STUDENT PROJECTS WITH CCDs

Priscilla J. Benson
Wellesley College
Whitin Observatory
Wellesley, MA 02181-8286

Received: February 19, 1993

Abstract

Observers with inexpensive CCDs on small telescopes without sophisticated software can still do worthwhile science.

New users of CCD cameras should not expect to be able to do too much at first. We have all heard about how wonderful CCDs are, but most advertisements don't prepare you adequately for the realities. Many commercial CCDs do not come with a provision for introducing a filter between the sky and the CCD chip. For most telescopes, the field of view with your CCD camera will be much smaller than with your eyepiece. This means you need to have excellent pointing and tracking capabilities. Lastly, CCD images take up a lot of space on your computer disk. If you plan to do photometry, each night you will need to take several "flat fields" for each filter you plan to use, and also to take several bias and dark frames (East 1991).

CCDs are most sensitive in the red part of the spectrum. This means that if you do not use filters, your observations will be incompatible with standard visual observations, photographic observations, and photoelectric observations. You cannot use your old filters designed for use with older technologies either, because many of them assumed low red response and allow red leaks in the blue and visual filters.

As a first step, I recommend using your new faint-light sensitivity for discovery projects. These projects do not need filters or fancy, expensive photometry software. Supernova searches can be exciting and scientifically useful. Choose a group of galaxies to monitor on a regular basis. It is most useful to observe galaxies which are rising in the east so that if you do detect a supernova, scientists can observe it for a reasonable length of time. If you are taking lots of pretty pictures with your CCD camera, be on the watch for asteroids in your field. You may note trailing of a single object in your longer exposures, or an object which has moved in a series of images.

Another discovery-type project is watching for the eruption of cataclysmic variable stars. The AAVSO can supply you with a list of recurrent novae and/or cataclysmics as well as finder charts with appropriate comparison stars.

Another project which can be done without filters is determining the timing of eclipses for eclipsing binary stars. There are many eclipsing binaries whose periods are not well determined or for which the time of eclipse changes. Observations of eclipses are good exercises for students because the students can see changes in a single observing session and can be assigned the task of plotting a light curve.

If you obtain a V filter, you should be careful that it has the appropriate red blocks (the standard Johnson V filter that you may have purchased for photoelectric photometry is not appropriate to use with your CCD camera). With this filter you can take advantage of your increased sensitivity to fill in the minima for fainter AAVSO program stars. Magnitude estimates can be made from your computer screen if you have a sufficient field to see the current AAVSO comparison stars. This is mostly feasible only with shorter focal length telescopes and/or with a reducing lens. The AAVSO will gradually be obtaining photometry on closer comparison stars using B, V, R, and I filters for use with small-field-of-view CCD systems.

If you have filters, appropriate software for doing photometry, and a telescope of appropriate focal length to have star images several pixels across, you can monitor smaller amplitude variable stars, supernovae, planets, and asteroids. This can be done with differential photometry. At this time, the AAVSO is not set up to handle the archiving of multi-filter CCD photometric data, but hopes to be soon. It may be difficult to merge data taken on different telescopes with different filters, CCD cameras, and telescopes. The CCD committee of the AAVSO is currently trying to test whether or not this will be a problem.

Reference

East, G. H. 1991, *J. Amer. Assoc. Var. Star. Obs.,* 20, 130.