted for undergraduates will give students success doing science even if they have no previous experience or access to telescope facilities.** We will develop the materials in English and Spanish.

<https://lco.global/education/usa-sky-partners/>

Goals of the Pilot Program

1. Fully develop partnerships between LCO, Occidental College, and the University of Puerto Rico-Río Piedras that provide real astronomy research experiences for undergraduates at a Hispanic-serving university and a small liberal arts college in Los Angeles with a diverse student population.
2. Develop the online video and written materials required to implement the pilot student research program, in English and Spanish, and run the program at both university partner institutions.

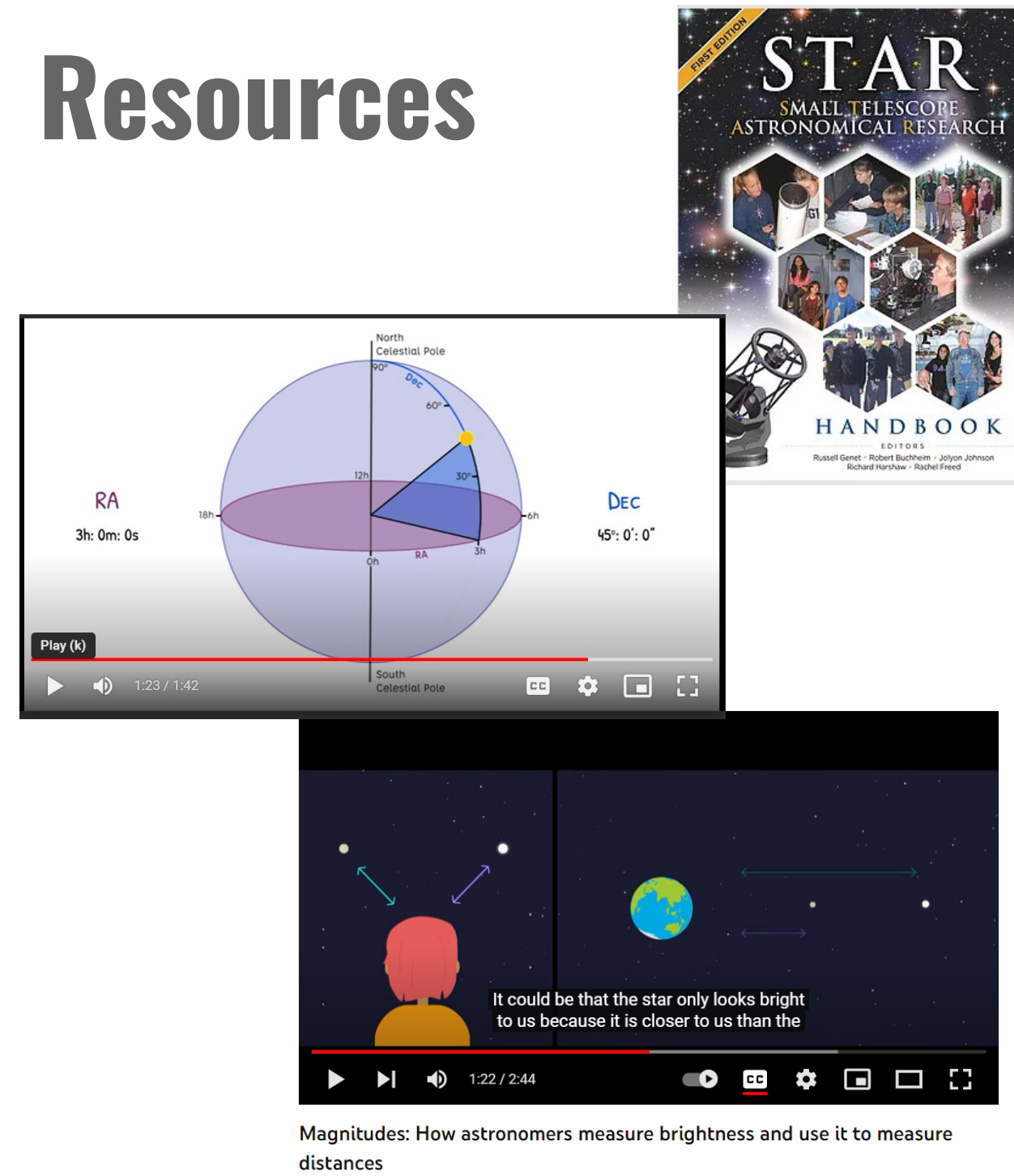


Engaging with an authentic audience



Students present their research at pro-am conferences and at workshops held at professional and classical observatories. Top left: a student presents at the NorthEast Astromaging Conference (NEAIC) in New York. Bottom left: Three student researchers pose with NASA astronaut Don Petit after their presentations. Right: Students presented their research at the "Building the NASA Citizen Science Community" workshop and interacted with the scientists in Tucson, AZ, June 2019.

Resources



STAR Handbook Chapters
I. Team-Oriented Research
1. Team Research within Communities of Practice
2. Planning Projects
3. Managing Projects
4. Writing and Editing Papers
5. Giving Talks
6. Presenting Posters
II. Astronomical Research
7. Small Telescope Research
8. Operator-Attended vs. Robotic Telescopes
9. Precision and Accuracy
10. Astronomical Cameras
11. Double Star Astrometry
12. Exoplanet Transit Photometry

Providing Workshops for Educators and Students

Workshops are being provided for educators and students who are interested in participating and leading an astronomy research seminar following the model developed here.

AAPT Summer Meeting - Sacramento, CA - July, 2023

Lessons Learned

Over the past decade it has been found that the following list is critical to success of the astronomy research program:

- Conduct research within a well-established, professional-amateur community of practice
- Narrow topic area to facilitate timely paper submission
- Nearly total focus on producing a high quality published paper / students split up the work
- Their research is supervised (but not led or managed) by a research supervisor (instructor)
- The students are supported by experienced researchers, all drawn from the relevant community-of-practice
- Unequal participation, based on time and expertise
- No prerequisites
- Diverse student teams

Evaluation

Surveys and interviews have been used to conduct research on the impacts of the Astronomy Research Seminar.

"Were there skills you learned about research or science?"

"The most valuable part was typing the paper because it's a different language. I wasn't used to typing papers like that. And working as a team and each having a role in the research." - Student 8 (2016; 8th gr; F)

"Have you had that sort of experience in any of your other classes?"

I've never typed a paper like that before. Since then my classes require more of those research skills. That was the first time I was exposed to it.

"Working in teams, is that a skill that you have learned and will be useful."

"Yes, definitely. I've worked in teams before. But it's a different experience to be writing a research paper like that. It's a whole different format and language and it's stuff we have all never done before so we have to work together and have to learn together. It's a really good experience."

How did the astronomy research seminar most benefit you?

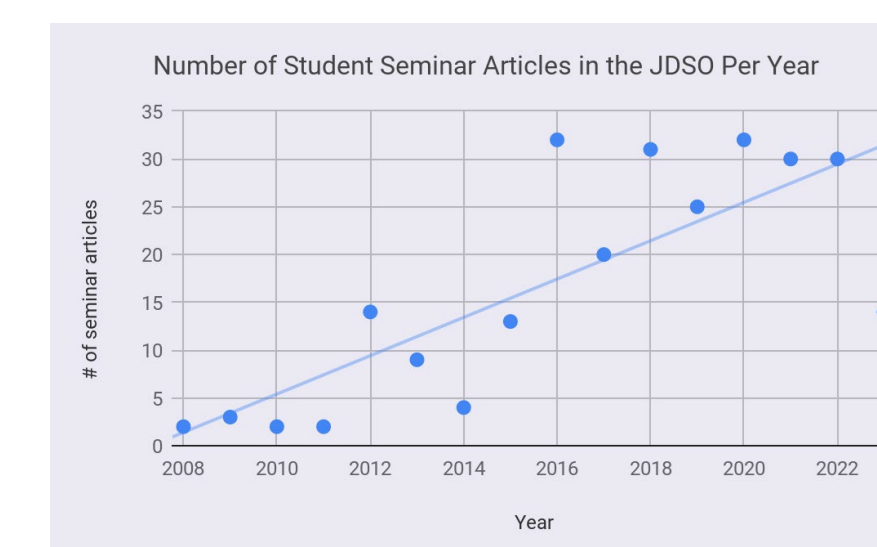
	% of responses included this
Paper writing	43
Scientific Research	34
Teamwork	26
Astronomy	9

Las Cumbres Observatory Global Telescope Network

Students and educators use Las Cumbres Observatory telescopes to collect data.



Student Publications in the Journal of Double Star Observations

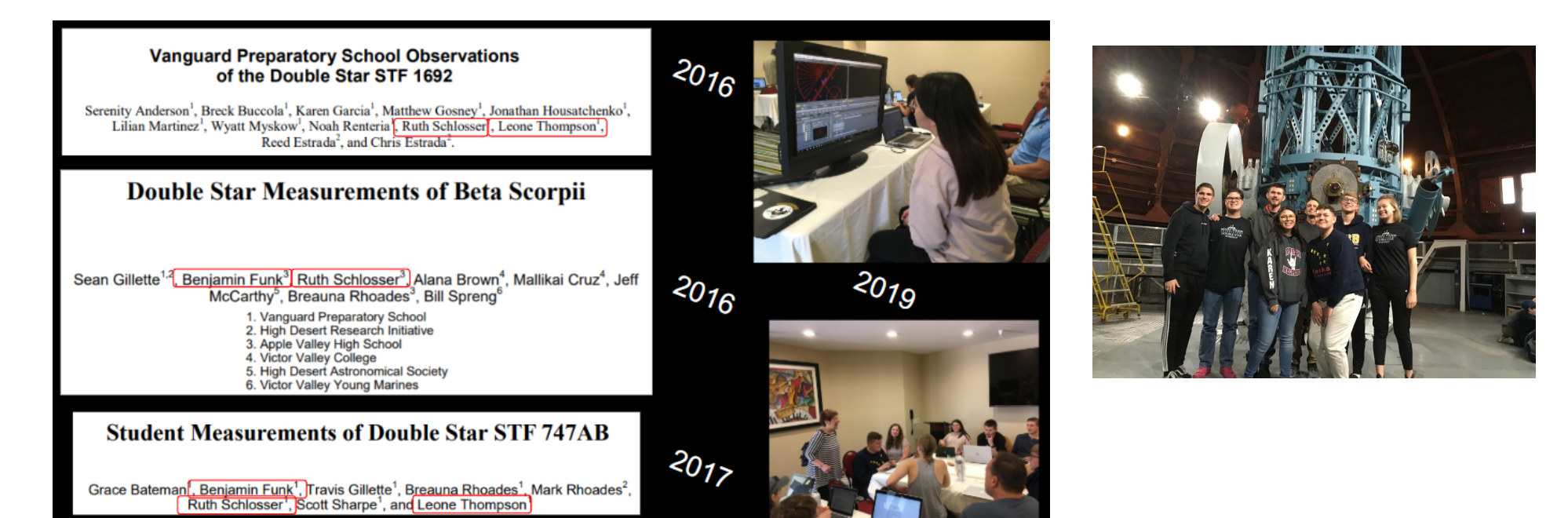


Left: The number of articles in the JDSO submitted by Astronomy Research Seminar Teams.

Right: The percentage of articles in the JDSO submitted by ARS teams. Journal of Double Star Observations: jds.org

Student retention in science and research

Many students become interested in continuing their research by either do more projects, become mentors to other students, or begin their own seminars.



Left: Students often participate in the astronomy research more than once. These students from Paso Robles High School have been involved for 5 years, including participating in a workshop using the 100" Hooker telescope on Mount Wilson for collecting their data in May, 2019. Right: They are shown with the 60" on Mount Wilson. The picture with the students working on writing includes author, Marcia Bartusiak, who interacted with and inspired the students for two days.

References

- Freed, R. (2019) Astronomy Research Seminar Expansion and Building a Community-of-Practice. RTSRE (Robotic Telescopes, Student Research and Education conference) Proceedings. Vol 2 No 1 pp 32-42. <https://rtsre.org/index.php/rtsre/article/view/55>
- Freed, R. (2018) The Astronomy Research Seminar: The Wide-Ranging Impact on Student Education and Careers. Preliminary Results. The Society for Astronomical Sciences 37th Annual Symposium on Telescope Science. pp 161-173. <http://www.socastrosci.org/Publications.html> (2018 proceedings)

This poster:
<http://bit.ly/3MUEwUh>

