

Texas Tech University Department of Physics & Astronomy
 Astronomy 2401 Observational Astronomy
 Alternative Lab Accessing and Processing Hubble Data

Introduction:

There are no clouds¹ in space! In tonight's lab, you are going to access the Hubble Legacy Archive (HLA) and make nice color images of some celestial objects. All NASA space telescope data is required by law to be made available to the public. This means there are vast database full of astronomical data that you can make use of as an astronomer. You can even apply for research funding to use archival data. Many astronomers make careers out finding new results in archival data. Tonight, though we will just make some pretty pictures.

Objectives:

There are three principle objectives for this laboratory session.

- (a) To become familiar using a public database that contains real astronomical data.
- (b) To practice your data reduction and image processing skills.
- (c) To put a cloudy night to good use.

Procedure:

You may need to refer back to the previous labs we have done in the past to complete this lab.

First, go to the HLA <http://hla.stsci.edu/hlview.html>. One you are there, do a search for ARP 147, a really cool pair of interacting galaxies. Something like this should be the result:

ID	RA	DEC	Level	Target	Detector	Aperture	Spectral ID	Microscan	Exposure	Duration	Dataset	Preproc	ViewRaw
03111831 011851.2	147.00000	18.51250	5	WPC2	F450W	32		8800	2088-10-27 13:02:13	11:00	hla_11802_74_wpc2_306w_wf	11802	11802_74_wpc2_306w_wf
03111831 011851.2	147.00000	18.51250	5	WPC2	F450W	32		8800	2088-10-27 13:02:13	11:00	hla_11802_74_wpc2_306w_wf	11802	11802_74_wpc2_306w_wf
03111831 011851.2	147.00000	18.51250	5	WPC2	F450W	32		8800	2088-10-27 13:02:13	11:00	hla_11802_74_wpc2_306w_wf	11802	11802_74_wpc2_306w_wf

¹ Ok, there are Giant Molecular Clouds in space, but you know what I meant!

You now need to pick 3 images to be your RGB channels. You'll notice two important columns, Level and Spectal_Elt. Level tells you how processed the image is. 5 means High Level Science Product, so those are many fully calibrated exposures that have been stacked (combined). Spectal_Elt is the spectral element, for many of these images this is where they list the filter. The Hubble filters have names like F814W. 814 is the central wavelength and W means wide. You can look up HST filters here: http://www.stsci.edu/hst/wfc3/ins_performance/filters/.

For ARP 147, add the first three level 5 images in filters F450W, F555W, and F814W to your cart and download them to your workstation. I'll leave it as an exercise to the reader as to which ones should be the red green, blue images when you combine them.

Next combine the fits images you downloaded just like we did in the color imaging lab using Photoshop. Save your final image and turn it in with your lab manual. After you finish ARP 147, go look up your favorite deep sky object in the HLA. Select three different filters for RGB. If you can't find any level 5 images in the filter or filters you want, you could use level 2, those they will be noisier. Don't use images at levels 1,3, or 4. Other objects may have a lot more data to choose from, so try to be sure the images look similar and are from the same detector. You can preview them by hitting display before you download them to be sure. If you aren't sure if you are picking good data to use, ask your wonderful instructor. Be sure to record what detector, filters, and processing level the images were in your lab notebook.

Once you download your data, processing it just like you did for ARP 147. If the images are not properly aligned, you can try aligning them in CCDSoft. Be sure to describe your processing steps in your lab notebook so I know what you did.