

Preparing Colorful Astronomical Images II

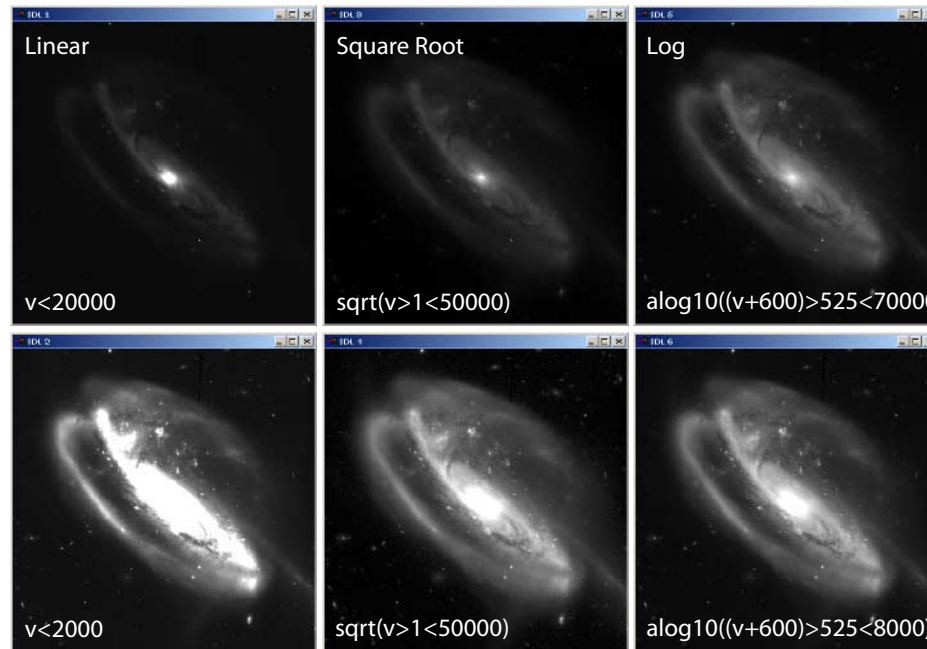
AAS • January 8, 2003
Seattle, WA • 91.10

Z. G. Levay and L. M. Frattare (STScI)

We present additional techniques for using mainstream graphics software (Adobe Photoshop and Illustrator) to produce composite color images and illustrations from astronomical data. These techniques have been used with numerous images from the Hubble Space Telescope to produce photographic, printed and web-based products for news, education and public presentation as well as illustrations for technical publication.

We expand on a previous paper to present additional techniques and more detail, taking advantage of new or improved features available in the latest software versions. While Photoshop is not intended for quantitative analysis of full dynamic range data (as are IRAF or IDL, for example), we have had much success applying Photoshop's numerous, versatile tools to work with scaled images, masks, text and graphics in multiple semi-transparent layers and channels.

How do I get images into Photoshop?



Tadpole Galaxy, UGC 10218 • HST/ACS
Credit: NASA, H. Ford (JHU) and the ACS Science team

Examples of different clipping values with linear, square root and log transform functions applied to the same grayscale image.

Log scaling applies the greatest com-

pression of dynamic scale; it decreases contrast in bright areas while increasing contrast at the faint end. Different stretches can be combined by judicious masking to extend the dynamic range.

In an analysis software package (**IDL** or **IRAF**):

- ✧ Clip (apply minimum and maximum data values) to isolate the appropriate data range.
- ✧ Transform (apply square root, log, or other function) if needed, to adjust contrast and compress dynamic range.
- ✧ Convert to 8 bit grayscale. The **IDL**

bitscl function scales any data type, returning a single-byte array.

The **rgbsun** task in the **IRAF** color package combines three images into RGB Sun rasterfile format.

- ✧ Write the image in a format recognized by Photoshop (**TIFF** recommended). The **IDL write_tiff** command generates a **TIFF** image from an IDL 2-D array.

How do I make the image look better?

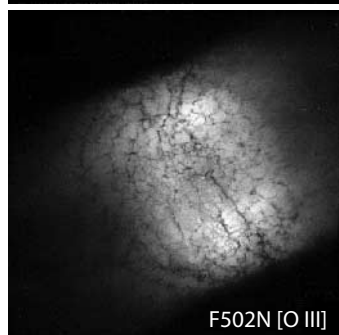
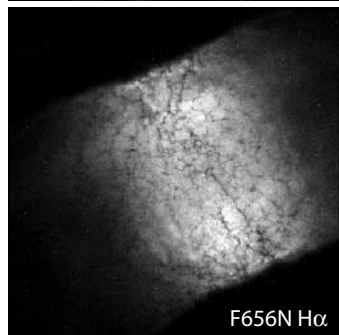
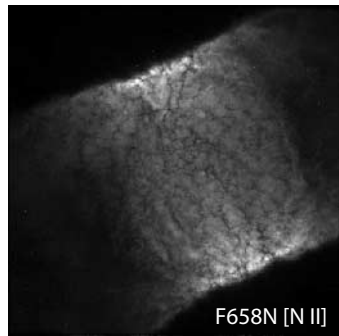
Note that much of this is subjective rather than dictated by hard and fast rules...

- ✧ A dark, neutral sky background is often preferred for astronomical images.
- ✧ Photographs usually benefit from having “shadow” and “highlight” details. That is, the darkest area should be close to black and the lightest area should be close to white.
- ✧ A broad “tonal range” with detail apparent at all brightness values usually looks best.

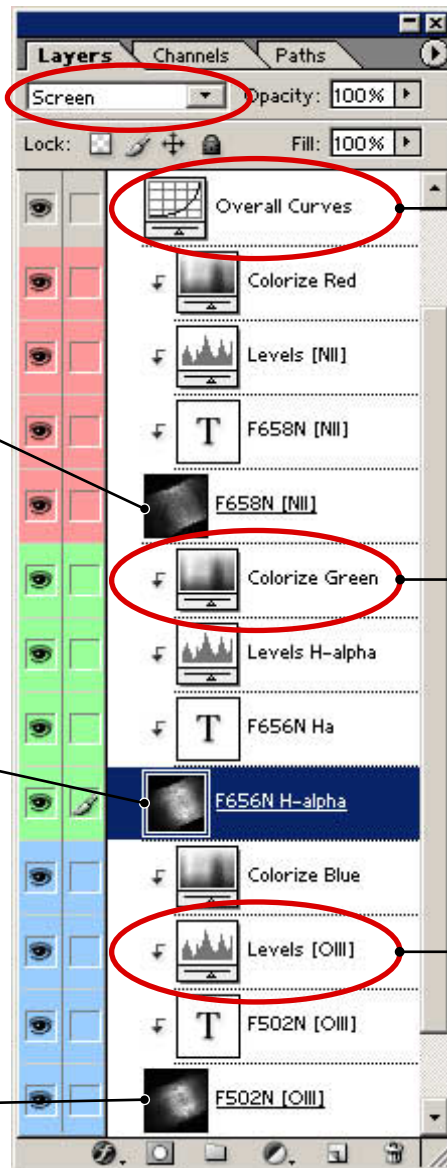
Photoshop Notes

- ✧ Apply adjustments to exposure layers individually to benefit from maximum flexibility in hue and tonal range.
- ✧ Avoid committing changes to a pixel layer unless necessary. All Photoshop modifications can be accomplished using adjustment layers, which permit unlimited changes without modifying the original pixel values.
- ✧ These examples were produced using Photoshop 7.0 on a Windows 2000 workstation, but it functions identically in MacOS and most features are available in previous versions.
- ✧ There is no up-to-date Unix version of Photoshop. The freeware GNU Image Manipulation Program (**The GIMP**) includes many of the same capabilities.

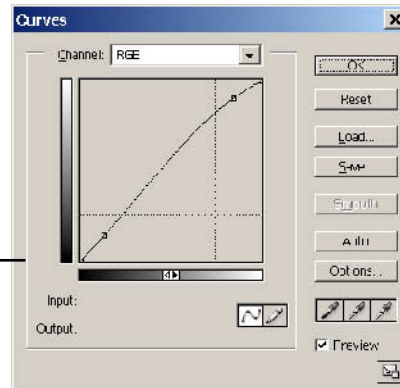
How do I combine images in color?



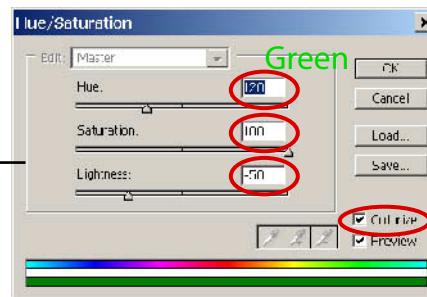
The individual grayscale images comprising the color composite



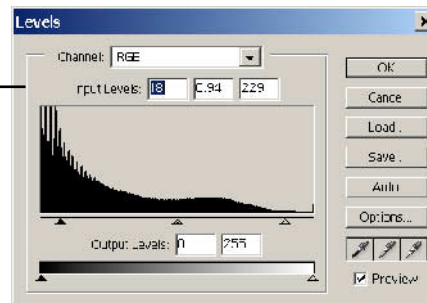
The Photoshop **Layers** palette for the color composite image.



Global **Curves** adjustment layer applies to all layers below.

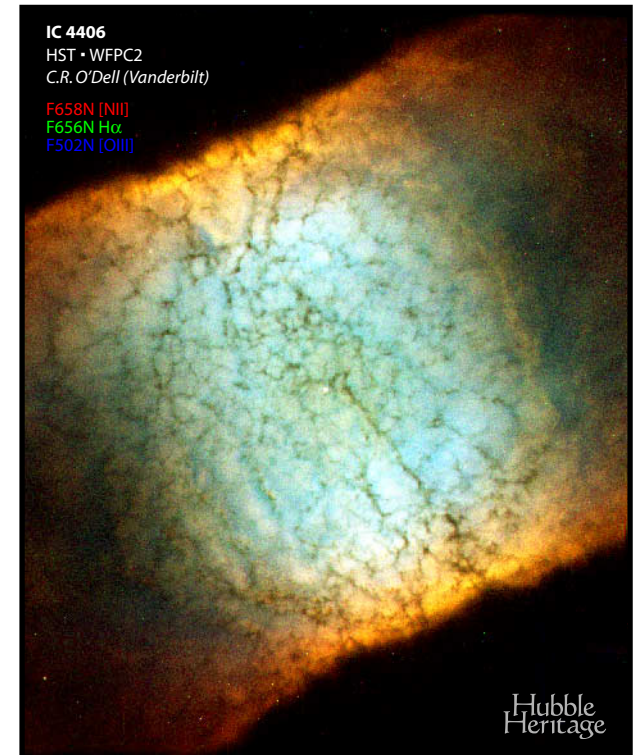


Hue/Saturation dialog for the F656N (green) layer of the IC 4406 color composite; converts grayscale layer into single-hue color layer.



Levels adjustment layer, grouped with the [O III] (blue) image, applies to that layer only.

- ✧ Place each grayscale exposures in a separate Photoshop layer.
- ✧ Set the layer blend mode to **Screen**, which “projects” each colored layer independently; this allows three primary colors to combine to produce all possible hues.
- ✧ Apply a **Hue/Saturation** adjustment layer grouped with each image layer separately; this renders the grayscale pixel layer in color.
- ✧ Select **Colorize** mode.
- ✧ Select the layer’s color by specifying the **Hue** value (0-360).
- ✧ Set the **Saturation** to 100% for maximum color.
- ✧ Set **Lightness** to -50.
- ✧ Optionally apply a **Curves** or **Levels** adjustment layer grouped to each image layer only, or to the entire image.



The composite color image