

Collimating a Newtonian Telescope

Neil Springate May '19

Introduction.

I'll let you into a secret. Collimating a Newtonian telescope of speed $f/5$ or slower is easy.

This guide is to get you up and running, once you have mastered this and worked out what is going on you can use other devices to improve accuracy.

I am happy to help out "live", all you need is to be able to take photos through the collimation cap and use messenger to get them to me.

"Al's Reticle" and "Mire de Collimation" are two handy little programs to have, they overlay concentric circles over an image to check if things are lined up. These are not necessary for this tutorial.

There are only three stages, all independent of each other, meaning that having carried out a stage you will not have to go back to adjust it as a result of carrying out other stages, so you will not be chasing your tail. Concentrate on each stage, get it right, then move on.

The hardest part of collimation is in your head - you have to train your brain to completely ignore the bits it doesn't need to see at each stage.

My advice would be to not get too hung up on accuracy to start off with. Get things as near-as-dammit, understand what you are doing and then go back to the start if you need to.

Equipment.

For this basic guide, all you need is a collimation cap and an Allen (Hex) key that will fit the three small adjusting screws that adjust the secondary. Later on you should progress to a Cheshire collimator, but for now the cap will be sufficient. The image below is of a collimation cap available from First Light Optics for around £5.50. You could make one yourself by drilling a 1mm hole on the center of an eyepiece cover plate, line the inside with white card or tinfoil to make it reflective.

Do not buy a laser collimator, they are a waste of time and money unless you spend a small fortune on them and have a scope that is faster than $f/5$. (By faster I mean a smaller number than $f/5$, e.g. $f/4.9$ or lower). Seriously, don't, unless you want to get into collimating a collimator.



Brain training for the first stage.

This is where you do a small exercise to sort your head out, to filter out all the confusing information you will be receiving when you first look through the collimation cap. For the first stage you need to totally ignore the fact that you can see mirrors. All you need to see are two circles. So, get a sheet of paper, roll it into a tube and look down it at the room around you. Concentrate on the circle at the end and ignore what you are seeing through the tube.



Can you see that beautiful sunset? If you answered yes, you've fallen into my cunning trap and failed, go back to your rolled-up paper and start again until all you can see is the circular outline.

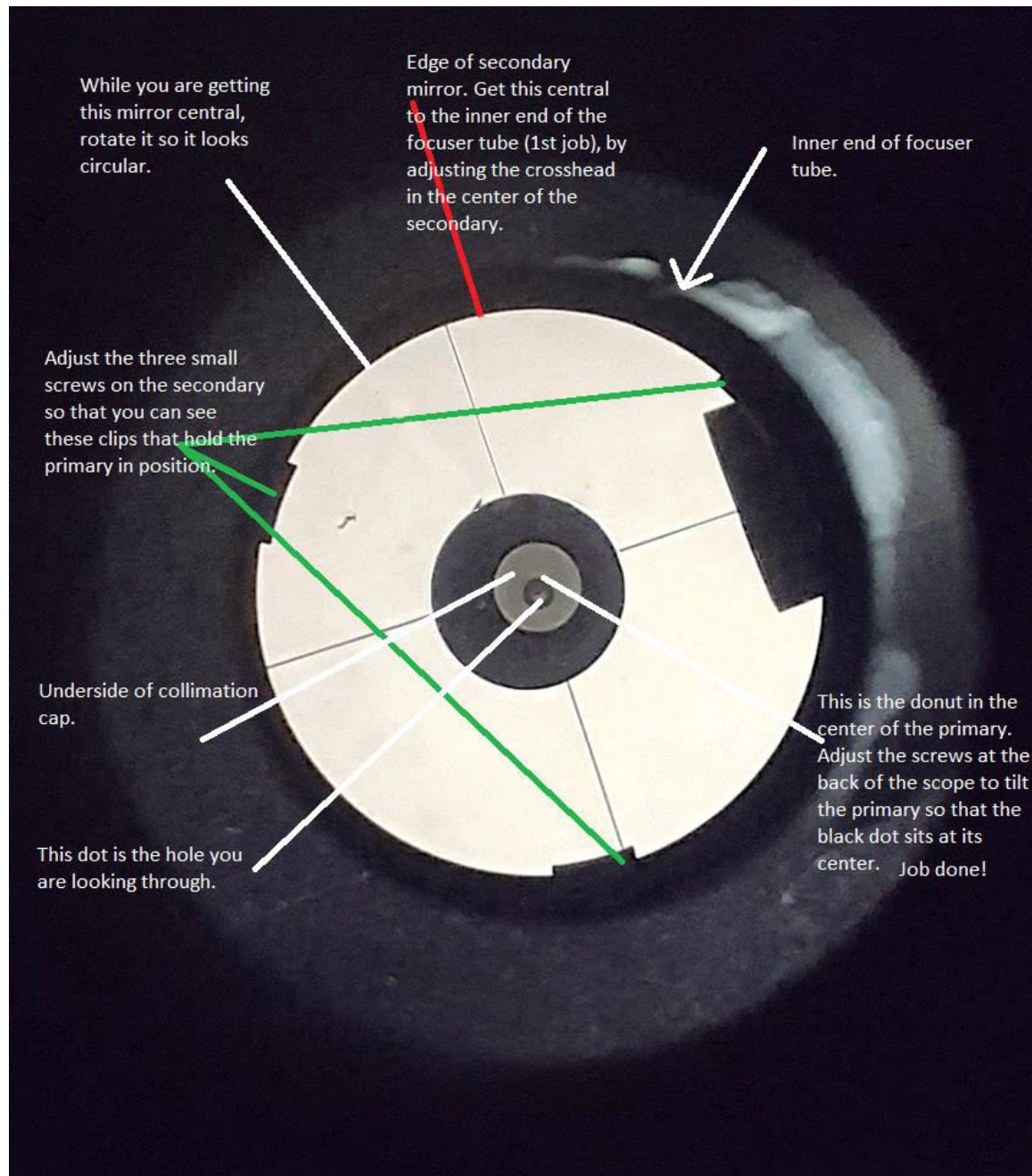
Take a look at the image below, this is a photo I took through my collimation cap using a smartphone. So this is my scope after collimation. What we will be doing is working counter-clockwise from the 1 o'clock position "Inner end of focuser tube".

Now we start.

Have your tube horizontal. You don't want to be dropping tools down onto the primary.

Don't be panicked by what you see below. At 1 o'clock you can see a label "Inner end of focuser tube". This is the equivalent of the circle that you saw with your rolled-up paper. Get comfortable with that, Ignore everything else. Starting at the 1 o'clock position we will be working counter-clockwise around the diagram.

Remove the eyepiece and look down the focus tube (without the collimation cap). Concentrate on the circle described by the Inner end of the focus tube, ignoring the secondary mirror and any reflections. It may help to shine a torch into the scope or point it at a bright wall to get it illuminated properly.



Comfortable? Good.

Fit the collimation cap.

Now we come onto the second circle, which has to be aligned central to the "inner end of focuser tube"

The circle you should be concentrating on is labeled at 12 o'clock as "Edge of secondary mirror....". Again, look at the circle, and completely ignore what you see inside it. You are not looking at mirrors yet.

Is it concentric to the circle described by the end of the focuser tube, and does it look circular? If yes, or close enough for now, leave things alone. If no, slacken off the three small bolts on the secondary by about 1/2 turn, then adjust the central larger bolt. This will move the secondary up and down the main tube. You will need to hold the stem attached to the secondary to stop it rotating while you do this, but you will need to rotate it deliberately to make sure it still presents a circular shape. Once you are happy that you have a concentric circular mirror, gently tighten the three small bolts. Do not tighten the larger bolt, that is simply there to move the mirror along the tube.

That is the end of stage 1.

Stage 2.

This is where you start looking at reflections, but you are only looking for the objects highlighted by the green lines in the image above - ignore the reflections in the middle. You are looking for the three clips that hold the primary mirror in place, look into the main tube at the primary, you will see the clips, these need to be visible in the secondary.

To get them visible in the secondary mirror you need to tilt it by adjusting the three small bolts that hold the secondary in place. In theory you should only need to adjust two.

This is fiddly, but take your time. When you can see all three clips, make sure all three of the adjusting bolts are reasonably tight. This is where it can get frustrating because as you tighten the bolts you can tilt the mirror and lose sight of a clip. Persevere, because once you get this right you will rarely need to adjust it again, unless you have taken the scope for a bumpy ride.

That is the end of stage 2.

Stage 3.

Now you can look at what is going on in the center of the mirror. You are looking for two things, the black dot (this is the hole in the collimation cap, your eye is in there) and a circular ring, this is the donut or ring-binder circle that you can see in the center of your primary if you look down the main tube. Ignore everything else.

The final stretch - all you need to do now is move the donut so that the black dot is inside it. You do this by loosening the locking screws and adjusting the primary bolts at the back of the scope. As with the three secondary bolts, you should only need to move two in theory, but do whatever you have to do. Once central, tighten the locking screws.

That's it!

The acid test is to get a star in the center of your fov and defocus the scope, you should see a large circle (the defocused star) with a central dark circle. If it is not central then adjust the primary bolts.

I hope this has helped, please pm me if you need further information, or if I have not explained things clearly enough.

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