Photometric analysis of close eclipsing binary stars

The mass of a star is a fundamental property governing its evolution. Binary stars provide a means to obtain stellar masses accurately when the orbital period and velocities of the components can be determined. Eclipsing binaries are particularly important as the inclination of the orbit to our line of sight can be determined from the light curve, and therefore allow calculation of the absolute velocity when combined with radial velocity data from high resolution spectra. Many southern eclipsing binaries have not been studied since discovery and spectra are not available. However, from a detailed studies of light curves in two or three filter band passes we can derive information about the stellar sizes, temperatures, luminosity and evolutionary state. The evolution of stars in close or contact binaries differs from that of single stars.

We can obtain sufficient data in 2 – 4 nights of observation for a contact binary with a period in the range of 7 – 12 hours.

This project will provide experience in
1. planning and executing observations of a contact eclipsing binary with a CCD camera attached to a telescope in a small observatory
2. selecting reference stars for comparison — similar colour index and magnitude to the variable
3. calibrating images (dark frame subtraction and flat field correction) and analysing the images with photometry software
4. preparing light curves and checking ephemeris elements.
5. Transform magnitudes to the standard Johnson system using images from a Landolt southern region
6. Test assumptions of the binary properties with astrophysical modelling.

Resources
Charts and variable star catalogue links:
http://www.aavso.org/vsx
http://www.aavso.org/vsp

Free software
Introduction to CCD photometry of variable stars:
http://www.aavso.org/ccd-observing-manual

CCD image reduction and photometry: C-Munipack v2
http://sourceforge.net/projects/c-munipack/files/

http://phoebe-project.org/

Requires use of the Python programming language — see http://phoebe-project.org/?q=node/24