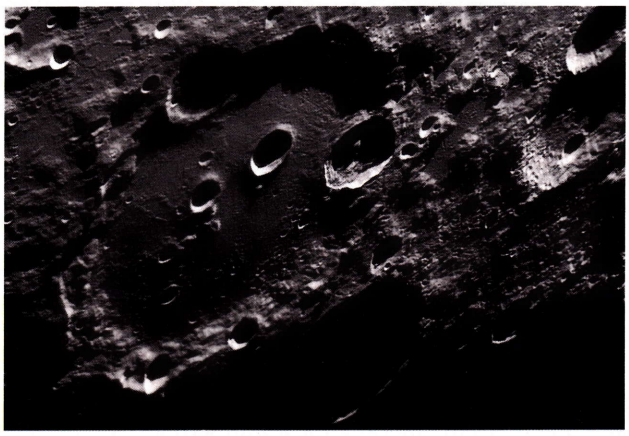
No-Tools Collimation

Here's a simple method for aligning your telescope's optics without lasers or other gadgets.

MOST READERS KNOW that the only way to get every last drop of optical performance from a reflecting telescope is to have the scope in good collimation. When we want to tune up the collimation we usually reach for devices such as a Cheshire eyepiece or laser collimator. But in spite of their utility and usefulness, many of these collimation tools have shortcomings. For example, most collimation devices require that the center of the primary mirror be accurately marked in some way. That's fine for Newtonians, but not for Schmidt-Cassegrains and Maksutovs. Luckily, there's an easy way of achieving optical alignment that doesn't require any of these tools.

The method outlined here is essentially a star test, but with a twist. It can be performed in the dark and only requires a clear night sky. Begin by centering a star that's around 2nd magnitude in your scope's field of view. For Dobsonian users in the north, Polaris is the ideal choice — it's the right brightness and essentially stationary. If your scope has a tracking mount, you have more options.

Next, choose an eyepiece that provides the right amount of magnification. The ideal power is around 25× per inch of aperture, which is what Dick Suiter recommends in his classic book, *Star Testing Astronomical Telescopes* (Willmann-Bell, 2009). Thus, you should use around 200× for an 8-inch scope. A simple, math-free way



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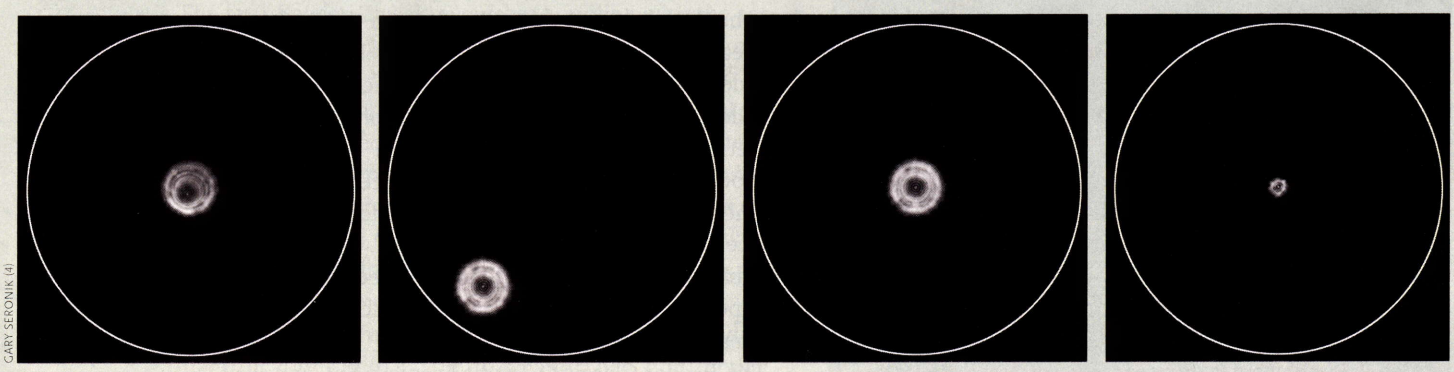
To enjoy the sharpest views of the Moon, planets, and stars, the optics in your telescope must be accurately collimated.



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As explained in the accompanying text, the offset central hole in this defocused star image indicates that the reflector is out of collimation.

Step 1: By re-aiming the scope, move the defocused star image around the field until its image appears the most concentric.

Step 2: By adjusting the scope's main collimation screws, move the defocused image to the center of the field.

Step 3: To further refine collimation, adjust the scope's focus to produce a smaller out-of-focus image and repeat steps 1 and 2.

to get 25× per inch of aperture is to choose an eyepiece with a focal length that matches the f/ratio of your scope. For example, if your scope is f/6, use a 6-mm eyepiece. If it's f/10, a 10-mm eyepiece is right.

Begin by adjusting the focus in or out until the star appears as a disk of light with a dark hole near its center (the hole is the secondary mirror's silhouette). If your scope is out of collimation, that hole will not appear centered in the illuminated disk, and thus your primary mirror's zone of optimum performance isn't centered in the eyepiece field. Your collimation task is to move that zone to the center of the field.

Begin this process by moving the out-of-focus star around the field of view by re-aiming the scope slightly. Eventually you'll find the location where the dark hole in the star image is centered, or most nearly so — that's the sweet spot. Then, by using your scope's collimation screws only, move the defocused star from that position to the center of the eyepiece field.

If you're working with a Newtonian reflector, it helps to have someone else make collimation adjustments to the primary mirror while you look in the eyepiece and give instructions. If you're collimating a Schmidt-Cassegrain, you can probably do the necessary adjustments to the secondary mirror yourself. Proceed slowly and methodically.

Once you've moved the defocused star to the center of the eyepiece field, adjust the scope's focus to shrink the star image down into a smaller circle of light — this ups the collimation sensitivity. Repeat the previous steps, then focus down tighter still, and repeat again. After one or two iterations, you will be looking at a star image that's just slightly out of focus, which is where this method is most accurate. Finally, when you think you're done, center the star, defocus it, then slowly refocus while paying close attention to the dark hole at the center of the star image. If your scope is well collimated, the bright rings in the defocused star image will collapse down concentrically around the shrinking black center.

This method works very well, but there are a couple of provisos. First, if you're collimating a Newtonian, you have to make sure your secondary mirror is already correctly positioned. (See the September 2012 issue, page 72, for details.) Second, collimation accuracy depends on atmospheric seeing conditions, but then too so does your scope's optimum performance. Finally, the star-test collimation method works best for a quick touch-up after the scope has already been roughly aligned — but most of the time that's all the collimation that's needed. Give it a try. I'm confident that with a little practice, it'll take you only a few moments to fine-tune your scope's optical alignment in the field. ✦

Contributing editor ***Gary Seronik*** *is an experienced telescope maker and observer. He can be contacted through his website,* ***www.garyseronik.com****.*