

# Image editing without capturing data.

Not having data to create an image due to the continual poor weather on the east coast of Australia, is no reason not to keep in practice and create images. Apart from using old image data to recreate new images, you can also use a remote imaging platform to capture new data. While you can choose to pay to capture data at some remote site that isn't plagued with poor weather, the Hubble space telescope is another choice and it's free. The Hubble telescope is so remote, that it doesn't even have the normal atmosphere to weaken the data, it's above the clouds and aircraft, and does suffer from the normal satellite issues we have on the ground. Also, the calibration and stacking of the images have already been done.

The inspiration for my Hubble data processing project came after watching a YouTube on the topic while the rain was pelting down yet again in Sydney in July 2022. I've seen other YouTube videos on the same topic and thought I'd try one day to process Hubble data. Yesterday was that day.

The inspiring YouTube video wasn't any better than others I've watched, it was just the one that the YouTube algorithm popped into my feed. It is called "[M104, the Sombrero Galaxy, Image Processing Flow Using Data from the Hubble Space Telescope](https://www.youtube.com/watch?v=0AVsQg15nG0)" (<https://www.youtube.com/watch?v=0AVsQg15nG0>) by the '[Peculiar Galaxy Astronomy](#)' YouTube channel.

I didn't use Photoshop as she used in the video, but after watching the video, I thought I'd use [PixInsight](#) and finish off with [Adobe Photoshop](#).

The video describes how to get the image files from the [Hubble Legacy Archive](https://hla.stsci.edu/hlview.html) (<https://hla.stsci.edu/hlview.html>) I suggest going to the site, typing M104 into the search box and click on the "Search" button.

Select the "Images" tab. With the default 'Show 20 results per page', go to page 7 and download the following files.



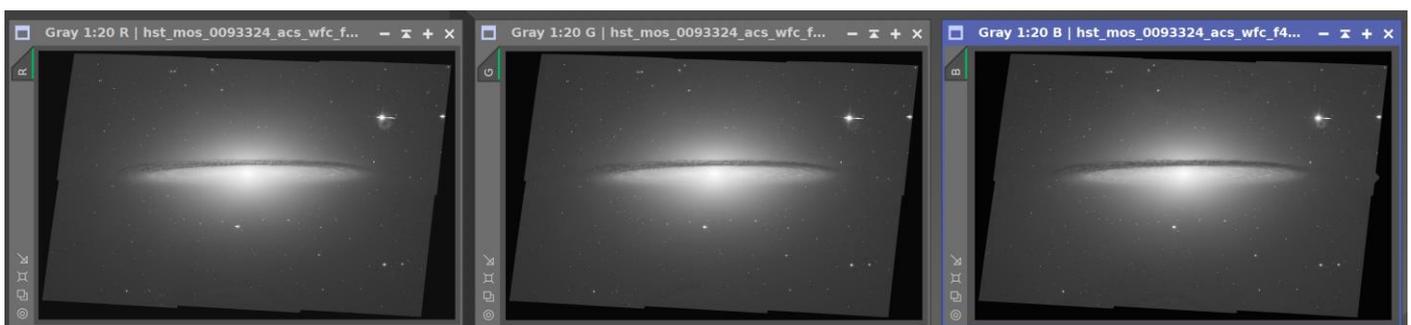
I used the 'Google Chrome' web browser to 'right click' on the Mosaic FITS file link to download each file.

hst\_mos\_0093324\_acs\_wfc\_f435w\_sci.fits (renamed it to R in PixInsight)

hst\_mos\_0093324\_acs\_wfc\_f555w\_sci.fits (renamed it to G in PixInsight)

hst\_mos\_0093324\_acs\_wfc\_f625w\_sci.fits (renamed it to B in PixInsight)

Then load the files into PixInsight:





The following is roughly the steps I used in PixInsight:

- **LinearFit** to match Blue & Green to Red
- **ChannelCombination** to create the RGB image
- **DynamicCrop** to crop and rotate image 180 degrees
- **PhotometricColorCalibration** to correct the colours  
(Search M104 to get RA & Dec, Date from Image, Focal Length = 57600)
- **DynamicBackgroundExtraction** (twice) to adjust the background
- **GeneralisedHyperbolicStretch** to stretch the image
- Extracted the luminance channel and used it as an inverted mask to protect the lighter areas so then I used **MultiscaleMedianTransform** and **TGVDenoise** to reduce the background noise.
- **CurvesTransformation** for Saturation and then for Contrast
- **HDRMultiscaleTransform** to get a bit of detail from the central area of the galaxy



The final PixInsight image was then saved as a 16-bit TIFF format file to be loaded into Photoshop.



Photoshop was used to remove the artifacts in the bottom left corner and to finish off the image.

Greg McCall, 5<sup>th</sup> of July, 2022