

# ENTER THE MATRIX

How to capture impressive high-resolution, wide-angle photos of the night sky

**F**EW ASTROPHOTOS are as awe-inspiring as a wide-angle view of the Milky Way arching above a dramatic landscape. But the devil is in the details—or lack of details, as is often the case. Zoom in close enough, and you'll usually discover that the myriad deep-sky objects are rendered as little more than indistinct blobs of colour a few pixels wide. Even with the impressive resolution of modern DSLR cameras, wide-angle lenses can't reproduce small features clearly.

But there's a technique that overcomes this problem, allowing you to enjoy the best of both worlds: wide-angle coverage *and* high

resolution. Simply switch to a lens with a longer focal length and shoot a matrix of several overlapping frames that you stitch together into a single, expansive, highly detailed shot. Although time-consuming, the results are visually striking and can lead to a newfound appreciation for the intricacy and breathtaking beauty of the night sky.

## THEN AND NOW

As a teenager, my initial attempt to create a Milky Way mosaic was an epic failure. The plan was to paste together a set of 4×6 prints I'd made using a 35mm film camera and a 50mm lens. Despite allowing a fair bit of

overlap between each print, I discovered it wasn't possible to accurately align the photos to match the apparent curvature of the night sky. This, along with the pronounced vignetting in the corners of each picture, made for a pretty sad-looking science project.

Fast-forward 40 years, and astrophotographers are in a totally different universe of possibilities. Thanks to digital technology, it's now a relatively easy task to create the sort of sweeping celestial scenes that defeated my younger self. The key is utilizing the powerful built-in panorama capabilities of Adobe Photoshop and Lightroom, as well as other "stitching" software. These

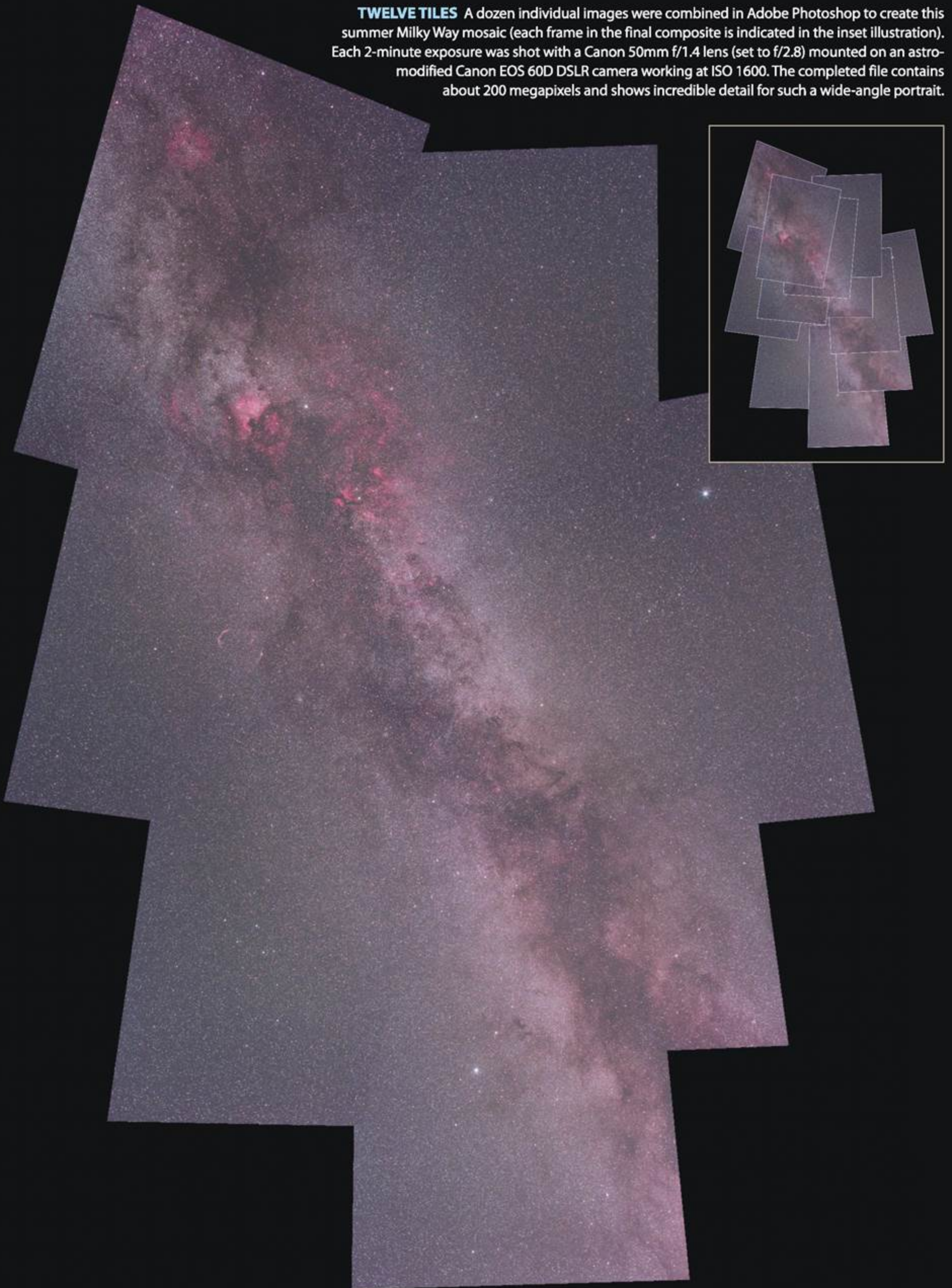


### SOUTHERN HORIZON

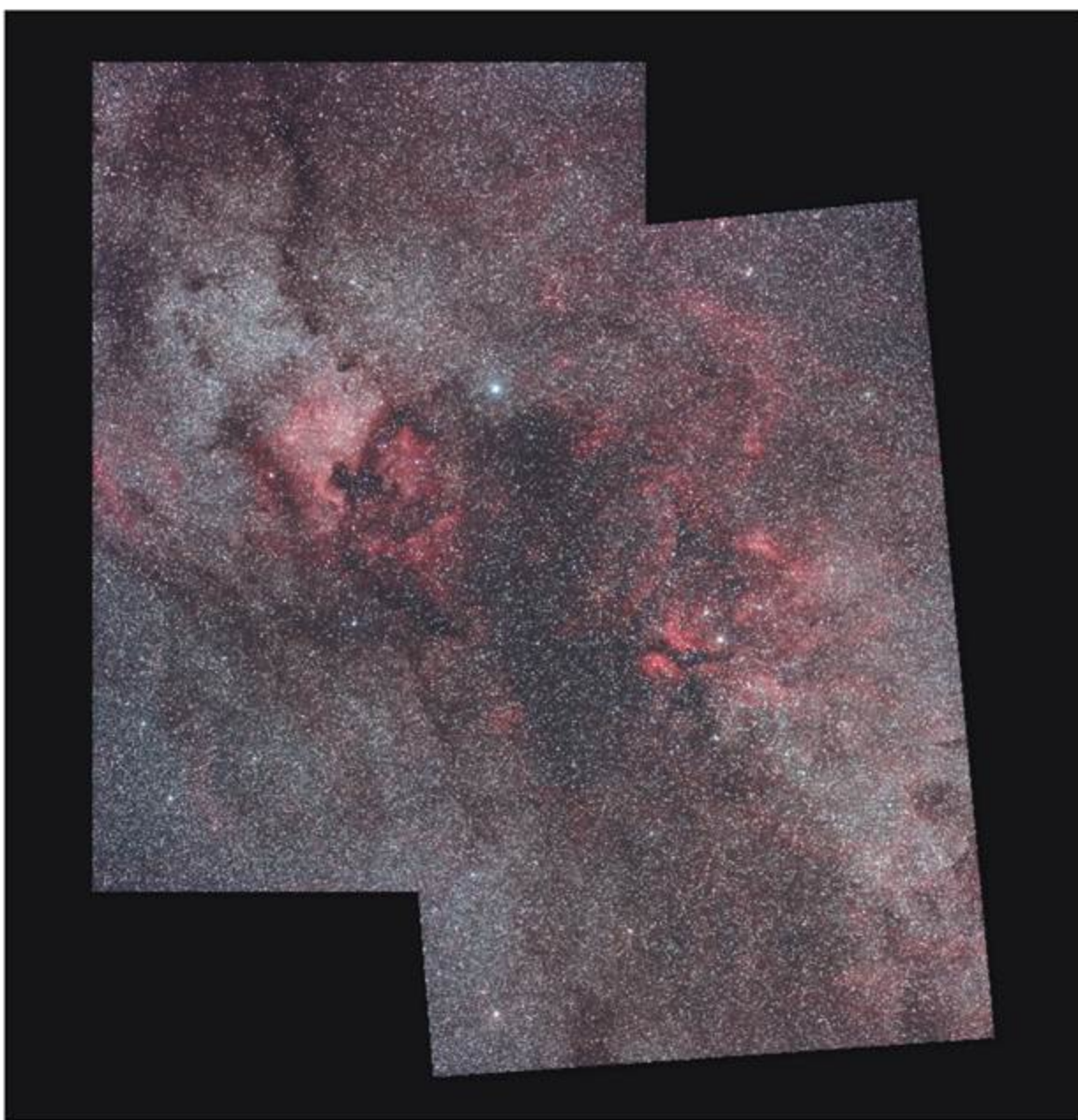
Thirteen 2-minute exposures (recorded at ISO 1600) were combined in Adobe Photoshop to produce this composite view of the southern horizon. Each image was captured with a Canon 85mm f/1.8 lens and an astro-modified Canon EOS 60D camera. Unlike with most wide-angle shots, zooming in on this scene reveals considerable detail in individual deep-sky objects. Some might decide to crop out the jagged edges, but that choice depends on your own aesthetic sensibilities.



**TWELVE TILES** A dozen individual images were combined in Adobe Photoshop to create this summer Milky Way mosaic (each frame in the final composite is indicated in the inset illustration). Each 2-minute exposure was shot with a Canon 50mm f/1.4 lens (set to f/2.8) mounted on an astro-modified Canon EOS 60D DSLR camera working at ISO 1600. The completed file contains about 200 megapixels and shows incredible detail for such a wide-angle portrait.







programs automatically align the individual frames, apply the correct amount of warping and remove vignetting.

To begin creating your matrix masterpiece, set your camera to Manual mode and use exactly the same ISO, aperture and exposure settings for each frame. If working in Raw mode (and you should be), check that you've selected a consistent white-balance setting in postprocessing. These steps will ensure that your frames blend together seamlessly.

Because you're shooting at longer focal lengths, some sort of tracking mount is necessary to avoid star trails. A lightweight model, like the iOptron SkyTracker Pro that I reviewed in the May/June 2017 issue (page 46), is a great option for smaller lenses. However, if you plan to use heavier telephotos, a beefier equatorial mount will likely be required. Although I started out

**START SMALL** If you're overwhelmed by the thought of combining dozens of individual images into a single mosaic, take heart—you can always start small. This photo of the region that includes the North America Nebula comprises just two 2-minute exposures (at ISO 3200) recorded with a Canon 85mm f/1.8 lens and an astro-modified Canon EOS 60D camera.





**WIDER THAN WIDE** The author combined half a dozen 2-minute exposures to create this horizon-to-horizon view of the Milky Way. For each image, he used a Canon 15mm f/2.8 fish-eye lens mounted on a crop-sensor Canon EOS 70D camera set to ISO 1600.

with a simple tracking platform, I've been spoiled by the ease of using a computerized GoTo mount, which greatly simplifies repositioning the camera for each exposure in a sequence.

## PLAN YOUR SHOTS, SHOOT YOUR PLAN

Careful planning is required for success. You need to execute your shots with a significant amount of overlap between frames to allow the software to perform its digital magic. Desktop planetarium software is indispensable for previsualizing the arrangement of each image tile required for your finished mosaic. Most of these programs can display a graphic overlay indicating the field of view for your specific camera and lens combination.

Each time you record a shot, select a star roughly 30 percent from the edge of the frame to use as a reference point for lining up the edge of the next frame. With a 50mm lens, you can cover wide swaths of sky quite quickly, but as the focal length increases, photographing the same area takes substan-

tially longer, since the field of view is smaller. A mosaic always involves a trade-off between resolution and coverage.

Although you might be tempted to try to get away with using the fewest shots possible, don't skimp on overlap. The last thing you want is to discover gaps in your coverage after you've put away your equipment for the night. Err on the side of too much overlap rather than too little.

When you've imported the images into your computer, it's a simple matter to assemble them using image-editing software. In Adobe Lightroom, select *Photo > Photo Merge > Panorama*. In Photoshop, it's *File > Automate > Photomerge*. Each program also offers a number of different projections to map your flat images onto a hemispherical sky. Experiment to see which one provides the most aesthetically pleasing results.

## FINE POINTS

In the northern hemisphere, it's a good idea to begin your sequence with the westernmost frames so that you don't have to worry

about that region of sky setting before you're finished. It's also wise to capture at least two exposures for each tile in the matrix in case a passing satellite or aircraft spoils one of your frames.

Although I've used this technique exclusively with camera lenses, there's no reason you can't apply it to telescopic images. After all, a scope is really just a super-telephoto lens. And, depending on the focal length of your instrument, making a mosaic may be your only recourse for big targets such as the Andromeda Galaxy and the North America Nebula.

If the prospect of taking dozens of perfectly overlapped images seems a bit daunting, don't despair—you can start with simple mosaics that combine only two or three images until you're comfortable with the technique. Once you get the hang of it, you'll happily enter the astrophoto matrix. ♦

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