## **Remote Telescope Results**

### **Retrieving Your Data**

The data we have available in response to your requests are on the server website at

```
http://sharedskies.org/archive/private/p108<sup>[1]</sup>
```

You may be asked for a username and password, and if so enter

- User: astrolab
- Password: asteroid

all in lower case.

Look for your name, click on the link, and the page will take you to data relevant to your request. Some of the results we have for you were done in the last few weeks, and others are from our long term archive. Usually the most recent images are the best. However, in the case of planets or comets, each date will offer something different.

Find an image file and right click on the name. Save the data to your own computer for use later. The "fits" files are astronomical image data types and usually very large so download will be slow. We recommend using Aladin to view all the astronomical images, although ImageJ is generally useful too. You may find that ds9, which shows only astronomical FITS images, is a tool you like as well. Use what works best for you.

#### **Using ImageJ**

ImageJ allows you to view files of all types. It is particularly good for looking at tif images and also useful for some fits files. You can experiment with it -- the difficulties of software are part of the lab experience!

ImageJ is installed on the computers in the astronomy lab. If you prefer, to run a version of ImageJ on your notebook you may click below to go to the link:

http://www.astro.louisville.edu/software/astroimagej/imagej<sup>[2]</sup>

You have a choice of downloading and installing the software, or running from our server. Either way, once imagej has started select "File" from its menu, "Open", and find the images you have downloaded. You might review your work on the Saturn unit to see what the different controls will do.

While ImageJ offers many image processing options, and allows you to build color images from individual images in each color, this easily installed version is not well suited to take full advantage of astronomical "fits" images, particularly those with a celestial coordinate system embedded in the file. Images of that type on our server have "wcs" in the file name and the extension ".fits". If you want to explore them, use Aladin or SAOImage ds9.

### Using SAOImage ds9

SAOImage DS9 is an astronomical imaging and data visualization program that is widely used for research. It is installed on the lab computers and you may find it the best way to view and measure astronomical FITS files. It is free software, and can be installed on Mac, Linux and Windows computers if you prefer to run it on your own. It is not a web application, and the files you use it with must downloaded to your computer first. For more information if you are working outside the lab, go to this link

http://hea-www.harvard.edu/RD/ds9/<sup>[3]</sup>

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#### **Using Aladin**

Aladin is ideal for viewing most fits files because it handles astronomical coordinates, and also allows you to overlay images from different sources. However, it does not do image processing particularly well, and if you want to modify an image a lot you may need ImageJ. The link to Aladin is

http://www.astro.louisville.edu/software/aladin/<sup>[4]</sup>

Use "File" and "Open local file" in the Aladin menu to view an image you have already downloaded. You may install Aladin on your computer. It is safe, free, and reliable.

#### In The Lab

Although the software will run on your notebook or home computer, and the data are available over the network, we ask that you do the work in the lab so that the assistant can help, and you can discuss your ideas with other students. You must submit your results in the lab that day.

#### What to Do

Now that you have the software and the data, you are probably wondering what to do with it. Recall your request and what led you to ask for the data, then see if you can answer your questions from what is available. You might compare the data with what you can find on the Internet too, perhaps in Wikipedia or an image search, but remember that the focus should be on the data you have requested from our telescopes. It will be quite different from the pretty pictures you may get from the Hubble Telescope or press releases from ESO.

This unit is an open ended inquiry. Start with the data we have provided and see where it takes you. Describe what you did and your conclusions in your response. Remember that typically discovery-based science generates new questions, and you may suggest other inquiries as part of your conclusion. Even if you work in small groups in the lab, each student must submit their own work at the end of the lab period.

#### References

- [1] http://sharedskies.org/archive/private/p108
- [2] http://www.astro.louisville.edu/software/astroimagej/imagej
- [3] http://hea-www.harvard.edu/RD/ds9/
- [4] http://www.astro.louisville.edu/software/aladin/

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