GETTING IN FOCUS

Here are some tips and tricks for taking tack-sharp astrophotos

WHEN IT COMES TO sharp night-sky images, there is no margin for error. If your lens is only slightly out of focus, your photos will have bloated stars surrounded by unsightly red or blue-green rings. Beyond purely aesthetic considerations, there's a solid technical reason for achieving the smallest star images possible. A poorly focused lens spreads out light, thereby necessitating longer exposures to show the same number of stars in a sharply focused image.

If you own a modern DSLR camera, you probably take its auto-focus capabilities for granted. Under normal daylight conditions, its speed and accuracy are nothing short of amazing. Yet try taking a picture of the night sky, and your camera's focus system struggles, racking the lens in and out as it hunts for something to lock on to. The small size and low illumination levels of stars are a recipe for auto-focus failure.

GOING MANUAL

For nighttime astrophotography, you won't be able to rely on your camera's auto-focus system—you'll have to go manual. Most lenses have a Manual/Auto-focus switch for this function, usually located on the side of the barrel.

However, there's a wrinkle when it comes to modern lenses. Older, non-auto-focus lenses had a physical "hard stop" at infinity focus. That made life easy for astrophotographers. But most modern lenses allow you to turn the focus ring beyond the infinity point marked on the lens. For these lenses, you need a different approach. Thankfully,

LAGOON AND TRIFID Your time under a clear dark sky is always limited, but be sure to take as long as you need to accurately focus your camera lens. This 6-minute exposure at ISO 1600, captured in pristine conditions atop Mount Kobau, British Columbia, shows M8 and M20, in Sagittarius. The author used an astro-modified Canon EOS 60D DSLR camera and a 300mm lens fitted with an Astronomik CLS filter.

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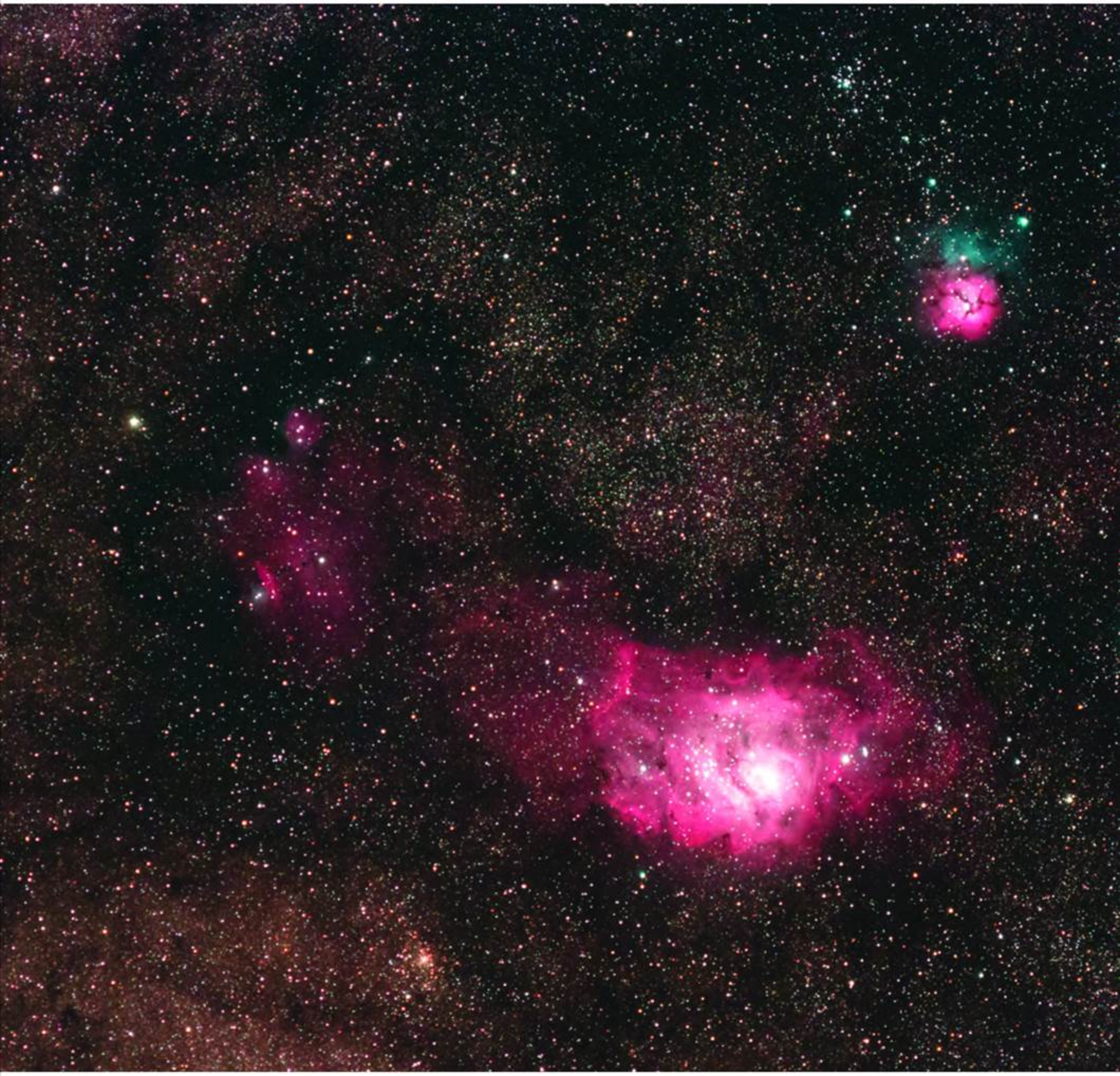
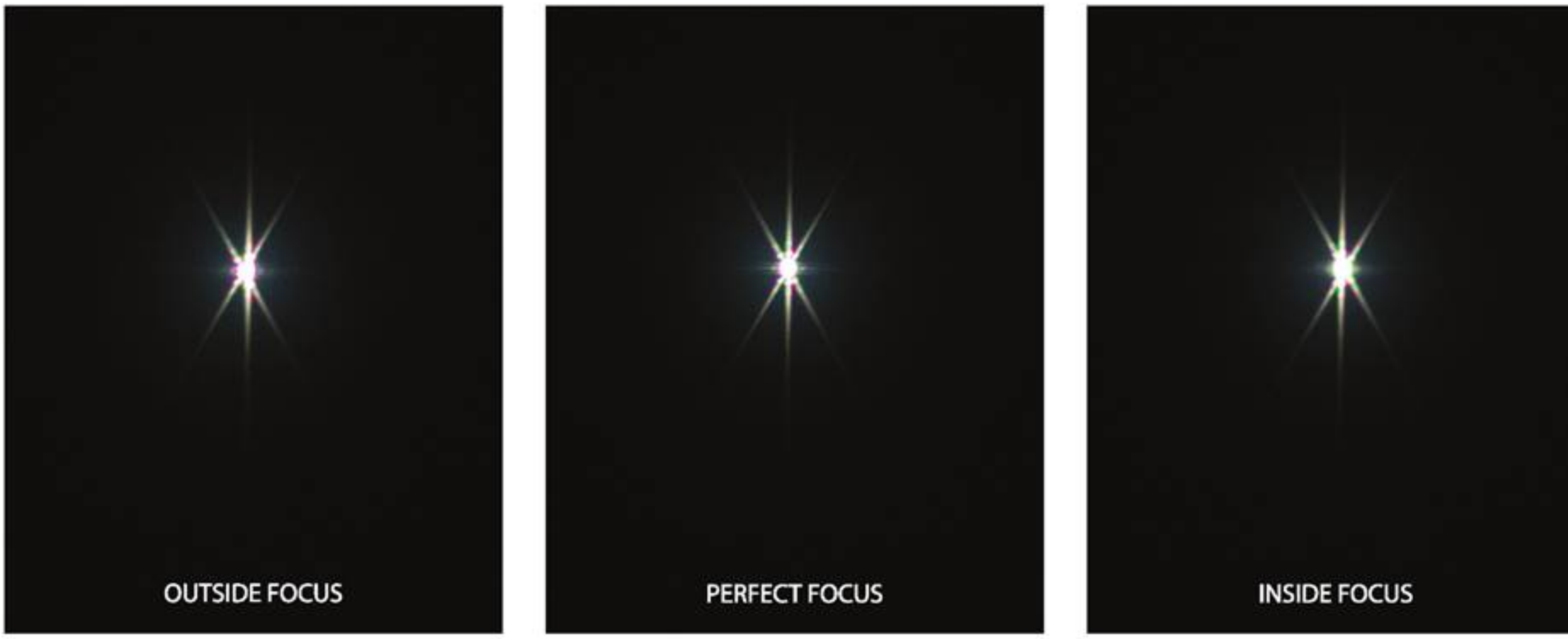
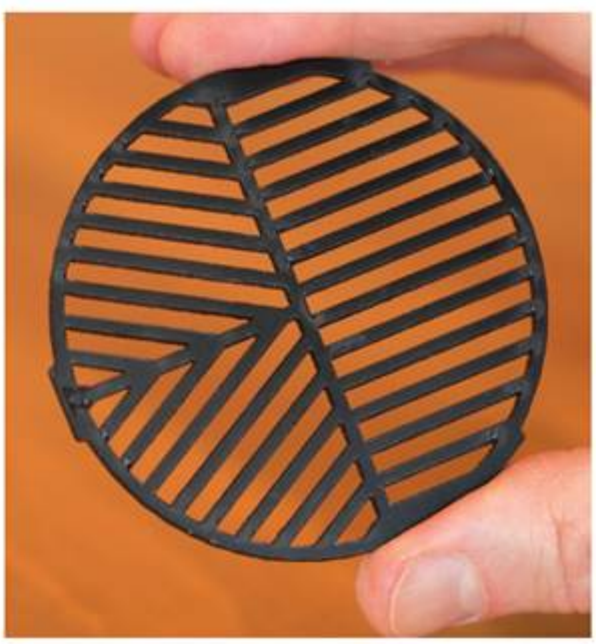
most recent digital cameras have a feature called "Live View." This allows you to zoom in and examine the image of a bright star or planet on the camera's display screen.

To focus with Live View, first set the lens's infinity symbol (it looks like a sideways "8") near the index mark, then centre a bright star in the field of view. (If you can't see anything when you turn on Live View, try using the optical viewfinder to locate your target star.) Next, gently turn the focus ring back and forth while observing the star under 5x or 10x magnification. The goal is to make that point of light appear as small as possible. On longer-focal-length lenses, the star image might exhibit chromatic aberration (colour fringing) when you are slightly off the point of best focus.







DOING THE BAHTINOV This sequence of images illustrates how to focus a lens fitted with a Bahtinov mask. When the central diffraction spike is positioned exactly halfway between the two diagonal spikes, the lens is perfectly focused. Left: This commercially produced Bahtinov mask made by Farpoint Astro installs much like a standard camera filter. The author uses it to focus his 300mm lens.

If you find yourself constantly struggling to see stars with Live View, it might be time to consider upgrading to a lens with a wider aperture. For example, I find it much easier to focus a 50mm f/1.4 lens than I do a kit zoom lens that has a maximum aperture of only f/5.6, because the image is so much brighter at f/1.4. Keep in mind that each change in f-stop value doubles or halves the amount of light reaching the camera's sensor. An f/5.6 lens, for example, gathers half as much light as one that's f/4. So my ultrafast 50mm f/1.4 lens produces a Live View star image that's 16 times brighter than my f/5.6 zoom.

Fast lenses aren't cheap, but the extra money usually gets you better mechanical quality too, which makes precise focusing easier. Sadly, the world of optics is generally one of those "you get what you pay for" situations. But just because an expensive fast lens is better doesn't mean you can't achieve good results with a kit zoom lens. You just have to take a little more time and work a little harder.

GOING REMOTE

Even with a high-quality lens, your ability to focus using Live View is often limited by the size of your camera's rear display. Worse yet, if you can't change the screen's orientation, you'll probably wind up contorting yourself into awkward and uncomfortable positions, especially when shooting objects near the zenith.

Luckily, many digital cameras can be connected to a computer with a USB cable or wirelessly via WiFi, allowing you to use your laptop's much bigger screen instead. Being able to comfortably view a large image makes it much easier to focus your camera.

Many manufacturers offer software specifically for this task. For example, Canon supplies a free application called EOS Utility, which allows you to view the camera's Live View feed on your computer screen. Moreover, you can adjust the focus of your lens directly with the software, which has the huge advantage of eliminating the vibration that arises when you touch your camera.

Even better, some specialized computer applications, such as Astro Photography Tool, BackyardEOS and BackyardNIKON, add a real-time numerical readout indicating the size of the star image. Simply adjust your lens for the smallest value possible, which corresponds to perfect focus.

Several camera models allow wireless control with a mobile phone or a tablet. Canon's Camera Connect app allows Live View and focus with iOS and Android devices. A number of other mobile applications, including qDslrDashboard and Cascable, support this capability with a variety of different camera brands. Check your manual to see whether your camera is equipped with WiFi so that it can work with these apps.

LIVING WITHOUT LIVE VIEW

If your camera lacks Live View, the best alternative is to capture a series of test shots. Examine the images at 100 percent magnification, and note the focus setting that yields the sharpest star images. You can speed up the process by using a very high ISO, which allows you to utilize short exposures. At ISO 12,800, I can get reasonable test images with exposures as short as 10 seconds. Just remember to reset the ISO once you're done, or you'll end up with a bunch of noisy, overexposed images. (Not that I've ever done that!)

Judging focus is made much easier with a simple accessory called a Bahtinov mask, which installs much like a regular lens filter. The mask is a black plastic disc with a series of slots cut in it to produce diffraction spikes around bright stars. Adjust the focus setting on your lens as shown in the sequence of images above. It works equally well in Live View or with a test-exposure sequence. Unfortunately, the mask is not very effective with wide-angle lenses because the diffraction patterns it produces

HIDING FOCUS Poor focus can be obscured by low-quality optics, unsteady seeing conditions, vibrations or even passing clouds, as was the case with this image of the North America Nebula, in Cygnus. The 2-minute exposure at ISO 3200 was captured with an astro-modified Canon 60D and an 85mm lens at f/2.5.

are tiny. However, it works very well with longer focal lengths.

Bahtinov masks are available in various sizes from commercial sources, but you can make your own if you're so inclined. Visit the website astrojargon.net/MaskGen.aspx to generate a pattern that you can download to cut your own mask from a sheet of black plastic.

Finally, achieving sharp focus is one thing, maintaining it throughout an imaging session is another. As your lens cools during the night, thermal contraction may cause the focus point to change somewhat. Also, some inexpensive lenses exhibit "focus creep," an unwanted effect arising from components shifting position slightly when the lens is pointed skyward. That's why it's prudent to recheck focus once in a while.

As with so many aspects of astrophotography, producing images with pinpoint stars requires attention to detail. But don't be discouraged if at first you seem to be spending a lot of time focusing your lens—practice makes perfect. And when you succeed, your reward is an image you'll be proud to call your own. ✦

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