Exploring Images Plus RASC Halifax Center

With the isolation of COVID-19 setting in the Halifax Center of the Royal Astronomical Society of Canada (RASC) has kicked off a series of virtual observing sessions and image processing walkthroughs to help pass the time before we can head back to dark skies again. The first of these walkthrough was a tour of Images Plus, an astronomical image processing package written by Mike Unsold. The software has always been reasonably easy to use, but it really came into its own with version 5.75 when full layer support and the feature mask tool were added. Together these additions changed the way the package was used to process astronomical images. The feature mask allows processing the stars and deep sky objects separately and makes starless masks and star masks a breeze to make.

During the walk through we processed a short 40 minute exposure of M8 taken from the St. Croix Observatory (SCO). Don't concentrate too much on the tool settings as they will change image to image. The important part here is the workflow and the steps used in processing the image. The general workflow is to first stretch the image to make a starless mask. Next we will use the mask and restretch the original image. The mask allows a very large stretch to be used and prevents star bloat and noise amplification in the darker areas of the data. Next the image is split into a deep sky layer and a star layer to allow separate processing to be used on each. Finally the two are recombined and the final background level is set.

Starting with the initial unstretched image an arcsinh stretch was used to brighten things up a bit. The idea here is to create a starless mask from this so the background is left quite bright to make it easier for the feature mask tool to remove the stars.

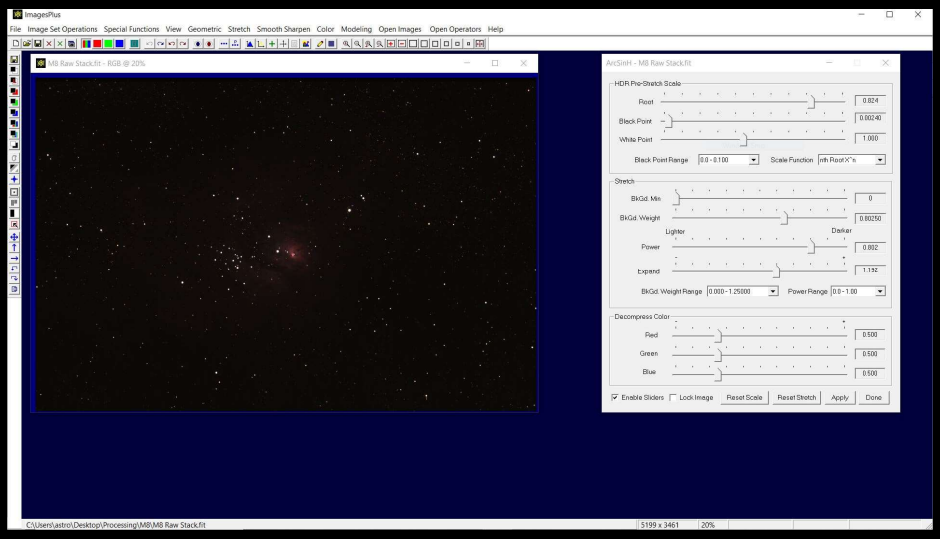

Figure 1 - Initial arcsinh stretch setup

Images Plus has one of the best arcsinh stretch routines in the industry, and the control has three panes that give very flexible control over the process. The middle pane specifies the arcsinh curve, the top pane (HDR pre-stretch scale) moves the input data around on the curve and the bottom pane restores most of the colour that can be lost in the stretching process. Here we leave the background bright to make it easier to remove the stars.



Figure 2 - The background of the arcsinh stretch is purposely left bright to improve the star removal with the feature mask tool

After passing the image through the feature mask tool and making a luminance mask out of the result we get the image shown below.

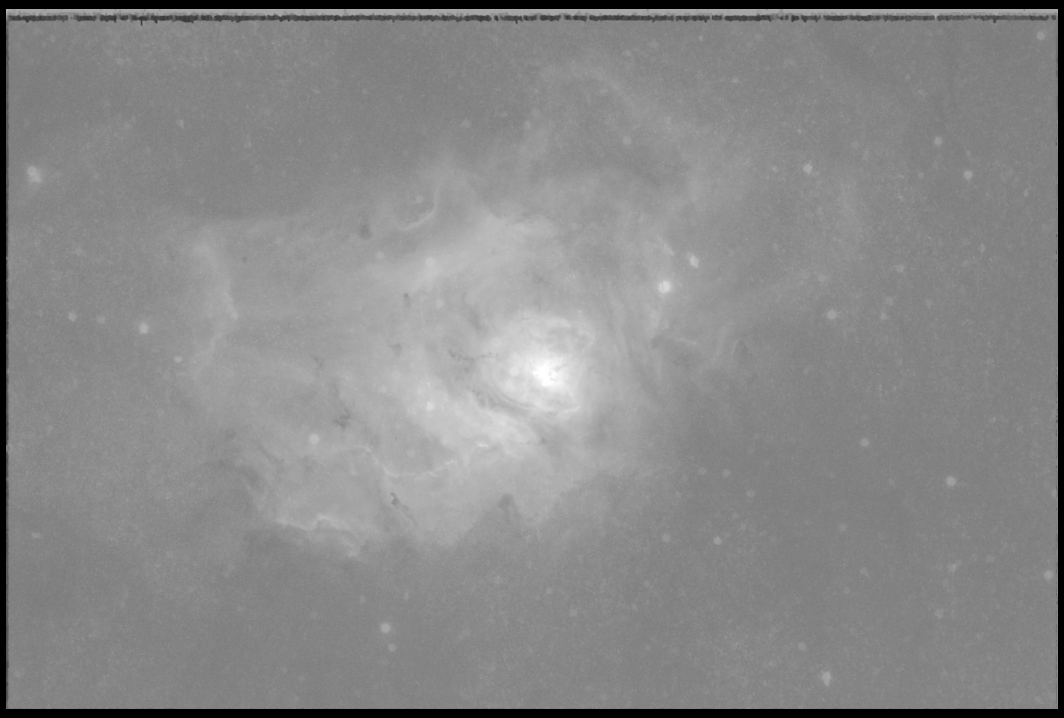

Figure 3 - Initial luminance mask ready to be refined

With a little creative cloning, a contrast boost, some sharpening and some general masked noise reduction the final mask looks a little better.

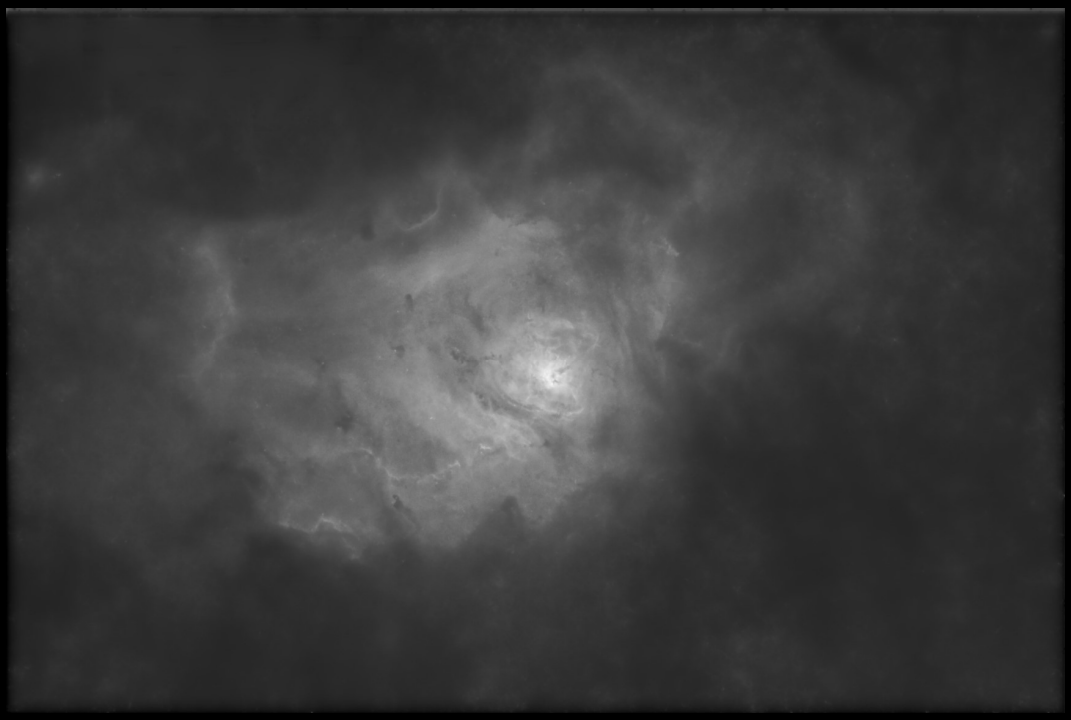

Figure 4 - Starless mask used to restretch the initial image

Next we restretch the original image using the arcsinh stretch tool again with the mask applied. This imparts the detail from the mask and prevents the star bloat that usually accompanies extreme stretches.

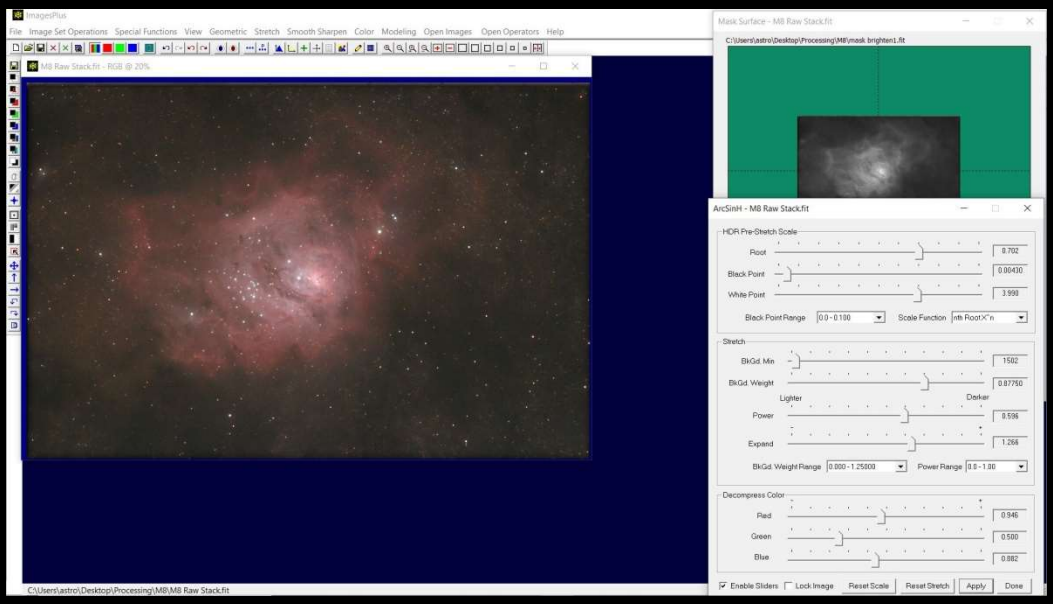

Figure 5 - Masked arcsinh stretch used to brighten the image and avoid star bloat.

The next step in the processing is to reduce the noise and further sharpen and refine the image. To avoid blurring the stars, the feature mask is used to split the image into a stars layer and a deep sky object or nebula layer.

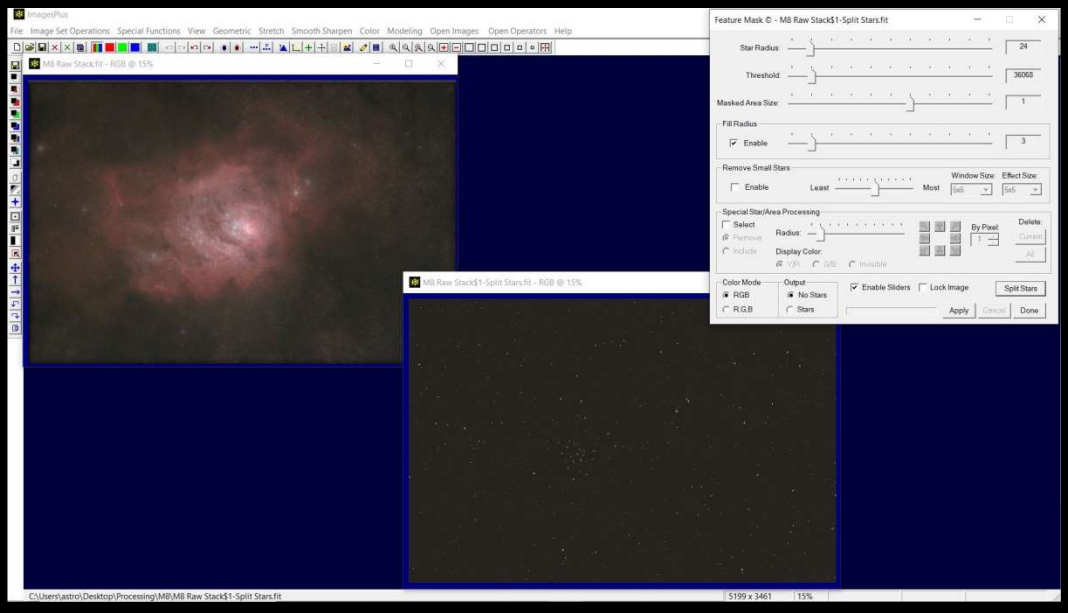

Figure 6 - Splitting the image into two layers for split star processing

Now we need to reduce the noise in the nebula layer before applying sharpening to avoid increasing the noise any more than necessary. A mask is made from the nebula layer, inverted, and used to tailor the effect of a frequency domain lowpass filter bringing down the fine grained noise.

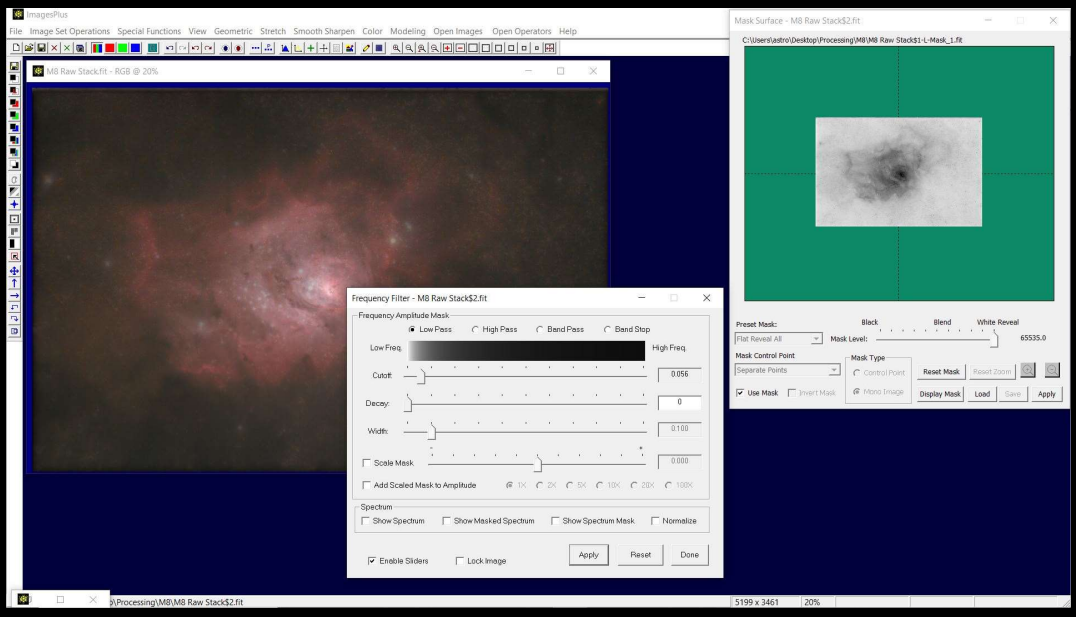

Figure 7 - Masked noise reduction used to smooth the fainter areas of the nebula layer.

Now that we have a reasonably noise free nebula image we want to sharpen it and enhance the contrast a bit. There are a variety of tools to accomplish these steps, but one of my favorites is the multi-scale decomposition tool. Typically these tools allow enhancing detail at various image scales, but here all but the largest scale layer are combined into a consolidated detail image. This is then combined with the original noise reduced nebula image to produce a sharpened result.

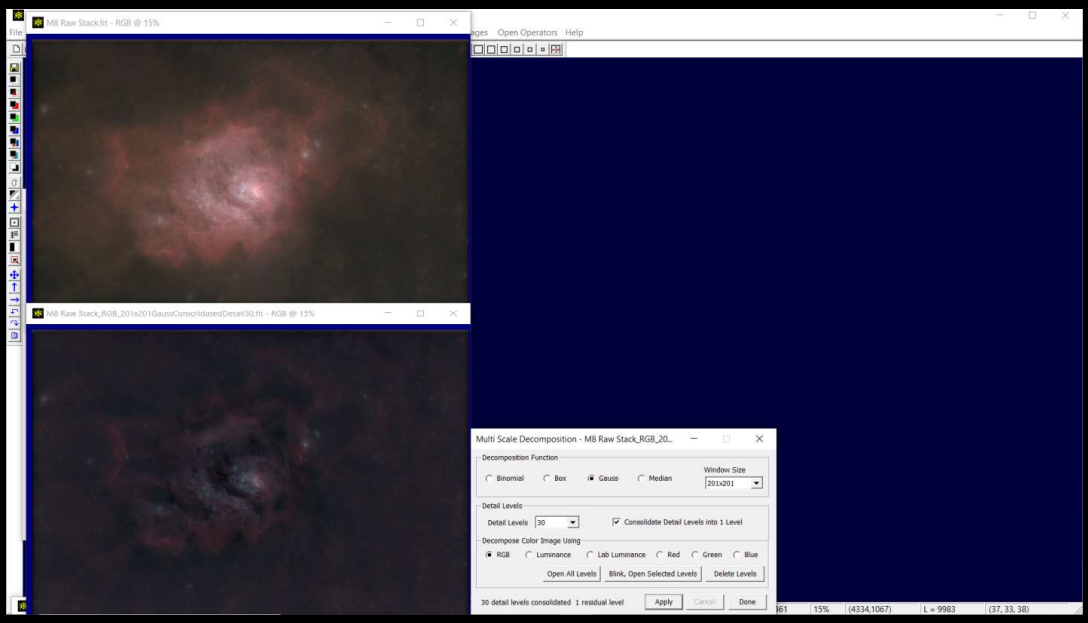

Figure 8 – Multi-scale decomposition tool used to make a consolidated detail layer.

The advantage to this approach is that the contrast is boosted at the same time the image is sharpened. The images are combined using the combine layers tool with merge split blend mode unique to Images Plus. A blurred luminance mask made from the nebula layer is used to limit the effect to the brighter areas of the nebula image. To make the mask the custom luminance mask tool is used with a large blur and the max slider turned down enough to darken the bright center.

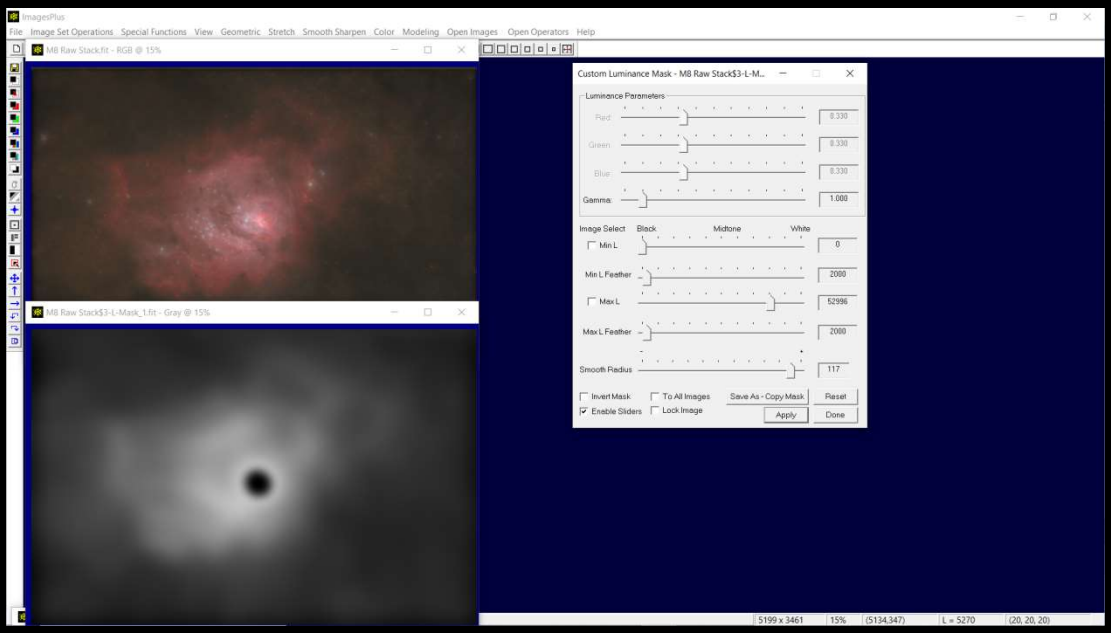

Figure 9 - Making the layer combining mask using the custom luminance mask tool.

Next we have to combine the consolidated detail layer with the nebula layer using the mask to limit the effect to the bright areas of the image.

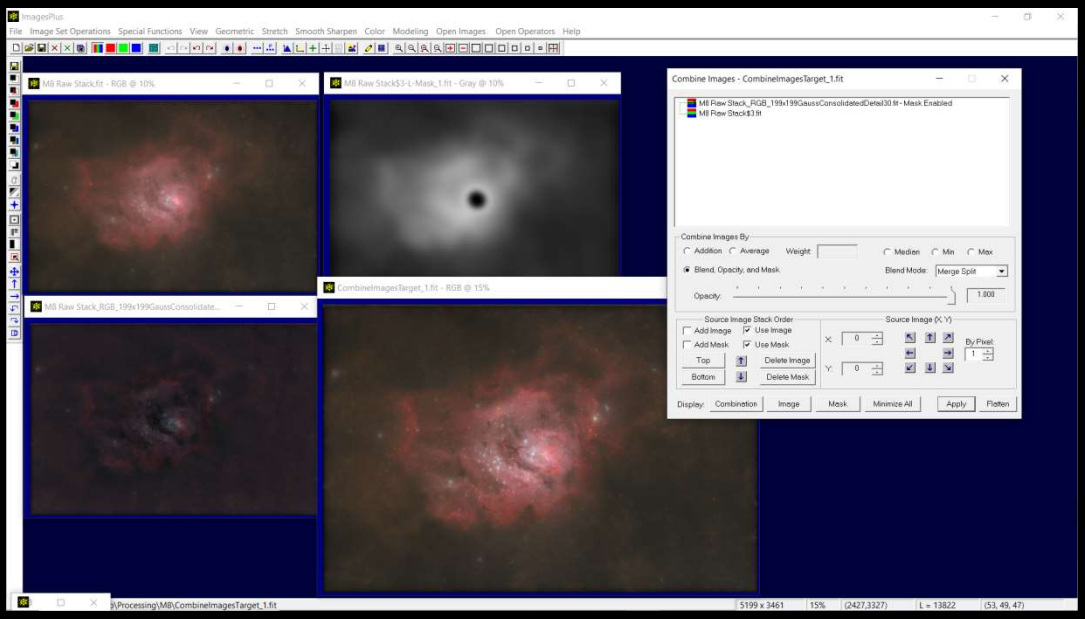

Figure 10 - Sharpening using a masked layer combine with the consolidated detail layer.

Now that we have a contrast and detail enhanced nebula image, one of the last steps is to recombine the nebula image with the stars. The stars are the top layer and the blend mode is once again set to merge split as shown below.

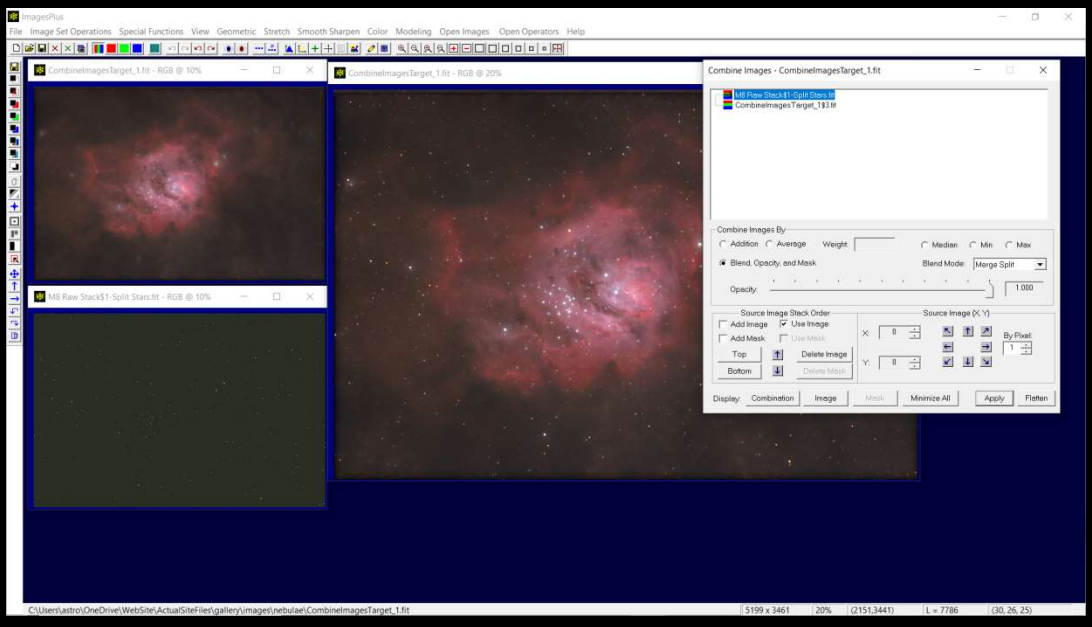

Figure 11 - Recombining the nebula with the stars

Finally the image is cropped to remove the stacking artefacts and then the levels tool is used to set the black point for the image.

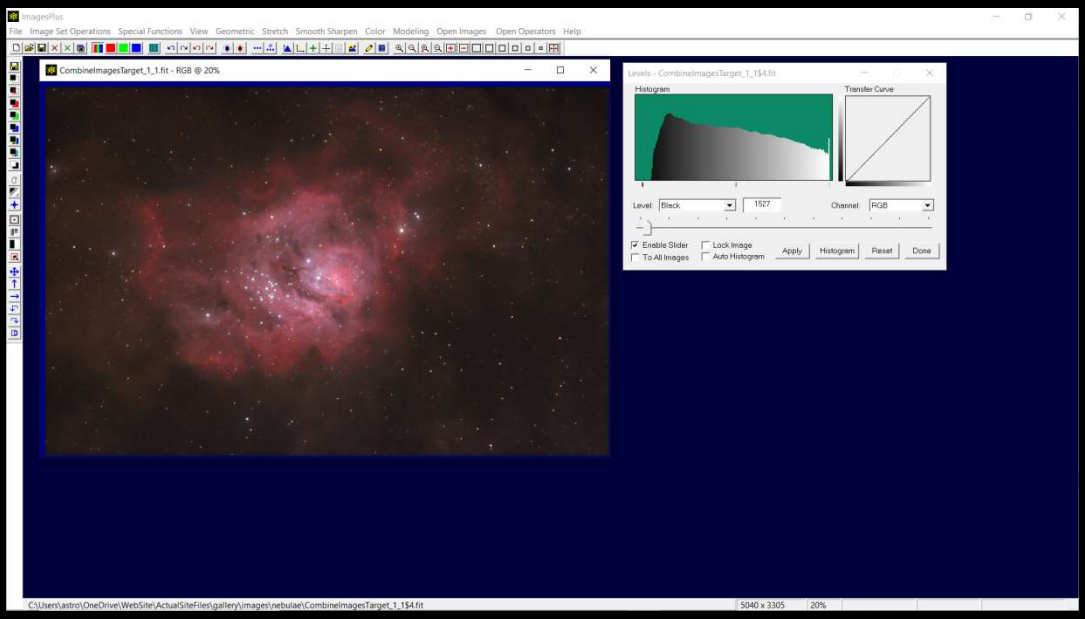

Figure 12 - Setting the final image black point using the levels tool

This produces the final image shown below. The split star process using masked stretches allows us to enhance detail without bloating and saturating too many stars. Note that nowhere in the process was star reduction done as it simply wasn't needed, and noise is well controlled without excessive blurring even though this is a relatively short 40 minute exposure. The technique produces a natural looking image with smooth transitions from the nebula to the background.



Figure 13 - Final processed image