



# A Group-Project Based Course in Observational Astronomy

David Mitchell

California Polytechnic State University

Gordon Research Conference

Colby College, July 2012

**CAL POLY**  
SAN LUIS OBISPO



## Abstract

ASTR 444 is an observational astronomy course at Cal Poly where the focus is on a group project, in accordance with Cal Poly's "Learn by Doing" motto. Students apply for telescope time, acquire their own data at the campus observatory, reduce and analyze all their data, and present their results at a class poster conference.

## Lab

In addition to three one-hour lectures, students meet weekly for a 3-hour "lab" section, held in a computer lab. They have directed activities that develop the following skills:

- Using Starry Night
- Basic unix commands
- Using online astronomy resources such as Simbad, Aladin, and Horizons
- Choosing their science targets and planning observations
- Using IRAF

## Observing

Students use the Cal Poly Observatory to acquire their science data. After one night of training, they apply for telescope time and are assigned 1-3 nights.

Students are responsible for finding their target objects, operating the telescope and camera, and closing down when they are finished, all with the oversight of a TA.

**Observational Verification of the HD189733b Planetary Transit**  
Astronomy 444: Observational Astronomy  
Jordan Tweeddale, Karsten James, Robert Campbell

**Background**  
In order to verify the transit of HD189733b differential photometry was used to generate a light curve. Differential photometry involves measuring the relative change in magnitude of a target star as compared to a companion star. The magnitude of the companion star which remains unaffected by transit will be equally affected by external conditions and serve as a baseline for comparing how the transit affects the magnitude of the target star. As the planet transits the target star it will block some of the incident light, causing a corresponding decrease in the magnitude of the star. This decrease in the magnitude will present itself as a corresponding increase in the difference in magnitude between the companion and target stars also known as the depth of the transit. In addition, the length of the transit can be calculated by measuring the time for which the differential magnitude is changed by the transiting planet.

**Observations**  
Observations of the transit of HD189733b were made with a LX200 12 inch Meade Schmidt-Cassegrain telescope using a Kodak KAF-3200ME CCD. The principal target was HD189733 with the companion star HIP 98233.

**Results**  
Differential photometric analysis produced the following light curves for the transit of HD189733b. These light curves show the transit of HD189733b across its host star. When calculating the depth of the transit the level part of the light curve prior to the obvious onset of vignetting was used.

**Conclusion**  
The results of the differential photometric analysis were compared to several papers and reports on transit of HD189733b. Despite problems, the fundamental characteristics of depth and length are in good agreement with previously published values.

**References**  
1. The first published observation of HD189733b. *Astronomical Journal* 127, 3001-3002 (2004).  
2. The first published observation of HD189733b. *Astronomical Journal* 127, 3001-3002 (2004).  
3. The first published observation of HD189733b. *Astronomical Journal* 127, 3001-3002 (2004).

## Poster Conference

Students present their project results at a class poster conference at the end of the quarter. Other students and faculty are invited to attend and ask questions, and vote on the best poster.

Through this process, students have a real sense of achievement and pride, and are excited to share their work with others.

## Student Projects

Students reduce and analyze their data with IRAF. Most of the projects are time-series photometry of variable sources.

Projects include:

- Extrasolar planet transits
- Eclipsing binary stars
- RR Lyrae stars
- Asteroid rotation periods
- HR diagrams of open clusters

**Experimentally Verifying the Light Curve and Period of the Eclipsing Binary Star System: RT Andromedae**  
Alexander Chin, Jennifer Rushing, Shaun Sternstrom  
ASTR 444: Observational Astronomy Research Project

**Background**  
For our research project, we experimentally verified the period and light curve of an eclipsing binary star system. Eclipsing binaries are a special type of variable star. Each orbit, one star passes in front of the other, causing a regular dip in the star's brightness. Each orbit, the other star passes in front of the other, causing a regular dip in the star's brightness. Each orbit, the other star passes in front of the other, causing a regular dip in the star's brightness.

**Observations**  
The observations were taken on two nights, 10/20/2011 and 10/27/2011. The observations were taken using a 12 inch Meade Schmidt-Cassegrain telescope with a CCD camera. The observations were taken using a 12 inch Meade Schmidt-Cassegrain telescope with a CCD camera.

**Analysis**  
The data was analyzed using IRAF. The data was analyzed using IRAF. The data was analyzed using IRAF. The data was analyzed using IRAF.

**Results**  
The results of the analysis show that the period of the system is approximately 2.8 hours. The results of the analysis show that the period of the system is approximately 2.8 hours.

**Conclusions**  
The results of the analysis show that the period of the system is approximately 2.8 hours. The results of the analysis show that the period of the system is approximately 2.8 hours.



Materials for this course are available at:  
<http://astro.calpoly.edu/dsm>