Astrophotography post-processing

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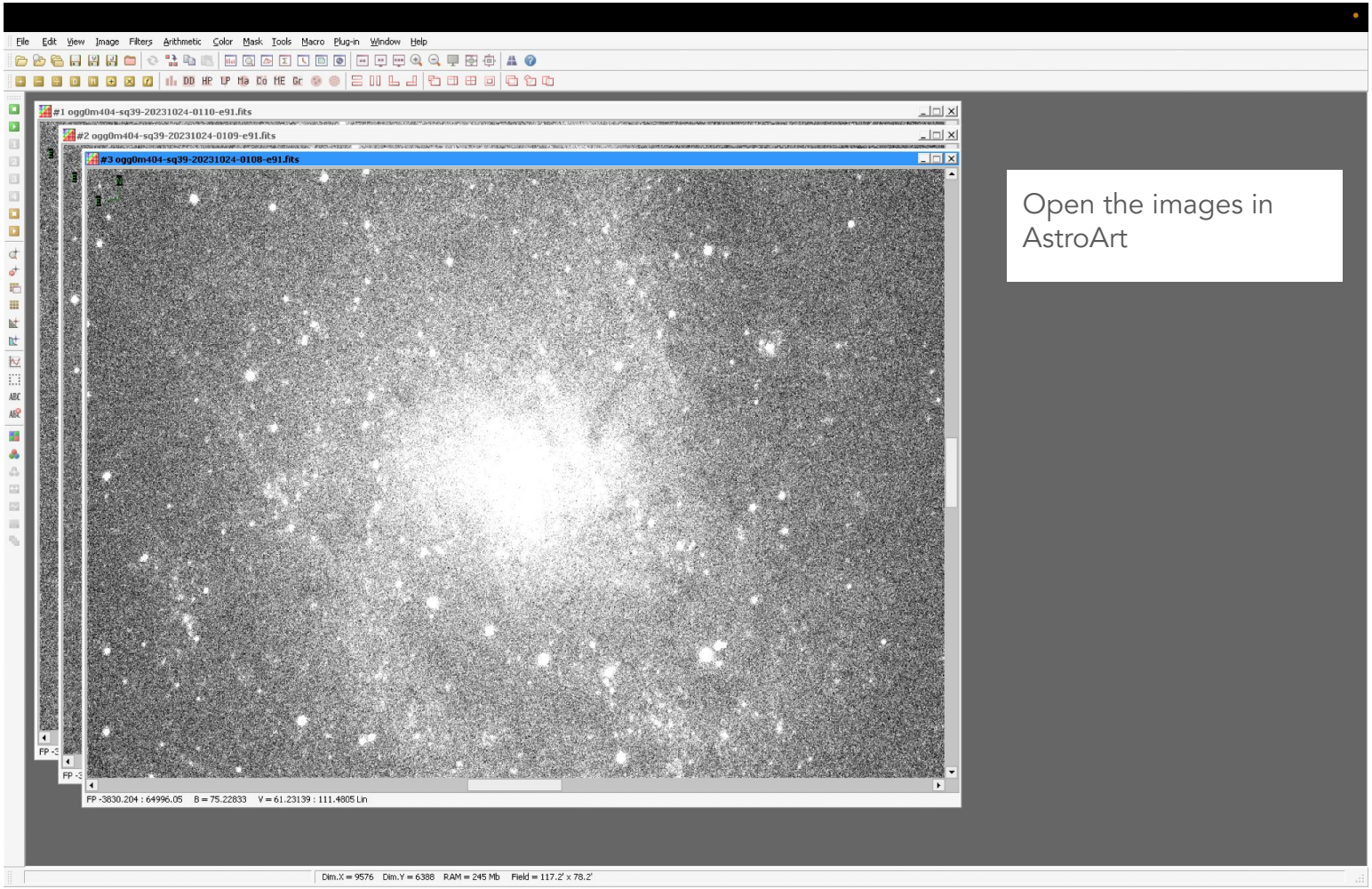
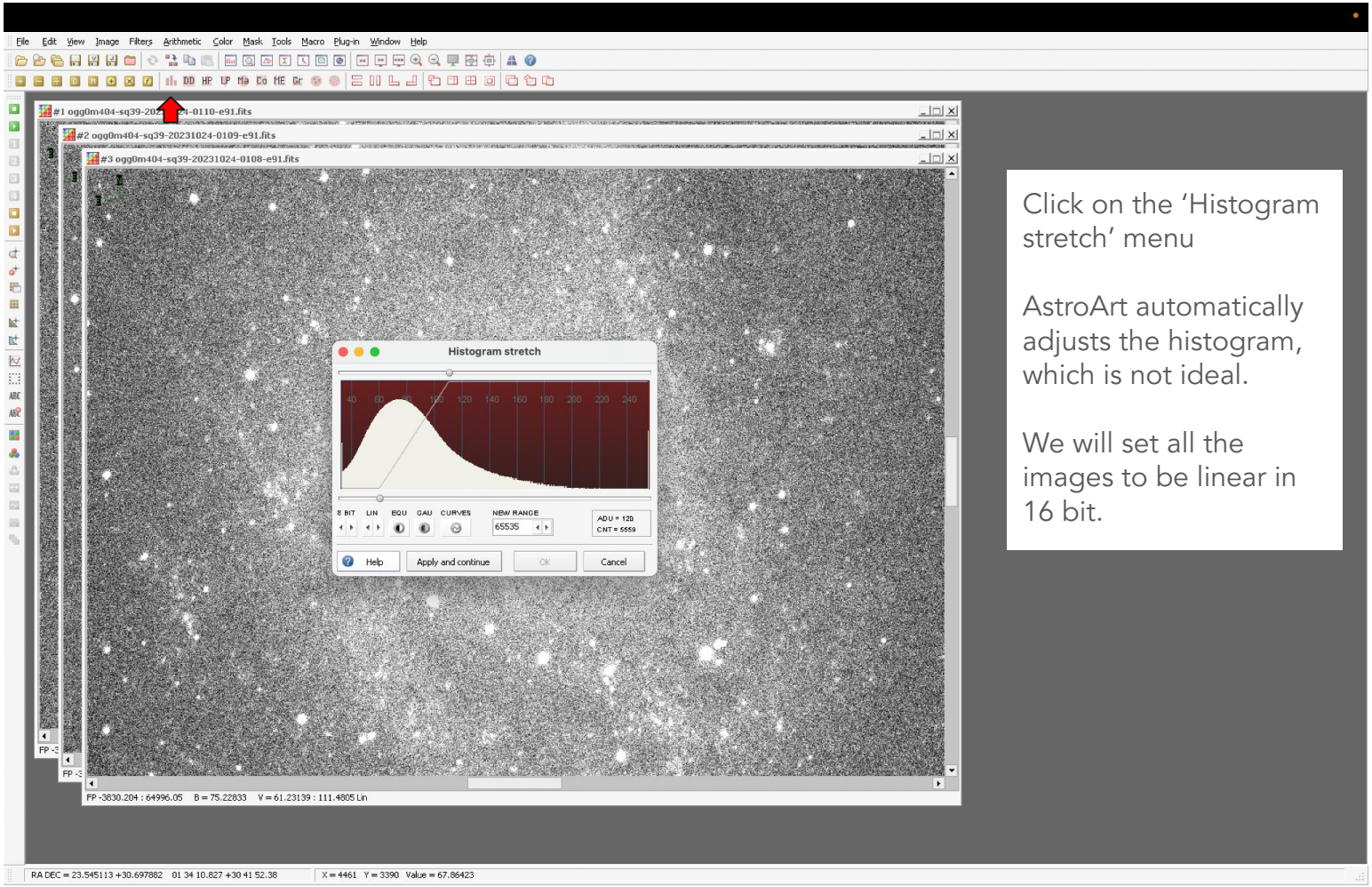
Image preparation

- .fz -> .fits decompression instructions here (https://lco.global/education/observing/fpack/)
- Images with suffix -e00 are raw, and -e91 are calibrated with the LCO BANZAI pipeline(https://lco.global/documentation/data/BANZAIpipeline/). Typically you would want to use the calibrated images.
- Important note: the following steps are primarily focused in making pretty pictures, NOT for quantitative analysis. You cannot use post-processed images for photometry.



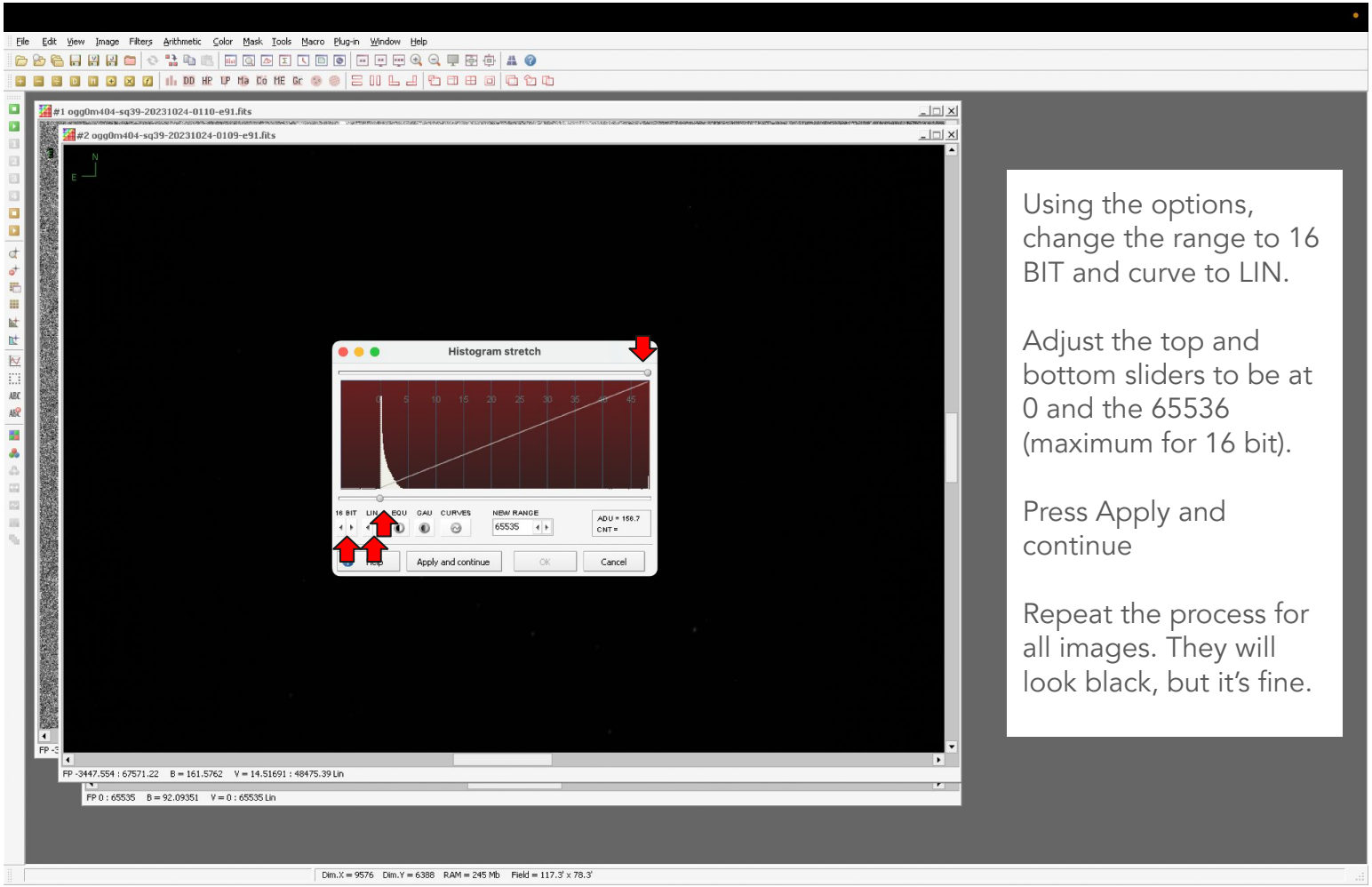
Open the images in AstroArt



Click on the 'Histogram stretch' menu

AstroArt automatically adjusts the histogram, which is not ideal.

We will set all the images to be linear in 16 bit.

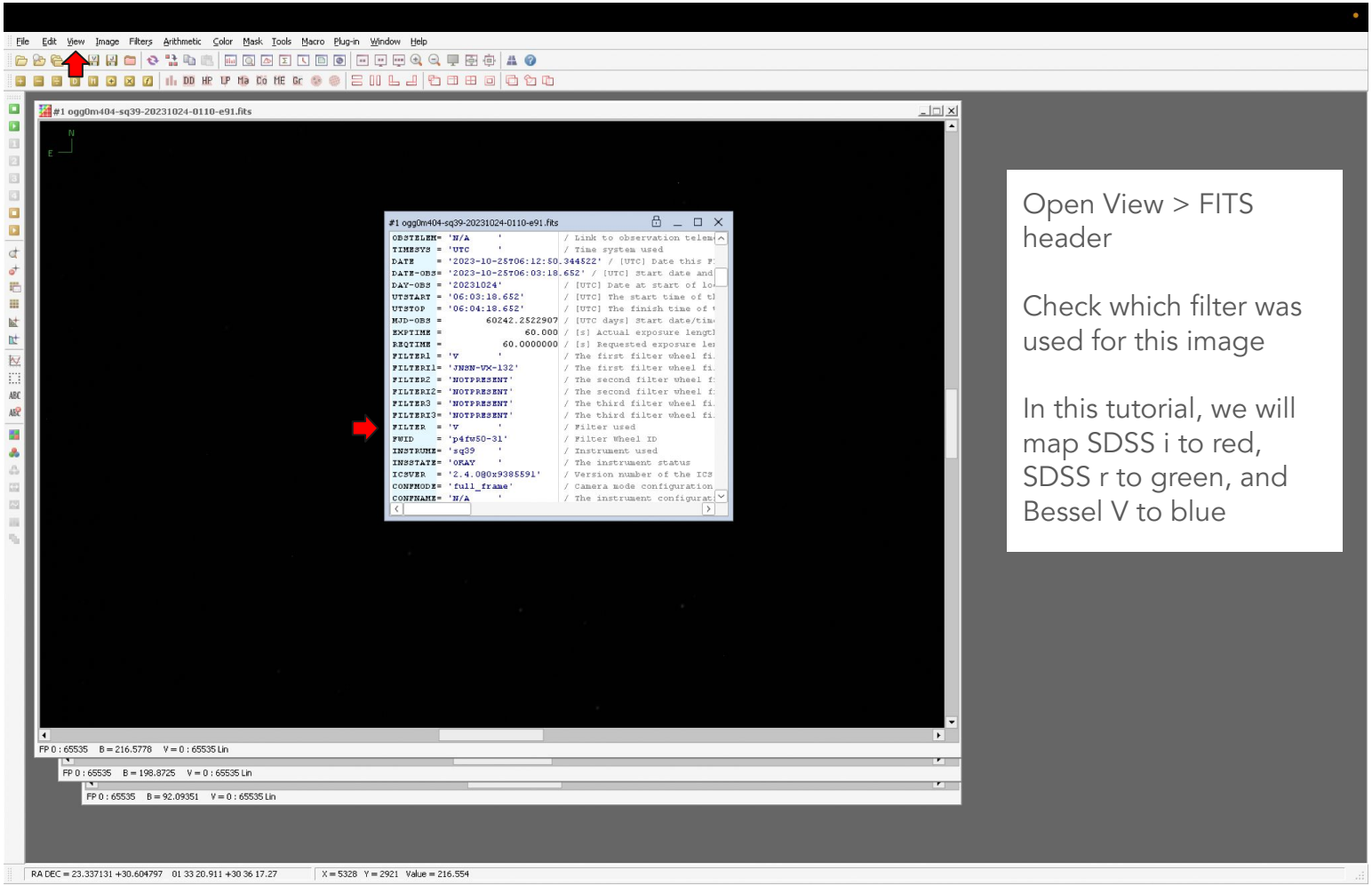


Using the options, change the range to 16 BIT and curve to LIN.

Adjust the top and bottom sliders to be at 0 and the 65536 (maximum for 16 bit).

Press Apply and continue

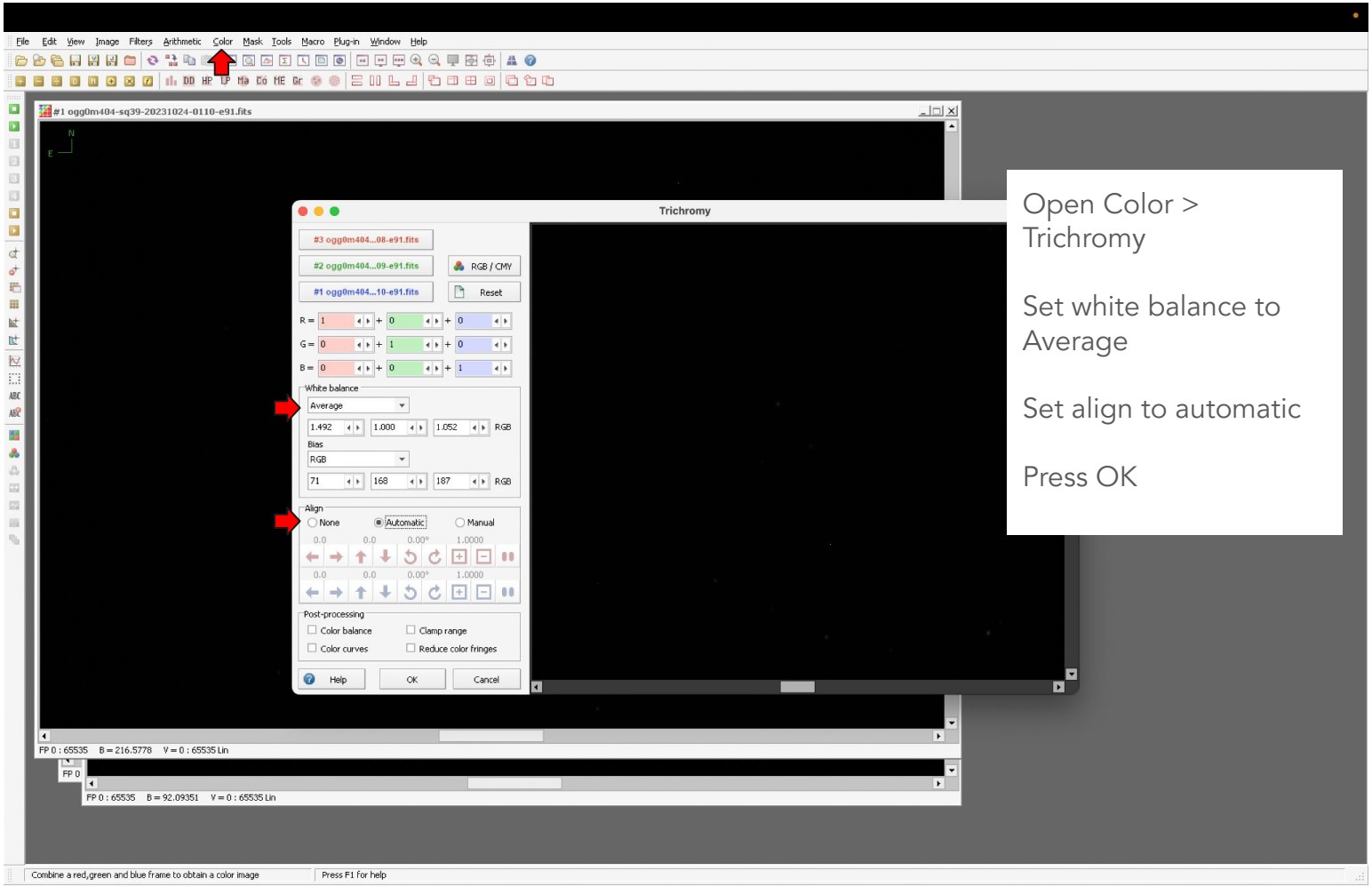
Repeat the process for all images. They will look black, but it's fine.



Open View > FITS header

Check which filter was used for this image

In this tutorial, we will map SDSS i to red, SDSS r to green, and Bessel V to blue

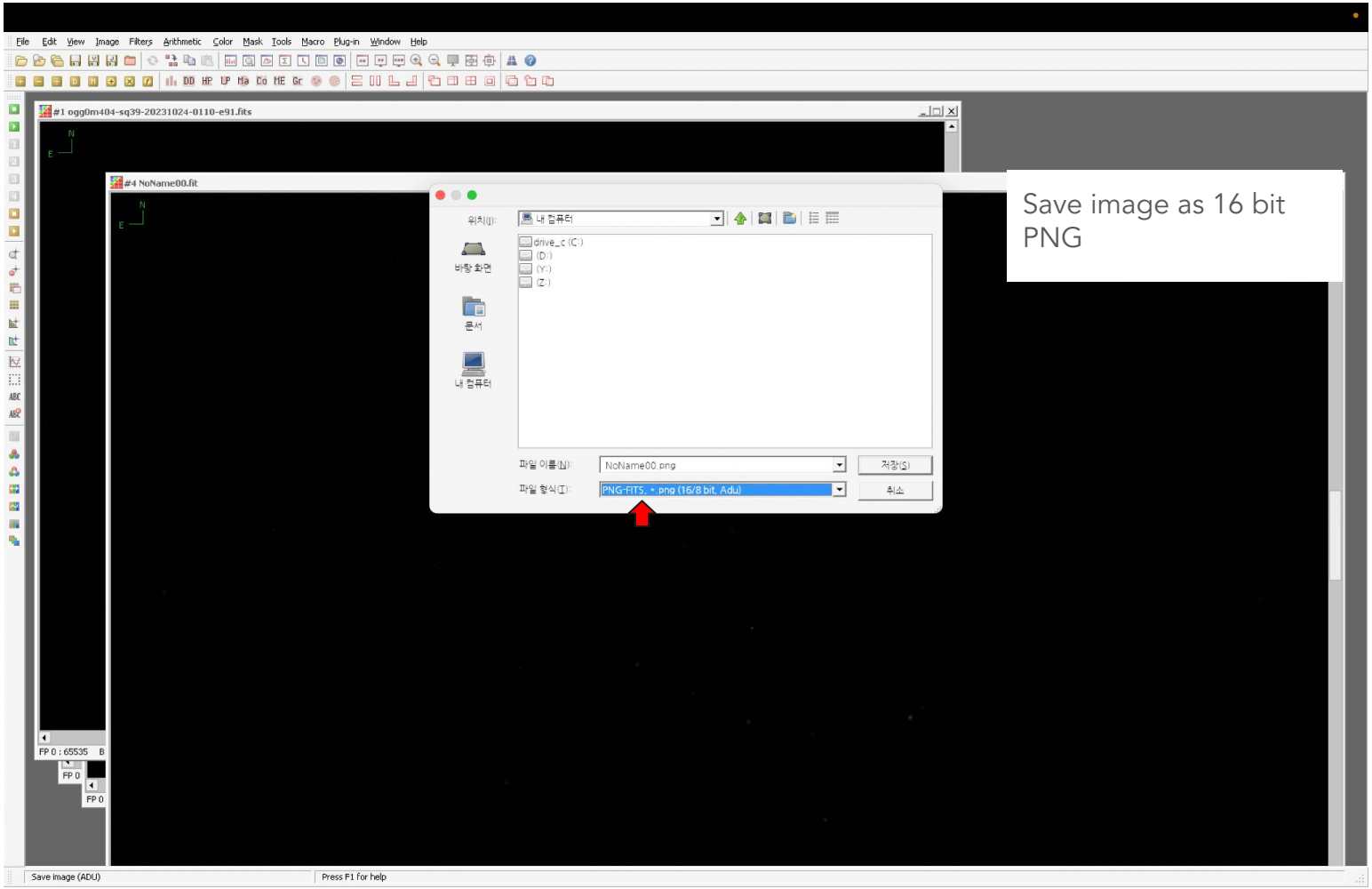


Open Color > Trichromy

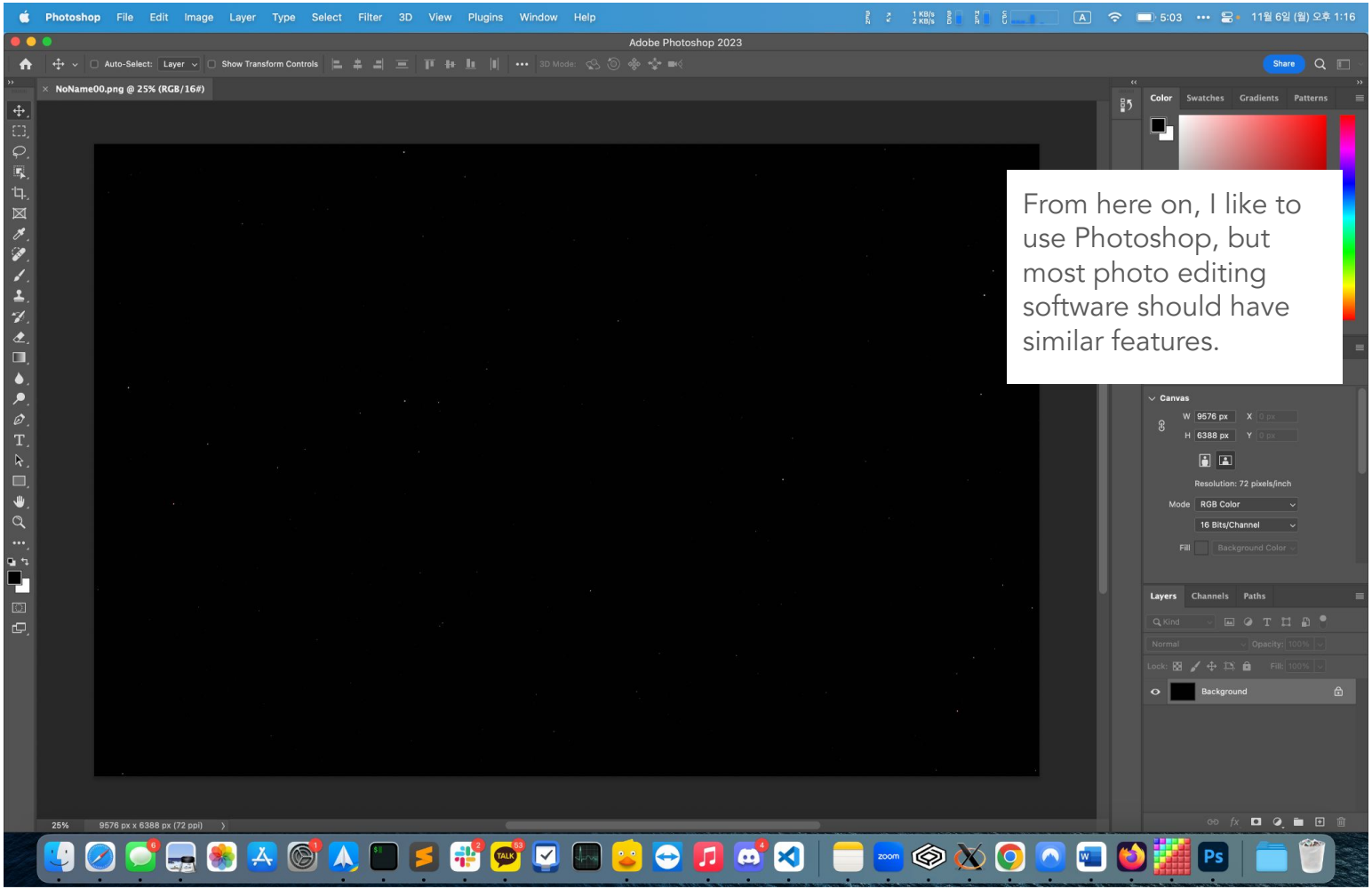
Set white balance to Average

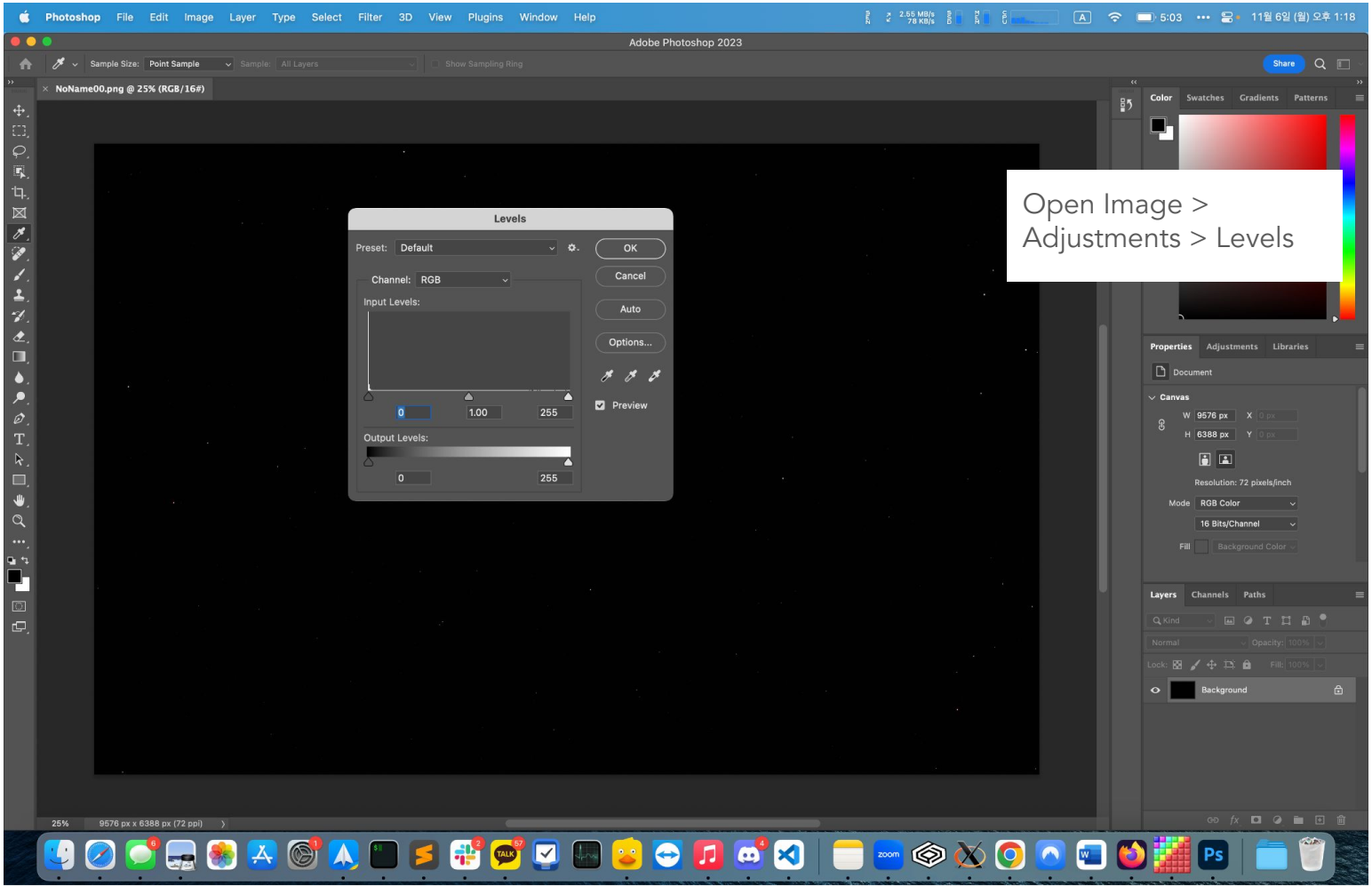
Set align to automatic

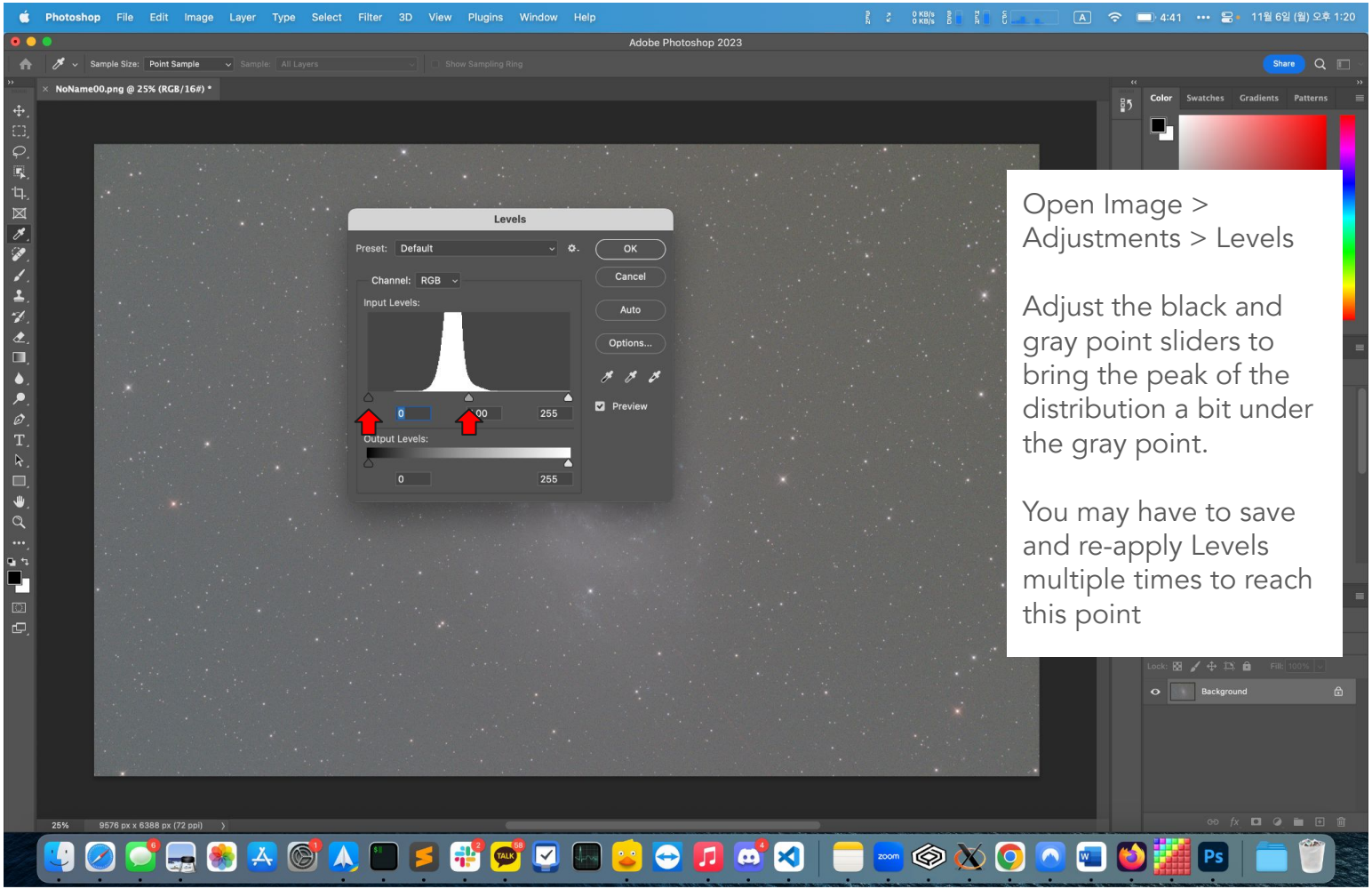
Press OK



Save image as 16 bit PNG


Photoshop File Edit Image Layer Type Select Filter 3D View Plugins Window Help
Adobe Photoshop 2023
NoName00.png @ 25% (RGB/16#)
From here on, I like to use Photoshop, but most photo editing software should have similar features.
Color Swatches Gradients Patterns
Canvas
W 9576 px
H 6388 px
Resolution: 72 pixels/inch
Mode RGB Color
16 Bits/Channel
Layers Channels Paths
Background
25%
9576 px x 6388 px (72 ppi)

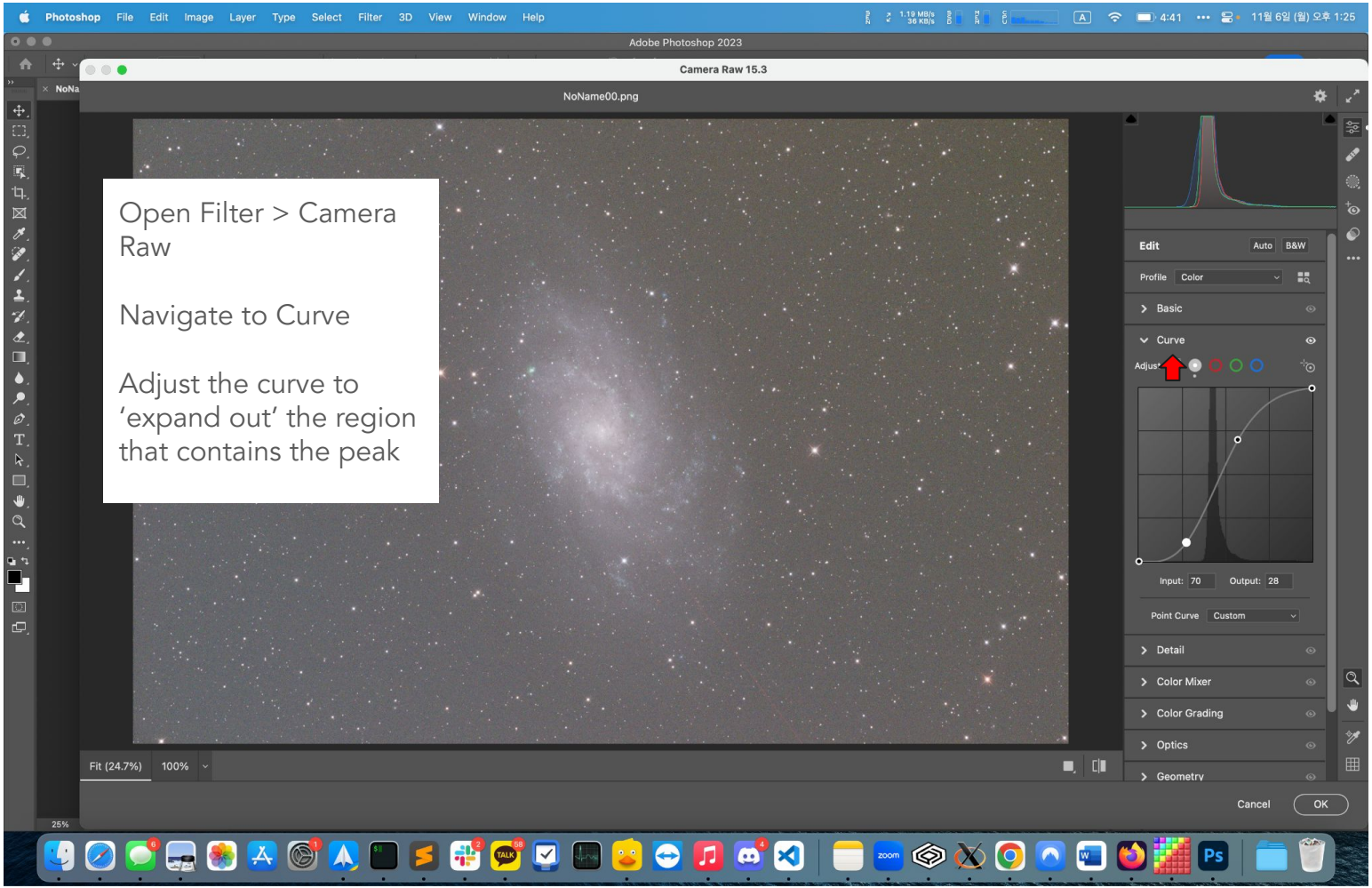

Photoshop File Edit Image Layer Type Select Filter 3D View Plugins Window Help
Adobe Photoshop 2023
NoName00.png @ 25% (RGB/16#)
Levels
Preset: Default
Channel: RGB
Input Levels:
0
1.00
255
Output Levels:
0
255
OK
Cancel
Auto
Options...
Preview
Open Image > Adjustments > Levels
Color Swatches Gradients Patterns
Properties Adjustments Libraries
Document
Canvas
W 9576 px
H 6388 px
Resolution: 72 pixels/inch
Mode RGB Color
16 Bits/Channel
Layers Channels Paths
Background
25%
9576 px x 6388 px (72 ppi)

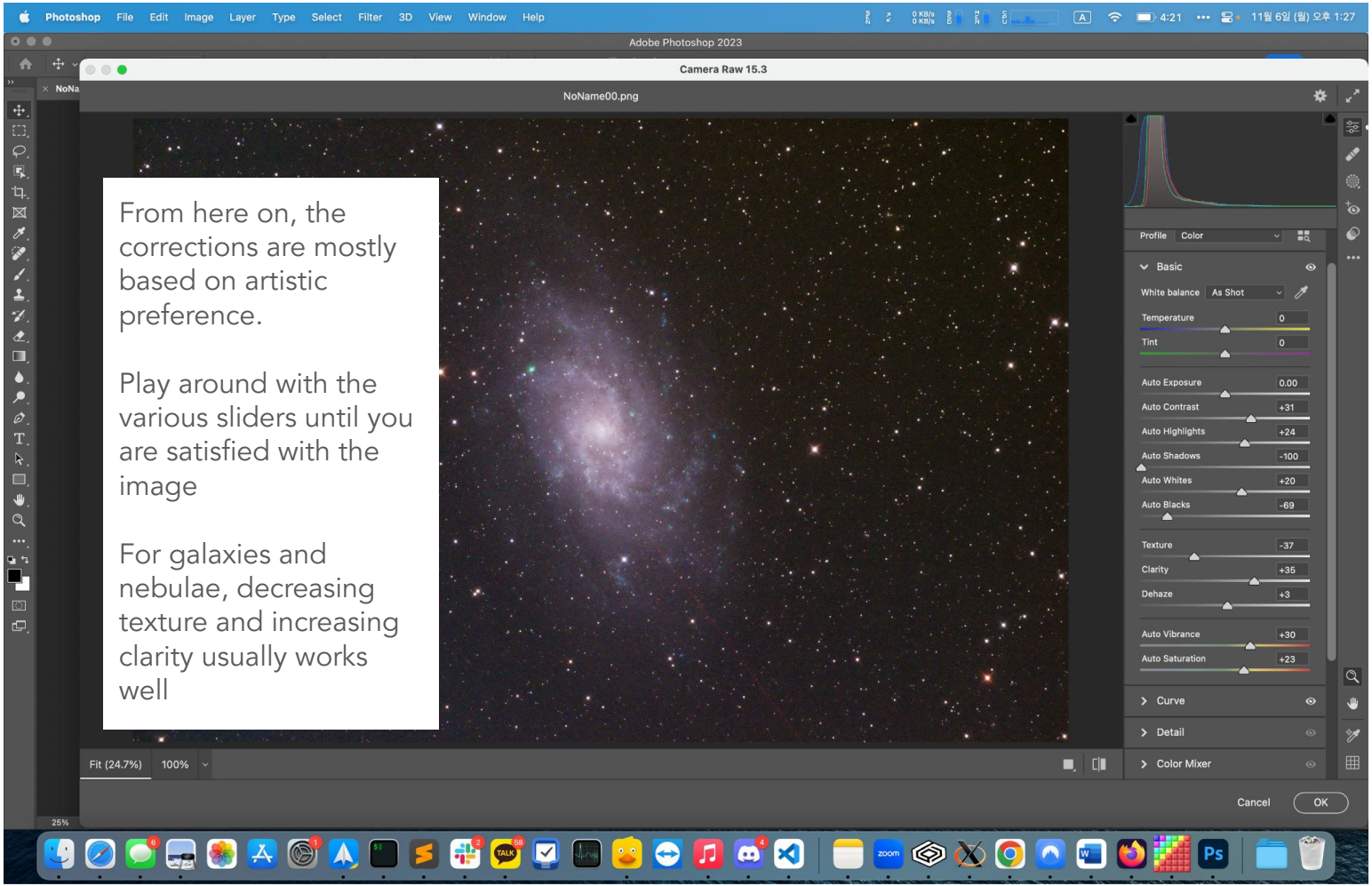


Open Image > Adjustments > Levels

Adjust the black and gray point sliders to bring the peak of the distribution a bit under the gray point.

You may have to save and re-apply Levels multiple times to reach this point


Photoshop File Edit Image Layer Type Select Filter 3D View Window Help
Adobe Photoshop 2023
Camera Raw 15.3
NoName00.png
Open Filter > Camera Raw
Navigate to Curve
Adjust the curve to 'expand out' the region that contains the peak
Edit
Auto
B&W
Profile
Color
Basic
Curve
Input: 70
Output: 28
Point Curve
Custom
Detail
Color Mixer
Color Grading
Optics
Geometry
Fit (24.7%)
100%
Cancel
OK


Photoshop File Edit Image Layer Type Select Filter 3D View Window Help
Adobe Photoshop 2023
Camera Raw 15.3
NoName00.png
From here on, the corrections are mostly based on artistic preference.
Play around with the various sliders until you are satisfied with the image
For galaxies and nebulae, decreasing texture and increasing clarity usually works well
Profile Color
Basic
White balance As Shot
Temperature 0
Tint 0
Auto Exposure 0.00
Auto Contrast +31
Auto Highlights +24
Auto Shadows -100
Auto Whites +20
Auto Blacks -69
Texture -37
Clarity +35
Dehaze +3
Auto Vibrance +30
Auto Saturation +23
Curve
Detail
Color Mixer
Fit (24.7%)
100%
Cancel
OK