Getting the Most out of Your Images
Photoshop Basics for Astrophotos

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Image credit: Suk Lee
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Forward: The techniques presented in this article are only the methods I have learned from other’s or just made up myself. There is, in my opinion, no single best way to approach astrophotography image enhancement. And the techniques shown are not presented as a scientifically accurate method of extracting data from raw images for the purposes of research. Rather these methods are to enhance the visual appeal of an image for public consumption.

The goal of this article is to correct the most common problems associated with astrophotography images. These include light pollution, uneven field illumination (ex. vignetting), under exposure and color balance problems. It should be noted that each of these can be improved if not entirely corrected for. Over exposure, poor tracking and flawed optics can be almost impossible to correct and therefore will not be covered in this article.

Requirements: It is assumed that you have a firm understanding of Photoshop’s tools and filters. Some of these techniques are fairly advanced and to describe each function would make this document prohibitively large.

Initial image analysis

Always start with your very best shot. I typically take as many images as I can in a given session so I can pick the cream of the crop. Even your best image will likely need a lot of improvement, but starting with the best will lessen the time and effort to improve it. Let’s take a detailed look at our chosen image.

We can see, in Figure 1, a darkening of the field illumination at the corners. Also, towards the right side of the image light pollution is beginning to overwhelm the dimly exposed stars. And lastly the light pollution has severely washed out our color and strongly influenced the color balance towards a deep cyan.
By applying Photoshop’s Auto Level function, the problems can be seen more clearly as shown below in Figure 2.
Setting white level

We will begin by setting up a white level for the original image. Select an area that appears to be white such as a bright white star.

Hit Control-L to bring up the levels dialog box and select the color picker button for white level as shown in Figure 3.

![Figure 3](image)

Figure 3

Then select the center of the bright star shown in Figure 4 to set our white level for this image.

![Figure 4](image)
Creating an anti-vignette layer

There are numerous ways to proceed with this section. These range from the simplest method where a Gaussian blur is used, to a tedious but very accurate method where we paint over any nebula or other bright objects to create an accurate field illumination map. I will present the more accurate method because I have not seen it described elsewhere and some of you may not have thought of this approach.

The problem with using only a Gaussian blur is that color purity can be distorted by objects that deviate in hue from the sky glow. The blur simply blends all colors into a new one. And although it may appear to our eyes that it hasn’t shifted much it can shift a lot numerically and later when final contrast and saturation enhancements are made, they will be amplified and taint the image. The painting method I prefer does use a Gaussian blur but only to smooth out a much smaller area.

Let’s begin by duplicating the Background layer and setting to Normal blend mode. Rename the layer to “Reference AV”. Now apply a Dust and Scratches filter and raise the pixel distance until only the very brightest stars and nebula remain. Paint over the brightest stars with the Clone tool but do not change the nebula. You should have something that looks like Figure 5.

![Figure 5](image)

Now study the image and look for the boundary around the nebula. We want to outline the area where the nebula ends and the uniform sky glow begins. Take your time determining this transitional area because it will be used later to do a zonal enhancement to the area within the nebula and the area outside it.
Once you have determined the transition area we need to trace it with the Lasso tool and save this selection off later use.

Begin by creating a new blank layer above our Primary AV layer. Name it “Reference mask”. Now with this layer active use the Lasso tool to trace the transition area. Figure 6 illustrates the area described.
With Reference mask still active fill the inside of the selection with white and the outside with black. This is shown in Figure 7.

![Figure 7](image)

Make sure your area selected is inside the white area. Change active layers back to Reference AV without losing your selection. Turn off visibility for Reference mask.

Our next step is to use a filter that will help us define color blocks that we will use to paint across the nebula thereby creating a uniform and accurate illumination field. Apply the Pixelate Mosaic filter to the selection containing the nebula in our active layer Reference AV. The pixel size of the filter can be visualized as our accuracy level. The smaller the blocks created the more accurate our sampling rate will be but also more time consuming to complete. For this example I have set the filter to 16. Figure 8 shows only the effect on the nebula region for clarity. To make the following step easier you may wish to do the same and merge the end product back into Reference AV when finished.

Activate a grid at the same pixel size as the Mosaic filter which in this example was 16. Turn on snap to grid.
The effect is very hard to see because our colors don’t vary much. But if you have done it correctly each block of the grid is filled with a single color that is averaged across the Mosaic filter pixel size. We will work across a row from left to right setting our foreground color to the first block and as we travel right we will set our background color to the last block. Then we will use a gradient fill to paint across the nebula region.
I'm sure I have lost you by now so the following images will show how I progress down the image painting across rows in a contrast enhanced version.

No rows painted  First row painted  Farther along  Finished

After all rows are finished apply a Gaussian blur just barely larger than your Mosaic pixel size. Figure 9 shows the completed Reference AV layer.

Figure 9
After completing your Reference AV layer we will come back and use it for other steps such as the next where we begin to actually correct our illumination field. If you’re still with me at this point congratulations! The bad news is there is a long ways to go yet =).

From this moment on the Reference AV layer and the Reference Mask layer will no longer be used actively other than to copy from for use in other layers. At this point you should have only the background layer active.

To make our anti-vignetting layer start by duplicating the background layer and naming it to “Primary AV”. Set the layer mode to Screen and group with previous layer (Background). Notice how the entire frame got brighter. We must make only the darkest areas brighter and to do this we will use our Reference AV layer as a selection mask for Primary AV. Copy the Reference AV layer into the selection mask and invert it. Then adjust the contrast via a Curves or Levels adjustment until an even illumination field is achieved. Figure ten shows the layer dialog box with the selection mask in place.

Figure 10

Figure 11 shows a side by comparison between uncorrected and corrected field illumination.
As you can see the field illumination is uniform across the entire image in the corrected version. But we still have a lot of light pollution to deal with. I suggest if you haven’t done so, save your file now if you’re satisfied with the result.

Correcting light pollution

To create a corrective layer to combat light pollution we could use the exact same method as we did for the anti-vignetting layer but to speed things along we will use the much simpler Gaussian blur method. Make sure only Background and Primary AV layers are active. Select all and use Copy Merged to capture the two layers together. Then paste it into a new layer above Primary AV and name as “Light pollution”. Do a 16 pixel Dust and Scratches and a Gaussian blur until no stars or nebula are found. It may help to do a heavier gaussian blur on only the nebula using our Reference Mask layer as the selection and a much lighter blur on the star field. If you blur it to much it won’t be accurate. After your satisfied the layer is nice and uniform do the following. Set the layer to be grouped with previous (Primary AV), invert the layers image and set to filter blend mode of Color Burn. Adjust the Light pollution layers opacity downward until the light pollution starts to creep back in. I have set mine to 67 percent opacity.
Setting the layer opacity for the Light pollution layer is subjective to each user. I decided in this particular image to allow some glow to the background to soften the contrast somewhat. But by all means experiment with yours until you are happiest with your result. Figure 12 shows the result.

![Figure 12](image)

**Figure 12**

**Zonal enhancement layers**

For this particular image I wanted to really bring out the central region containing the nebula and star clouds and somewhat subdue the outer region. This technique is used commonly in commercial art to draw the viewer’s gaze at a particular region of an advertisement. The same technique can be used in astrophotography to bring the object being captured to front stage if you will.

To do this we need to create adjustment layers that are selective to a region based on our original Reference mask layer. The same technique to apply a selection mask to a regular layer is used here. I did a mild Gaussian blur of each selection mask channel tied the adjustment layer to better facilitate the blend between inner and outer regions.

Create two Level adjustment layers named Inner and Outer. And two Hue Saturation adjustment layers named similarly. Set each adjustment layer to be grouped with previous. Then paste our Gaussian blurred Reference mask into each layers selection mask and invert one in both groups so the layer list looks like Figure 13.
Adjust each to suit your own tastes. Try to find a balance in contrast and color so it looks natural. This is the fun part and I often spend hours upon hours playing with the adjustment layers until I think it looks just right.
Final touches

For my final image I noticed the stars were a little hard looking. So I decided to knock them down a tiny bit by doing a very slight blur on the hottest pixels. First use Select color range and set the selection to highlights. Then apply one application of the Blur filter. This is very subtle and wont cause any loss of definition that the viewer will notice. Then as a nice finishing touch I used a method very similar to Suk Lee’s diffusion filter overlay technique in his article on cloudy nights to give the brightest star a little more volume. His article can be found at…

http://www.cloudynights.com/astrophotography/DiffusionFilter.htm

I would like to thank Suk Lee for providing me with an excellent image to base this article on. And I would like to thank everyone at cloudy Nights for making a truly wonderful place to share knowledge and have a few laughs too. Good luck and clear skies.