INSTRUCTION MANUAL

Orion® Quick-Collimation Cap

#7358

This Quick-Collimation Cap is a useful but inexpensive tool to aid in the precise collimation of telescope optics, most often those of Newtonian Reflector telescopes. The small hole in the center of the Quick-Collimation Cap ensures that your eye is centered when looking into the focuser during the collimation process to check the optical alignment.

Insert the collimation cap into the 1.25" collar of the telescope's focuser, then follow the instructions outlined below.

Figure 1. The Orion Quick-Collimation Cap

Collimation of Newtonian Reflector Optics

Collimation is the process of adjusting the optics of a telescope so they are precisely aligned with one another and with the telescope tube. For a Newtonian reflector telescope, the primary and secondary mirrors must be in precise alignment. Accurate mirror alignment is important to ensure the sharpest possible images viewed through your telescope, so it should be checked occasionally. With practice, collimating is relatively easy to do and can be done in daylight.

It helps to perform the collimation procedure in a brightly lit room with the telescope pointed toward a bright surface, such as a light-colored wall. The telescope tube should be oriented horizontally (parallel to the ground). Placing a piece of white paper in the telescope tube opposite the focuser (i.e., on the other side of the secondary mirror from the focuser) will also be helpful (see **Figure 2**). Check what tool(s), if any, will be needed to turn the collimation screws for both the primary and secondary mirrors. For the secondary mirror collimation screws, you will typically need to use either a Phillips screwdriver or an Allen wrench (and often a metric Allen wrench).

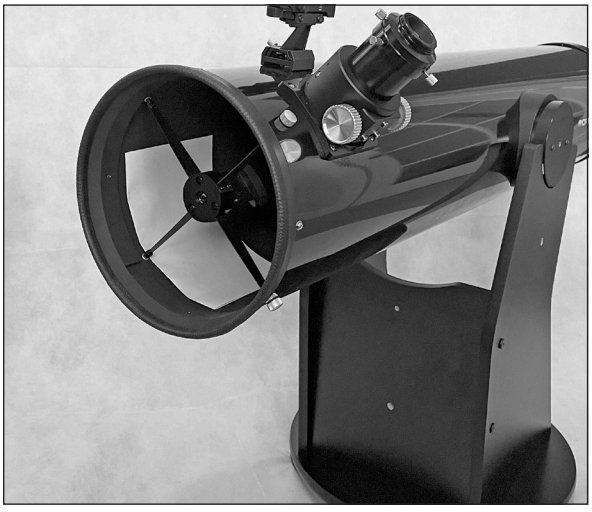

Figure 2. Before collimating the telescope, place a piece of white paper inside the tube opposite the focuser, and position the optical tube in the horizontal position as shown.

First you will want to check you telescope's collimation to see if any adjustment is even needed. Remove the eyepiece if one is installed in the focuser, and look into the focuser. You should see the secondary mirror centered in the focuser, as well as the reflection of the primary mirror centered in the secondary mirror, and the reflection of the secondary mirror (and your eye) centered in the reflection of the primary mirror, as in **Figure 3A**. Got all that? Review it again carefully, and compare what you see to **Figure 3A**. If anything is off-center, proceed with the following collimation procedure.

NOTE: Precise collimation is best achieved by using a collimating tool, such as the Quick-Collimation Cap. Figures 3B through 3D assume that you have the collimation cap installed in the focuser.

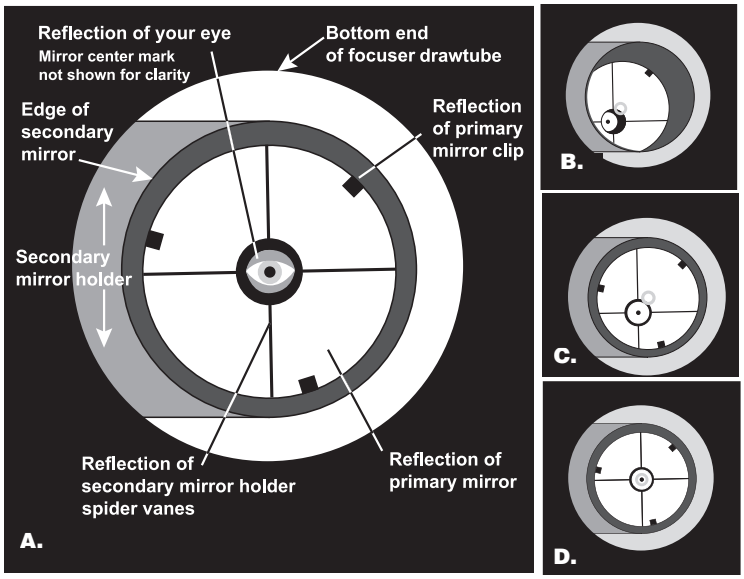

Figure 3. Collimating the optics. **(A)** When the mirrors are properly aligned, the view down the focuser drawtube should look like this. **(B)** Here, only part of the primary mirror is visible in the secondary mirror, so the secondary mirror needs to be adjusted (tilted). **(C)** Here the secondary mirror is correctly aligned because the entire primary mirror is visible in it. But the reflection of the secondary mirror is off-center. So the primary mirror still needs adjustment. **(D)** Now the primary mirror is correctly aligned, so the secondary mirror is centered.

Primary Mirror Center Mark

You may have noticed that the primary mirror on your Newtonian reflector telescope has a small adhesive ring or dot in the center. This "center mark" allows you to achieve a very precise collimation of the primary mirror; you don't have to guess where the center of the mirror is, which is important in the collimation process. This center mark is especially useful when using a collimating tool such as the Quick-Collimation Cap.

Note: The adhesive ring/dot should not be removed from the primary mirror. Because it lies directly in the shadow of the secondary mirror, its presence in no way adversely affects the optical performance of the telescope, or the image quality. That might seem counter-intuitive, but it's true! Leave it in place.

Aligning the Secondary Mirror

Align the secondary mirror first, as follows.

With the collimation cap installed, look into the tiny hole in the center of the cap. You will see the telescope's secondary mirror. If the entire primary mirror reflection is not visible in the secondary mirror, as in **Figure 3B**, you will need to adjust the tilt of the secondary mirror. This is done by alternately loosening one of the three secondary mirror alignment screws then lightly tightening

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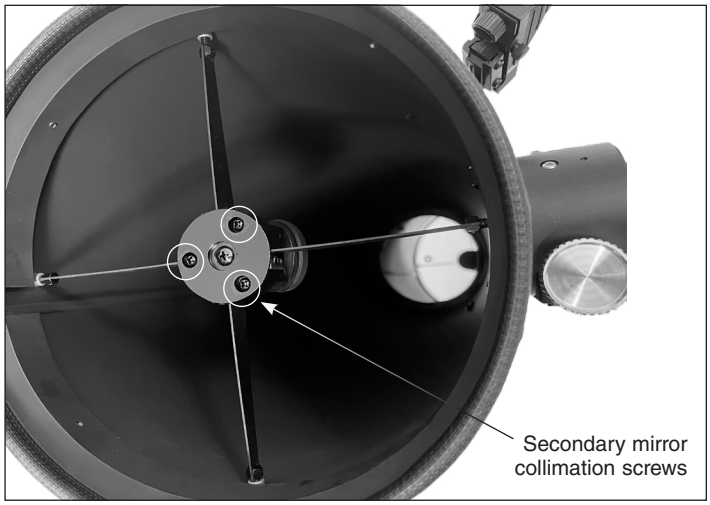

Figure 4. Secondary mirror collimation is performed using the three screws (usually Philips or Allen screws) circled here on the secondary mirror holder.

the other two (**Figure 4**). The goal is to center the primary mirror reflection in the secondary mirror, as in **Figure 3C**. Don't worry that the reflection of the secondary mirror is off-center. You will fix that in the next step. It will take some trial and error to determine which screws to loosen and tighten to move the reflection of the primary mirror to the center of the secondary mirror. But be patient and you'll get it.

Aligning the Primary Mirror

The final adjustment is made to the primary mirror. It will need adjustment if, as in **Figure 3C**, the reflection of the primary mirror is centered in the secondary mirror, but the small reflection of the secondary mirror is off-center. The tilt of the primary mirror is adjusted using (usually) three spring-loaded collimation knobs and three smaller locking thumbscrews on the back end of the optical tube (**Figure 5**).

First loosen the three locking thumbscrews a turn or so. Then tighten one of the collimation knobs about a quarter turn and see if the secondary mirror reflection has moved closer to the center of the primary (where the center ring/dot is). If it moved farther away then try loosening the same collimation knob a bit. Repeat this process on the other two sets of collimation screws, if necessary, adjusting them one way or the other and seeing if the secondary mirror reflection moves closer to the center of the primary mirror. It will take a little trial and error to get a feel for how to tilt the mirror in this way. When the center hole in your collimating tool is centered as much as possible in the ring/dot on the primary mirror, your primary mirror is collimated. The view through the collimation cap should resemble **Figure 3D**.

Finally, very lightly tighten the three locking thumbscrews so that the primary mirror stays in that adjusted position. A simple star test will tell you whether the optics are accurately collimated.

Star-Testing the Telescope

When it is dark, point the telescope at a bright star and accurately center it in the eyepiece's field of view. Slowly de-focus the image with the focusing knob. You should see a series of diffraction rings surrounding a dark center spot, which is the shadow of the secondary mirror. If the diffraction rings are perfectly circular around the dark spot, telescope is correctly collimated (**Figure 6**). If the image is unsymmetrical, with rings that are not perfectly circular and the dark spot is not centered within them, the scope is out of collimation.

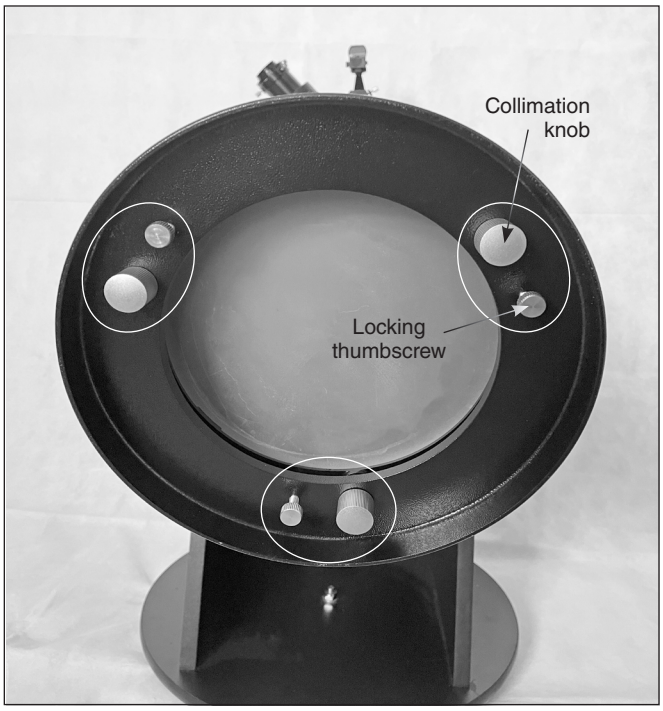

Figure 5. The optical tube's rear cell has three pairs of collimation screws. The larger knobs are the (often spring-loaded) collimation knobs while the smaller thumbscrews are the locking screws.

Note, however, that if the bright star you have selected is not centered in the eyepiece, the optics will always appear out of collimation, even though they may be perfectly aligned. It is critical to keep the star centered, so over time you may need to make slight corrections to the telescope's position in order to account for the sky's apparent motion.

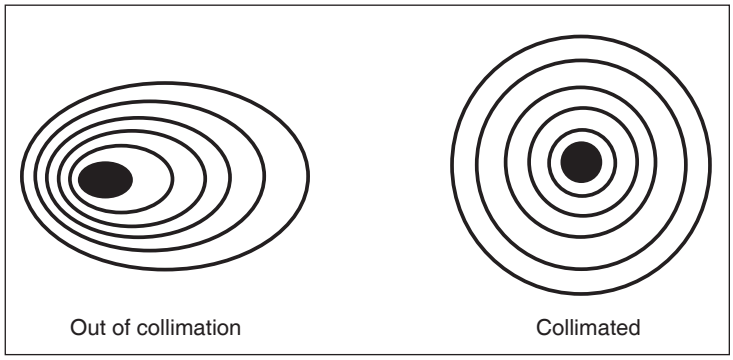

Figure 6. A star test will determine if the telescope's optics are properly collimated.

One-Year Limited Warranty

This Orion product is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid. Proof of purchase (such as a copy of the original receipt) is required. This warranty is only valid in the country of purchase.

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