Tutorial

Colouring Solar Images using 'Curves'

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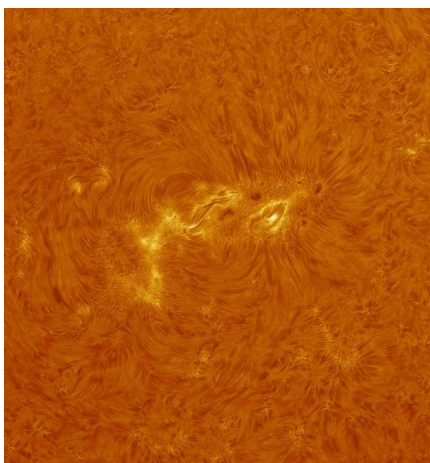
Introduction

It is quite common to colour solar images using a 'gamma colour wash' in which the RGB channels are adjusted linearly to achieve colour. In this tutorial we're going to colour a solar image using the 'curves' transformation function as an alternative method. Using the curves transformation function enables the user to colour the image with more subtlety and control than can be achieved with the 'gamma' colour wash, as curves provides a means of adjusting the colour over the entire luminance range of the image with a large degree of independence. I'm using PIXINSIGHT, although this works with any other image processing software with a curves function and the principles are the same, whichever software you are working with. A more complete description of the curves transformation function (for PixInsight) can be found at
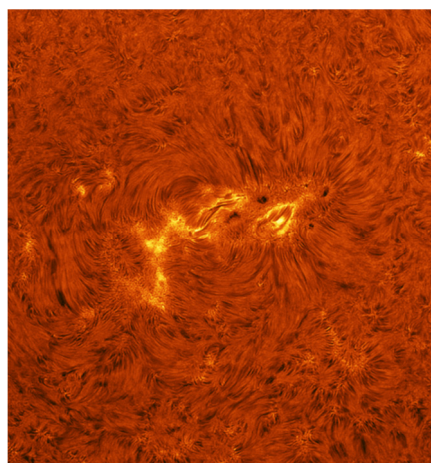http://pixinsight.com/doc/tools/CurvesTransformation/CurvesTransformation.html

Of course, the final colour that we choose for our images is a matter of personal taste, so what I'm presenting here is a process, not what is right or wrong. Others reading this may have their own ideas on how to colour solar images. This is just an illustration of how I colour mine.

The examples below show a traditional gamma coloured hi-resolution image (Figure 1) and one coloured using the curves transformation function (Figure 2) (Thanks go to Ralph Smith (Solar) for the original image, which I've modified for the purposes of illustration). Using this method Shadows can be darker red/orange, whilst highlights can be emphasised with yellow, or white, for example.
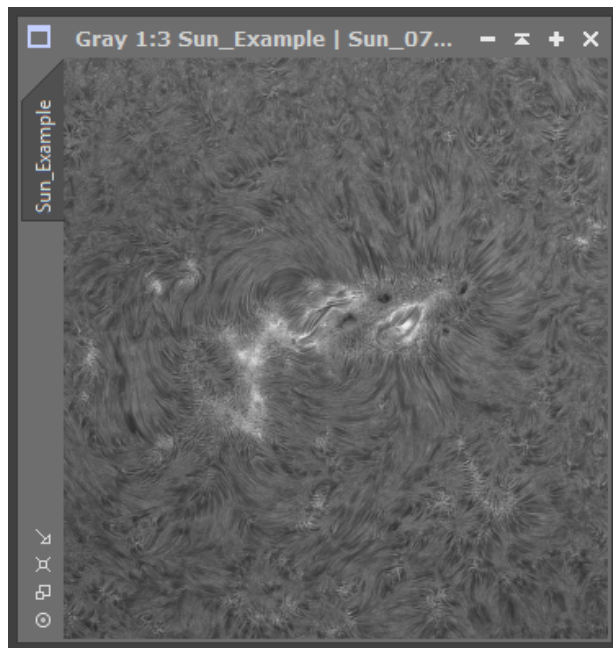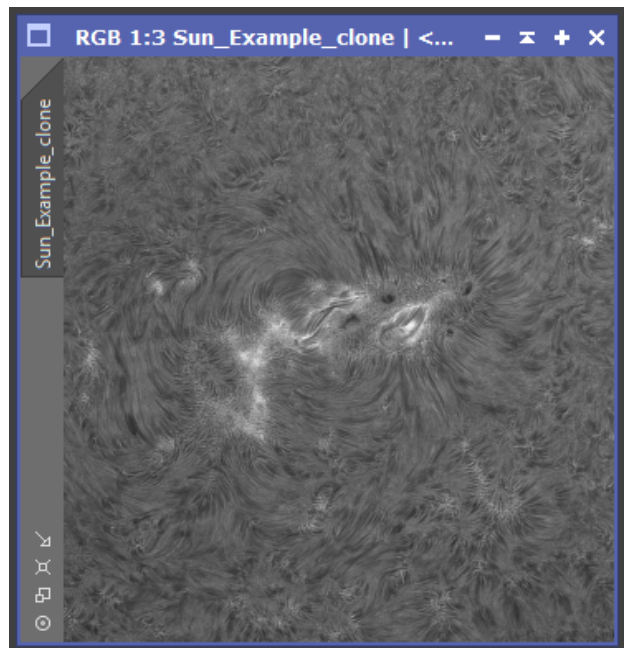

Figure 1- Example Gamma wash

Figure 2- Example curves colour

The process

Start by converting the original grey-scale image (Figure 3) to RGB colour (Figure 4). This separates out the red, green and blue channels which can then be adjusted independently in order to colour the image. Note that even though Figure 4 is now technically a colour image, it appears monochrome because the corresponding pixel values are the same for each RGB channel, respectively. Note that these are screen shot images with limited resolution and are provided for illustration only.
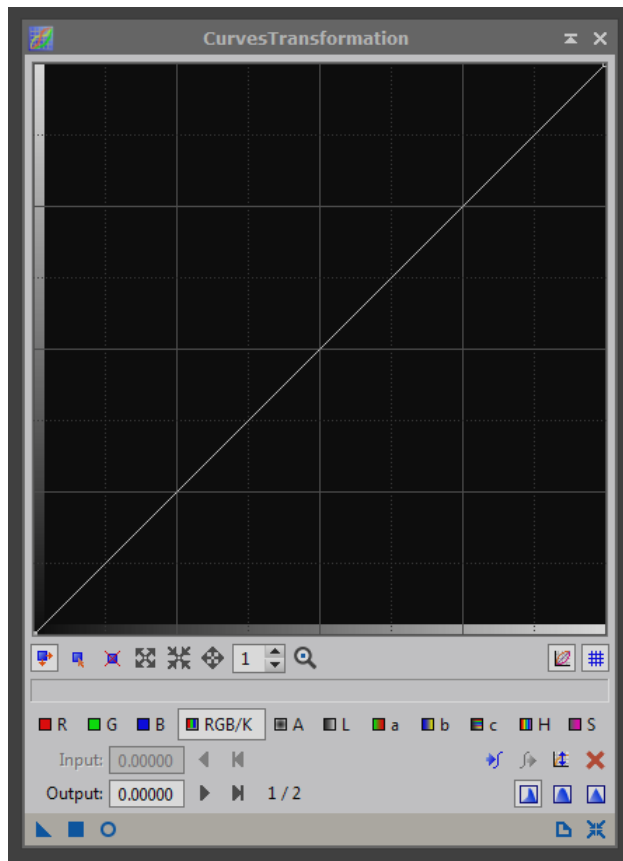

Figure 3- Grey scale   Figure 4- RGB space

Opening the curves transformation function (Figure 5) provides the typical input/output curves found on other image processing packages.

Working in RGB space provides four curves (initially superimposed): Red, Green, Blue and one that enables all three channels to be adjusted simultaneously (RGB/K).

Figure 5- Curves transformation screen- RGB channels (plus additional colour and lightness functions not used here).

Using this transformation function, each channel can be selected independently and the curve for each channel adjusted to the appropriate position to change the colour of the image. This takes some experimentation and sometimes a couple of iterations to get to the colour required.

For solar colouring, I find it best to increase the red, significantly reduce the blue and adjust the green down a little to achieve the red/orange tones that I'm looking for. As mentioned, with curves, it is possible to adjust the amount of red/green/blue in the darker (left) and lighter (right) regions independently, so as to emphasise yellow/whiter active regions and provide deeper contrast in the shadows.

Figure 6 shows a screen shot of the red curves transformation function and the corresponding 'monochrome' image in RGB colour space. Figure 7 illustrates the tinting effect produced by increasing the amount of red, accomplished by adjusting the red curve upwards close to centre, above its original linear position.
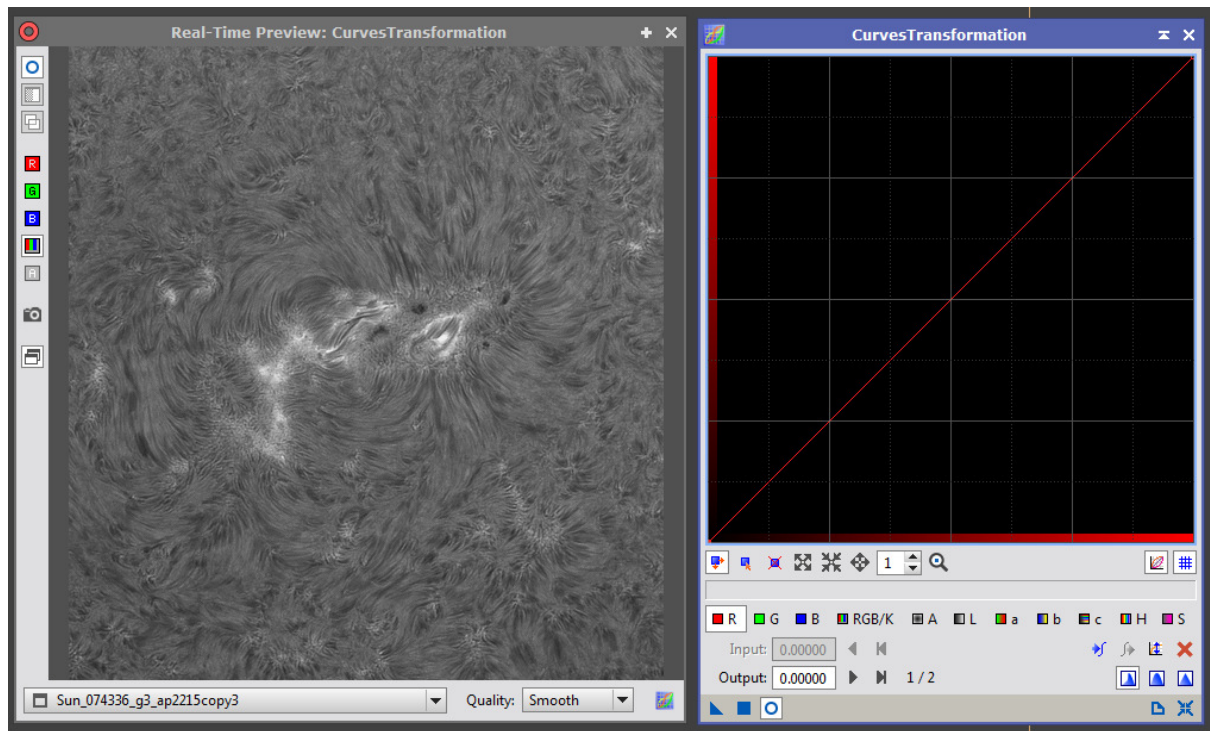
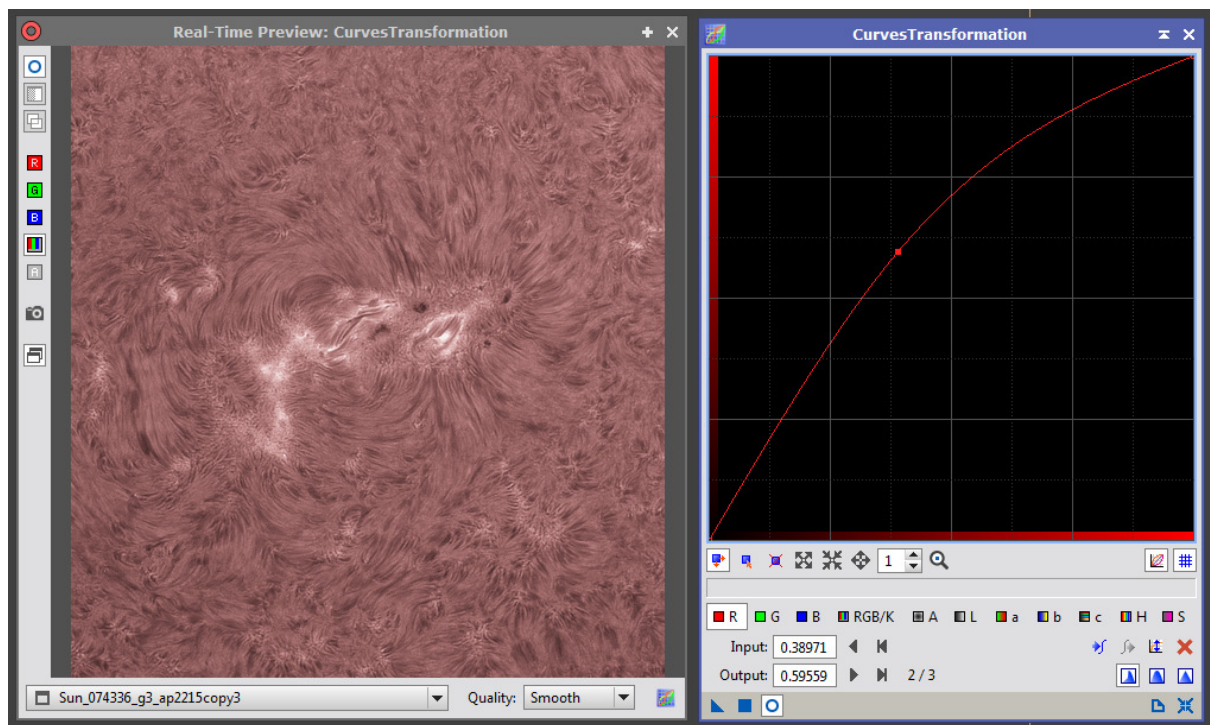*Figure 6- Curves transformation window with red channel selected.*

Figure 7- Effect of increasing the amount of red in the red channel.

This image still contains unchanged levels of green and blue, which need to be reduced in order to meet the colour target. Figure 8 shows the effect of reducing the blue contribution. As can be seen, the image now takes on a green/brown cast. Green now needs to be reduced by selecting the green channel and dragging the curve down.
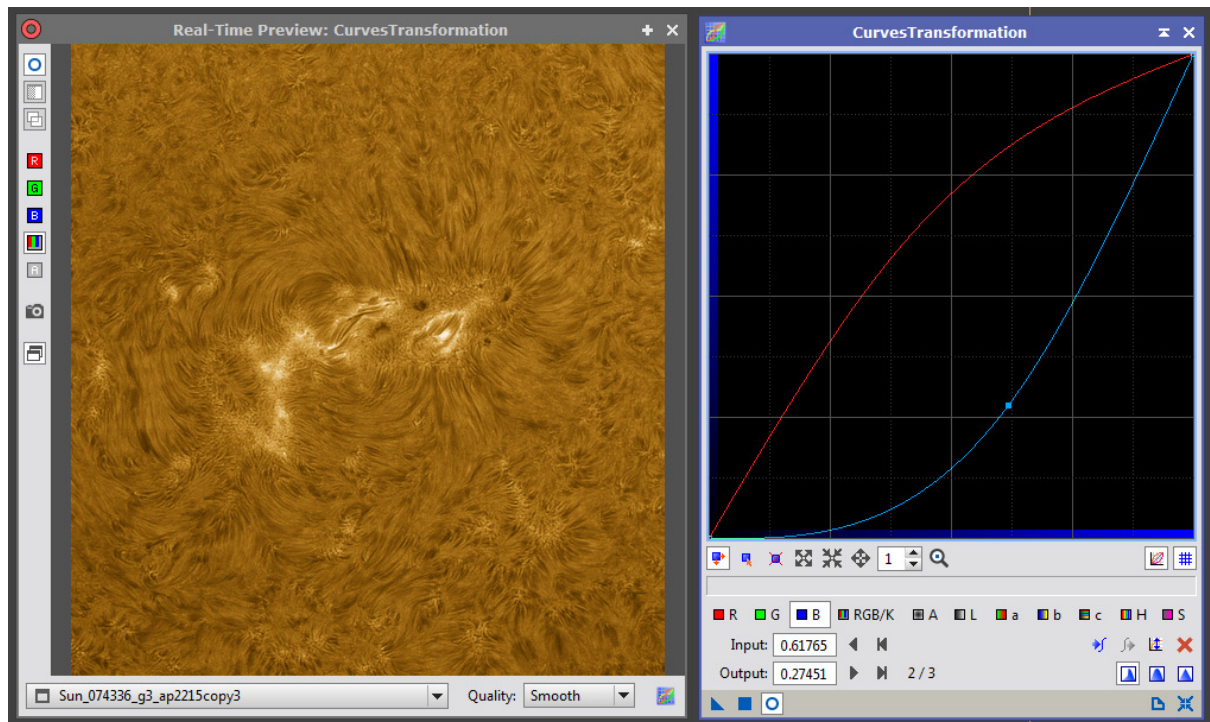
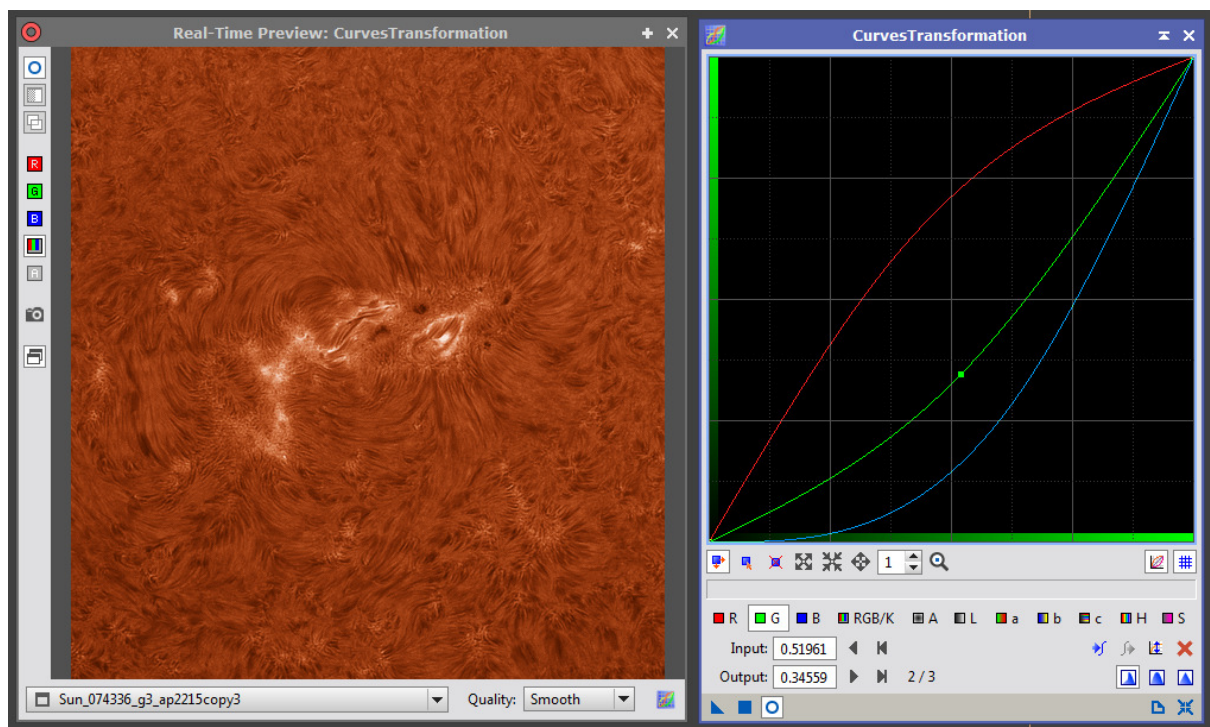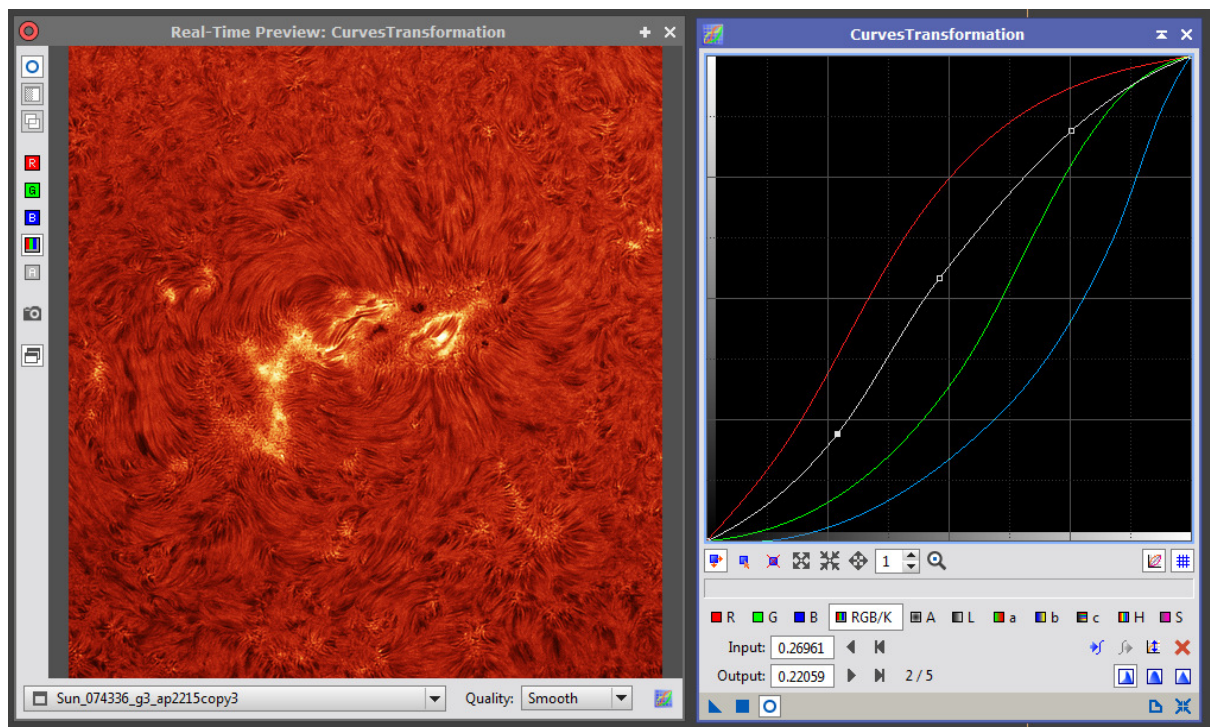*Figure 8- Reducing blue colours the image green/brown .*

Figure 9- Reducing the amount of green by dragging the green curve down a little.
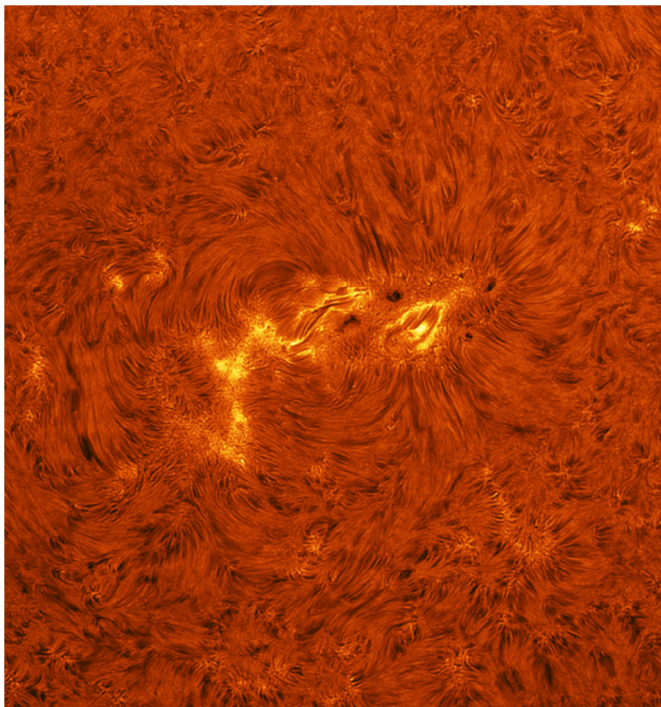
Figure 9 illustrates that reducing the amount of green in the image creates something closer to the required red/orange colour.

Contrast can be enhanced and further colour modifications can be achieved using the curve found under RGB/K, as shown in Figure 10, which adjusts all three channels together. Note that further adjustments to the RGB colour channels have also been made at this point.
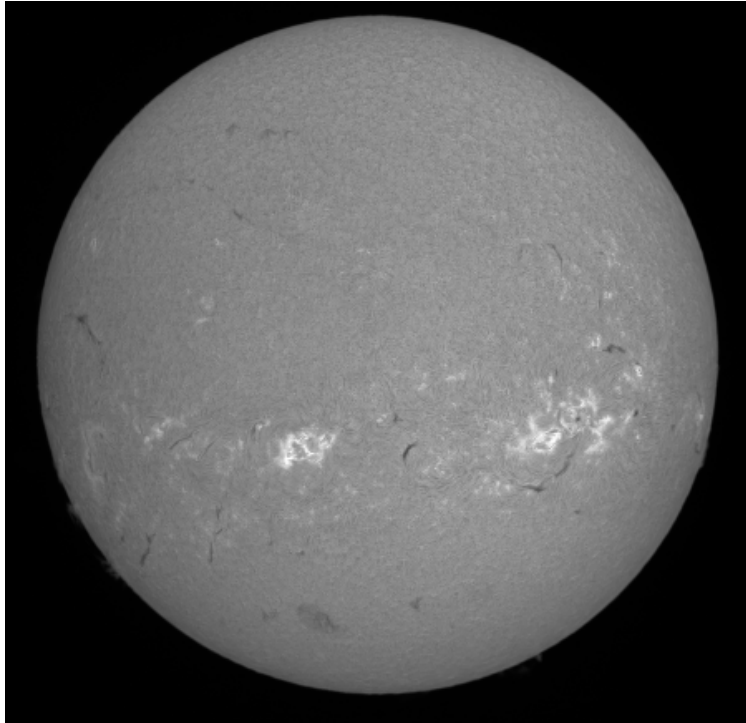

Figure 10

At this stage further fine adjustments can be made to each of the channels in order to modify the image colour and contrast to your personal taste.

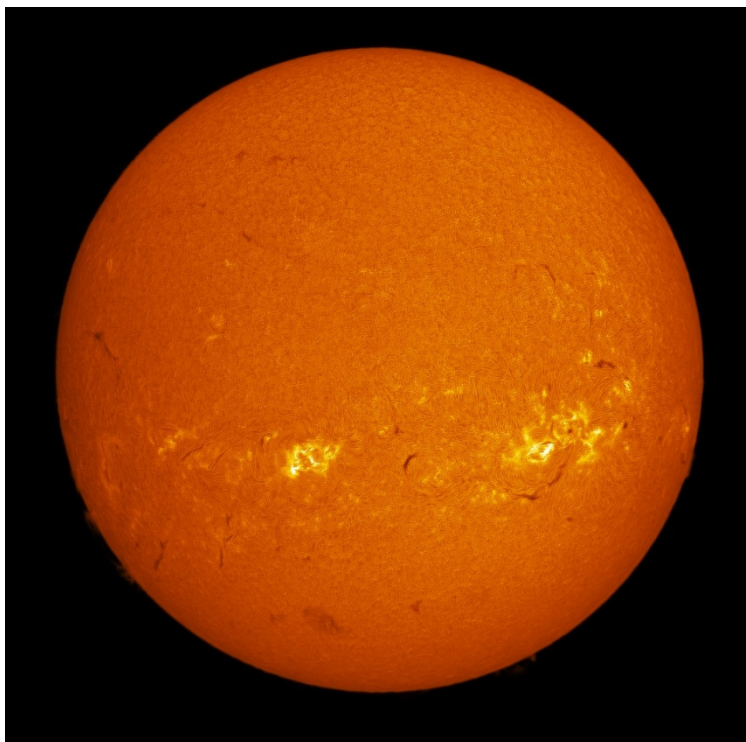*Figure 11- Final image after some further adjustments to the individual curves.*

This process also works for full disk images, as illustrated in Figures 12&13 (original image courtesy of Alexandra Hart (Montana)).

Figure 12

Original monochrome full disk image.

Figure 13

Full disk image coloured using curves.