

# How to Collimate a Newtonian Telescope

By Ninian Boyle



Image Credit:  
Ninian Boyle

**A scope is well collimated when its primary and secondary mirrors are perfectly aligned with each other**

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Every type of telescope requires collimation – the alignment of the optics and mechanics of your telescope so that it produces sharp, clear images. If you're nervous about altering the alignment of your reflector's mirrors, read on. We'll show you a simple and quick method of collimating your Newtonian telescope that will give you good results every time.

When you're collimating, work in an area that gives you room to move around your scope comfortably. Keep your movements considered and gradual: steady, small adjustments of alignment screws are far better than large movements. Many Newtonian scopes will have been roughly collimated in the factory, but after shipping they'll seldom keep even this basic alignment.

Depending on your scope, you'll need either a crosshead or flathead screwdriver, or an Allen key. You'll also need a collimation tool such as a 35mm film canister with a 1-2mm hole drilled in the bottom, which fits in place of the eyepiece in the focuser. Other collimation tools can also be used, such as a Cheshire eyepiece or laser collimator.

The first task is to check there are no major misalignments. Tilt the telescope tube so you can see down it from about a metre away. The primary and secondary mirrors should look concentric with the tube and each other. If they don't, you'll need to adjust the primary mirror cell adjustment screws, behind the main mirror at the bottom of the tube. You may have to remove a cover to see these.

### **Pairing up**

Mirror cells often have two sets of screws: adjustment screws and locking screws next to these. Establish which is which by turning one set only and then see what difference turning each adjustment screw makes to the mirrors' alignment. By adjusting these screws less than a quarter of a turn each time, bring the primary mirror to a position where it makes a clear circle around the secondary mirror, which should look concentric with the primary.

Now place a collimating tool in the focuser, look through this and move the focuser outwards until the shadow of the focuser tube disappears from the field of view. Examine the view to see if the primary mirror appears as a perfect circle. If it doesn't, you will need to adjust the secondary mirror.

Be careful when adjusting the secondary mirror, as you'll be holding a screwdriver over your telescope's main mirror; if you drop it you could smash the mirror. To guard against this, tilt the telescope tube at an angle of less than 45°. Turn one of the screws on the secondary mirror anti-clockwise about a quarter of a turn. Check to see what effect this has through the collimating tool: does the primary mirror appear less or more circular? As you loosen one screw, you'll also need to gently tighten the others. Keep checking what the view through the collimating tool looks like. Remember to turn the screws no more than a quarter of a turn each time. If you find you are going the wrong way, retrace your steps and try again.

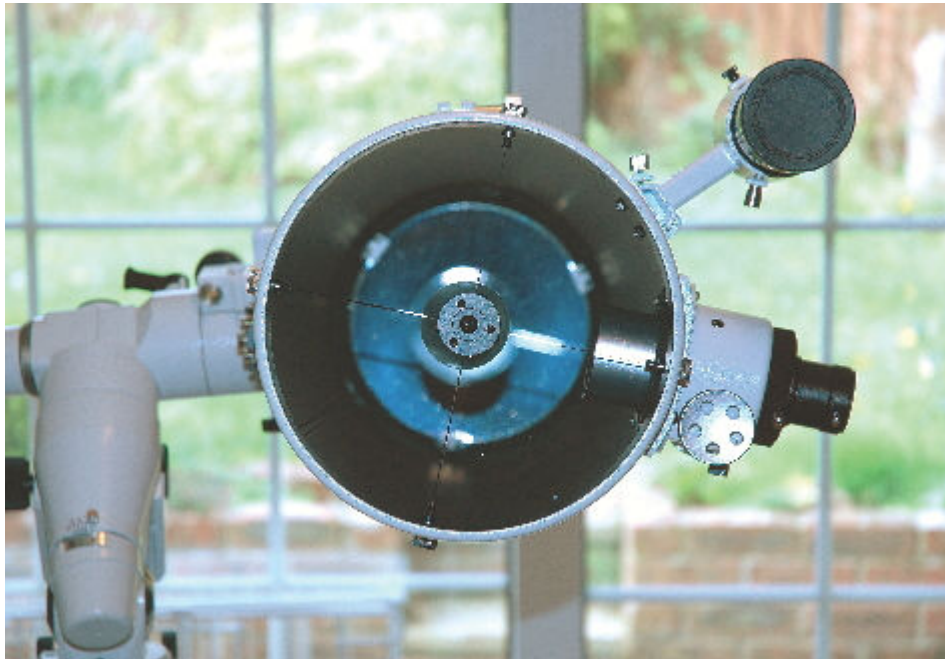
### **Primary concerns**

Once you've got the primary mirror looking circular, you can turn your attention to aligning the primary mirror itself. Through the collimating tool, see if the reflection of the secondary mirror appears concentric with the main mirror. If there's a small reinforcing ring in the centre of your primary mirror, this will help you judge whether the reflection is central. If you find that the secondary looks more off-centre, retrace your steps and adjust the collimation screw(s) on the other side of the primary mirror. Take another look through the collimating tool and see if this is making the view of the secondary mirror move in the right direction. Once everything looks concentric, you know that you've got good collimation.

Finally, test out your telescope on a star. Using a high-magnification eyepiece on a bright star, move the focuser in and out. In a well-collimated telescope, as well as coming into sharp focus, the star image will be nice and round either side of the focus point when it's out of focus.

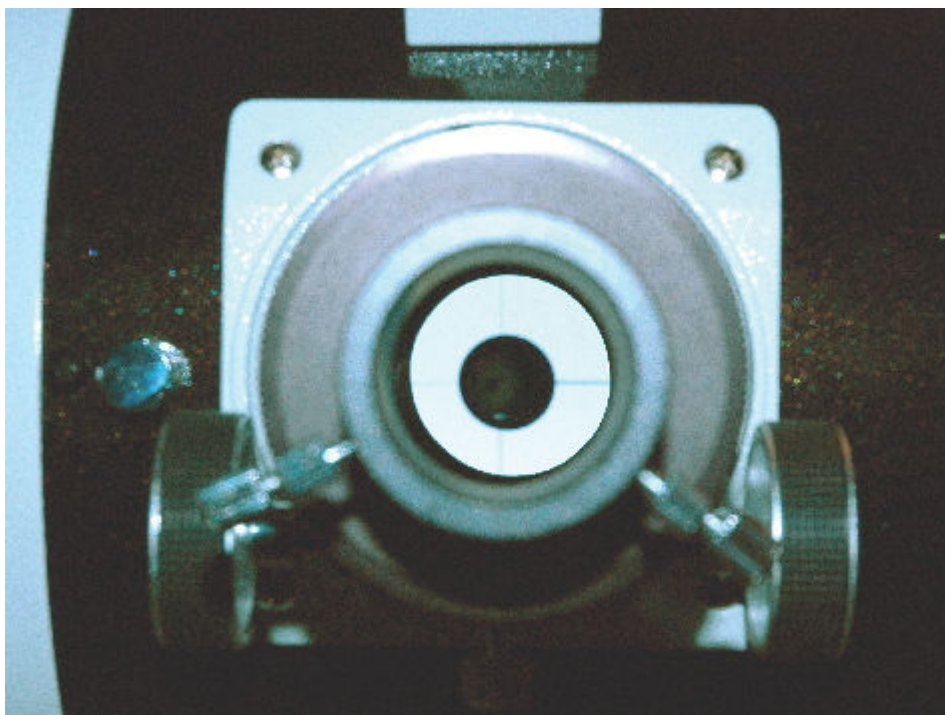
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## Collimating your Newtonian: a step-by-step guide



### STEP 1

Tilt the telescope tube so that you get a good view down it when you're standing about a metre away. Look for major misalignments by checking that the mirrors look concentric with each other and the tube itself. If they don't, you will need to adjust the main mirror.



## STEP 2

Place your collimating tool in the focuser, take a look through it and slowly move the focuser out to remove the shadow of the focuser tube from the view of the primary mirror. This gives you a clear view of the whole mirror to see if the mirrors line up perfectly.



## STEP 3

Adjust the secondary mirror's collimation screws to give you a good view of the whole primary mirror. Do this slowly and carefully, and don't undo the central locking screw of the secondary mirror unless it is absolutely necessary, as this will complicate the process.



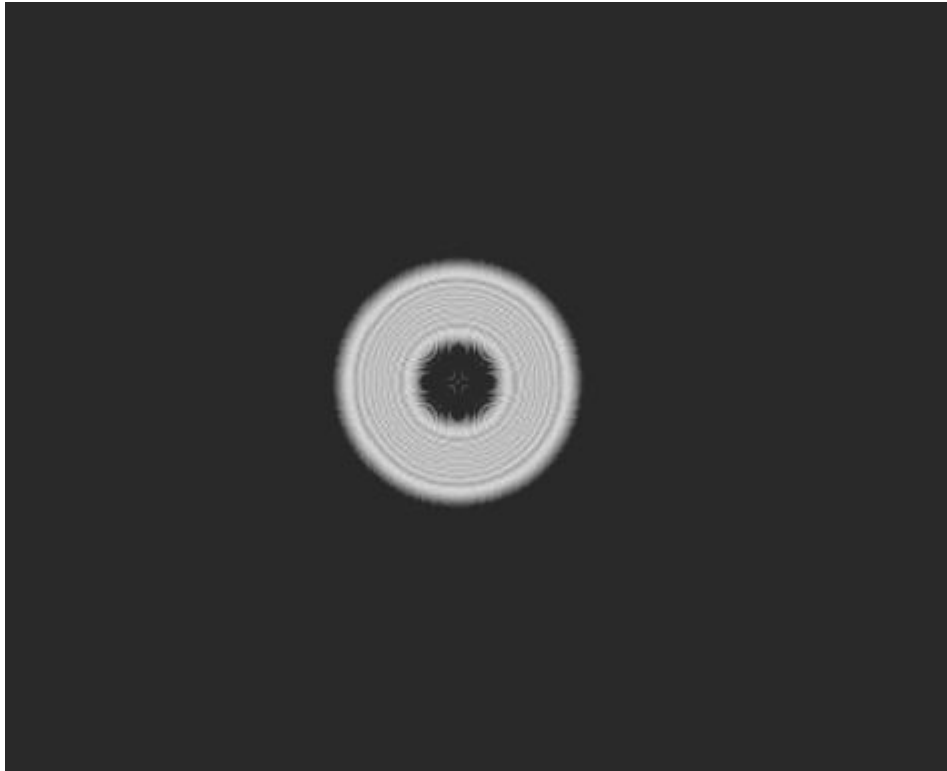
#### **STEP 4**

Start adjusting the primary mirror screws slowly and check through the collimating tool that the view of the secondary mirror is concentric. Once you're happy, lock the primary mirror in place using the locking screws next to the adjusters.



#### **STEP 5**

You can check how well collimation is going with either a Cheshire eyepiece or a laser collimator. However, use them alongside the manual method because the weight of these instruments can cause flexure in the focuser and produce a false reading.



#### **STEP 6**

Finally, check your handiwork using a high-power eyepiece on a bright star. Move the focuser out of focus and check that the view stays nice and circular, as shown above. Do this both sides of the focus point. This will tell you if you need to collimate more.

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