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ASTRONOTES

Spotlight on the Sun

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Images of the Sun taken with an H-alpha filter (narrow band red filter, centered on the 6563-Angstrom emission line in the hydrogen spectrum) offer unique glimpses of features of the solar chromosphere, which are not visible in "white" light. Students can see sunspots, flares, plages, filaments, and even granulation. Digital images taken at the NOAA Solar Observatory in Boulder, Colorado are among the many types of images available from the ASTRORAAP bulletin board and are a source of enrichment for any physics curriculum.

The Astrophysics Group at the University of California, Santa Barbara (UCSB) maintains an educational bulletin board (BBS) from which callers can download a wide variety of digital CCD images, including daily H-alpha images of the Sun. The ASTRORAAP BBS is part of the Remote Access Astronomy Project, funded by the National Science Foundation and the Center for Particle Astrophysics, NASA, and the University of California. The bulletin board is currently maintained by undergraduate students in our physics department. The solar images are downloaded daily from NOAA via INTERNET, and converted to standard FTS format before being posted on the bulletin board. Several month's worth of current images are kept "on line"; older images are archived, but can easily be retrieved upon request. ASTRORAAP began downloading daily solar images in July, 1991.

We also offer an image-processing activity that uses daily observations of sunspots to calculate the rotation rate of the Sun at the equator. Students observe the motions of sunspots across the solar disk in images separated by 24 hours and calculate the rotation rate for the solar equatorial regions. When high-latitude sunspots are visible, students can calculate the rotation rate for these features and compare their results with the values they obtained for the equatorial regions.

The "sunspot lab" also offers background information on how the images are obtained, as well as references for further reading. The appropriate equations necessary for calculating the actual positions of sunspots on the spherical Sun from their pixel locations on the flat image are provided. Teachers can download this file from the curriculum file area of the bulletin board and tailor it to suit their particular needs.

The solar images are about 100 kilobytes (compressed), and take from one to three minutes to download, for baud rates of 9600 or higher. Once downloaded, the images must be decompressed with the program PKUNZIP, which is also available on the ASTRORAAP BBS, as well as almost every other bulletin board.

The number of the ASTRORAAP BBS is 805-893-2650. To call, set the data format in your calling software to no parity, 8 bits, 1 stop bit ("N-8-1"). First-time callers are given access to all the images in the public areas, including the NOAA daily solar images. From the Main Menu, type F for the Files Menu; type L to see a list of the available file areas. The solar images are located in the Daily Solar Images file area, which is normally file area 4.

Other images of interest include daily weather images taken by the GOES satellite, images taken with UCSB's atomic force microscope, GIF images from Compuserve, Voyager images, infrared images of our own galaxy, spectacular visible-light images of galaxies and nebulae, utility programs, and image processing activities for high-school physics classes. ASTRORAAP supports all major file transfer protocols.

The Remote Access Astronomy Project at UCSB developed out of a desire to improve astronomy education at the undergraduate level. It now includes a remotely operated telescope with cooled CCD camera, local area network for users at the university, and the ASTRORAAP bulletin board through which outside users can access the large database of images. The project began four years ago when a team of undergraduate students from our physics department began constructing the camera interface, filters, weather station, and weather-proof dome for the telescope. The students also wrote the computer programs to operate the telescope, dome, and weather station.

During the summer of 1990 a bulletin board and modem were installed to extend the use of the growing database of images to high-school users in California. Eventually the use of the remote optical telescope will be extended to participating high schools as well. The intent of introducing the project into secondary schools was not simply to introduce new data and technology into individual classrooms, but to create a network of science teachers and students who share ideas, curricula, and data on an ongoing basis. The typical secondary classroom is an isolated entity, but as part of an educational network can become a classroom without walls in the electronic sense.