OFF-CAMPUS SPACE GRANT UNDERGRADUATE RESEARCH INTERNSHIP PROJECTS
2008-2009

The following projects have been proposed by scientists at Lowell Observatory and the US Geological Survey who would like a Space Grant Undergraduate Research Internship student. All projects will be conducted at either Lowell Observatory or the US Geological Survey. If you are interested in one of these projects, please contact Dr. Barlow (room 207) who can give you more information and the contact person for the project.

Lowell Observatory:

(Directions: Lowell Observatory is located on Mars Hill just west of downtown Flagstaff. From NAU you go north on San Francisco, turn left on Route 66, and go straight (onto West Santa Fe Avenue) as Route 66 curves to the left under the railroad tracks. Follow West Santa Fe past Thorpe Park (on the right), then follow the signs up to Lowell Observatory.

1) LOWELL OBSERVATORY INSTRUMENT SYSTEM (LOIS)

Lowell Observatory Instrumentation System (LOIS) is a modular instrument control system built on a core written in C with a TCL/Tk layer for scripting and Graphical User Interface functions. LOIS currently operates a wide variety of CCD cameras at Lowell and elsewhere. We are in the process of re-architecting LOIS to a more modern framework using a Java GUI for the front end and keeping the core functions written in C and TCL. Communication between the front and the back end is done via a messaging system. Separation of the GUI from the core instrument control functions provides a more modular and robust design. The Java GUI is based on the eclipse platform (www.eclipse.org) with a plugin architecture allowing independent development of individual pieces of the GUI.

One of the pieces intended to be part of the GUI is a plugin for a quick look at the data during the observation. This module is intended to include the following functions:

- Display of the data in real time.
- Display interactive functions such as cursor position and pixel value, zoom and centering, contrast scaling and color table adjustments, and markers.
- Quick and simple analysis of the data such as determining line profiles; point spread functions; image position, size, and brightness.

We don't intend to write all the software from scratch since we can leverage existing open source libraries. The project will involve researching existing open source software, integration of chosen libraries along with writing custom software.

The needed qualifications for participation are:

- A good understanding of any of the modern operating systems such as Linux, Mac OS X, Solaris.
- Proficiency in the Java language.
- Interest in user interface design.

2) STELLAR GYROCHRONOLOGY

The student would install, integrate, and automate various pieces of astronomical software in a unix/linux setting, aimed at deriving precise time-series photometry for stars in open clusters for "gyrochronology." The project would also involve writing software to connect the inputs and

outputs of the relevant software, including shell scripts, finding the relative merits of different approaches to the same problem, and testing the results for accuracy. The software involved is IRAF, DAOPHOT and related programs, ISIS, IDL, CLEAN, and other time-series analysis software. Finally, we will use the product to analyze astronomical time-series data for an open cluster, and publish the results. The project requires some prior familiarity with unix/linux, some programming experience in this setting, and a student who has the initiative to identify and solve problems.

US Geological Survey:

(Directions: From NAU, take San Francisco north to the intersection with Forest (by the hospital). Turn right onto Forest and follow it up the hill (where it turns into Cedar). You will see a brown sign for Buffalo Park and the USGS—turn left onto Gemini Drive. The USGS is on the left before you get to Buffalo Park.)

1) SAVING SPACE: PRESERVING AND PROMOTING HISTORIC NASA DOCUMENTS AND IMAGES IN THE USGS ASTROGEOLOGY BRANCH

The United States Geological Survey (USGS) Astrogeology Branch in Flagstaff, Arizona, has played a key roll in NASA's space projects since the early 1960s. In addition to lunar and planetary mapping and spacecraft landing site selection, Astrogeology personnel trained Apollo astronauts and tested advanced exploration equipment, such as planetary rovers. In December 1972, USGS geologist Harrison Schmitt became the first professional scientist to walk on the moon. The story of Astrogeology's involvement in space exploration is chronicled in hundreds of documents and photographs stored in Astrogeology's Regional Planetary Information Facility (RPIF). The Space Grant student intern would assist the RPIF Manager in preserving and improving access to Astrogeology's archival holdings. This opportunity is ideal for students interested in archives, libraries, space history, science & technology history, or local/regional history.

2) SECONDARY CRATERS ON MARS

The proposed project would consist of mapping secondary crater chains within the northern plains of Mars and backtracking these chains using GIS-based spatial statistics to locate source craters and then applying these findings to the stratigraphic record of Mars. The effort is anticipated to culminate in an assessment of whether secondary crater chains can be reliably used to sub-divide the Amazonian period (post-Vastitas Borealis) of Mars' geologic record. Such sub-division is similar to the method by which lunar surfaces are subdivided. With Mars, however, using crater chains and their morphologies, we can expect to more reasonably assess cross-cutting relationships because these chains have contrasting morphologic signatures depending on their location relative to latitude and elevation as well as interpreted geologic units. The work would consist of researching styles of GIS-based spatial statistics and investigating the means in which to implement these in the Arc GIS format. The student would first be delineating crater chains (as polygons), identifying individual craters within these chains (as points), and characterizing the crater chain morphology. This portion of the project would entail some tedious and routine digitization of small craters. The second part of the project would be using the digitized secondary crater data set and reducing these to long axes, propagating these axes around the globe, and identifying statistical intersections of the propagated "great-circles". The project falls within the umbrella of two PG&G-funded geologic mapping projects, one regional in scale and one global.

The anticipated student would be one who is comfortable with guided research but who also can working independently, one who has some GIS knowledge, and is familiar with geologic and stratigraphic principles. Someone with some programming experience could be useful but not necessary. The project can be adapted to the selected student.