THE SKY OVER CRYSTAL LAKE

George S. Mumford
Tufts University
Physics Department
Medford, MA 02155

Received: December 2, 1991

Abstract

Software for making photometric observations in a simulated sky is described.

One of my students has just discovered a nova! It appeared (will appear?) in the December 2068 sky over Crystal Lake Observatory, Melbourne, Florida. As the first to be spotted that year, it will be designated Nova 2068a. What's going on? Actually, this woman discovered the nova (and maybe she was the 500th, or so, person to have seen it) while viewing the monitor of a Macintosh on October 18, 1991, at about 3:00 pm. The sky over Crystal Lake, you see, is totally fictitious and is brought to us through the programming wizardry of Craig Young with his simulator program TS-24. TS-24 simulates the sky as viewed through a 24-inch Cassegrain reflector with an f/16 optical configuration.

If you have ever wondered how to get a daughter or son, grandson or granddaughter involved in your passion for variable star observing, here is a way. The software, available for IBM, IBM compatibles, and Macintosh computers provides the convenience of "observing" at any time of day from the comfort of home or office.

The piece of sky that is represented is some five degrees square. While the right ascension and declination of this patch refer to a region in Gemini, there is no correlation between the real and fake areas. The approximately 8000 stellar images are representative of a sampling of stars in our galaxy. Included are hot stars, cool stars, dwarfs, giants, and variables: RR Lyrae, Cepheids, long periods, irregulars, fast novae, and eclipsing binaries. Coordinates for some are provided in a workbook entitled *Variable Stars,* as was true for the nova, but others are to be located by you, leading to the thrill of discovery.

The telescope is equipped with four eyepieces of focal lengths from 12.5 to 80mm. Each contains cross hairs that may be illuminated. Auxiliary instrumentation includes a photon-counting photoelectric photometer that may be used in either a manual or an automated mode and a CCD (Charge Coupled Device) camera. Observations may be carried out with standard U, B, and V filters.

Your night (day?) begins at Crystal Lake when you specify the date for your observation, subject to a couple of constraints. The telescope was placed into service on November 1, 1989, and will be usable until February 28, 2088. For the best views of the available sky, operation is restricted to four hours each night between the first of November and the end of February. With the date set, the weather forecast must be checked or the dome can't be opened. Crystal Lake maintains a separate instrument that monitors the sky and records changes in seeing in addition to changes in the temperature. With a "crystal clear" sky and a seeing of 9.0, open the dome. If the night is rainy, the dome remains closed. However, you can reset for the same date if you wish as the weather system does not remember.

That night (November 1, 2068) and for the next few, my student searched for Nova 2068a. The search began by aiming the telescope to the given position which was stored into memory for use on other dates. A CCD exposure was taken, the

dome was closed, another date was chosen, and another CCD exposure was taken, and so on until December 15, 2068. The CCD pictures were processed consecutively and viewed on the monitor. A saturated image that had not previously been recorded appeared in the December 15 photograph. Clearly this represented the nova.

Stars in the TS-24 sky twinkle, and extinction by the earth's atmosphere has to be taken into account when one is determining magnitudes and colors. An automatic data reduction program, however, takes care of this automatically and light and color curves of the stars you observe may be displayed directly on your monitor.

With the software a beginner will learn a bit about the operation of a telescope, more about the procedures involved in making photoelectric observations, and something about CCD photography. A major emphasis in the workbook is the obtaining and analyzing of data and interpreting light and color curves of variable stars. In addition, one may discover asteroids, estimate the number of stars in this fictitious sky, establish a color-magnitude diagram for a galactic star cluster, and assign spectral types to stars from knowledge of their color indices.

Members of the AAVSO should find this software not only fun to play with on a cloudy night - it's an excellent form of computer game - but useful in helping to introduce others to certain aspects of observational astronomy. In fact, if the neighborhood school has no one experienced or knowledgeable enough to use TS-24, a local astronomy club might have members volunteer to teach students something about our universe and thereby make a contribution to overcoming science illiteracy.

BUILDING A HOMEMADE CCD CAMERA

Paul Boltwood
1655 Main Street
Stittsville, Ontario
Canada K2S 1N6

Received: November 8, 1991

Abstract

An amateur astronomer relates his experiences while building a semi-professional grade photometric CCD camera. He has produced a successful camera but does not recommend that most other amateurs try to build their own CCD camera because the time and monetary expenditures are too great.