

# Using Telescopic Observations to Mentor High School Students in STEM

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## ABSTRACT

Over the past two summers (2009/2010) the NASA E/PO Group at Sonoma State University (SSU) has sponsored local high school students in a summer science internship program at the University. The students, chosen from Sonoma County high schools in a competitive selection process, work in various STEM fields throughout the School of Science and Technology at SSU. The two interns sponsored by the E/PO Group each summer monitor active galaxies using GORT, the NASA/Fermi-sponsored robotic observatory operated by the Group. They are mentored in their projects by E/PO Group personnel and by SSU undergraduates who have experience with the telescope. The students learn about the sky, telescopes and the active galaxies they observe. They also learn how to make telescopic observations and how to reduce the CCD images obtained. Interns also participate in weekly meetings with other interns working on different projects around campus. At the end of the summer all the interns present their research results at a symposium held on campus. The symposium is attended by the interns themselves, their parents, their high school science teachers, and university faculty and administrators. The program has had a positive impact on how our interns view science, and specifically on their view of astronomy, as reported by the interns themselves in the first two years of the program.

**Keywords:** Education, STEM, Telescopes in Education

## 1. INTRODUCTION

The summer science intern program is a cooperative arrangement between the Sonoma County Office of Education (SCOE) and the School of Science and Technology (SST) at Sonoma State University (SSU), each of which provides partial funding for the program. SSU faculty are solicited every year for their willingness to work with a student over the summer and for a project suitable for a student intern. The projects range across the disciplines in the SST, from biology and nursing to computer science, physics and mathematics. The interns chosen undertake their projects during the summer between their junior and senior years. They are paid a stipend of \$1000 over the summer, for which they agree to work a total of 160 hours (roughly one month equivalent).

The NASA E/PO Group has sponsored two interns each summer. The students learn to use an automated queue system to submit observations to our robotic telescope, GORT, and to retrieve their completed observations. They are taught how to calibrate the images and to perform photometry on them. These photometric data go into a database of long-term light curves of active galaxies (AGN), part of the E/PO program for NASA's Fermi Gamma-ray Space Telescope.

Besides working with the telescope and data, the NASA interns are given background reading materials on astronomy and AGN. They have regular discussions with Group staff about the nature of the objects they observe, how their observations can be used to understand the objects better, and how their projects fit into the larger world of astronomical research. Since most of the high school students have not had an astronomy course, this summer experience provides an intensive crash course into astrophysical ideas, and from a very different perspective than they would get in a classroom.

In September the University hosts an evening symposium where the interns present research findings from their summer projects. Symposium attendees include the interns, faculty and administrators from the University and participating high schools, and parents.

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## **2. EFFECT OF THE INTERN EXPERIENCE ON ATTITUDES TOWARD SCIENCE**

One of the primary goals of the internship program is to increase the interest of high school students in STEM fields and to encourage them to consider STEM careers. While it is too early to know if the program is having that effect, we have attempted to measure our progress toward this goal. At the end of last summer (2009) we asked WestEd (the external evaluator for our E/PO program) to conduct interviews with our interns and with the SSU students and staff who worked with them over the summer. These preliminary results were encouraging. In the summer of 2009 the NASA E/PO Group had interns from two different high schools in Sonoma County, one in Petaluma and one in Santa Rosa. Both of the 2009 interns said that they had learned a lot about astronomy and how measurements are made and scientific projects undertaken. Both said that they had enjoyed the project and that their opinion of science and interest in it had improved and deepened over the course of the summer. All the interns come to the program with an interest in science, of course. One of our interns had not listed astronomy as her first choice, but she said she found the project extremely engaging and was pleased to have done the project with the telescope rather than the one she had initially requested. She had not realized before how interesting astronomical topics could be.

For the current summer (2010) we have two new interns. As this poster was being presented at the ASP Meeting in Boulder they were nearly through their summer internship, having only an additional two weeks left. Both interns were highly motivated and highly interested in physics and astronomy. These two students were part of a group from their high school that lobbied their teachers to allow them to create a science club at the school; they both attend Healdsburg High School. Their level of enthusiasm was clearly quite high, and their summer experience seems to have encouraged them even more. The following quotes were recorded by our outside evaluator during an interview with our 2010 interns at the end of their summer research experience:

This internship is the best job ever. You get to learn new things and do interesting work all at the same time.

I think this project would make most students more engaged in science.

Working with real professors was amazing. They have the best jobs in the world.

## **3. DEVELOPING A COHORT AMONG THE INTERNS**

The organizers of the intern program would like to develop a collegial feeling for the interns over the course of the summer, but this has proved difficult. The interns all come from different schools, and even different towns in Sonoma County. They work with different faculty members at SSU, sometimes in different parts of campus. To help them become acquainted there is a weekly lunch that interns and faculty mentors are encouraged to attend. However, participation in these lunches tends to decline over the summer. Perhaps this is not surprising given the diverse group of students and projects in the program. However, it is worth trying to continue to foster camaraderie among the students, as it is one of the valuable aspects of the university community. The only times the interns are otherwise all together is at a welcome reception held in the spring, and at the symposium held in the fall where they present their research results.

## **4. INTERACTIONS BETWEEN THE INTERNS AND SSU STUDENTS**

One of the positive aspects of this program is the opportunity for the high school students to interact with students at Sonoma State. The NASA E/PO Group generally employs a number of SSU students, both during the academic year and over the summer. Over the past two summers we have been fortunate to have a student who is familiar with the data reduction, and he has been the primary instructor for both the current and previous high school interns. He has said that the experience has helped him to better understand the data reduction process. "You never really learn a subject until you have to teach it" is a well-known adage to many an instructor, and it illustrates an additional benefit of the summer internships: The SSU college students benefit from their roles as mentors to the high school interns. And of course, the interns benefit from working with people who are closer to their stage in life and can give them a glimpse into the college world that they themselves will soon enter.

## **5. SUMMARY**

The high school science intern program run as a partnership between the Sonoma County Office of Education and the School of Science and Technology at Sonoma State University, now in its second summer, provides important opportunities for sharing of talent and educational resources. The high school student-interns gain unique experiences working in a research environment on scientifically viable projects. College students, in turn, benefit from their role as mentors to the high school interns. While it is still a young program, initial results seem to be positive. The program continues to attract more applicants than there is space to accommodate. Time will tell if it increases the proportion of Sonoma County high school students who decide to pursue STEM careers. Experiences with recent interns suggest it will. As they told our external evaluator, "We liked the project so much we created a rap to describe what we did."

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