

OUTSIDE LAB 3: Astronomical Photography

OBJECTIVE: *To image the moon and planets using a digital camera.*

DISCUSSION:

In this laboratory you will replace the eyepiece of the telescope with a digital imaging chip. This will basically transform the telescope into a camera with a very long telephoto lens. For this, each group will need one laptop with an installed copy of AviStack2 and EZPlanCap and the camera driver software. The laptop must have at least 10 GB of free disk space. Create a New Folder, where you will store all your files in an easily accessible location on your computer.

All software required for this lab can be found at
http://physics.wfu.edu/lab/109/lab_software.html
Your TA will assist you in downloading and installing all the software required.

The camera you will be using is the Orion StarShoot 5MP Solar System Color Imager. It's basically a high resolution web-cam modified to fit in a telescope's eyepiece holder. It has a resolution of 2592×1944 pixels and shoots video with up to 15 fps.

SETTING UP THE TELESCOPE:

First, inventory the items in your accessory case. Note any missing items.

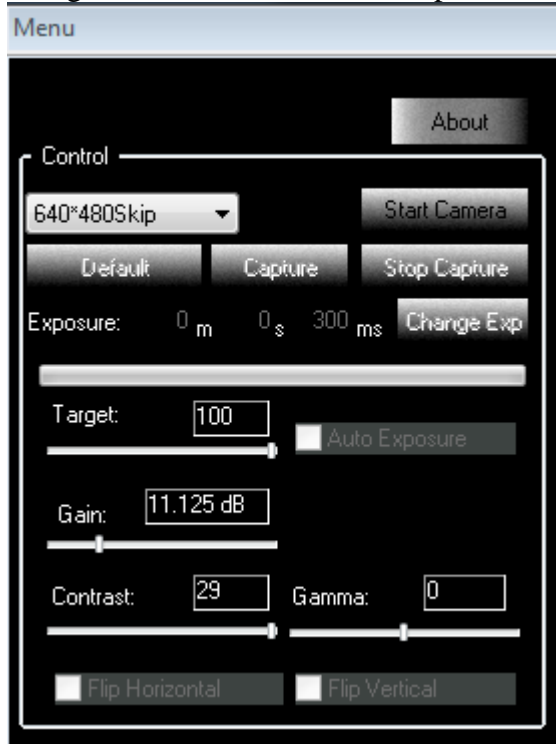
Accessory Kit # _____
1 LED battery flashlight
32 mm Plössl lens and 2 caps
25 mm Plössl lens and 2 caps
12.5 mm Plössl and 2 caps
2X Barlow lens w/ screw and cap
Red, Green, Blue, and Gray filters
1 electronic eyepiece
1 USB cable (under the flashlights)
1 StarShoot camera

Next, set up and align the telescope as you did for Outside Lab 2.

Then, point the telescope at one of the objects you will be imaging this evening. Carefully center the image in the eyepiece. If any moons are visible, sketch their location relative to the planet; they may be too dim to be visible in the final image.

SETTING UP THE CAMERA:

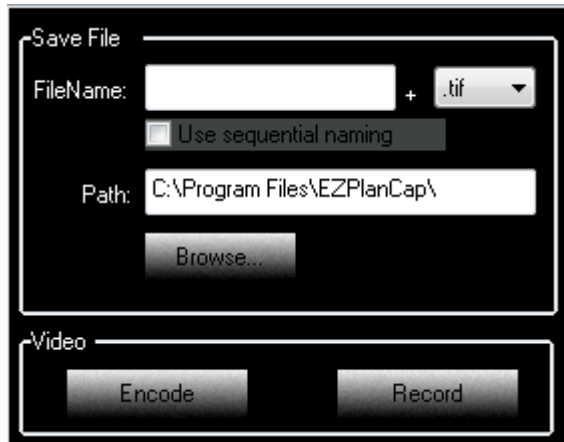
1. Connect the digital camera to your laptop with the USB cable.
2. Launch EZPlanCap
3. Select the drop down menu under control which says 2592 × 1944 and change this to 640 X 480Skip.



- 4.
5. Click Start Camera
6. Point the camera at a light to ensure it is capturing images.
 - a. If you screen is only black or grey adjust the Gamma to 70 and Adjust the Contrast to 50.
 - b. If the camera is still not operating, ask your TA for help.
7. Select the box next to Auto Exposure. (Exposures may be many seconds long so be patient)
8. Verify that the object is still centered in the eyepiece.
9. Carefully remove the eyepiece and replace it with the camera
10. Adjust the focus until you see a sharp image of the object on the screen.
11. Steer the telescope to center the object on the screen.

CAPTURING IMAGES:

1. Select the bottom right tab picture, select the folder and file name for saving the image or video.



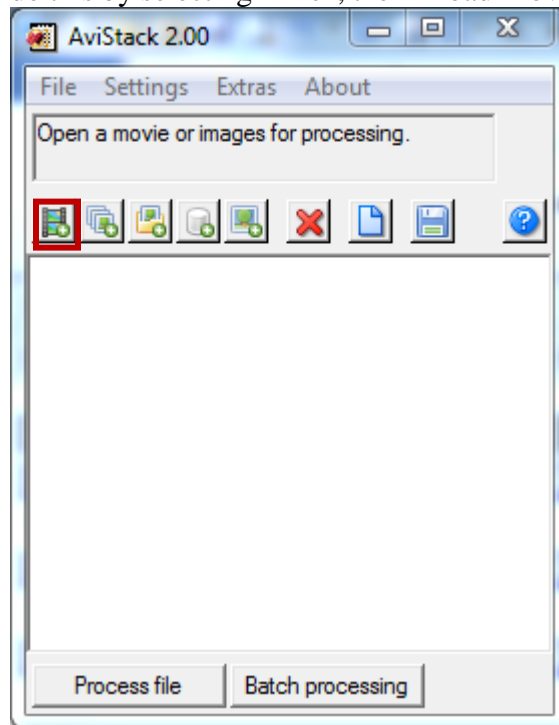
2. Click Use Sequential Naming.
3. Click “Browse” and select the folder you created earlier.
4. Select **Record** button under video. Now you are recording a video.
5. After about 20 seconds, select **Stop**.
6. From the folder you selected check the video to verify its quality.
7. You may need to make a new video if you can see no details in your video, by adjusting the gamma and contrast as well as manually adjusting the exposure.
8. If you wish, you can attempt to use the Barlow 2X in conjunction with the camera to make a larger image. (this works well for planets).

Once you have successfully captured a short video of the first object, move on to the next object. *Make sure to rename the file!*

IMAGE PROCESSING

The video you recorded of the object is basically a sequence of still frames. It may seem strange to make a video of a scene that is not moving; however, there is a very good reason for this. The original images you made suffer from a number of problems. Turbulence in the atmosphere causes blurring waves to ripple across the object. Also, the object jumps around from frame to frame throughout the video. Finally, there may be digital noise from the camera itself. By taking all of the frames from the video and averaging them together, you can produce a single high quality photograph. This is what AviStack2 does.

1. Open AviStack2 on your laptop.
2. Click AviStack2 and then click “Click to Continue” and finally check “accept the terms and conditions”.
3. Select the movie from your file folder by pressing the “Add Movie(s)” button which is far left below “Open a movie or images for processing.” You can also do this by selecting “File”, then “Load Movie(s)” from the dropdown menu.



4. Then choose the drop down for “Settings, Processing and All Automatic” from the drop down menu.
5. Click on the file in AviStack2 and then press “Process File”.
6. Select Okay once it is done.

When that process is finished, you will be presented with your final image. You can open this image in any image viewing software you prefer from the folder you saved it in.

IMAGE ANALYSIS:

Morphology of planets

Look at the details of the planet itself. What features can you identify? Atmospheric bands? Polar caps? Surface features? It may be helpful to adjust the color saturation to bring out detail.

Morphology of the Moon

Take a long, hard look at the image. What features can you identify? Look for craters, maria, mountains, rilles, rays, etc. A map of the moon will be provided to help you identify features.