About Projects for Stars, Sight, and Science

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One of the most desirable outcomes from SSS projects is students gaining a positive impression of "real" science and scientists. Project time is filled with opportunities for informal interactions. These are opportunities for lessons that science is a human endeavor with very human practitioners – and that there are no barriers to entry that our students cannot overcome. It is probably more important that our students learn these lessons well than that they are able recall the details of the Poggendorf illusion or stellar evolution in the HR diagram. It is useful to keep this in mind while leading your students on their project.

Obviously there is also science content in each of the projects. Although the designs below are fairly "ready-to-wear", there is plenty of room for your own ideas in them. Also, it is not unheard of to design your own, new project – or significantly modify an existing design – in consultation with the rest of the SSS instructional team, and particularly in the context of the Maui Professional Development Workshop. Don't underestimate the difficulty and time-commitment of design work, however.

In previous years, projects for SSS have largely consumed the final 2-3 weeks of COSMOS. For astronomy projects, there were (very roughly) 30 hours of official contact time and 2-3 students per project. Vision projects (again very roughly) had about 15-20 hours of contact time and 1-3 students per project. The students who do vision projects also do a small "side" project in astronomy which equalizes the time. The culmination of students' projects is an all-out professional (PowerPoint and all) presentation in front of their peers and instructors that will make you beam with pride.

This year, we are hopeful that we can schedule projects into just the last 2 weeks or so.

Here are quick blurbs to give you an idea what the existing project designs are. Obviously these don't detail everything that happens in 2 weeks of project time.

Visual illusions: Students learn about the eye-brain connection, in particular how the brain makes clever assumptions to assist the interpretation of visual data. Students then investigate several illusions which trip the brain up on some of those assumptions. Among others, students may investigate the Ponzo, Poggendorf, and Müller-Lyer illusions. They conduct experiments, testing their fellow students to explore how elements of the illusion (figure shape, line thickness, etc) affect how people are "fooled". They learn to analyze these experimental results, and present their projects. The experiments are done with some software which is simple to learn. Previous instructors are available for consultation.

Color blindness: Students learn about the eye's tricolor receptors, and the types of color blindness that result from the lack of any of those receptors. They learn how to test for these color blindnesses with the D-15, AO-HRR, and Ishihara tests, and test the SSS students and staff. They learn what the world looks like to people with any color blindness. Students present their projects. The tests are available, as are previous instructors for consultation.

Variable stars: Students observe a variable star system with a small telescope on campus or the 40" on Mt. Hamilton. They investigate the photometry to try to determine what sort of system they have. Tabletop photometry experiments and computer simulations help elucidate the lightcurves of various kinds of systems, and in the end students determine that they have an eclipsing binary star. Students present their investigation. The tabletop setup and variable star simulation software are in hand and simple to learn. This project is somewhat documented and its designer is available for consultation.

Galaxy morphologies: Students learn about galaxy properties. They investigate galaxy morphology, develop their own classification scheme, and learn about astronomers' classification systems. They learn about the connection between morphologies and colors. They observe galaxies with the 40" on Mt. Hamilton and produce color images from *BVR* images. Students present their project. Various solutions (IRAF, IDL, insert your favorite here) and algorithms exist for making color images, and expertise can easily be shared among all the astro projects on that point. This project has extensive documentation and available activities.

Globular clusters: Students learn about globular clusters. They take photometry of a cluster using the 40" on Mt. Hamilton and software (DAOPHOT in the past). Students also produce a color image of their cluster from *BVR* images using your favorite algorithm and software (see above in the galaxy project description). Students learn about stellar evolution in the color-magnitude diagram, and use their photometry to get the age and distance of their globular cluster. In addition, students may compare/contrast their work with the similar open clusters project, below. They present their project and results. DAOPHOT is not too hard to learn, and there are scripts around for doing this project. This project is somewhat documented and previous instructors are available for consultation.

Open clusters: Basically the same as the above project, but with a young open cluster instead of an old globular cluster. Students may compare/contrast with the globular clusters project. They present their project.

Astro project for vision project students: Students who do a vision science project also get a chance to observe with the 40" on Mt. Hamilton and produce color images from *BVR* data (see above in other astro projects for details). Students do not present this project (since they present their vision science work), so there is some additional freedom in this project. On the other hand, there is quite a bit less contact time involved. In previous years, the content of this project has been planetary nebulae (once) or galaxies (twice). There now exists a design for a somewhat free-form guided inquiry on galaxies for this project, but it is not set in stone that it must be that way. That design is almost well-documented and the designer is available for consultation.