Educational Activity Packages in Support of IDA Program Goals

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Abstract: The International Dark-Sky Association (IDA) is involved with influencing public policy to limit the effects of artificial lighting on the night sky. A long term educational program, commencing in elementary school and extending through post-graduate continuing education, is a potentially valuable adjunct to the tools IDA employs to achieve its goals. Such a program can educate students in subjects as varied as mathematics, physical and environmental sciences, engineering and political and social sciences. We have begun to develop a suite of such educational activities that are addressed to a broad age range, and which take advantage of some unique astronomical data sets relevant to issues of night sky brightness. We present here some background to this effort, a list of some of the activity areas under development and an example of one of the software tools and its application for one set of the activity packages.

The Observations: The Moving Object and Transient Event Search System (MOTESS) is an automated, scan-mode, three telescope observatory located in Southwest Tucson, AZ. This is the prototype for a larger network of automated telescopes: the Global Network of Astronomical Telescopes (GNAT). For this project images from the GNAT photometric image archive were used:

- 48 arcmin x 360 deg field of view
- FITS format images
- pointed at prime meridian
- fields at +02° and +03° declination
- same area of sky observed each night.

Methodology:
- Develop an activity goal.
- Develop software tools for making/analyzing measurements.
- Assemble image sets for students to measure and study.
- Prepare a student guide to the activity.
- Prepare a teacher's guide for the activity.
- Beta test the activity with professional scientists.
- Beta test the activity with grade appropriate teachers.
- Beta test the activity with students.
- Assemble and distribute the final package.

Sample Activities:
- Monthly lunar cycle effect on sky brightness/stellar visibility.
- Annual changes in night sky brightness.
- Year-to-year changes in night sky brightness.
- Effects of air pollution and clouds on night sky brightness.
- Tracking effects of artificial lighting on night sky brightness.
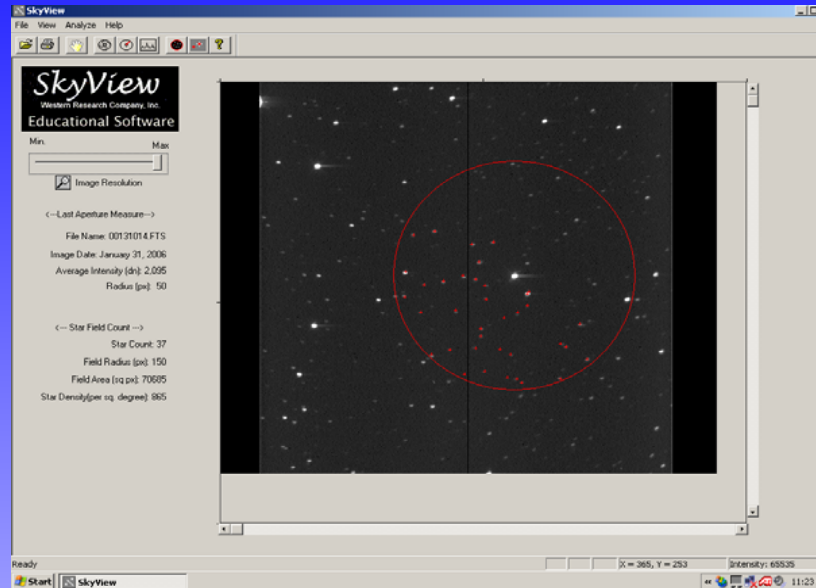
SkyView: SkyView is one of a series of software packages which has been developed by Western Research Company, Inc., in collaboration with GNAT, to assist students at several grade levels to measure and interpret astronomical images.

In the configuration shown here, students can measure and record both the average brightness of the background sky, as well as obtain a normalized measure of the number of stars which are visible in a selected area.

These data can be plotted, either using an exported Excel™ file, or, for younger students, drawn as a graph or histogram, in order to show the effects of sky brightness on the visibility of stars in the night sky.
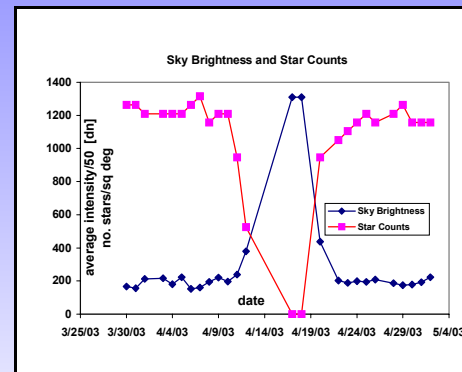
At left is an example of a graph of typical middle or high school student measured image data showing the inverse relation between sky brightness and stellar visibility, generated using SkyView and GNAT/MOTESS FITS images.

These educational activities are prepared in several different versions to appeal to students of varying ages and capabilities. For use in elementary school, the activity goals are deliberately generalized to allow teachers to customize the activity to fit their own state standards.

Through this program, students can not only learn about specific issues relevant to the IDA mission, but they learn invaluable lessons about how scientists in many specialties collect, measure and analyze data, and how they draw conclusions from those efforts. For older students, emphasis is also placed on understanding the nature and sources of errors which occur in data collection and analysis, and how this should lead to skeptical interpretation of information.