A Simple Guide to the LRGB Technique

What is LRGB?

LRGB and its cousin, WCMY, are techniques for improving the overall clarity and quality of "true color" images. This discussion will relate to astronomical images, although the technique can be used for more prosaic images as well. The technique was introduced to amateur astronomy separately by Robert Dalby of the UK and Kunihiko Okano of Japan ("Lab Color" technique variation).

How does it work?

LRGB uses a conventional (and in many cases low quality) RGB color image and combines it with a high quality (high S/N) greyscale image of the same object. This combination is done so that only the color information is taken from the RGB image, thereby "dumping" the noise often present in these images. The clarity of the final product, or "luminance" (hence the "L" in LRGB), comes largely from the clear, high S/N, greyscale image. The result is a much cleaner, more esthetic image.

Step by step

I will try to take you though assembly of an LRGB image. You should recognize that one can use several different software packages to do many of these operations. I will use PhotoShop to illustrate these operations since it is one of the most commonly used for this technique.

Get good images first!

Although the LRGB technique will do wonders to improve the quality of your color images, it is not a substitute for good equipment and good imaging technique. Poorly guided images, images of insufficient exposure, or images with gross defects will always have a negative effect on the final product. LRGB is not magic, although it is close!

Get the RGB

The first step is to collect your red, green, and blue images, their dark frames, and the appropriate flat frames as required. The normal image calibration should be done using these frames. It is important, of course, to make sure that the exposures represent the correct ratios of R to G to B. In some cases, and with some cameras, you may wish to take the RGB components in a binned or lower resolution mode in order to decrease your exposure times and increase these components S/N ratio. You will find that this lower resolution in an RGB component has little effect on the apparent resolution of the final LRGB composite. This is yet another advantage of the technique.

Let's make it clear!

Since the improvement in the final product comes from the high quality, high S/N greyscale (L) component, it is very important that when you acquire this component, you achieve the highest quality possible. Some imagers accomplish this with long exposures, some by stacking multiple exposures, some do both. Most LRGB imagers expose the greyscale image with no filtration, removing the IR blocking filter that is used with the color components. This allows maximum S/N in the final image by taking advantage of the IR sensitivity of most CCD chips. Attention should also be paid to the sampling of the greyscale image. This will, of course, depend on your focal length, pixel size, and the quality of the seeing. Most imagers feel that for this application (LRGB esthetic images), one is better to be a just a bit over sampled (too many pixels on a given area of sky) rather than under sampled. The results are generally more esthetic.

Astroimaging software first

Since the component images need to be calibrated before applying the color techniques, you will want to do this within one of the many astronomical image processing packages. Several of these packages will also allow the registration and perhaps the combination of the red, green, and blue components into the RGB color image. If you are doing registration of the images using one of these programs, you may wish to register the final greyscale component image to the RGB component before exporting the images to PhotoShop as this eliminates the need to register in PhotoShop and often does a more precise job of registration. I register all of the component images to each other using imaging software (Mira) before any combination is done.

Into PhotoShop

Most astronomical images are more than 8 bit images. Most common is a 16 bit format. Versions of PhotoShop newer than 5.0 will read a 16 bit .tif file and even a 16 bit astronomical .fits file with the correct plugin. These 16 bit files will need adjustment in PhotoShop, however - see below.

In The .RAW

To open a 16 bit file in PhotoShop, select [File] [Open] and select the .tif or .fits file you wish to open. Now select [OK]. You will now see the image loaded and it will probably be mostly or completely black. To correct this, select [image] [adjust] [levels]. Drag the rightmost pointer under the histogram (Figure Two) most of the way to the left and the image will begin to appear. Then select [OK]. Repeat this process until you get the image looking like it did when you left your astronomical software. You will likely need to adjust the black level (left) pointer and the middle pointer a bit on the last time through. Two or three passes will usually do it. Once this is done select [Image] [Mode] [8 bit]. You are now in 8 bit mode.

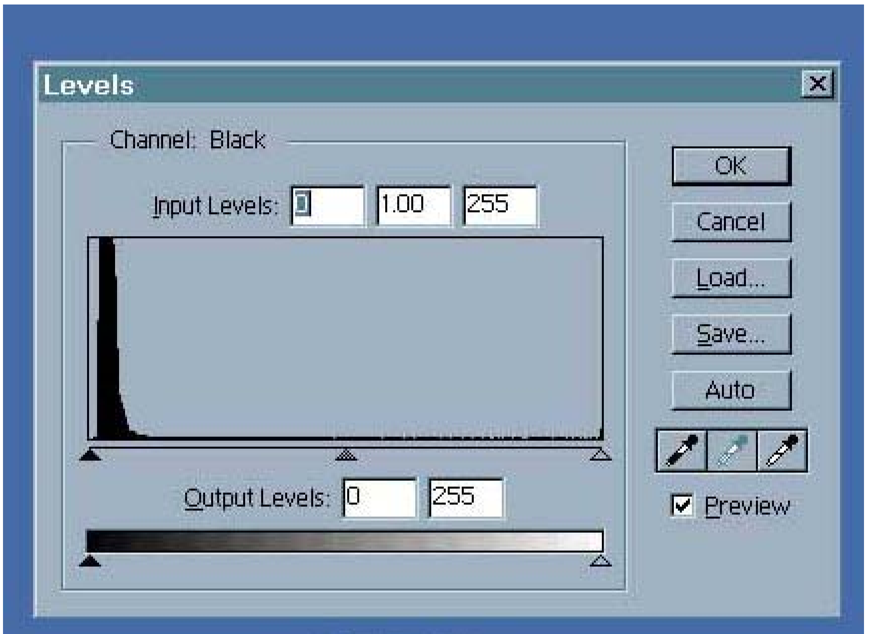

Figure 1

RGB yet?

If you have already combined your red, green, and blue images into an RGB color image in your astronomical software, you need only save this as a (24 bit) color .tif and load it straight into PhotoShop along with your 8 bit greyscale unfiltered image which is to be your “L” component. If you have not combined your color images into an RGB yet and wish to do this in PhotoShop, you will want to do that next.

Bring on the color!

By this time you will have your red, green, and blue components converted to 8 bit and loaded into PhotoShop using one of the methods above. You should also have your 8 bit “L” component opened (but minimized for now to avoid confusion). The first step in the color combination process is to display the channels window (Figure Three). Select [Window] [Show Channels]. Next, select the small arrow to the upper right of the Layers/Channels window and go down to [Merge Channels] and select this. A new dialog box will appear (Figure Four). Select [RGB Color] in the top box and leave the other (Channels) box set to [3], now select [OK]. The next dialog box will ask you which images to use for each channel. Enter the appropriate images for each channel and select [OK]. Your color image should now appear. If you have registered it, it should look pretty good (maybe a bit noisy) at this point. If it has not been registered in your astronomical program, then this should be done next.

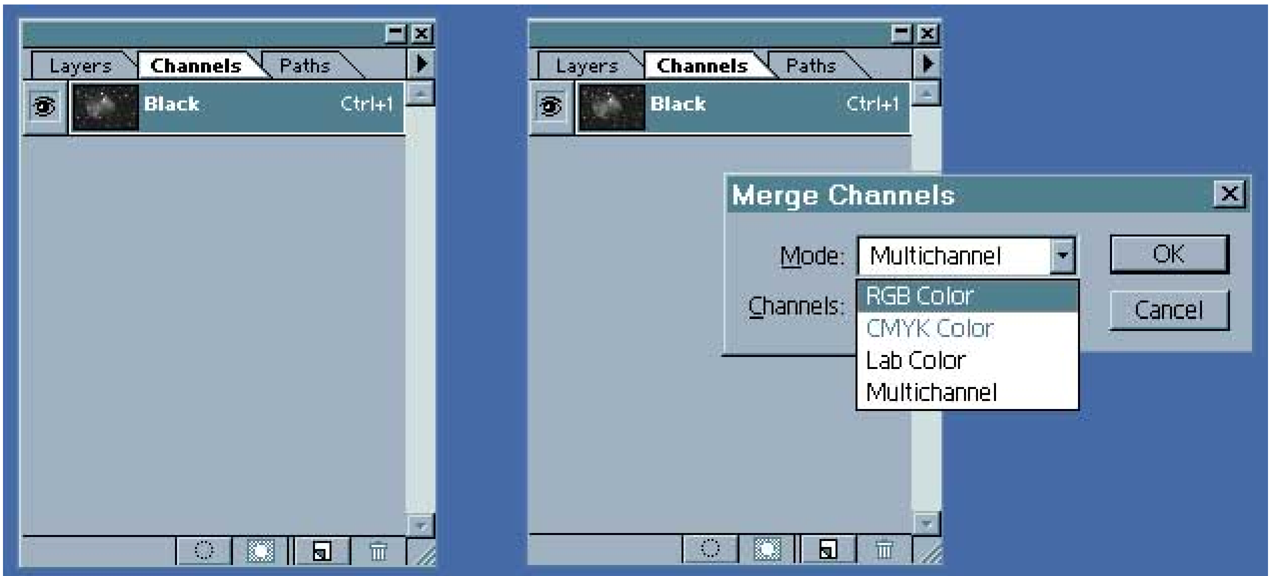

Figure 3 Figure 4

Before if you can

It should be noted here that PhotoShop is not designed to do precise registration of astronomical images. If you have a program that will do a precise sub pixel level registration, you would be better off doing this before bringing the images to PhotoShop. You will not only find this easier, you will almost certainly find that it does a better job. There are quite a few image processing programs that will do this (MaxIm and Mira, to mention just a couple).

Line 'em up

If you are doing registration in PhotoShop, start by being sure that you have the channels window displayed and be sure that you have selected the move tool from the toolbar. Next make sure that you are viewing all channels, including the RGB, this can be done by insuring that the "eye" icon is visible to the left of each channel in the channel window (Figure 5). The next step is to select the channel that you wish to act upon by clicking on the main bar part of this channel in the channel window – the bar will change color indicating that it is the channel currently being acted upon. It is also helpful to zoom in on a set of stars, this allows a more precise registration. The user will next want to use the mouse and move tool to do a rough alignment by moving the color channels selected to align them. Fine adjustment can be done using the arrow keys. Once the alignment is complete, unzoom the image and zoom on several other parts of the image. If one part of the image is well registered and others are not, the color components are very likely rotated relative to each other. Although it is possible to correct this by selecting and rotating the channels with PhotoShop in much the same way as you shifted them, it is better (and much easier) to do this ahead of time by registering with an astronomical imaging program.

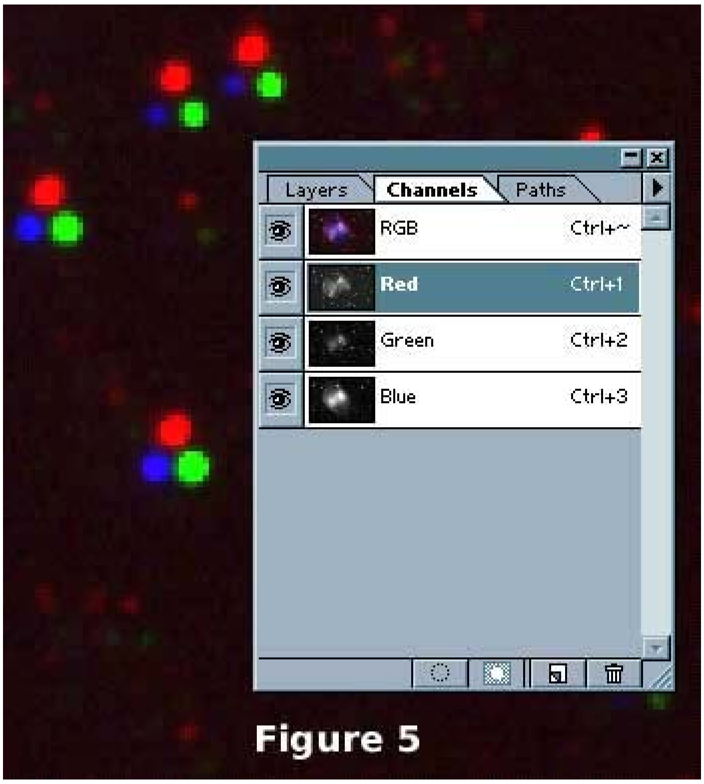

Figure 5

If you wish to adjust the color balance at this time, you can do this by highlighting the channel you wish to adjust in the channel window and then selecting [Image] [Adjust] and [Levels] followed by adjustment of the histogram pointers to balance the color as you feel is appropriate. If you are viewing the RGB image ("eye" symbol), you will see the effect of your adjustments on the RGB image. It should be noted that these adjustments can still be done after adding the luminance layer.

Now for the good stuff!

Next let's perform the magic and add the luminance layer. To the left of the channels tab you will see the layers tab (Figure 6). Select this and you will see that there is presently one layer called "background". This is the layer made up of the RGB image that you just assembled. To add a new layer select the "corner folded paper" icon at the bottom of the layers window. This will create a new layer called "Layer 1". The default characteristic of this layer is [normal] (see the top of the box). Change this to [luminosity] which is found at the bottom of the selection list. OK, remember your unfiltered, high S/N image, that was minimized at the bottom of PhotoShop? You should now open it again and select the entire image using [Select] and [All]. Then copy this image to the clipboard using [Edit] and [Copy]. You can now minimize the greyscale image again to get it out of the way. When you minimize the greyscale image, your RGB image will again become the active image. Now click on "Layer 1" in the layers window to select it. If you have already registered your greyscale image to the RGB image, leave the [Opacity] set to 100%. If you have not registered it yet, you will need to do this next and you will want to set the opacity (for now) to approximately 50%. Next select [Edit] and [Paste]. This will paste the greyscale image into the luminosity layer. If you have already registered the greyscale, you will see the instant improvement in the image that LRGB gives you. It should be quite a distinct improvement. If you still need to register the greyscale image and have set the opacity to 50% as mentioned above, you will be able to "see through" the RGB image to the greyscale image. Use the move tool (like you did when you registered the Red to Green to Blue) and move the greyscale image into registration with the RGB image. Once you have it where you want it, move the opacity slider back to 100% to see the result.

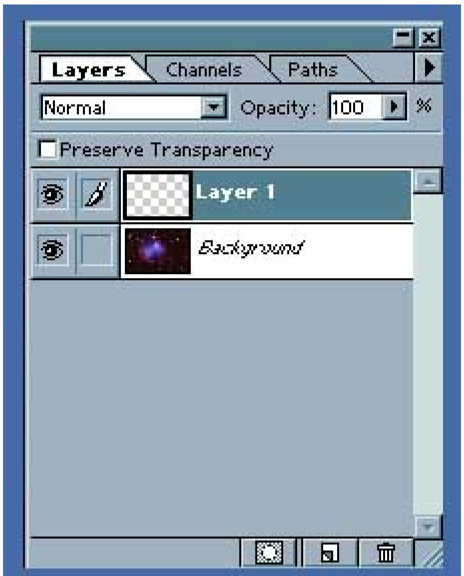

Figure 6

Are we there yet?

Except for the removal of artifacts like cosmic ray hits, blooming, etc. you are mostly done. You can still alter the color balance by selecting the RGB layer in the layers window and the color you wish to adjust in the channels window (and then adjusting the levels). If you do this, be sure the you DO NOT have the luminosity layer selected or you will not see the changes you expect! Once you are satisfied with the results, go to the layers window, select the arrow to the upper right and then [Flatten Image]. This combines the layers so that the image can be saved as .tif and other common files. You may wish to save the image as a PhotoShop file as well before flattening, since this will preserve the layers and allow future changes without redoing everything.

One more technique

It is usually quite obvious that the RGB image is of lower "quality" than the luminance component. Usually this takes the form of a grainier RGB image. This can be reduced greatly by the LRGB method. There are other problems than may be present in the color components that are not automatically reduced by application of the luminosity component, however. Such things as poor guiding in one of the color images, chromatic aberration that causes the stars to be slightly larger in one color than the other (resulting in colored "halos" around stars), or other defects can sometimes be reduced or eliminated by the next technique we will discuss.

Fuzzy wuzzy

Artifacts like those mentioned above can be treated by blurring the color components of the image. “But”, I can hear you say, “doesn't that blur the final image?” If you remember that the sharpness comes from the “L“ component of the LRGB, and you recognize that we only blur the R or G or B component, you can see that the blurring effect on the final image will be minimal. Let's say that the stars, especially the brighter ones, have a bit of a green halo due to the stars in the green component being just a bit larger (this is not uncommon). Start your correction of this by selecting the RGB layer in the Layers window. Next switch to the Channels window by selecting the [Channels] tab to the right. Then select the color channel you wish to modify and be sure you are viewing the full LRGB image so you can see your changes. You may want to slightly zoom in on an offending area to make your changes more visible, but not so much that you can't see the effect on the wider areas of the image. Next select [Filter] [Blur] [Gaussian Blur] and make sure [Preview] is checked (Figure Seven). Adjust the radius slider until the desired effect is seen on the image. You may need to unzoom afterward to be sure that you have not overdone it. The idea is to get rid of the artifact without affecting the image in a negative way. Two things need to be noted here. First, it may not be possible to get rid of the artifact entirely (obviously it depends on the type and degree of the problem). Second, you will often need to blur the other color channels as well to a similar (but not necessarily identical) degree – this tends to reduce color distortions often present from modification of just one channel.

Figure 7

A few final thoughts

I would like to say to the dedicated scientific types out there that I am quite aware that these techniques are not for science. They are strictly intended to produce attractive color images of CCD objects. In that regard, I think they are quite successful. The major “artifact” introduced by the technique is that it tends to turn the stars “white”, especially the brighter ones. Some imagers find this objectionable, but personally, I find it no better or worse than the over saturated, colored stars of the straight RGB image. In fact, it tends to look more like the film images we are familiar with. One could argue forever about what “true color” is for deep sky objects (we have all seen these discussions on the net), and there are several new techniques (see WCMY) to help with this issue, but the one thing that is hard to disagree with is that LRGB (or WCMY) just “look better” than plain old RGB. I hope you enjoy the technique.

Take a look at an example of "before and after" LRGB.

More Images, More Information

More LRGB, WCMY images and information can be found at the following web sites:

Robert Dalby

Kunihiko Okano

Al Kelly

Chuck Shaw

Ed Grafton

Images captured from PhotoShop V 5.0 by Adobe Inc.

These pages created and maintained by William McLaughlin

Contact Me