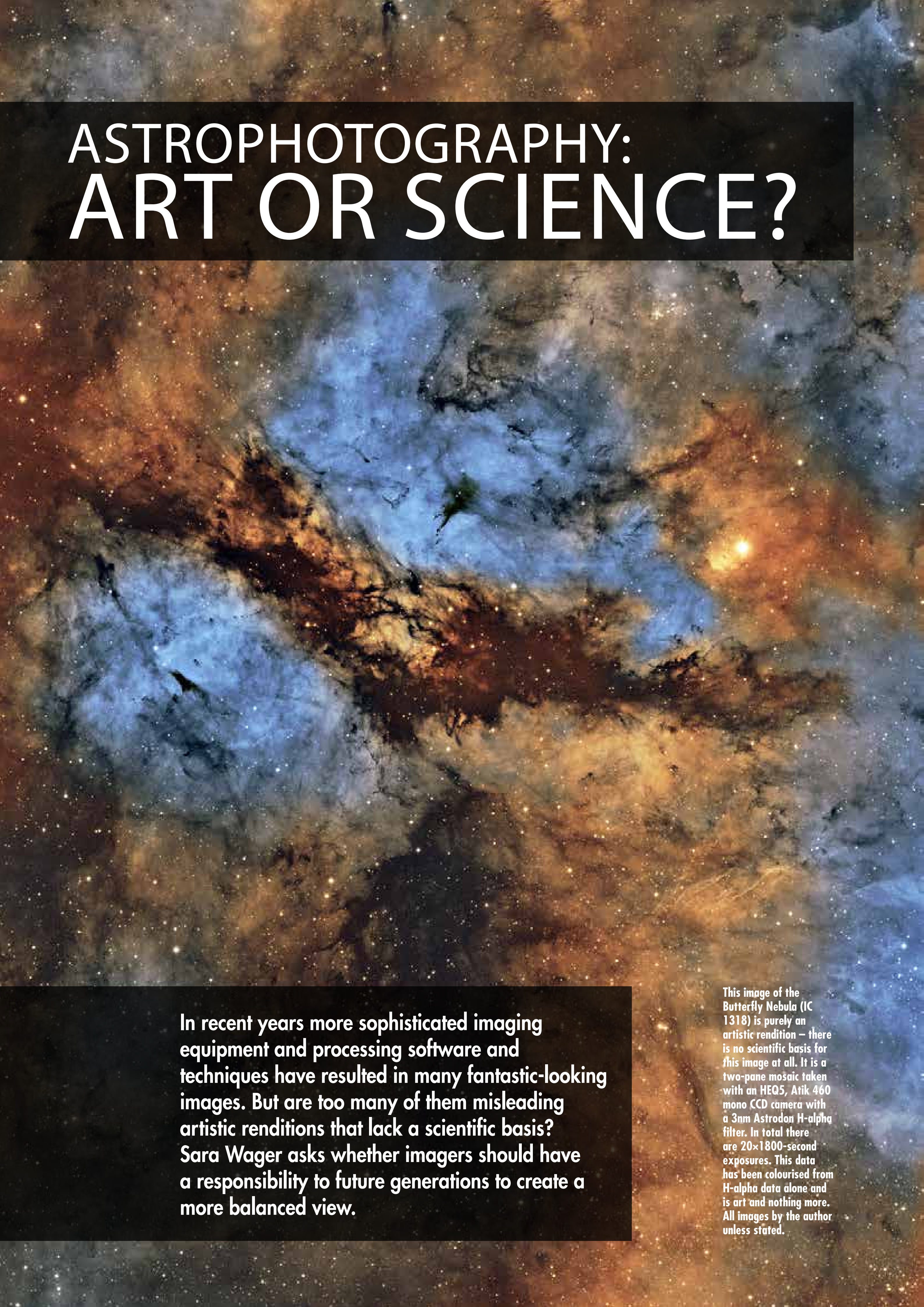
ASTROPHOTOGRAPHY: ART OR SCIENCE?



In recent years more sophisticated imaging equipment and processing software and techniques have resulted in many fantastic-looking images. But are too many of them misleading artistic renditions that lack a scientific basis? Sara Wager asks whether imagers should have a responsibility to future generations to create a more balanced view.

This image of the Butterfly Nebula (IC 1318) is purely an artistic rendition – there is no scientific basis for this image at all. It is a two-pane mosaic taken with an HEQ5, Atik 460 mono CCD camera with a 3nm Astrodon H-alpha filter. In total there are 20×1800-second exposures. This data has been colourised from H-alpha data alone and is art and nothing more. All images by the author unless stated.

An interesting conversation ensued after I posted one of my images recently. “A textbook example of how to ruin perfectly good data” was the comment from a purist in the astro-imaging community. It made me stop in my tracks and question what we do as astro-imagers. I wondered about any responsibility we may have for ensuring that future generations looking skyward actually know what is real colour and what is perceived to be real. I know this may sound odd coming from an imager whose main interest is narrowband, false colour in itself, but let me explain where I'm beginning to feel that my responsibility may lie.

My starting point before I start processing is to look around the Internet and in books to see what's been done before. Not necessarily to emulate and thus continue an idea of what is 'normal', but to get a feel for what a more usual colour balance is within a target, to examine the colour separation within it.

Comparing images

Armed with more Internet images than you would think possible, as well as information about how I felt it should look, I began processing. Once I'd finished, I thought that my image was pleasing to the eye, containing colours not too dissimilar from those in many other images I looked at, and that it stacked-up well enough against them. The 'over processed' comment led me to search to find out what Thor's Helmet should really look like. What I mean by this is an image that has been balanced according to scientific knowledge of the predominant gases present in the nebula, where the stars have been accurately calibrated for their colour and where some sort of genuine scientific information could be obtained from the image.

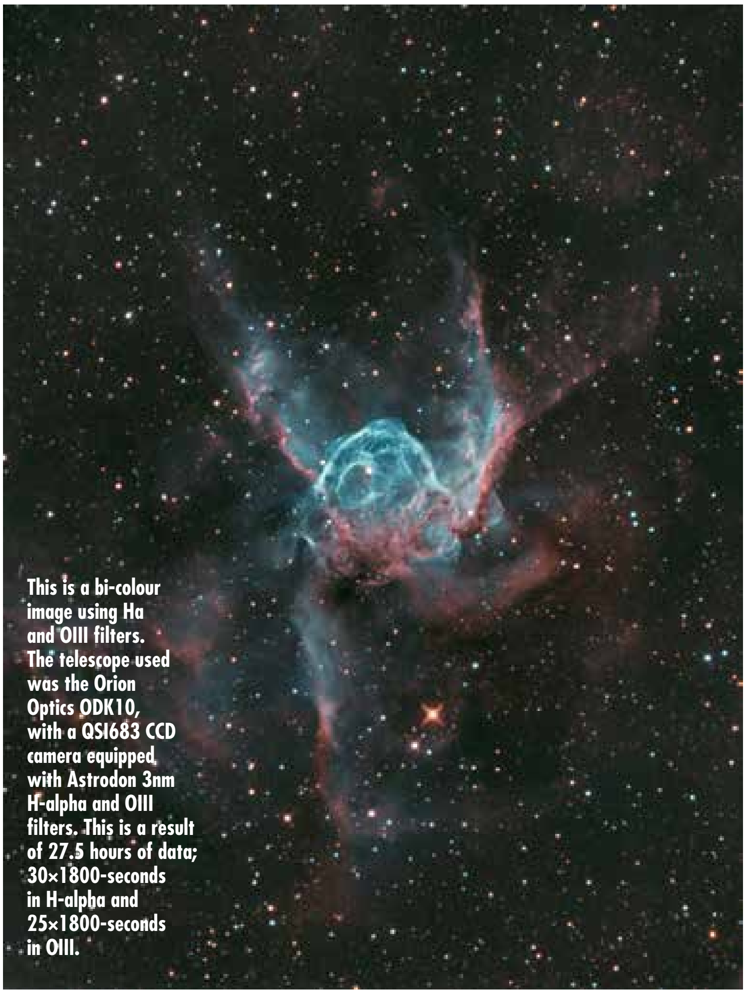
There is an abundance of images of Thor's Helmet available, most of them showing bright colours with green and blue hues. To seek out a more natural appearance, I ended up looking at film images from Japan, seemingly one of the last bastions of the astro-film age. These showed an image far removed from those we generally find and one that I have to say, for me at least, was far less pleasing to the eye.

Scientific responsibility?

I began to question whether we hold any degree of responsibility to keep at least the 'real' images alive in today's huge and rambling reference library – the Internet. In time, we produce so many manipulated images that the 'real scientific' ones can get lost in a sea of lovely colours and stunning scenes. Of course, these things can also change with a 'fashion'; the Hubble Space Telescope (HST) palette is very much in vogue these days.

Artistic impression

Fast forward this idea to something that I have been working on – creating a coloured image from one channel of mono hydrogen-alpha data. It's fantastic for time-saving in a cloudy climate, but quite possibly an affront to our responsibilities. As pleasing images, I think that both the colourised one-channel images of the Rosette Nebula and IC1318 shown here tick the right boxes and look similar to Hubble Palette versions, but they are different in one major way as both contain only one channel of data (hydrogen-



This is a bi-colour image using Ha and OIII filters. The telescope used was the Orion Optics ODK10, with a QSI683 CCD camera equipped with Astrodon 3nm H-alpha and OIII filters. This is a result of 27.5 hours of data; 30×1800-seconds in H-alpha and 25×1800-seconds in OIII.

This image is courtesy of Photo Abiko Astro by Sakai from Japan and is very much a natural picture. These types of images are very difficult to find, as the Internet is full of images of colourful and detailed bi-coloured examples of Thor's helmut. Of the two images of Thor's helmet, which one is more 'scientific'? Furthermore, in time these more 'natural' images become harder to find as they are swamped by the types of images that we all want to see. Image: Photo Abiko Astro by Sakai, Japan.

COMMON WAYS OF IMAGING

BI-COLOUR

This method uses two narrowband filters, traditionally H-alpha and OIII. The H-alpha filter is placed in the red channel and the OIII filter in blue and green. This will generally give you a very red image, as the Ha tends to be dominant. I use the Colour Select tool in Photoshop to change the colours to get an image that is more pleasing to the eye. While the colours are changed, the filters will still show up their specific wavebands, albeit it as a different colour.

Narrowband filters allow less light through, necessitating longer exposures (generally 30 minutes per exposure). My images of Thor's helmut is an example of a bi-colour image.

BROADBAND OR LRGB

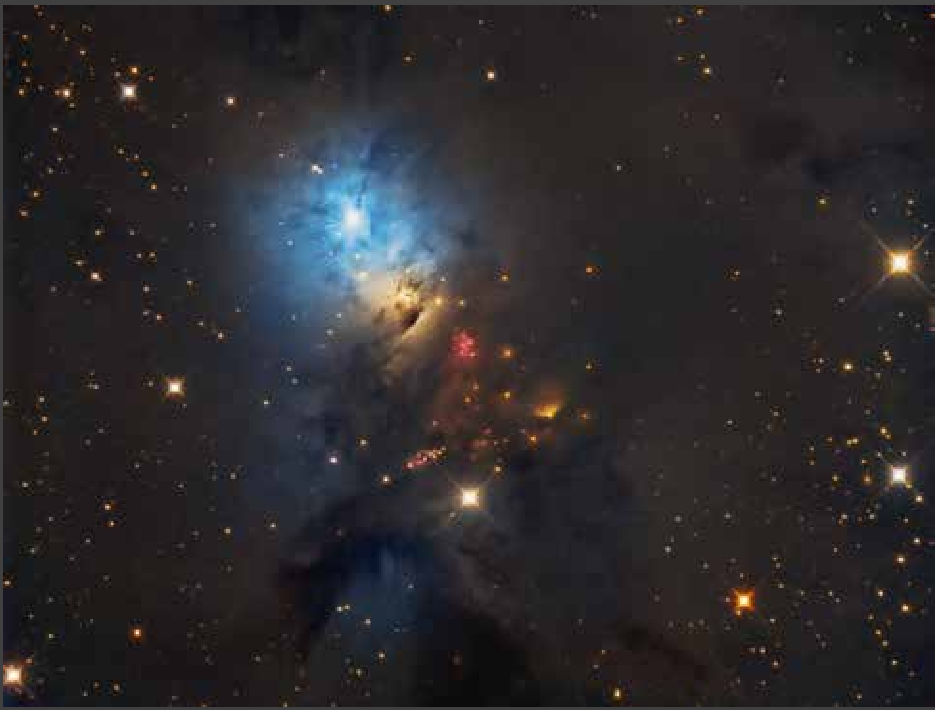
Broadband images (often known as LRGB) are the more traditional images, taken through red, green and blue filters. These images contain data from all the filtered wavelengths (RGB) and often luminance data (L) is added to give the 'detail' of the image. The luminance filter captures all wavelengths and so the detail in the final image is scientifically correct. The colours can be manipulated a little to suit; perhaps the blue area would be made more magenta for example, but the general colours remain the same.

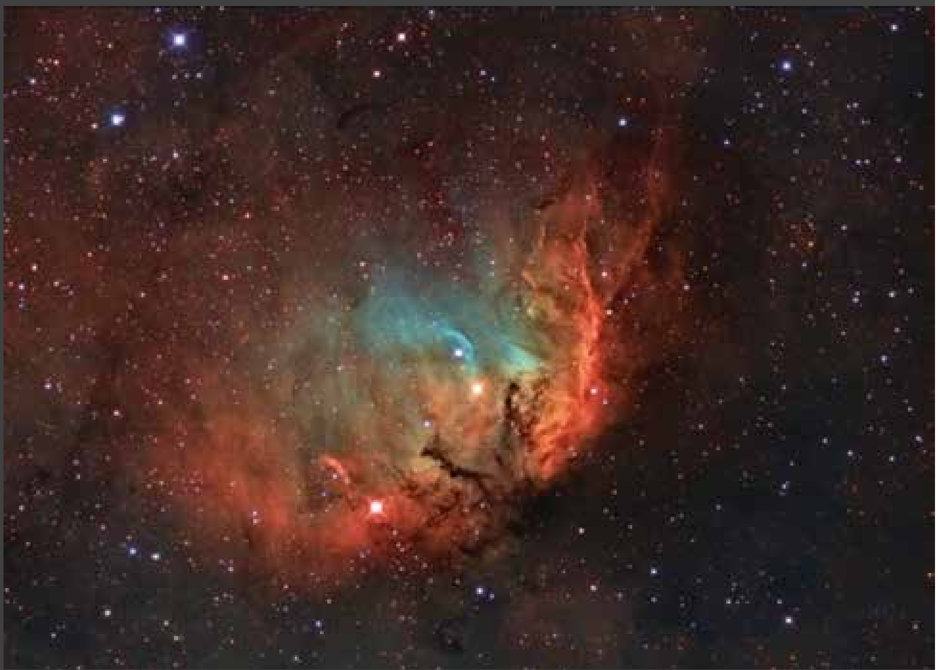
The exposures times with LRGB tend to be much shorter, owing to more light being allowed through each filter than is the case with the H-alpha filter. This can cause the colours to saturate much quicker, so you run the risk of losing all colour data.

HUBBLE PALETTE

The Hubble palette uses H-alpha, OIII and SII filters assigned to the following colours; SII to red, H-alpha to green and OIII to blue. This combination is used in some of the famous Hubble images, such as the 'Pillars of Creation'.

The first image will usually be rather green, as the H-alpha light tends to be dominant throughout the image. This can be counteracted to some degree by increasing the signal through the OIII and SII filters, but will require more overall exposure time.





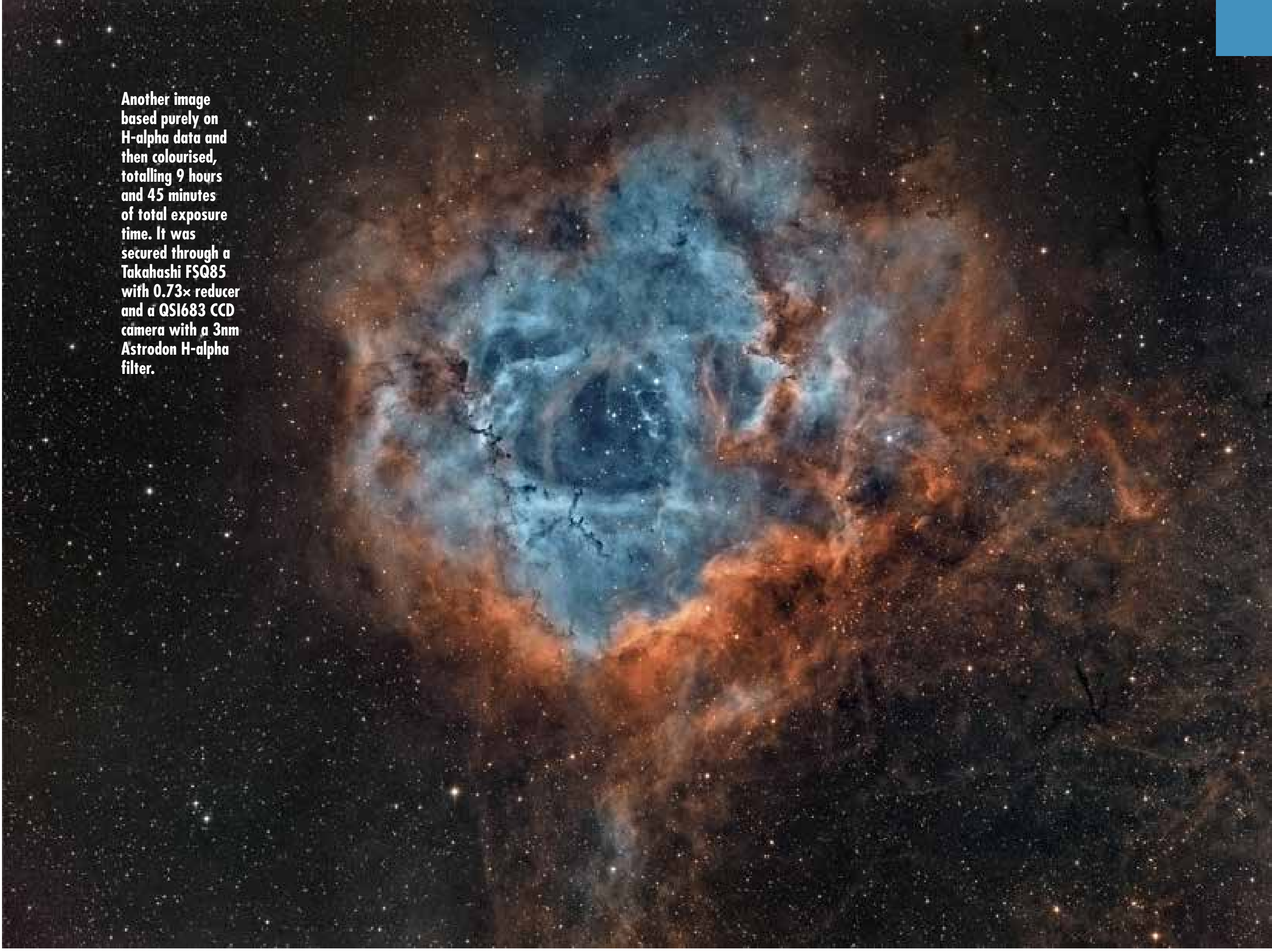
Top: Totalling 25 hours of total imaging time, this image of NGC 1333 in Perseus was taken using an Orion Optics ODK10 telescope and a QSI683 CCD mono CCD camera with Baader LRGB filters. 60 × 600-second subs were taken through the luminance filter, with 30 × 600-second subs through each red, green and blue filter.

Above:The Tulip Nebula (Sh2-101) has been captured using an Orion Optics ODK10 telescope and a QSI683 CCD Camera with 3nm H-alpha, OIII and SII filters. I took 25 × 1800-second subs in H-alpha, 25 × 1800-second subs in OIII and 24 × 1800-second subs in SII. In this case, the Colour Select tool was used to manipulate the colours.

alpha in both cases), and the colours have been arbitrarily 'placed'. They bear absolutely no scientific resemblance to different filter use; the colour separation within the image holds no water for the purists. These two images are totally art, through and through. Yes, they may look nice as a screensaver, but one fails if trying to extract any scientific meaning. That is the honest fact of the matter.

Images such as these go into that big reference library via a number of means, such as social media, magazines, websites and shares between friends. From the start, I am at great pains to say that the technique is artistic rendition and to ensure that people know it has no scientific base. I do not want to deceive anyone and make them think it's anything more than a piece of art.

Next, the image gets shared on a blog or on a social media page. Now my endeavours to ensure



Another image based purely on H-alpha data and then colourised, totalling 9 hours and 45 minutes of total exposure time. It was secured through a Takahashi FSQ85 with 0.73× reducer and a QSI683 CCD camera with a 3nm Astrodon H-alpha filter.

it's known as an artistic image are diluted. I've even taken to adding text across the top of the image to say that it's an artistic rendition, but people look at it and assume that it is scientifically based. It goes into the 'reference library' as a credible image of and may be used for years to come as a reference for how that target should look. How the filter wavelengths should behave.

HST palette: blurring the science

Slightly less contentious is the HST palette, which has now become the norm and generally accepted across the board. But even here, the colours within the palette are manipulated so much that they too become less informative with regards the actual colours, and even colour separation.

Many imagers, myself included, work hard to erase green in HST palette images and replace it with other colours, using tools such as 'Colour Select'. The green within the HST palette, when originally assigned to a channel shows the high presence of H-alpha bandwidths, as the H-alpha is mapped to the green channel when the data are combined. If the green is replaced with blue (or whatever colour you like) by using the Colour Select tool, and this new manipulated blue colour merges with the real blue data, how do we know that green was ever there in the first place? If such manipulated images are later examined for scientific purposes, what can be ascertained from the colours? How does that impact on the reference image of that data for years to come… – it becomes the 'right' way to present the image.

Imaging motives

Each of us has our own reasons for imaging; some want to be able to draw scientific conclusions from what they capture, while others want to create images that are pleasing to the eye. Some people will say that to create only a pleasing image in effect gives others false and incorrect ideas about what is right and what is wrong. It gives people expectations and increases the speed at which the 'true' images are buried within the 'reference library'.

I have certainly questioned my own responsibility and I wonder how I can address it. I like to try different things, but I try to ensure that people are clear about what I have done and how I achieved it. But it gets lost within a short space of time, owing to today's instant shares and likes across many forms of social media. There is little that can be done to change the speed at which images go across the world via the Internet, and to change the way that people share and look at an image. However, armed with a little knowledge and a sense of responsibility, we could try to help to keep that 'reference library' just that little more accurate.

Sara Wager is an astrophotographer originally from Somerset, now living in Spain.