BASIC SOLAR PROCESSING

Solar processing is a combination of basic principles mixed with art and a little voodoo thrown in for good measure. In this tutorial, we are going to look at the basic process of getting an image from the camera to a finished "product"… A JPEG image that is sized properly for display on the web.

CAPTURE

The vast majority of solar imagers use a monochrome cam. The image(s) used here were captured as AVI files with an ASI174MM-cooled monochrome camera. There are two methods used to produce an image with a surface and any accompanying prominences… A single capture of the surface only, or two separate shots that are combined during processing. We are going to use the latter, as it is the most common method and provides an opportunity to work the two images independently before combining.

STACKING

When an AVI file is captured, it is nothing more that a series of individual frames (usually 1000)… some are good while some are not due to a myriad of reasons. We need a method of figuring out which frames are the best and putting them "stacked" to have a resultant TIFF file that we can process.

There are several applications that can stack our AVI files, but the most common is Autostakkert (AS!3) by Emil Kraaikamp. It is free software, and I won't go into a tutorial on how to use it as there are plenty available on the web.

Let us look at our two images after stacking with Autostakkert…

Not overly impressive, huh? The prom image was captured at a much higher exposure which caused a lot of noise in the atmosphere, whereas the surface has a much cleaner background. We'll fix that next.

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CLEANING UP THE IMAGES

Both of our stacked images need to have their histogram adjusted and some sort of process applied that will bring out or details to the point where we can be confident that we are on the right track. The two most common software applications that can do that are Registax & IMPPG… Both are free.

Registax allows for some histogram adjustment and does the detail enhancement via a "Wavelet" adjustment of six levels of detail. It also provides sharpening, but it is very subjective… If you decide to sharpen when using Registax, you can do it later with other software.

IMPPG provides an excellent way to adjust the histogram and brings out those delicious details via a Lucy-Richardson Deconvolution routine that is far superior to the Wavelets adjustment in Registax.

There are plenty of tutorials on-line for using both Registax and IMPPG, so we will not waste the time here. Here are our two stacked images after a pass through IMPPG…

Notice the difference? The prom image has almost all its atmosphere cleaned up and the details are orders-of-magnitude better in both images. We'll make even more improvements in our next step.

There are at least a dozen photo processing applications available on the market… Adobe Essentials, CorelDRAW, and PaintShop Pro just to name a few. However, by far, the most popular for our application are GIMP and Photoshop. I use Photoshop CC 2020 and will take you through the steps without trying to "give you a lesson" on how to use Photoshop. The key is to recognize the concepts, not how to use your particular software.

I do take advantage of several "plug-ins" in Photoshop, most notably Topaz Labs, but will not use any of them in the following demonstration.

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PHOTOSHOP

We will get started by bringing both of our monochrome TIFF images into PS. We will do the prom image first and get it ready to accept our processed surface when it too is ready.

For convenience down-the-road, we are going to change the Mode from grayscale to RGB Color and save both images. (Image>Mode>RGB Color, 16Bits/Channel) You may be thinking, "Why not wait until later?" Because we are going to take advantage of temporary color to make us aware of minute things that are not always obvious in grayscale.

The Prom Image…

First off, we will deal with that light artifact in the upper right corner. Just take a soft brush (~300 px) and set the color, using the eyedropper tool, to same color (black) as the area outside the offending area and paint it away. Easy.

A word about Color before going forward. I mentioned that we will use color, not only for the final image, but to help with processing. There are many methods of coloring an image, we are going to use Color Balance for this demonstration. Here are the Color Balance settings that we will use every time, all the way to the final product…
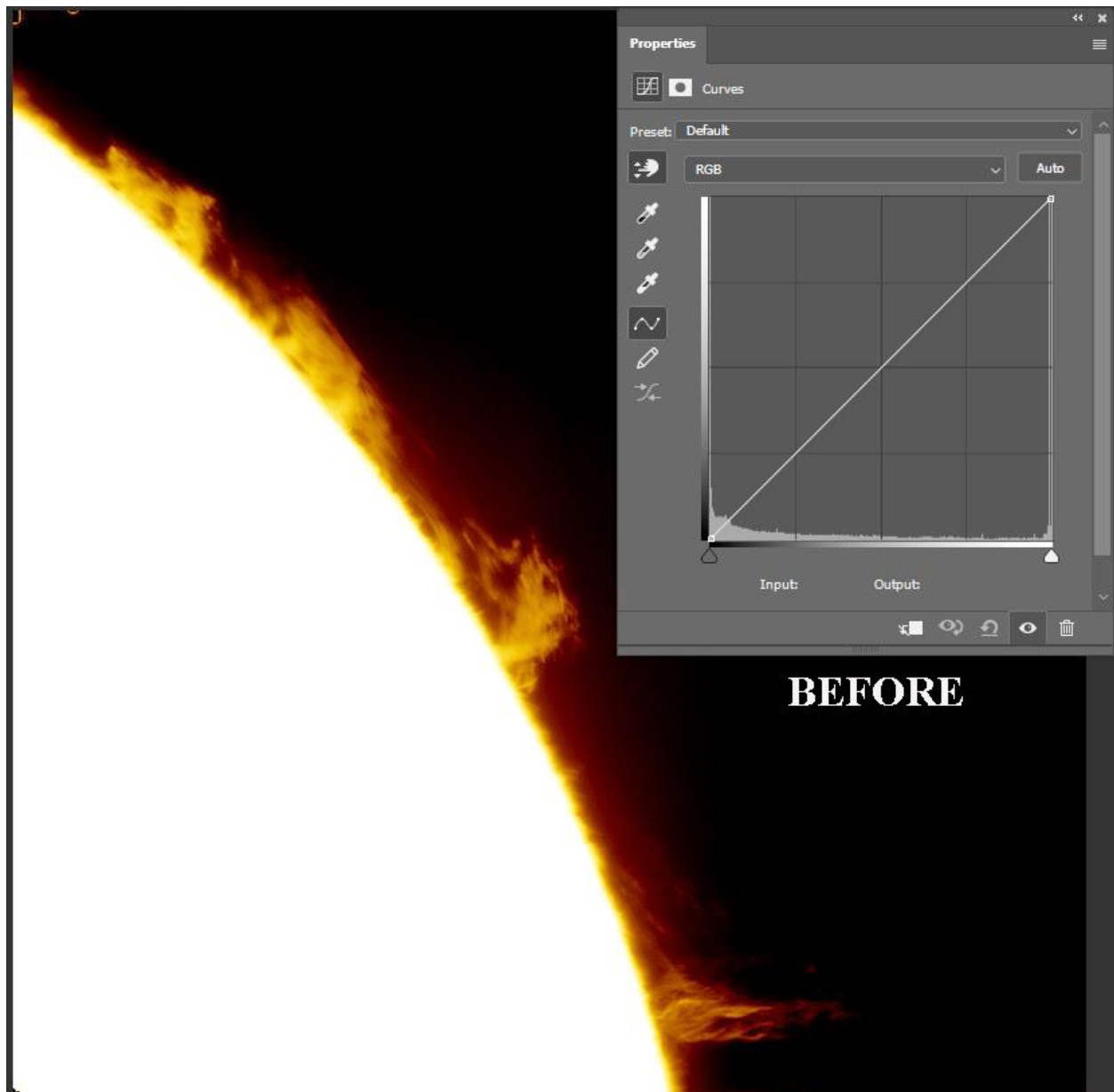
USING COLOR BALANCE TO SET COLOR IN PS			
	RED	**GREEN**	**BLUE**
SHADOWS	50	10	-100
MIDTONES	20	0	-60
HIGHLIGHTS	30	-20	-40

It may seem tedious to set nine values every time you want to add color. However, Photoshop will let you "record" an Action that will apply those values to a Color Balance Layer with one click of the mouse.
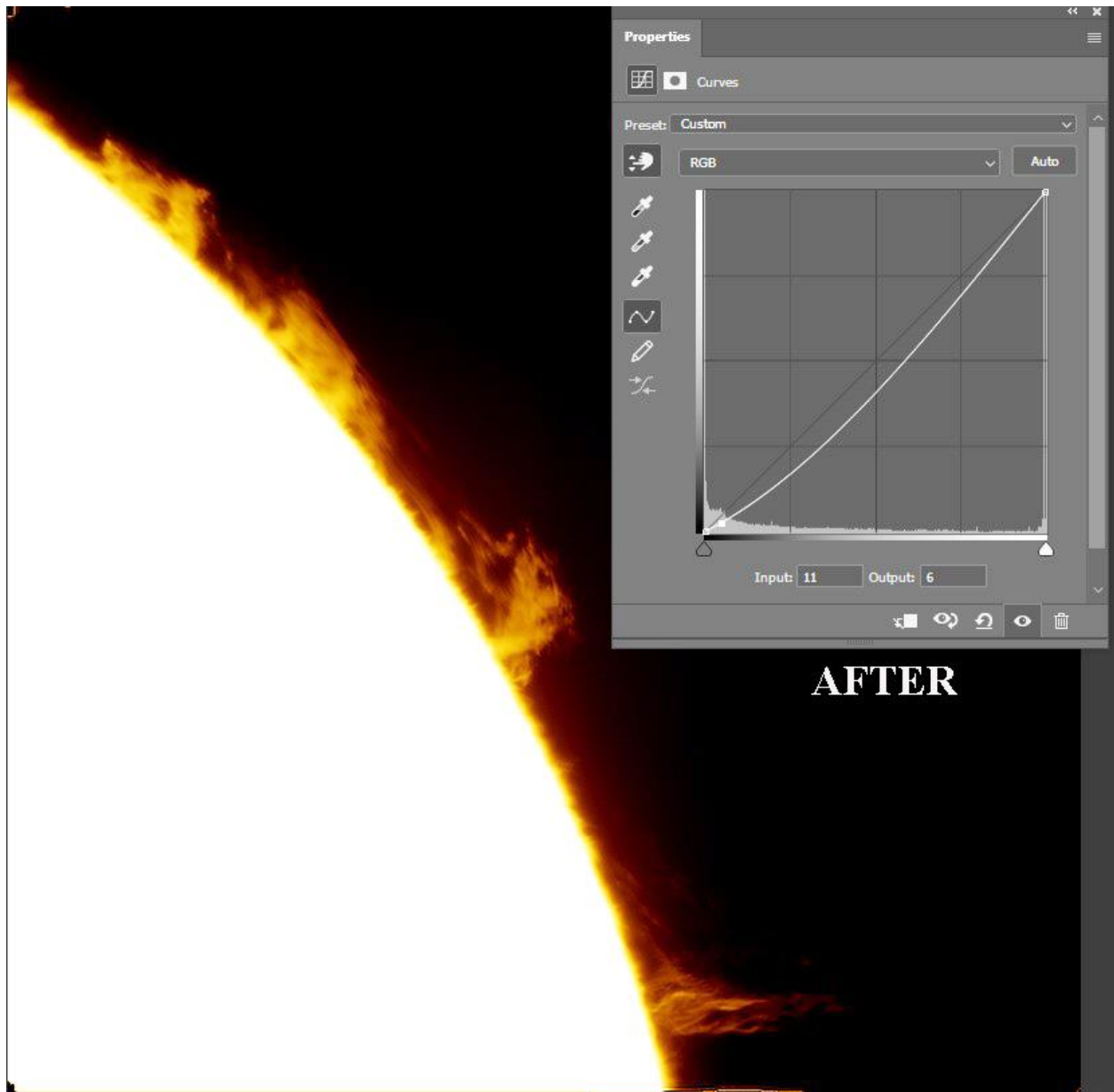
Apply a Color Balance layer at the top of your prom Layer stack. That will reveal that there are some slightly over-exposed areas in-and-around your proms. We want to get rid of most of that. Some is okay as proms usually have a small amount of ionized gas around them anyway, but we need to get rid of any excess. We will do that with a Curves Layer just above our Color Balance layer that is stacked atop our image.

It may not be obvious in the two screenshots below, but the difference will be obvious when you are doing your own prom image. It is easier to see the difference by comparing the "twisted" prom at the bottom of the image.

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AFTER

Now, <u>disable the Color Balance Layer</u> by clicking the eyeball off, or simply delete that layer entirely. <u>Leave the Curves Layer in place and flatten the image.</u>

SHARPENING

Simply stated, sharpening is nothing more that adjusting the contrast of an image. There are as many techniques to sharpen as there are stars in the sky. Most techniques, when applied aggressively, will result in some residual noise… There is an eternal argument if one should denoise beforehand or not, and many sharpening routines include a variable denoise function. I caution the reader to avoid over-sharpening, especially with proms. Proms are generally willowy and overdoing it can ruin an otherwise fine capture.

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This image did not really need any sharpening, but I'm going to walk you through a method that will sharpen proms quite well with zero noise. It is called a High Pass Filter. Here is how…

I assume you flattened your image as pointed out above. This is important… Make a Background Copy just above your flattened image. We will apply the filter to that layer, and if you've "over-cranked" it you can always delete that background copy layer and try it again.

Working with the Background Copy active, go to Filter>Other>High Pass. When the dialog box opens set the Radius to 1.3 pixels and press "OK". Now, set the blend mode of the Background copy to either Overlay or Soft Light. (I prefer Soft Light for proms.) Be gentle with the Radius settings… A number between 0.8 & 1.5 will suffice for most prom shots.
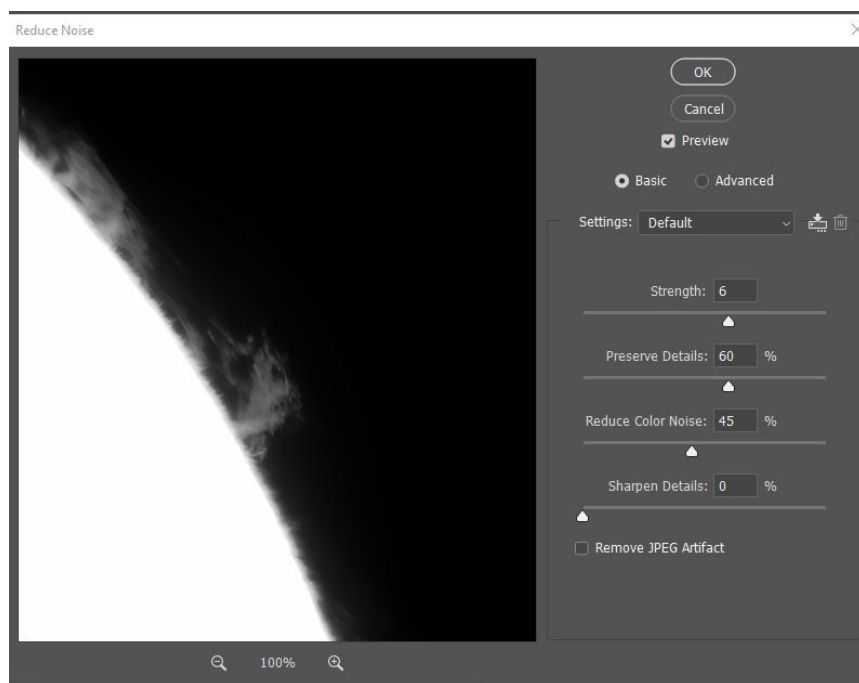
If it is not what you want, simply delete the Background Copy layer and start again. Note: Savvy PS users would point out that making the Background Copy layer a Smart Object would save a few steps, but this is not the place to discuss such things.

DENOISE

Much like sharpening, a little goes a long way when applying a denoise filter to a prom image. A little noise is most often a good thing when it comes to proms. So again, be gentle.

I will assume you have a background copy that you have already sharpened. If so, it is time to flatten the image leaving only a background layer that now contains your sharpening. Next, make another Background Copy Layer directly above the flattened Background layer.

Now, we are going to open the Reduce Noise filter's dialog box… Filter>Noise>Reduce Noise. This filter will operate on your background copy just like the High Pass Filter did previously. Here is the box…
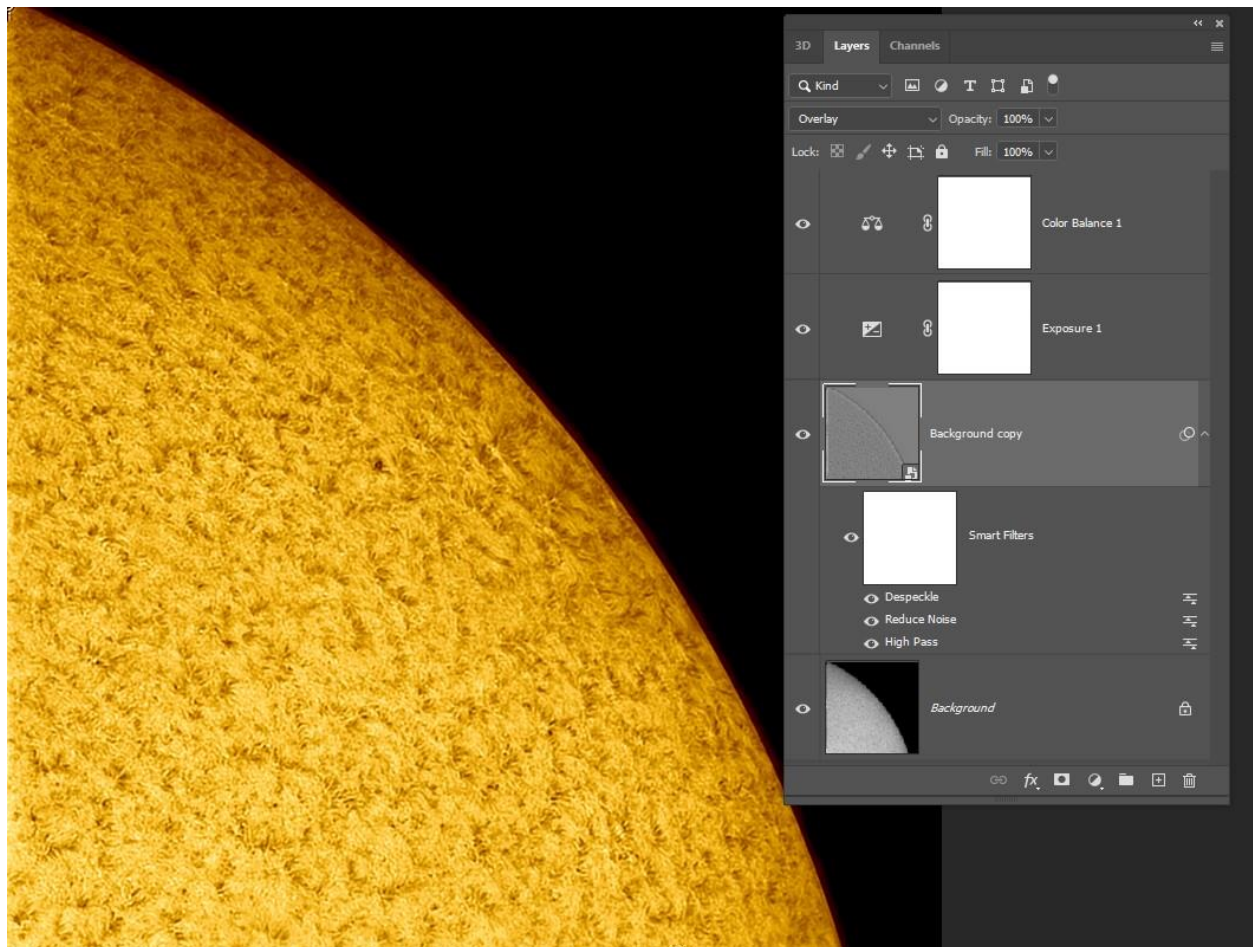

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Those settings are pretty common for a prom image. Reduce Color Noise does not really matter with a monochrome image. I will bring your attention to the Sharpen Details slider. It does allow the user to sharpen the image somewhat, but we have already done all the sharpening we wanted to do, so we will leave it at 0%... Experiment. Remove JPEG Artifact is not needed since we are working with a TIFF image.

Once you have it where you want it, press "OK" and the operation will be applied to your background copy. You can then go ahead and flatten your two-layer image and you are done with the prom for a while.

The Surface Image…

Since some may not be accustomed to all this talk about layers and other such terms that I have been throwing around, I thought it might be helpful to show my stack when working the surface. Here is where it is right now…

At the very bottom is the "Background" layer. It is simply the image that we got from IMPPG. Recall that we changed its Mode to RGB early on. Jump up to the highlighted layer entitled Background copy. That is a layer you should always have atop your background. If you do not have one installed, do so now.
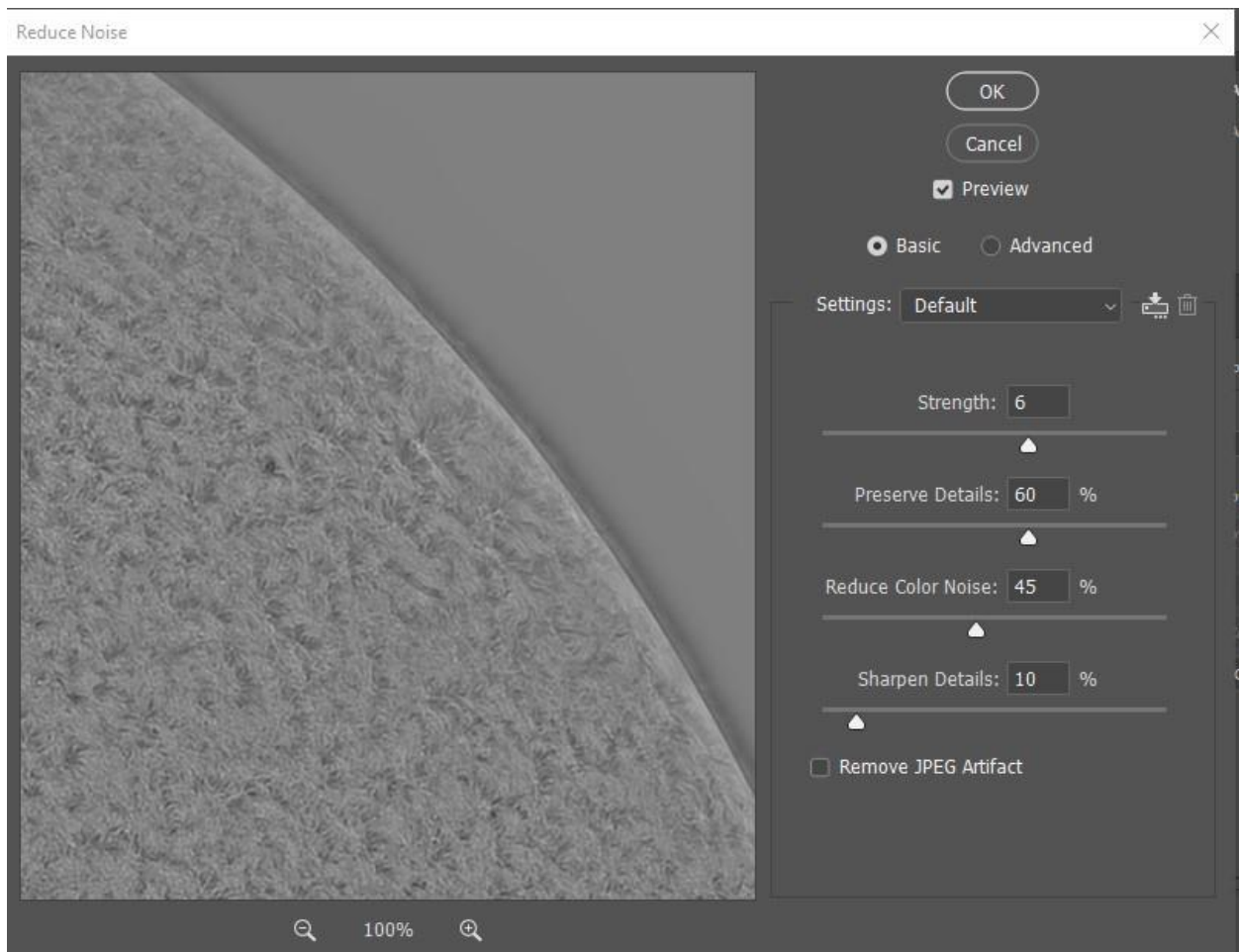
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Jumping to the very top there is our famous Color Balance Layer. Like with the prom, its temporarily there to let me see how things are going during the adjusts. We will remove it before flattening the image to leave an adjusted, seemingly grayscale image that is ready to place on the prom image.

Lastly, let's examine the indented second layer that says Smart Filters. When and adjustment or a filter is used on a layer, that filter/adjustment cannot be changed. By making the Background Copy a "Smart Object" all filters and/or adjustments are listed below and can be further adjusted as needed before flattening.

The Background Copy's blend mode should be set to Overlay or Soft Light for everything to function properly… Smart Object or not. Do that now.

My first action was to run our old High Pass Filter with the Background Copy highlighted, set at a robust 15 pixels. Do that now.

Next came our old friend Reduce Noise, set as follows. Note that I did some sharpening that I did not do with the prom image.
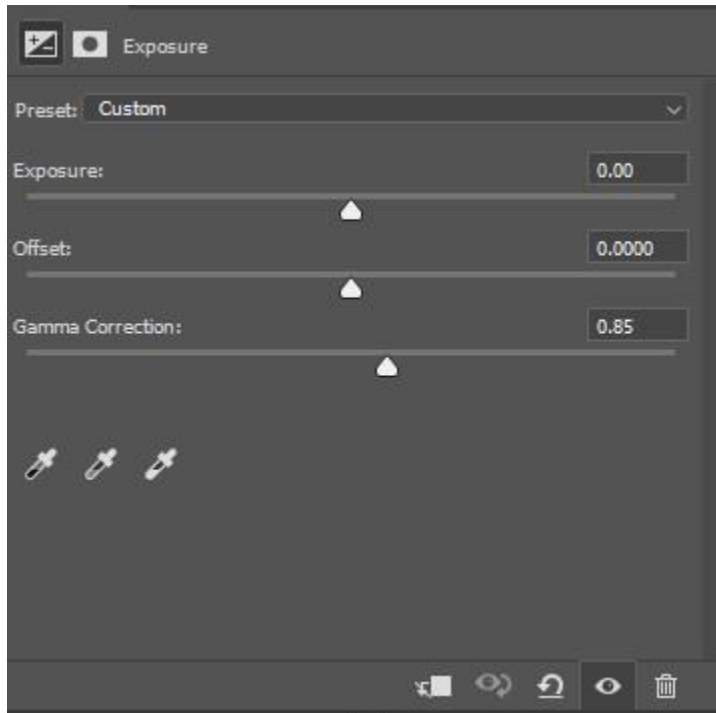

You should apply the Reduce Noise filter to the Background Copy now, if needed for you image.
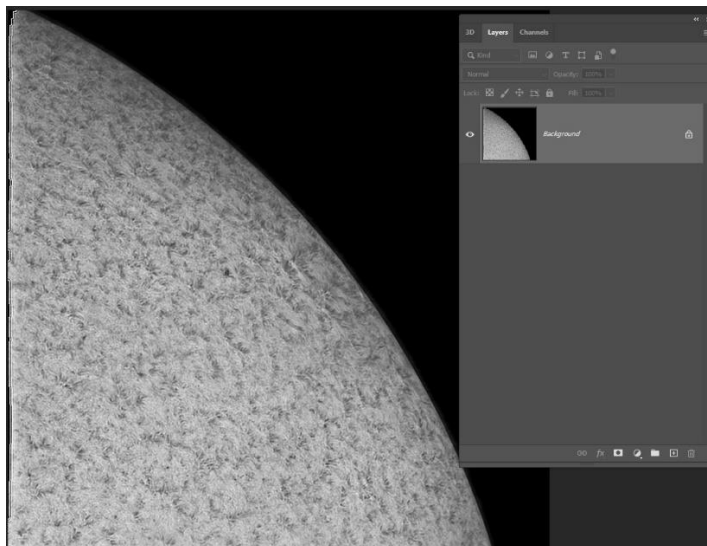
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Once I had ran the High Pass Filter and the Reduce Noise filter, there were some tiny, white artifacts across the surface. To get rid of them, you can run yet another filter atop of the Background copy called Despeckle. Filter>Noise>Despeckle. If you have tiny snowflake spots on your image, run that now.

After running the above routines, my image had developed a hard edge that was going to show up when I married it to the prom. To get rid of that edge, I ran the Exposure Layer just below my temporary Color Balance layer…

The slight Gamma Correction (0.85) was enough to soften that sharp edge that could have caused trouble during the marrying process.
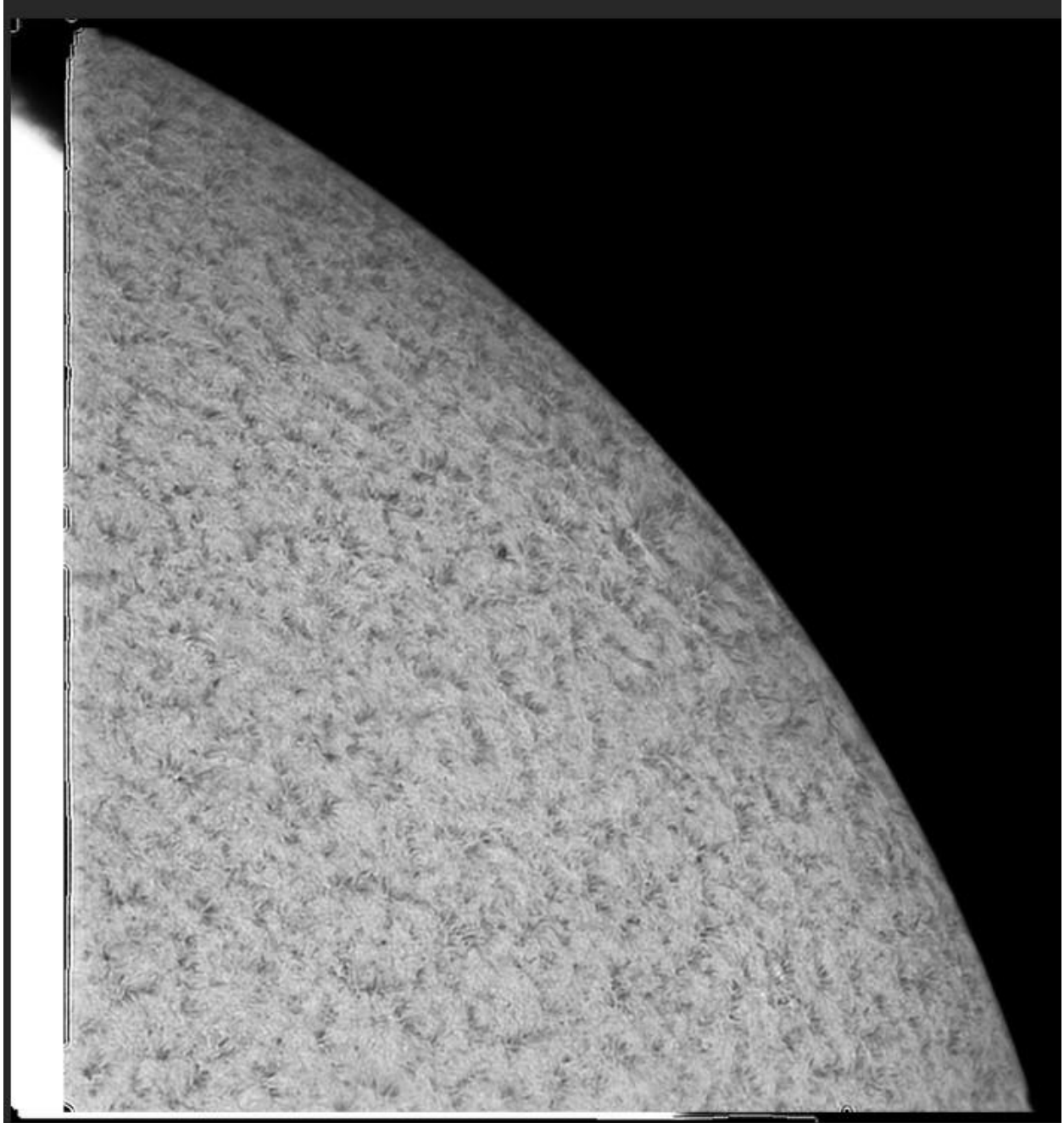
I like what I see, so I will delete the Color Balance layer and flatten the image.

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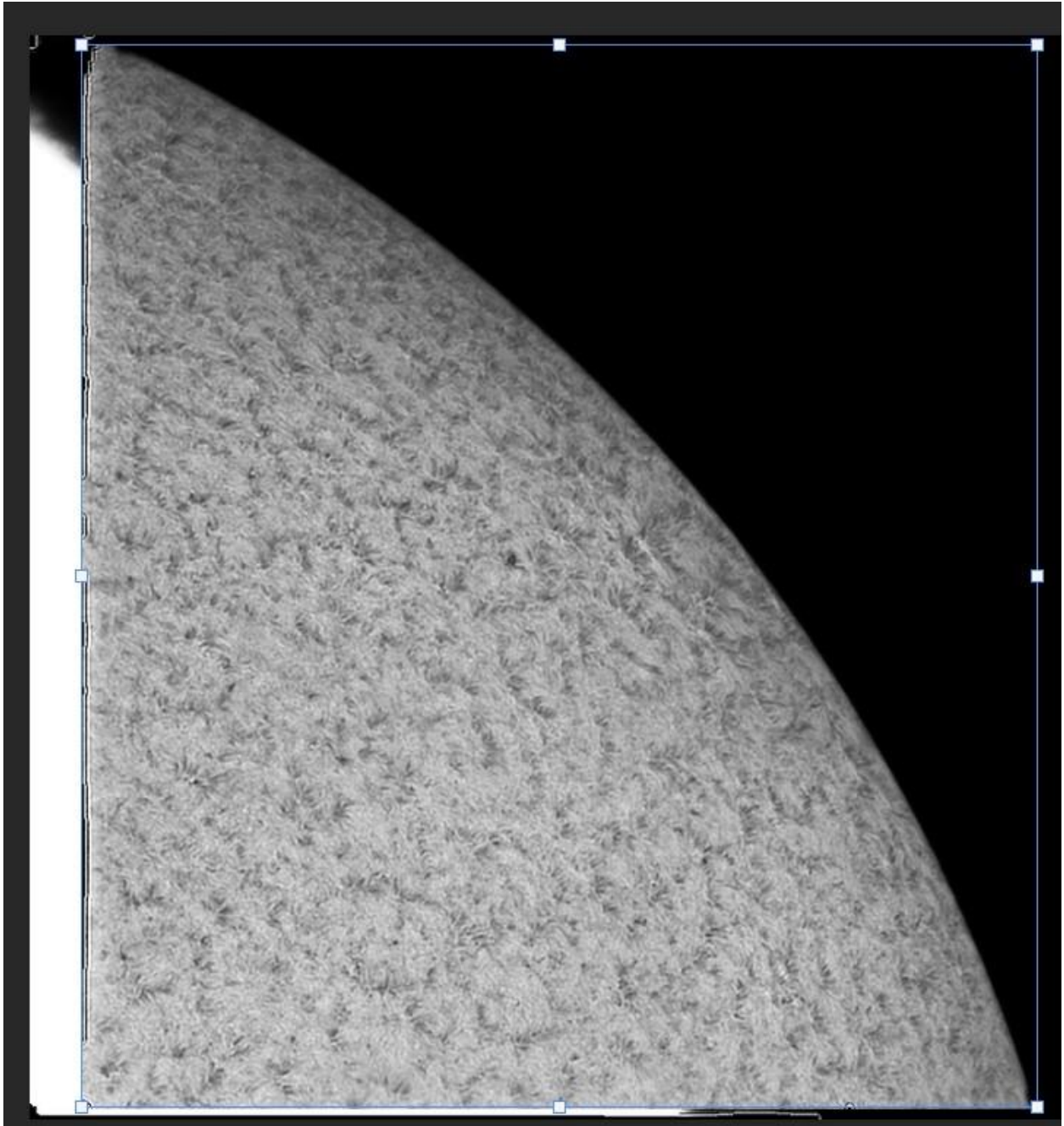
Marrying the Surface & Prom Images...

The process is simple. We are going to "Select" the surface and copy it our computer's clipboard (CTRL-C on Windows). Then we will paste (CTRL-V on Windows) that selection on our surface. It will be necessary to correct for field rotation, but we will cover that below.

Note that the sky in the background is the sky that we cleaned up when processing the prom image.

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Now we will grab the still selected surface with the Move Tool to position it correctly on the prom image. The blue rectangle will activate if you press CTRL-T.
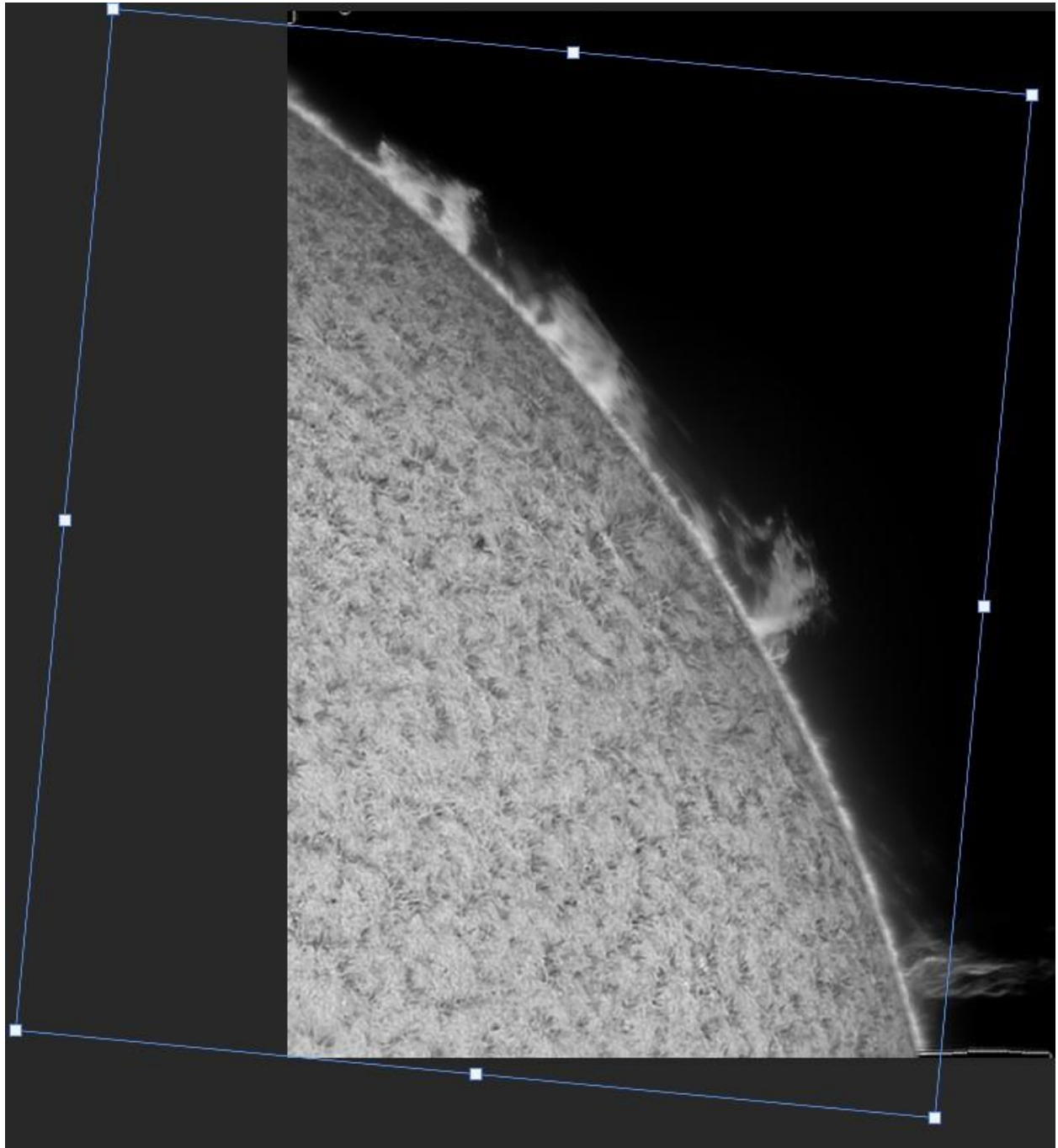

You can move it with the mouse from the center, and rotate it as needed using the curved arrow that will appear if you hold your cursor a little bit off any corner. NEVER change the size of the image!

We want our surface to just touch the rim of the prom disk to reveal any spicule data that might be present.

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Here are our two surfaces finally meeting in wedded bliss…

Just click the check mark at the top of Photoshop to release the Move Tool.
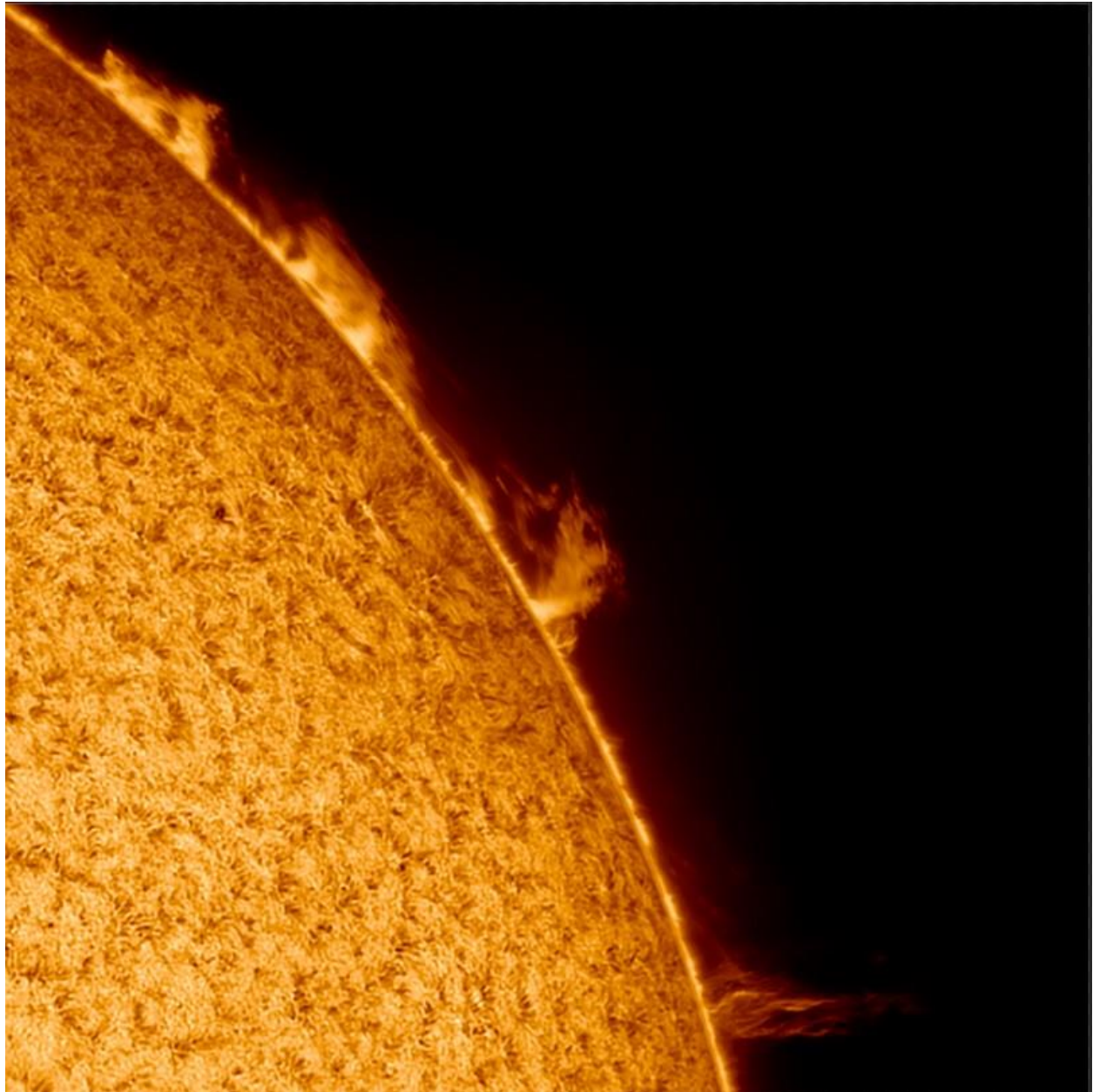
You likely have noticed that I did not crop either image during the processes above. Now is a great time to crop it for content… We will resize it properly for presentation on the web a little bit later.

 LATER NOTE: I cropped the image for content and it came out 750 X 749 pixels so there no need to resize, as 800 X 800 pixels is about what we are looking for on the web on this type of shot. See next page.

Now that we have that grayscale image before us, it is time to add our color. Just flatten the image and place our Color Balance on top… Easy as pie. You will likely notice that it is a slightly different color on the screenshot below. After throwing the Color Balance layer on top, I adjusted the Midtones just a bit... I set the Cyan/Red slider to -18; the Magenta/Green slider to -73; and the Yellow/Blue slider to -40. I am color-blind so I have to go by-the-numbers. LOL

Because I felt it need a little more "pop", I added a Vibrance layer atop the whole thing… Vibrance to +14 & Saturation to +6.

Last thing is to flatten the image and save it as a JPEG for the web.

Thanks for the peek. Note that the pics here are all screenshots. The actual image is much better. John