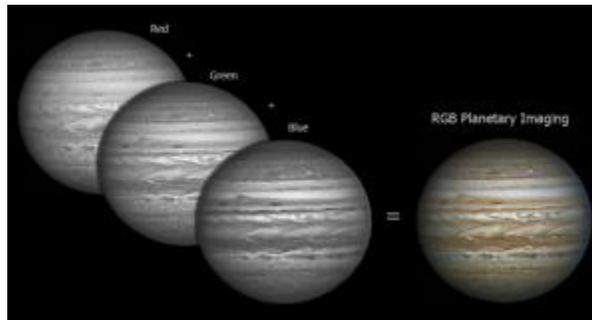


RGB Planetary Imaging with a Monochrome Camera
Submitted: Friday, 29th February 2008 by Mike Salway

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RGB Planetary Imaging

Introduction

Planetary Imaging is a fast growing field of astrophotography – boosted by tech-savvy amateur astronomers, larger and cheaper (but good quality) telescopes becoming more accessible, and the proliferation of low-cost webcams as imaging devices which can capture up to 60 frames per second (fps) without compression. It's never been easier to try your hand at astrophotography and capture that first image of the moon or a planet.

The aim of this article is to serve as a tutorial for creating an RGB image using a monochrome camera, and/or to help you to decide whether mono RGB imaging is right for you. The article will describe exactly what you need to buy (in both hardware and software) and what you need to consider (in capturing and processing) to start down the road of capturing and creating your first RGB Planetary Image.

The article is aimed at an audience of intermediate level planetary astrophotographers, who most likely have already had some previous experience using a colour camera (like a ToUcam/NexImage or a DBK/DFK camera) to capture and process planetary images and are looking to go to the next step of a monochrome camera, but aren't sure what's involved. I'm certain though that a lot of the techniques and tips described in here will be just as useful to beginners and will hopefully reduce the huge learning curve that they're starting down. Most advanced planetary astrophotographers are already using a monochrome camera and are creating wonderful RGB planetary images, but hopefully there may be something of interest to you in here as well. I welcome all of your feedback and suggestions for future revisions of this article.

As a first step, I'd suggest having a read through my previous article, [Planetary Imaging and Image Processing](#). It discusses the factors that influence high-resolution planetary imaging, as well as a step-by-step guide to processing planetary images. It's almost 2 years old but the content is still extremely relevant. I won't repeat much of that information in here – it's best to use both articles side by side to determine if RGB Planetary Imaging is for you, and also the environmental and technical factors you need to take into account to get the best images you can.

Background

In general, there are two types of cameras that can be used for imaging the planets – **monochrome** (mono) and **colour** (one-shot colour, or OSC).

Colour cameras have a colour CCD chip in a [bayer filter configuration](#), where 50% of the sensor captures green wavelength light, 25% captures red and 25% captures blue. This means you're not getting the whole resolution in each colour channel.

A **Monochrome** camera on the other hand, when used in conjunction with RGB colour filters (special imaging filters that let through specific wavelengths, not the coloured filters for visual observing) use the whole resolution to capture each colour channel. You then create a colour RGB image in post-processing.

Benefits of Monochrome over One-Shot Colour:

- Higher resolution
- Ability to choose a filter with matched spectral characteristics according to what you want to image
- Ability to re-focus between colour channels
- Ability to change settings (fps, gain etc) between colour channels

Benefits of One-Shot Colour over Monochrome:

- Lower cost (no need to buy filterwheel and filters)
- Easier to use during capture (no need to capture 3 avi's for a single image)
- Faster processing (don't need to process 3 avi's for a single image)

Obviously the benefits of one are the disadvantages of the other. The comparison above also assumes that both types of cameras use a lossless codec and can transfer all the data at the fastest frame-rate without compression.

If you want to get the most out of your imaging setup, you should get a monochrome camera – it will deliver superior results over a one-shot colour camera.

Hardware

So, assuming now you've made the decision to get a monochrome camera – exactly what do you need?

Monochrome Camera

Obviously, the starting point is the camera. There are a number of options, however most times the choice comes down to two cameras – the DMK21 series from [The Imaging Source Astronomy Cameras](#), and the SkyNyx 2-0M from [Lumenera](#). A third option that is likely to become more popular in the next 6-12 months, is the Dragonfly 2 from [Pt Grey Research](#). All have their pros and cons (specifically for use in planetary imaging), which will be discussed here.

	DMK21	SKYnyx 2-0M	Dragonfly 2
Max Framerate	60fps	60fps (or more with ROI)	60fps (or more with ROI)
Resolution	640x480	640x480	640x480
CCD	1/4" Sony ICX098BL	1/3" Sony ICX424	1/3" Sony ICX424
Pixel Size	5.6 microns	7.4 microns	7.4 microns
Digital Output	8 bit	8 or 12 bit	8 or 12 bit
Connection Type	USB2.0 or Firewire	USB 2.0	Firewire
Price	US\$390	US\$995	US\$795

Subjective Comparison

NB: I haven't owned or used a SKYnyx 2-0M or a Dragonfly2, so I'm basing my comparative analysis on the specifications and from speaking with users of those cameras.

- All cameras can do up to 60fps at 640x480 resolution. The SKYnyx/DR2 can do higher framerates using ROI mode, but in real use, most planets (with the exception of Venus) are simply not bright enough for most moderate sized telescopes to be able to capture at more than 30fps. Firewire cameras with format7 mode (like the Dragonfly2) can let you choose an arbitrary framerate (up to the bandwidth of your connection, either 400mb or 800mb). This is a very useful feature - for example, 30fps (1/30s) may be too bright, but 60fps (1/60s) may be too dim. Format7 mode cameras allow you to choose 45fps (1/45s exposure) (for example) and match the framerate to your histogram.
- The smaller Pixel Size of the DMK means it will produce a larger image than the SKYnyx or DR2 when captured at the same focal length. However the benefit of the larger pixel size means it can capture more photons, and therefore will have better sensitivity and dynamic range.

- The ability of the SKYnyx and DR2 to output 12bit data is better than the 8 bit output of the DMK. The higher bit depth gives a greater resolution to the dynamic range, and allow more grey values to be captured.
- The DMK and SKYnyx have the option of a USB2.0 connection, allowing fast, uncompressed transfer of the data to the computer. The DR2 is firewire (the DMK has this option too) and also has fast uncompressed transfer, but depending on your laptop you may need to power the firewire camera with a powered hub. Firewire cameras can be run from operating systems other than Windows, and do not require any proprietary vendor software.
- Price is obviously a major consideration for most people, and the DMK is almost 1/3 of the price of the SKYnyx and ½ the price of the DR2. Are those cameras 2 or 3 times better than the DMK? From individual results I'd say definitely not, but the SKYnyx and DR2 do have lower noise and greater sensitivity. For most people trying to push the limits of their setup, even a 5-10% increase in quality may be worth the extra money.

For me, I started out with the DMK21AF04 (firewire version) – the USB model wasn't available at the time. I have since moved to the DMK21AU04 because it means I don't need to use a powered hub or PCMCIA card to power the camera, giving me greater flexibility and portability. The DMK21AU04 is the right camera for me right now, delivering excellent performance for people on a budget.

There are also some larger format monochrome cameras that weren't considered in the comparison, such as the [DMK31](#), [DMK41](#) and [Astrovid Voyager X](#) (review). These cameras can be used for planetary imaging, however the slower framerate and larger format makes them primarily suited to lunar astrophotography so they won't be discussed here.

Filterwheel

Ok so you don't absolutely need a filter wheel – you could screw the filters onto the camera nosepiece manually between each capture, or you could use an exposed filter slide – but neither of these are recommended if you're serious about your planetary imaging.

The cheapest option for people on a budget is a manual filter wheel, such as these ones from [Atik](#) or [Orion](#) (they are exactly the same). They have 5-slots, which give you room for your R,G,B filters as well as 2 extras for clear (Luminance), IR or UV filters.

You unscrew the top housing of the wheel, screw your filters into the slots and put the cover back on. Not a difficult task, but not something you'd want to do out in the field at night. A tip I was told and appears to work well - don't screw the housing cover back on too tight; leaving it a little bit loose will make turning the wheel (changing filters) easier and smoother, meaning less shake and therefore less dampening time. I use the Atik manual filter wheel, and if I'm careful not to be too rough, at high-resolution (> 10m focal length) I can change filters and start the next capture within 3-6 seconds.



Click to Enlarge
My manual filterwheel with the cover off, showing my current 5 filters



Click to Enlarge
The DMK21AU04, with the filterwheel and the 5x powermate

Manual filter wheels are great, easy to use and cheap – but it does mean getting up from your chair and changing filters 2 or more times for every capture run. It would be nice to control everything from the convenience of your laptop or table.

For people who want that extra convenience, at the extra cost, you can get motorised filter wheels such as these ones from [Atik](#) (cheapest I've seen), [Andy Homeyer](#) and [TruTek](#) . They start from around US\$350 and go up from there but can be controlled from your laptop or a hand controller – definitely more convenient. They still have a dampening down time of 2-4 seconds.

You'll need to connect the camera to the filter wheel, and depending on the camera + filter wheel you get, you may also need to get the right adapters to screw them together. Discuss your requirements with people like Steve Mogg from [MoggAdapters](#), who make custom

adapters for all sorts of cameras and filter wheels.



Click to Enlarge
The trio connected together



Click to Enlarge
The trio connected together

Focuser

If you can, get a motorised/electric focuser – it's much, much easier if you don't need to touch the focuser and wait for the dampening to die down to check whether you got it right. I'd say it's almost essential if you plan to get serious about planetary imaging.

It doesn't need to be expensive – I used a [home-made motor](#) on my [Moonlite CR2](#) when I had my old 10" dob. At the very least, try and get a focuser with 2-speed fine-focus control like the [GSO 10:1](#) or Moonlite CR2 etc. Also stay away from Newtonian rack and pinion focusers or SCT mirror flop focusers – crayfords are much smoother and more accurate.

For the best results, an electric focuser that can be computer controlled is essential. An example of this is the [Smart Focus](#) unit from JMI that connects to their Moto Focus motorised focusers.

You'll be doing critical, small focus changes almost constantly through any session to keep the ccd right in the middle of the best focus region. At longer focal lengths of >10m a change in focus position as small as 20 microns (0.02mm) makes a clear change to the image. You simply can't do this by hand.

Even with parfocal filters, you'll find that each colour channel comes to critical focus at a slightly different location, likely due to the combination of barlow lenses in the system. You will have to adjust focus for each filter to compensate, again impossible to do by hand.

Without an electric focuser, you will always struggle with focus and never be sure that you're nailing it each and every time.

I'm currently using a single-speed crayford with an [Orion AccuFocus](#) unit fitted to one focus knob. It's not repeatably accurate and has some backlash, so it's not ideal. I ensure I spend a lot of time getting focus right to compensate for the problems with my focuser.



[Click to Enlarge](#)
My cheap motorised single-speed crayford



[Click to Enlarge](#)
The more expensive JMI type

LRGB Filterset

With a monochrome camera, you're going to need to get a set of RGB filters so that you can produce a colour image. The ideal requirements for a filterset, is that they should be:

- Parfocal (although this doesn't mean you won't need to adjust focus between filters),
- Contain a Luminance (clear) filter,
- They should be specifically designed for RGB imaging. Visual/Observing coloured filters do not have the correct bandpass.

There are a number of RGB filtersets around, but I'd recommend getting the best you can afford. There are cheaper alternatives, but the bandpass may not be as accurate and transmission may not be as high. This will result in dimmer raw data, and will make it harder to calibrate the colour balance in your images. If you buy a cheaper set, like I did the first time around, you'll have to spend more in getting it right the next time.

After starting with the Baader set, I now use the [Astronomik LRGB Type II](#) filterset and love them.



[Click to Enlarge](#)
Astronomik LRGB Type II Filterset

Software

You're going to need to get some software to help you capture and process your images. For capture software, the DMK series comes with

IC Capture – a very good program which does almost everything I'd like in a piece of capture software. If you'd like to though, you can use any third party software which can use the WDM driver for the USB DMK (such as virtual dub, k3ccdtools etc).

For the SKYnyx 2-0M, most people use the third party [Lucam Recorder](#) because the supplied software isn't up to scratch. If you're using a firewire camera, then you can use [Coriander](#) under Linux which is one of the best capture programs available.

The processing software you need depends on your processing routine. I do some pre-processing of the data before processing in registax and photoshop, but that's not for everyone. You can read about my processing routine in the [Planetary Imaging and Image Processing](#) article.

My current software stack consists of:

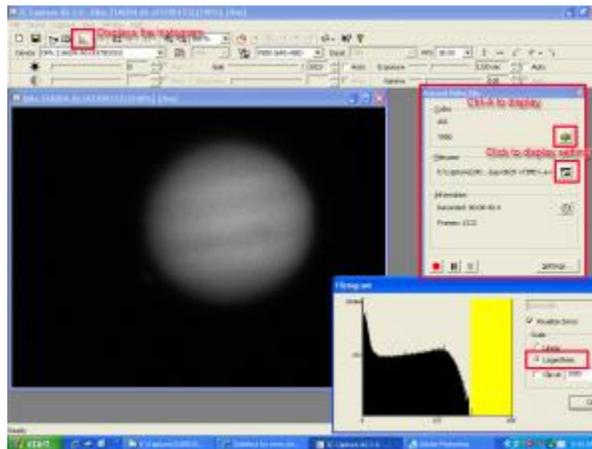
- [ICCapture](#) - capturing the data
- [Virtual Dub](#) - saving as bitmaps
- [PCFE / ninox](#) - crop, centre, sort
- [Registax](#) - align, stack, wavelets
- [AstraImage](#) - deconvolution, recombine
- [Photoshop](#) - recombine, post-processing.

Preparing to Capture the Data

Ok you've got everything you need in hardware and software, now it's time to capture some R,G,B avi's. In this section I'll explain my workflow for capturing the data, and the settings I use in IC Capture.

IC-Capture Settings

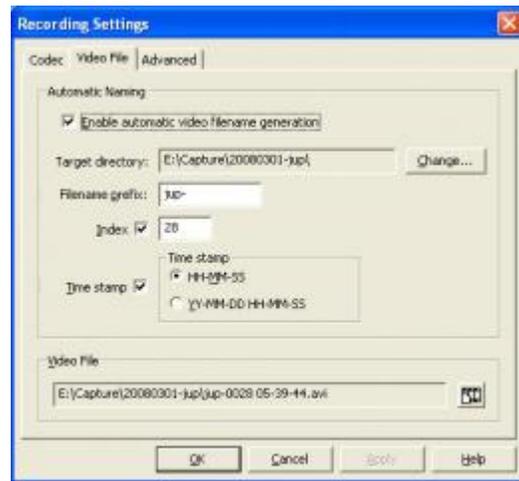
- Press Ctrl-A to get the show the settings/recording dialog
- Set the Path and filename for the capture files
- Turn on Auto file naming
- Set the codec to Y800 (it's a lossless codec)
- Press the histogram icon to show the histogram, and change it to Logarithmic.



Click to Enlarge
IC-Capture Settings



Click to Enlarge
First tab of settings dialog



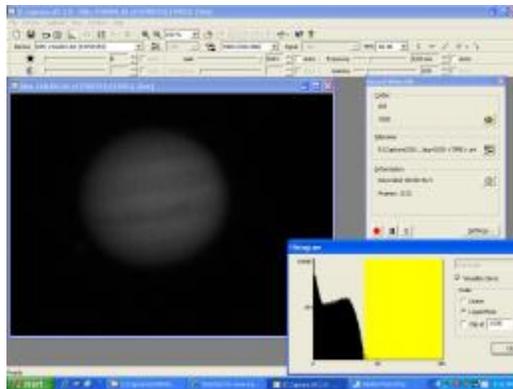
Click to Enlarge
Second tab of settings dialog

Histogram

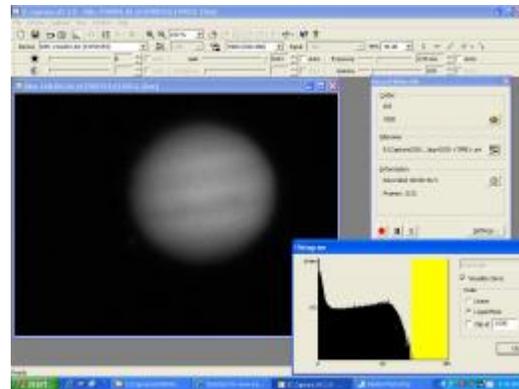
Using and interpreting the histogram is absolutely essential. You want to ensure the histogram peak is the same for all 3 colour channels – it makes colour balance easier and more accurate. You also want to get the histogram as exposed as possible– ideally you want all 3 channels to reach 250 or so without overexposing. You will need to adjust your framerate and gain to get the right exposure, and will depend on the size of your telescope, the focal length you're working at and the object you're imaging.

A faster framerate is great if the object is bright enough, but there's no point capturing at 30fps (1/30s exposure) if your histogram falls off at under 120 (see image on the left below). The dim image will need to be stretched more during post-processing, which will reduce the depth and quality of the final image. Ideally you should change back to 15fps (1/15s exposure) and get more light in with each frame if the seeing is very good, as there won't be much movement within each frame so the longer exposure won't hurt your resolution (see image on the right below).

In practise, if the seeing is less than very good, sometimes a faster shutter will deliver better individual frames and better spatial resolution, with the tradeoff of having a dimmer image. So there's a balancing point you'll need to experiment with to find the right framerate and exposure for the object, your telescope and the local seeing at the time.



Click to Enlarge
Example of an underexposed image (poor seeing)



Click to Enlarge
Example of a properly exposed image (poor seeing)

Capture Workflow

Preparation

"Preparation Prevents Problems", as my son now knows after his teacher made him write lines of it :)

Due to the fast rotation rate of some objects at long focal lengths, once you've started a capture run you're under the pump and will be pressured to get all 3 channels captured in a set amount of time. Spend the time before you press "record" to get things right – it'll make it much easier when you're in the middle of a capture run and changing filters.

Go through each of the colour channels and experiment with the framerate and gain in preview mode to determine the correct exposure for each channel. Depending on the object, one channel may be the brighter than the others. The blue channel is almost always the dimmest as it's the most scattered by the atmosphere, and is the most likely to need a much higher gain, or even a slower framerate to get the histogram peaking at the same point as the red and green channels.

Make a mental note of the adjustments required for each colour channel so you can do it quickly and efficiently once you've started your capture run and change between filters.

Focus

I'm sure I don't need to tell you how important focusing is. You don't want to throw away data captured in a night of good seeing because your focus was off. Some tips for focusing:

- As discussed above, get a motorised or electric focuser.
- Double-check and triple-check your focus – go back and forth through critical focus until you're confident it's as good as you can get it.
- Even with parfocal filters, slight changes in focus may be required for each colour channel. I've found it mostly depends on the altitude of the object and the seeing at the time. During the preparation phase, go through each colour channel and check the focus – if any changes are required, you want to know how far and which way to focus so that you can do it quickly and efficiently once you've started your capture run.
- Determining critical focus is easier when the contrast is high and the framerate is fast – so even if the histogram is poor at 30fps, you can still set it at 30fps to check your focus, and change it back to 15fps (if required) when you start capturing. Try also increasing the contrast and lowering the gamma as a focusing aid – these changes make it easier for the human eye to judge the image, but remember to change the settings back to default when you start capturing.
- Focusing is very challenging if the seeing is poor, sometimes it's almost impossible to know if you've got it right. When conditions are like this, sometimes it's best to pack it away and try again next time.
- I find it much easier to find critical focus on a small object like one of Jupiter's moons. Even if it's out of frame, I'll slew to the moon, get the focus right, and then slew back to Jupiter.
- Use a focusing aid like a Hartman mask.
- You'll need to readjust focus constantly throughout your imaging session. Temperature changes make the optical path expand or contract as the evening goes on. Also as the object changes altitude, focus will need to be adjusted as you're imaging through more or less atmosphere.
- Lastly, focusing is an acquired skill. You'll soon learn to tell when you are just-so-slightly out of focus because features on your target start to "flutter". An adjustment as small as 0.02mm can make that go away, and effectively double the number of usable frames you're capturing.

Recording the Data

The preparation has been done, you've got critical focus, now it's time to record. How long do you capture each channel for? It depends on the object and the focal length you're working at. What you want to avoid is rotational blurring as a result of capturing for too long, and when the frames are stacked together the small-scale features get mashed together because registax will align on the high contrast limbs.

Here are some rough guides for capture time for planetary objects (remember these are per channel capture times for a monochrome camera). Where capture time is irrelevant, ensure you capture enough frames for a smoother, less noisy image.

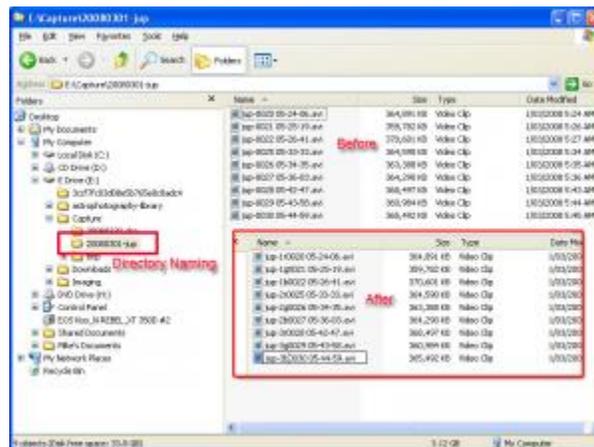
Object	Focal Length	Capture Time	Notes
Mercury	Under 10m	Any (1-2 mins+)	In white light, there are very minor albedo features and the rotation rate is slow, so even with a near-IR filter, capture time is irrelevant.
	Over 10m	Any (1-2 mins+)	As above
Venus	Under 10m	Any (1-2 mins+)	In white light, there are no albedo features so capture time is irrelevant. Even with a UV filter to show cloud details, the rotation rate is slow enough that capture time is irrelevant.
	Over 10m	Any (1-2 mins+)	As above
Mars	Under 10m	2-3 mins per channel	There will be some rotation from the start of the red channel to the end of the blue channel.
	Over 10m	1-2 mins per channel	As above

Jupiter	Under 10m	1 minute per channel	There will be some rotation from the start of the red channel to the end of the blue channel
	Over 10m	40 secs per channel	As above
Saturn	Under 10m	Any (1-2 mins+)	If there is a storm visible at the time, keep your captures to about 1 minute per channel.. Otherwise there are no surface albedo features so capture time is irrelevant. Saturn really benefits from lots of frames to get a smoother globe.
	Over 10m	Any (1-2 mins+)	As above
Uranus	Under 10m	Any (1-2 mins+)	Rare to see any albedo features, and at a small focal length it won't be much more than a small green dot anyway.
	Over 10m	Any (1-2 mins+)	As above.
Neptune	Under 10m	Any (1-2 mins+)	No albedo features, so capture time is irrelevant. At short focal lengths it will just be a blue/green dot.
	Over 10m	Any (1-2 mins+)	As above.

Re-Naming the Files

I start with a directory, where the directory name is the date and the object, for example 20080228-jupiter. The avi's I capture get saved into this directory.

Some capture software designed for RGB imaging will do the file-naming for you with "R", "G" or "B" in the filename; unfortunately IC-Capture doesn't do this so I go through the files and manually rename them to add R,G or B into the filename, as well as the "capture run" number as shown in the example below.



Click to Enlarge
Before and After - directory and file naming

Pre-Processing the Data

The avi's can now be fed straight into registax, but I do some pre-processing on them using ninox (ppmcentre). To do this they need to be saved as bitmap files, so I use virtual dub to save the avi as a set of bitmaps. I then crop, centre and rank the bitmaps using ninox and PCFE. For a full step-by-step guide on exactly how this is done, see the [Planetary Imaging and Image Processing](#) article.

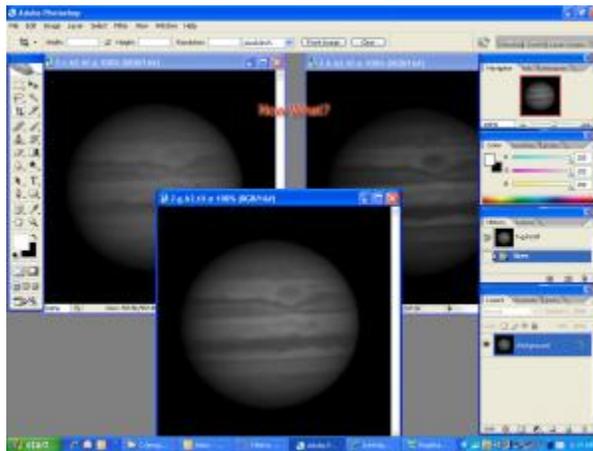
Once Ninox/ppmcentre has finished, the set of bitmaps is ready for processing in Registax.

Processing the Data

Processing images from a monochrome camera can take more time – you need to process the individual colour channels separately, and then recombine them at the end. The benefit is that you can apply individual processing for each colour channel – more noise reduction, more sharpening etc.

The [Planetary Imaging and Image Processing](#) article discusses the step by step process of feeding the bitmaps into registax for aligning, stacking and wavelet processing so I won't go into it again here.

Instead i'll concentrate more on the recombining of the monochrome images back into a colour image; from reading forums that seems to be the step most people are confused about.



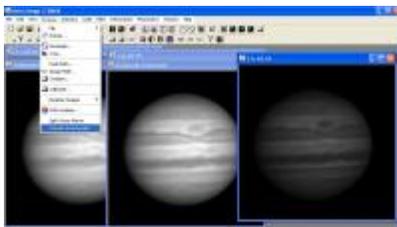
[Click to Enlarge](#)
You've processed the 3 colour channels - now what?

Combining into an RGB (Colour) Image

So you've done all of your wavelet sharpening and/or deconvolution on your monochrome images, and now it's time to recombine them. I use one of two programs to do this – AstraImage or Photoshop.

Steps in AstraImage

1. Open your R,G,B channels
2. Convert to greyscale (Process->Convert to Greyscale)
3. Perform any deconvolution or other adjustments
4. Select "Process->RGB Combine..." and select the 3 channels.
5. Realign the colour channels (using a pixel value for movement of each channel in the X/Y direction). Click "Update" to see the changes in the preview window.
6. Save the recombined RGB image as a TIF file for further processing in photoshop.



[Click to Enlarge](#)
Converting to Greyscale



[Click to Enlarge](#)
Picking the image in the "RGB Combine" dialog



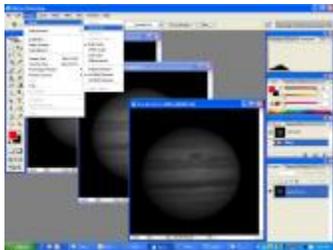
Click to Enlarge
Using the "Plane Shift" to re-align the colour channels



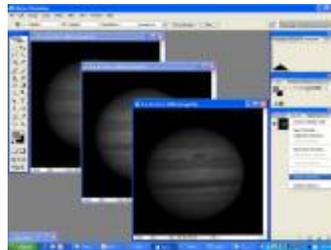
Click to Enlarge
Saving the combined image as a TIFF for further processing in Photoshop

Steps in Photoshop

1. Open your R,G,B channels
2. Convert to greyscale (image->mode->greyscale)
3. Go to the channels palette, click on the little arrow on the right, and click "Merge Channels"
4. Select "RGB", click ok, and then select the 3 channel filenames
5. Realign the colour channels (click on each channel and use the move tool until the features are aligned)
6. Save the recombined RGB image as a PSD file for further processing



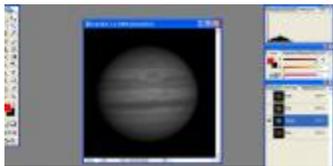
Click to Enlarge
Convert each image to greyscale



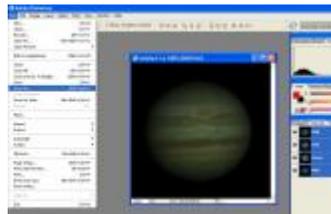
Click to Enlarge
Merge Channels



Click to Enlarge
Selecting the colour channels



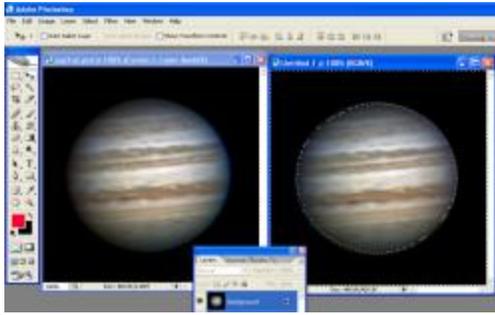
Click to Enlarge
Click on each channel and use the move tool to re-align



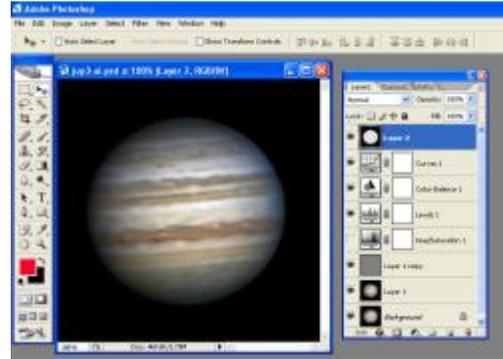
Click to Enlarge
Saving as a PSD file for later processing

It is important to align the colour channels as accurately as possible. Where you have captured for a long time and there is some rotation between the red and blue channels, it is best to align on the "features", not the limbs. This can mean your image ends up with red/blue limbs but the middle of the planet contains the important detail.

For aesthetics, you can re-combine twice – once aligning on the limb, and once on the middle, and then using photoshop, select the outer 10-20 pixels of the limb-aligned image (feathered by a couple of pixels) and paste it on the middle-aligned image.



Click to Enlarge
Showing the 2 images - one aligned on the features, one on the limb



Click to Enlarge
Combining them using a feathered selection of the limb

Post-Processing the RGB Image

Now that you've got a colour image, you most likely need to do further post-processing to improve the colour balance, levels, curves etc. This part is subjective, and depends entirely on the image – ie: the quality of your seeing, transparency, how well you kept the histogram exposed and equally exposed for each colour channel.

I use layers in photoshop to adjust the saturation, levels and curves and sometimes do some final sharpening of the combined image.

Again, keep an eye on the final histogram in photoshop. Check that you're not clipping any detail from either end – ie: removing faint detail, or blowing out the highlights.

Save your final image as a photoshop file in-case you want to go back to it later, and also do a "file->save for web" to save it as a web-quality jpeg (ideally under 800px wide, under 200kb).



Click to Enlarge
Final post-processed image before saving for web

But what about LRGB? What is LRGB?

LRGB is "Luminance" combined with RGB data. Luminance is the unfiltered data – either no filter is used, or the "Clear" filter from your LRGB filterset is used – which usually blocks IR/UV wavelengths as your RGB filters do.

An LRGB image takes the **detail** from the luminance channel, and the **colour data** from your RGB channels. For planetary imaging this isn't often used, but it can be useful when you have a short capture window or a dim object. You can capture more luminance frames over a longer time (to get a smoother, less noisy image), and use a shorter time to capture the RGB frames to get the colour data. The clear filter allows greater light transmission so you can use a faster framerate, shorter exposure and/or less gain.

I've tried using this technique on Jupiter on a number of occasions during the 2007 apparition, and in most cases, the straight RGB image ended up sharper with better resolution of the fine details. Only once has the luminance channel been sharp enough to use in an LRGB image. It appears that the spread of wavelengths being captured actually softens the image and can result in a more blurry appearance.

Creating an LRGB Image

You capture and process the luminance channel the same as any other colour channel – align, stack, wavelets, etc.

If you do end up with a sharp luminance channel, you can create your LRGB image by following these steps in Photoshop:

1. Open the Luminance channel and the (previously combined) RGB image.
2. Copy (shift-A/Ctrl-C) the RGB image and paste it as a new layer on top of your Luminance image.
3. Ensure the images are aligned – use the move tool and the “eye icon” to blink on and off and align the images accurately.
4. Change the Blending mode of the RGB image layer to “Colour”

Now you can blink the RGB layer on and off to see the effect it has had on your image. The detail is taken from the base luminance channel, and is being coloured by your RGB data.

You can adjust each layer independently, using noise reduction or sharpening, levels or curves on your luminance layer, and similarly for the RGB layer – adjusting saturation, curves, etc. until you are happy with your image.



Click to Enlarge
Open both the Luminance and the combined RGB image



Click to Enlarge
Copy the RGB image as a new layer on top of the Luminance image, and set the Blending mode to "Color"



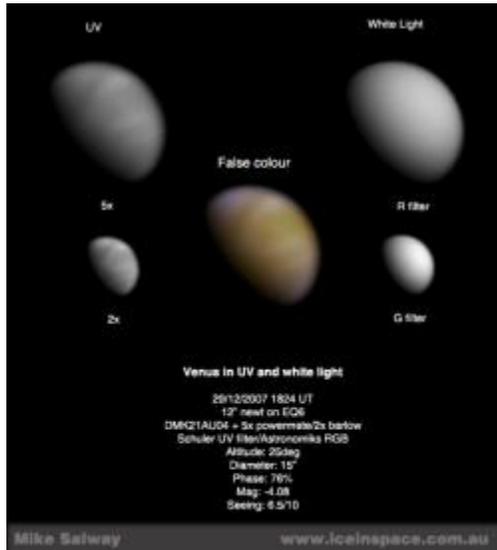
Click to Enlarge
Now you have the Luminance channel showing the detail, being coloured by the RGB image



Click to Enlarge
Final image after levels, curves, saturation, colour balance etc.

The luminance channel doesn't need to be an unfiltered (or clear filter) image. For different types of objects, other wavelength filters can be used as the “Luminance” (detail) channel. For example:

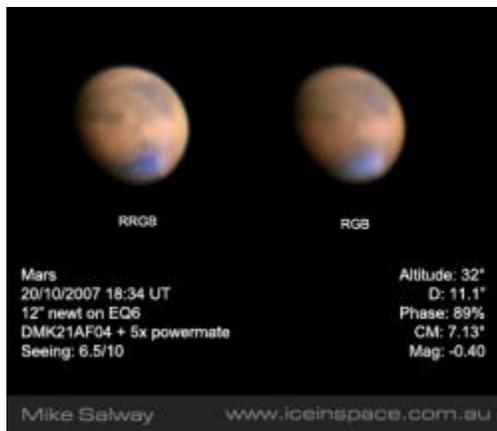
- a UV-pass filter for capturing cloud detail on Venus. The UV channel is used as the detail, and combinations of RGB data can be used to false-colour the image and highlight the cloud detail. (image 1 below)
- an IR-pass filter on Mars can be used as the luminance to create an IRRGB image – very useful when the seeing is poor. (image 2 below)
- The sharpest channel (usually red, as it least affected by the atmosphere) is used as the luminance, and the RGB data is used as colour to create an RRGB image (image 3 below).



[Click to Enlarge](#)
Venus in UV false colour



[Click to Enlarge](#)
(R+IR)RGB Mars by Anthony Wesley



[Click to Enlarge](#)
Mars in RRGB and RGB

Care must be taken with this type of approach, as some detail is only visible in some wavelengths – so by using a specific channel as your luminance, you might be misrepresenting the features visible on the planet at the time. See [this article](#) from [Damian Peach](#) which discusses colour balance using Mars as an example, and the various combinations of channels to achieve your final image.

Conclusion

I hope this article has helped as a tutorial for creating an RGB image from a monochrome camera, or helps you to decide whether mono RGB imaging is right for you.

It is more work in capture and processing, but the greater control and flexibility, and enhanced resolution make it the obvious choice if you're trying to deliver the best quality planetary astrophotography that your setup and seeing will allow.

Resources and Links

- [The Imaging Source Astronomy Cameras](#)
- [Planetary Imaging and Image Processing](#)

- [Anthony Wesley's website](#)

Thanks to [Anthony Wesley \(bird\)](#) for his review and contributions to this article.

Article by Mike Salway ([iceman](#)). [Discuss this article](#) on the [IceInSpace Forum](#).

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