

Photographing the giant

Damian Peach provides some tips on how you can replicate his mesmeric images of the giant planet Jupiter, now that it is reaching opposition.

With Jupiter finally well placed in UK skies (for the first time in several years) now is the best opportunity in a long time to try your hand at photographing the Solar System's largest planet. There is a wide range of affordable equipment available with which to begin photographing Jupiter and, with patience, getting decent results is easier than you may think. All you need is a small telescope on a driven mount, a laptop and a webcam.

Getting in close

The first thing you'll need to do once your telescope is set-up and properly cooled down to ambient temperature, is to increase the focal length. This can be easily achieved through the use of a Barlow lens. Aiming for a focal length of around $f/30$ is generally a good guide for most telescopes. Once you have done this, and if you have a reflecting telescope (especially a Schmidt-Cassegrain), you'll need to collimate your telescope. This is a vital step in obtaining sharp images, not just of the planets but anything at all! On the other hand refracting telescopes don't generally require collimation.

To collimate, choose a bright star close to Jupiter – Hamal, also known as alpha (α) Arietis, is a good choice at present. Choose a power of around $25\times$ per inch (25mm) of aperture (so $200\times$ for a 200mm telescope.) Examine carefully the out of focus star image. Is there a dark hole in the centre of the pattern of rings? If not you'll need to adjust the telescope's collimation using the adjustment screws on the secondary mirror (or for a Newtonian both primary and secondary mirrors.) Take your time until you're happy you have got the dark hole in the centre of the pattern of rings. Once done, try using a higher power and defocusing the image less to make more refined adjustments to perfect the alignment. This process can take time but is it absolutely vital if you want to obtain sharp images. I generally spend time collimating before every session to ensure the telescope is performing as well as it possibly can.

▼ Jupiter captured by the author using a small 150mm reflector and a low cost webcam. Even modest equipment can reveal a wealth of detail on the Jovian disc. All images: Damian Peach.

On to Jupiter

Once collimation is complete you're ready to turn the telescope toward Jupiter. Even small telescopes will reveal its four main bright satellites and dark equatorial belts. The Great Red Spot may be visible provided that the correct side of the planet is facing you at the time. With progressively larger telescopes more detail will become visible provided the atmospheric seeing conditions are steady. Plug the camera into the eyepiece holder while the camera is running. You can then easily centre Jupiter within the field-of-view and set the exposure/gain settings to achieve a good view on the monitor. Once you've got Jupiter in the field-of-view carefully focus the image. Take your time with this to achieve the best focus you can. Electric focusers will make this task far easier as it means you don't actually have to touch the telescope to achieve focus.

There are various suitable cameras available for the task of photographing the planets. A Philips ToUcam webcam (which are available second hand for around £50) would be a great starting point. More expensive cameras are available from other companies such as The Imaging Source DMK cameras, Lumenera and Point Grey Research, although these are considerably more expensive, starting at around the £200 mark (although they do offer considerably better image quality).

Capturing the data

Once the camera is set up and running with Jupiter on screen its time to start capturing the data. With the ToUcam a frame rate of 10 frames per second (fps) is optimal. With the more advanced DMK or Lumenera cameras for example, rates of 30–60fps are ideal. Always make sure the image is well exposed and try not to have the gain set too high as this will give a very noisy result.

Jupiter rotates very rapidly (within ten hours) so the time within which we can obtain an image is rather limited. With typical amateur scopes in the 150–250mm range a window of around

two minutes is the maximum time allowed before Jupiter's rapid rotation will begin to blur detail. With large telescopes of 300mm and up operating under good atmospheric seeing conditions a window of 60 seconds is about the limit for a single capture.

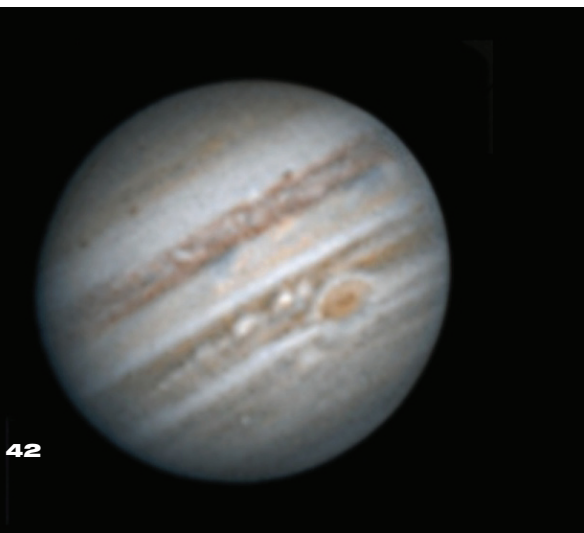
If you are using a colour camera it is important to use an infrared blocking filter in front of the camera to prevent the image being polluted with infrared signals as CCD chips are very sensitive to these wavelengths. Infrared blocking filters are widely available from various suppliers for a modest sum. More experienced observers may want to try their hand at imaging through colour filters that, although being more time consuming and challenging, can offer superior results.

Shooting through filters has several advantages. Filtered imagery is less affected by atmospheric turbulence. Mono cameras are generally much less noisy and more sensitive to light meaning faster frame rates and smoother images. Of course shooting through three filters in such a short space of time isn't for the faint hearted and the process does take practice!

The art of image processing

Whether shooting with either a colour or mono camera the basic technique of image processing is the same. Cameras typically save the image sequences in video files such as AVI format. These video files consist of many individual frames that we can stack together to greatly improve the signal-to-noise ratio. To do this we need special processing software in the form of *Registax*. This free program allows the frames within the video sequence files to be registered and stacked together.

Using the latest incarnation of *Registax* (version 6), set the alignment method to '3 × 3' and then click the 'set align points' button at top left. Red dots will then appear over the image. You can then click the 'Align' button and the program will co-register all the frames in the sequence. Once this process is completed you can then stack the frames together to produce



planet

► Jupiter on 20 August 2011 taken by the author from his back garden in West Sussex. Io and its shadow are seen in transit with the Great Red Spot at bottom left.

a smooth raw image. Always save this raw image so you can go back to it whenever you would like to in order to process the image again from scratch.

You then move onto the sharpening stage using the wavelet sliders. This is where it really comes down to personal choice in how you want the image to look. Slide the various slider bars off to the right and observe how they affect the image. Be careful not to over-sharpen the image creating excessive noise or artifacts. Once sharpened you can move the image into other programs such as *Adobe Photoshop* for other forms of processing such as smoothing or labeling the image (or assembling a colour image from the green and blue filtered images.)

Much useful science is done from amateur Jupiter imagery and I would encourage you to submit your images to the British Astronomical Association (BAA) or Association of Lunar and Planetary observers (ALPO) for further analysis (see *Find out more*).

Jupiter is a fascinating world that never grows tiring or dull. Even after countless hours spent imaging it over the last fourteen years I still get excited at the prospect of heading out to observe it. It is one of the few objects in the night sky that is both very dynamic and easily accessible to amateurs and the years ahead present UK observers with an ideal opportunity to see this magnificent world at its very best.

Damian Peach is a world-renowned astrophotographer, and is Assistant Director of the BAA Jupiter observing section.

FIND OUT MORE

Damian's instructional DVD on planetary imaging:

www.damianpeach.com/dvd.htm

Read Martin Mobberley's book, *Lunar and Planetary Webcam User Guide*, published by Springer (ISBN 978-1-846-28197-0).

The British Astronomical Association's Jupiter Section website:

www.britastro.org/jupiter

The Association of Lunar and Planetary Observers (ALPO) website:

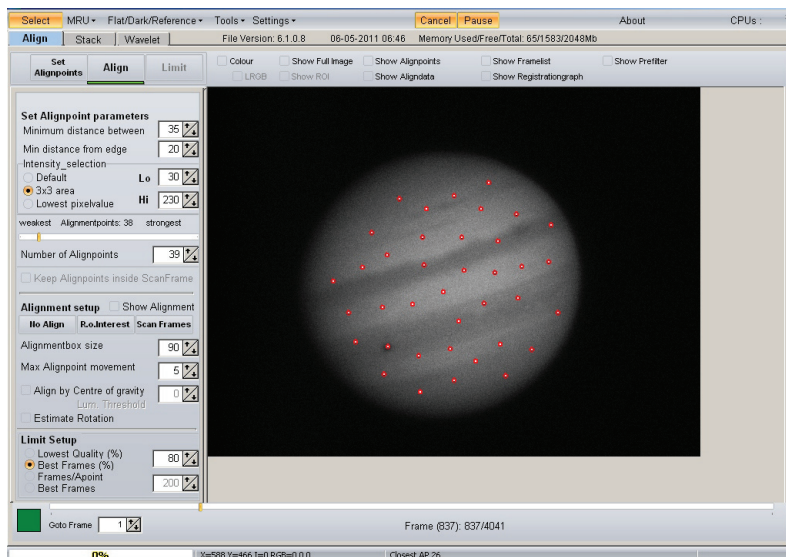
<http://alpo-astronomy.org/>

In-depth guides on using *Registax* are available at

www.astronomie.be/registax/



▼ A Jupiter sequence ready for alignment in *Registax 6*. Note the red dots indicating the alignment points.



■ Damian processing some of his Jupiter images using *Registax*.

