



# Spitzer's Education Legacy: NITARP

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<http://nitarp.ipac.caltech.edu/>

**Abstract:** Spitzer's Education and Public Outreach (EPO) team started a program called the Spitzer Space Telescope Research Program for Teachers and Students. SSC director Sofier granted small DDT programs to small groups of educators with a mentor astronomer. This program grew into what is now called NITARP, the NASA/IPAC Teacher Archive Research Program. The Spitzer program ran from 2005-2008; NITARP has been running since 2009. This poster will summarize some of the tremendous education and science results from this program started under the auspices of Spitzer.

**What is NITARP?** NITARP, the NASA/IPAC Teacher Archive Research Program, gets teachers involved in authentic astronomical research. We partner small groups of educators with a professional astronomer mentor for a year-long original research project using archival data from IPAC. The teams experience the entire research process, from writing a proposal, to doing the research, to presenting the results at an American Astronomical Society (AAS) meeting. The program runs from January through January. Applications are available annually in May and are due in September. The educators' experiences color their teaching for years to come, influencing thousands of students per teacher.

**We're presenting results.** We have 68 science posters, 71 education posters, 8 astronomy research journal articles, and 6 education journal articles.



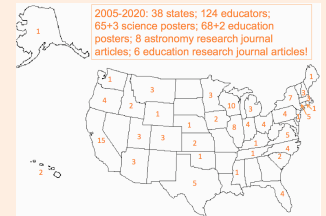
Photo from 2020 AAS: 2019 class (2 teams) finishing up; 2020 class (2 teams) starting up; AND alumni who raised their own money to come!

## What are the major outcomes of NITARP?

- Understanding the **nature of science**: 47% self-report some change, 27% report major changes in understanding.
- **Teamwork**: half the teachers list it as the most important thing about the trips. Science is collaboration and sharing; teachers build those skills. NITARP alumni = community of practice. We have historically underestimated the importance of teamwork!
- Recognition of the **skills to be an astronomer**: collaboration (30%!); also patience, persistence, creativity.
- **Comfort with the unknown**: at least ~40% describe being more confident in tackling complex projects where they don't know all the answers or even exactly how to get there.
- **Student empathy**: Remembering what it's like to be overwhelmed.
- **Research community**: Maintaining linkages to astronomy community. Alumni returning to AAS to be part of this community. Collaborations among alumni.
- **Professional growth**: 80% report wanting to learn/grow. We had a significant role in **major career changes of at least ~12% of alumni**; some report "life changing."
- **More/better science in classrooms**: At least 60% tell us that they are including richer, more authentic science activities in their classrooms.

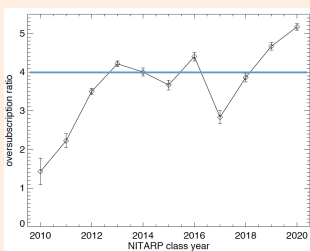
For more information, see refereed education research articles, including Rebull et al. 2018, PRPER, 14, 020102 and Rebull et al., 2018, PRPER, 14, 0148, available in ADS.

**We cover the country... mostly.** We select participants from a national application process; see map below. We still have not had participants from some states; most commonly, teachers have problems getting release time and enough flexibility to incorporate NITARP resources in class.



## Alumni still want to be involved!

NITARP alumni find us valuable enough that they want to come back and do more! They raise money (or pay out of pocket) to come back to subsequent AAS meetings (often with students) to present new work. This is entirely alumni-driven!



**Demand is still high.** Most recently, we have  $\geq 5$  applicants for each spot. As Common Core and NGSS come into wider use, NITARP is a good match, but only for those teachers whose schools give them enough freedom to participate in these sorts of programs.

[educator: NITARP] was one of the strongest experiences I have had in my 20+ years teaching. Your program is amazing and you are wonderful. It is priceless. I know you invest so much into it; I wanted to share a bit of the impact you are having. Thanks for doing what you do so well.

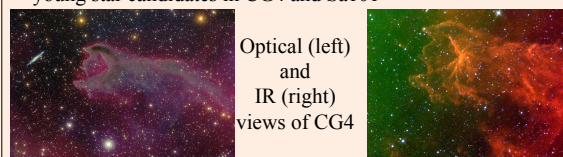
[student:] I remember being so used to teachers telling me every single thing I had to accomplish and every thing I wasn't supposed to do or try. This project taught me that you will never get a checklist in a scientific career. There are no answers yet, and it's up to you to figure them out. [...] It's easy to get an A when you have everything you're supposed to do as a checklist, but there is no learning in that. You can't fail at something that's already done for you.

[educator:] I wasn't expecting as many "well, let's try this" side roads. I thought the process would be more linear, but this felt more authentic somehow. You don't know the answer, and you don't have a clear roadmap for finding the answer, but you have some background and can use that to start reaching towards an answer.

[student:] Astronomy isn't a one-person job, it includes many people that will contribute their part to the project until it is complete.

## Some astronomy research results in the refereed literature:

- Rebull, et al., 2015, AJ, 150, 123. When stars move from the main sequence to the giant branch, any close-in planets will get 'eaten.' But will this leave any observational signatures? Some models say an IR excess can result. This team found complicated and confusing results that overturned expectations.
- Rebull et al., 2013, AJ, 145, 15. This team discovered new young star candidates in BRC 27 and BRC 34
- Rebull et al., 2011, AJ, 142, 25. This team discovered new young star candidates in CG4 and Sa101



[educator:] Astronomy is imagination powered by math and inspired by the sky. I am surprised and delighted at the sheer volume of data available and all the opportunity hidden inside it.

We gratefully acknowledge funding via NASA Astrophysics Data Program funds.

[educator:] I appreciate knowing that astronomers celebrate their "geekiness" and their families. I believe that point alone squelches many preconceived notions. Not only did it change how I understand astronomers but how others understand astronomers. The look on people's faces when I talk about the Caltech astronomer and how \*she\* is guiding us through the research process, is extremely telling. I think it is easy to point the finger at others when they profile astronomers as "old white guys in lab coats" but I am afraid I may have also held that misinformed preconceived notion.