



## Detailed Wide-Angle Astrophotos

Overlapping frames allow you to capture generous swaths of sky in high resolution.

**S**tunning, wide-field images of the night sky are possible with nothing more than a modern digital camera, a fast wide-angle lens, and a sturdy tripod. Add a dark-sky location with a compelling landscape, and you have all the ingredients necessary for an award-worthy photograph. Still, there's room for improvement.

As impressive as typical wide-angle shots can be, it's always a bit disappointing when you zoom in to examine the details. Deep-sky objects are rendered as nothing more than indistinct blobs of color just a few pixels wide. Even with the tremendous resolution of modern camera sensors, wide-angle

lenses simply can't deliver enough detail to display small objects clearly.

Luckily there's a trick you can employ to create extremely high-resolution, wide-angle images. The "trick" is to use a longer focal-length lens and stitch multiple, overlapping frames into a single, highly detailed, wide-field image. Although such photos take more time and planning to create, the

resulting resolution lets you explore the complexity and breathtaking beauty of the night sky down to the pixel level.

### Connecting the Shots

I have to admit my first attempt at using this technique was a total failure. Back in the film days, I tried to create a wide-field panoramic image of the Milky Way by pasting together

▲ **WIDE AND SHARP** *Left:* The author cropped this expansive photo of the Cygnus Milky Way from the 12-tile mosaic shown at right. The technique described in this article allows you to create the kinds of photos normally produced with a wide-angle lens, but with a level of detail only a longer-focal-length optic is capable of. *Right:* A total of 12 individual images (each outlined in white) were combined to create this mosaic. Each individual, 2-minute exposure was captured with a Canon 50-mm f/1.4 lens working at f/2.8 and an astro-modified Canon 60D camera working at ISO 1600. The resulting image file is about 200 megapixels in size and shows incredible detail.



several 4×6 prints made with a 35-mm camera and a 50-mm lens. Despite including a fair bit of overlap between each photo, it was impossible to make the flat paper prints match to the spherical shape of the night sky. This, along with heavy vignetting at the edge of each image, made for a rather sad-looking photo project.

Fast-forward a few decades and it's now possible to use the built-in panorama features in image-editing software to automatically apply the proper corrections and merge the individual frames into a single, seamless, wide-angle image. I find *Adobe Lightroom* the easiest to use. Plus, it has the ability to save your merged image as a DNG file, which allows extensive post-processing. Other options include *Adobe Photoshop*, *Affinity Photo*, and *PTGUI*. Each of these programs requires a significant amount of overlap between the individual image tiles to perform their digital magic, so careful planning is important to ensure the best results.

Each time you take a shot, pick a star that's about one-third of the way in from the edge of the frame and use it as a reference point to line up the edge of the next image in the sequence. You can follow either a simple linear arrangement or execute a cross-like pattern in which the central image is surrounded by additional frames on all four sides. Even with a 50-mm lens on a full-frame camera, you can quickly cover impressively wide regions of the night sky. However, as your lens focal length increases, the process requires more frames in order to cover the same field of view and therefore takes substantially longer to shoot.

You might be tempted to use the absolute minimum number of shots possible to photograph a given area, but in my experience it's better to strive for more coverage rather than less. A generous amount of overlap ensures that you won't discover any unsightly gaps when you stitch together your frames.

### Quick Tips

In the Northern Hemisphere, you should start your shooting sequence



▲ **A QUESTION OF RESOLUTION** This pair of cropped images of the region near Deneb, in Cygnus, shows the dramatic difference in detail captured by a 50-mm lens (left) and a 15-mm fisheye (right). Note how sharp the stars are and how well defined the nebulae are in the 50-mm shot.



▲ **START SMALL** If the thought of combining dozens of individual frames to create a mosaic is overwhelming, take heart — you can always start with fewer images. This portrait of the region near Deneb consists of just two overlapping frames captured with an 85-mm lens.

with the westernmost edge of your image set first. This allows you to maximize your sky coverage before Earth's rotation causes objects to sink into the muck near the horizon or, worse, set entirely. You don't want to be in a situation where you have to rush your shots. I'd also suggest shooting at least two

exposures for each tile in your matrix just in case a passing satellite or aircraft spoils one of them. It's even possible to shoot the individual tiles over successive evenings so long as sky conditions remain consistent.

Desktop planetarium programs like *SkySafari* are helpful for pre-visualizing





▲ **SOUTHERN HORIZON** The author combined 13 individual frames photographed with an 85-mm lens to create this composite view of the Sagittarius Milky Way. Unlike with typical wide-angle shots, zooming in on this image reveals considerable detail in individual deep-sky objects. If desired, the mosaic can be cropped to create a final image suitable for printing or display.

the individual image tiles you'll need to create your final mosaic. Most of these programs can display a graphical overlay to indicate a specific field of view. Select a rectangular-shaped frame that matches your particular camera-and-lens combination. For example, my Canon EOS 60D with a 50-mm lens has a field of view measuring  $25^\circ \times 17^\circ$ .

Once you're ready to start shooting, put your camera in Manual mode and be sure to use the same ISO, aperture, and exposure setting for each frame. When shooting in RAW mode, the only post-processing required will be to set a consistent white balance across all the images. This will help everything blend neatly when you assemble your image.

### Getting on Track

On your first attempts with this method, keep things simple by shooting with a fixed tripod. The main drawback to this approach is that your exposure time will be limited by your lens's focal length. Over time, the Earth's rotation causes the stars to drift across the sky and leave trails on your images. The effect is more pronounced with longer lenses. For example, a 16-mm lens (on a full-frame camera) allows an exposure of up to 30 seconds long without seri-

ous trailing. However, that same camera equipped with a 50-mm lens will be limited to just a 10-second exposure before the star trails start to show. (This topic was discussed in greater detail in the February 2023 issue, page 55.)

Fortunately, many lenses in the 50-mm focal-length range have extremely wide apertures (low f/stop numbers, such as f/1.8), which allows them to gather light more quickly than their slower, wide-angle cousins. This can partially compensate for the shorter exposure times you'll need to use. You can also boost your camera's ISO setting to keep exposure times suitably short.

For lenses with even longer focal lengths, you'll need a tracking mount to achieve untrailed stars. Lightweight units such as the iOptron SkyTracker Pro or Sky-Watcher Star Adventurer are simple, portable options. For larger telephoto lenses, a more substantial equatorial mount will be required to carry the extra weight. Although I've used this technique exclusively with camera lenses, there's no reason you can't extend it to include images captured with a telescope. For example, if you have trouble fitting the full extent of the Andromeda Galaxy (or even the Moon) in your photo, you can shoot multiple,

overlapping frames to create a synthetic wide-field view while retaining the exquisite detail that a long-focus instrument provides. Indeed, some of my best Moon shots have been captured this way.

### Panning for Gold

Once you've imported your images into your computer, it's a simple matter to blend the images together with image-editing software. In *Adobe Lightroom* you simply select **Photo > Photo Merge > Panorama Merge**. This will launch the Panorama Merge Preview dialog box. Three options are presented for the type of projection used to create the final panorama: Spherical, Cylindrical, and Perspective. Experiment to see which one provides the most aesthetically pleasing results for your particular set of shots. Surprisingly, *Lightroom* and *Photoshop* seem to have slightly different algorithms for blending panoramas, so if one program fails to work well, try using the other.

For most of the images in this article, I've left the ragged, saw-tooth outline of the individual image tiles visible. If you prefer, you can crop your resulting mosaics so they have a more traditional rectangular shape, which makes them easier to display on your monitor. And by carefully planning the initial arrangement of the tiles, you can create a final mosaic that supports both horizontal and vertical crops. This is handy if you plan to post the image on various social media platforms, each of which has its own preferred aspect ratio.

If the prospect of taking dozens of overlapped images seems a bit daunting, don't worry — you can start by using just a couple of frames. Once you're comfortable with the technique, you can attempt more elaborate and expansive shots. Eventually your confidence will grow, and soon you'll be making detailed, wide-angle photos that you'll be proud to post online and show to your friends and family.

■ **TONY PUERZER** is an avid amateur astrophotographer. He's happy that his photo mosaics no longer involve scissors, glue, and posterboard.