

### What is GROWTH SURF?

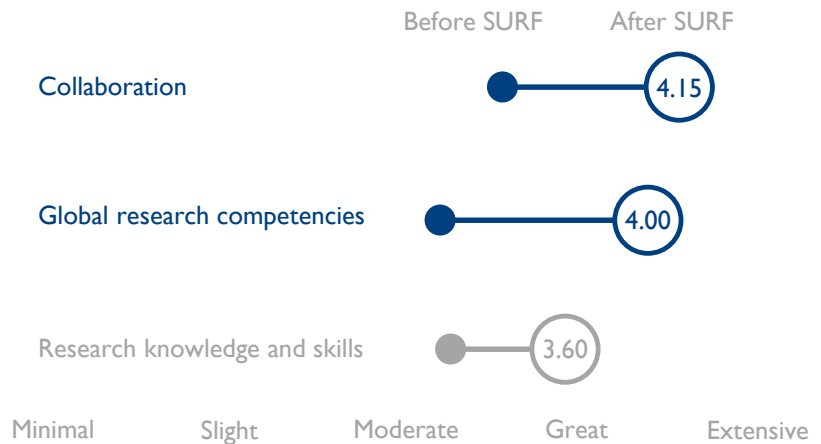
GROWTH SURF is an international undergraduate summer research program where students conduct research in astronomy and astrophysics at partner institutions. Students are exposed to hands-on research, international collaboration, and leading experts in the field. Five students participated in SURF in summer 2017 and completed an evaluation survey. Two also took part in interviews and provided a more detailed account of the experience.

### Who participated in GROWTH SURF?

Three students are male, two identify as Hispanic or Latino and three as white, and four are first-generation students. Students completed their internships at four different partner institutions: National Central University (Taiwan), Tokyo Institute of Technology (Japan), Caltech (USA), and Humboldt University (Germany; 2 students).

### Impact of SURF program on respondents

Overall, all students had an **increased understanding of how to collaborate** with researchers from other countries and disciplines (rated 4 areas), as well as **increased global research competencies** (rated 3 areas), as evidenced by their reflective ratings before and after participation. In fact, one student said, “[It] was good to see how to collaborate [because] that will be useful in any field.” Students also reported an increase in their research knowledge and skills (rated 4 areas), with one student saying, “I learned a lot about coding python, which is essential. I learned some of the science behind neutrino and particle astrophysics.”



The program was less effective in increasing students’ career and education interests; however, this is likely because students had a high level of interest in astronomy and astrophysics before participating in the program. Three students did not report any changes in their education or career plans, with one student sharing: “I was already planning on going to grad school and trying to get into academia...[the SURF program] didn’t change my mind because I was already committed.” One student reported being less interested in pursuing a graduate degree in astronomy and astrophysics, and in conducting research, and shared the following: “At the moment, I feel like it would be in my best interest to improve my programming before participating in further astrophysics work or research.” On the other hand, one student reported feeling more interested in conducting research and pursuing an academic career in astronomy and astrophysics. This student felt that he/she had improved his/her skills in Python and LaTeX, which would be beneficial for his/her graduate school plans.

Students stated that in addition to gaining new skills, the program also helped them to prepare for graduate school and participate in research:

#### Preparation for graduate school



“I think participation has prepared me somewhat for grad school or a career in astrophysics.”

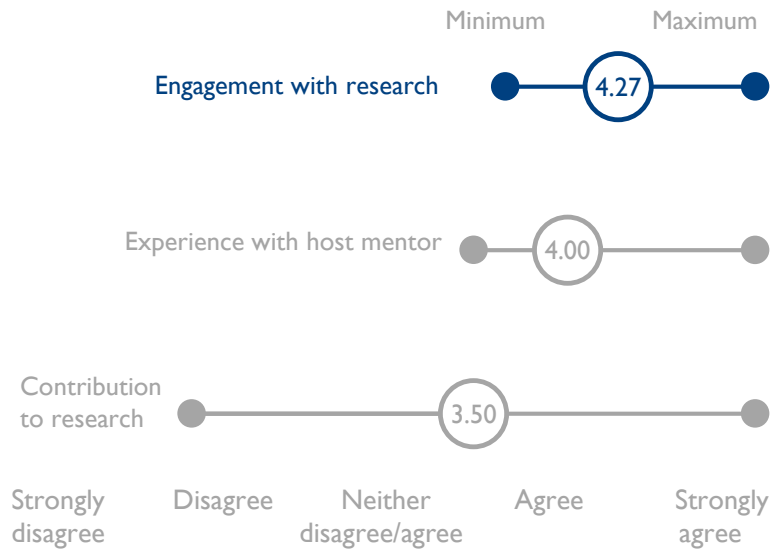
#### Participation in further astronomy and astrophysics research



“Astronomy research has been part of my goals for years. I find it interesting and I want to continue to learn and do more interesting research.”

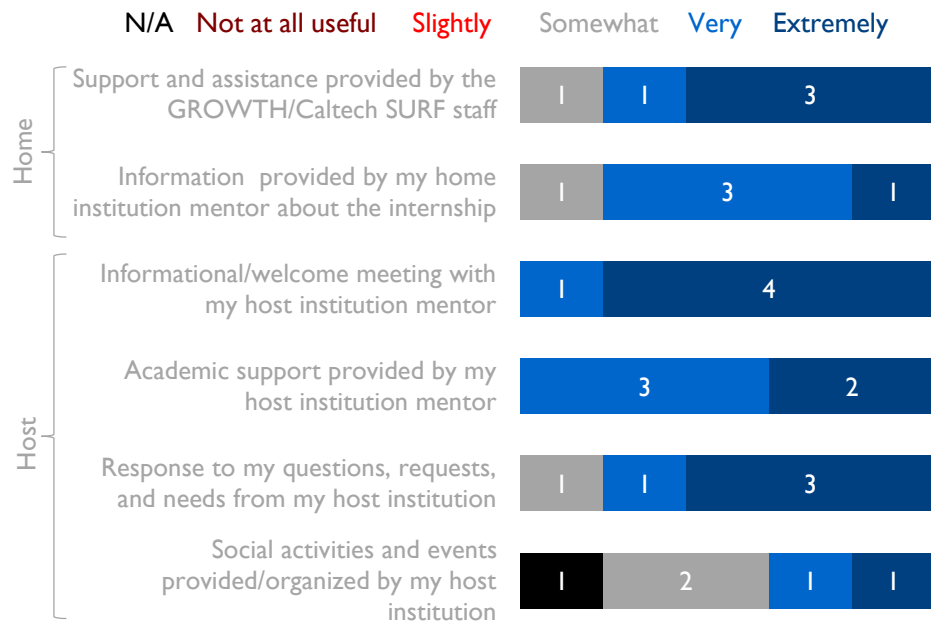
## Satisfaction with SURF

Overall, students agreed that they had a good experience, particularly that they were **engaged with the research** (felt motivated/engaged, challenged by work and learned new skills). Students had mixed opinions on whether they contributed to the research. One student did not feel his/her contributions were valuable to the project or that he/she had the necessary skills. In general, students agreed that they had good supervision from and engagement with their host mentor. One student also mentioned that he/she did not know much about GROWTH before the internship and said, "I think [coordinators] need to encourage you to learn more about GROWTH, the structure, how it works. [It would] be nice for them to be more in your face about what GROWTH is. Have your mentor to tell you more about what GROWTH is."



## Internship support

Students reported that the support they received from their home and host institution was useful to their success during the summer. Students mentioned that they enjoyed socializing with other students at the host institutions, but found these opportunities to be lacking and wished those interactions would have happened more frequently. One student would have liked to keep in touch with other SURF participants while abroad and said, "It would be cool if throughout the summer there was regular communication with the other students to figure out what they're doing. It could be through weekly Skype hangouts."



## Suggestions for improvement

Students suggested the host mentor should be present and available for the entire experience. They also suggested that mentors share the skills that students need before the internship begins as well as discuss the challenges and difficulties students may face in the beginning.



"...it would be better if the mentor were present for almost all of the length of the program. I realize astronomers usually travel a lot, but it still makes it difficult to work through difficulties when there is only sporadic assistance."



"Talk with the students and discuss their programming experience. This way the student can know what he or she is lacking, so that they can learn in advance or at least come in with the mindset that they may struggle for a little bit while they learn the material."

## Evaluator recommendations

For the next group of SURF participants, coordinators should consider the following:

- Ensure students understand how their project fits in with the overall work of GROWTH and work with mentors to make sure students are successfully growing their skills.
- Ensure mentors can be present throughout the summer to support their students.
- The host institution should share more information about social activities and events.
- Consider a forum for students to utilize while abroad to communicate with each other and share their experiences. This could be led by the students while abroad.