Hello collimators, everywhere,

The following is by no means a definitive description of collimating a Newtonian, neither is it the easiest method to teach or learn. However, it has the advantages of being free, no equipment needed, and, once learned, the principle can be applied to most telescopes.

I will refer in the text to a `Polo mint' It is the easiest method I know to refer to a particular view through the telescope when using this procedure. For those who have lived a very sheltered life, a Polo mint is a circular white mint with a central hole of approximately 25% of the overall mint's diameter. Technical stuff! If you can have someone to help in this procedure you will find things are resolved much quicker.

Procedure:
The first thing, which must be done, is to examine the telescope in daylight when positioned horizontally (ish) and facing an even light coloured surface. In your house and pointing towards a light painted wall or similar is ideal. If you point it to a surface that is unevenly lit, uneven colouration, or texture it can deceive your eyes in positional aspects.

If you can leave about 10 foot between the end of your tube and the `wall' so much the better.

Stand as far away from the end of the tube and look down it. You should see everything symmetrical. When you position your head so as to see an even amount of inside the tube surrounding your mirror, your eye should be blotted out with the secondary holder. Try it you will immediately see what I mean. If you are too close to the tube this pre-test is not possible. If symmetry is not obvious the main mirror's collimation is out. Get your apprentice to slacken just one of the wing nuts at the mirror end of the tube while you are viewing down the tube. Only ¼ turn and you will see a movement in the annulus of inner tube/mirror/your eye relationship changing. Adjust the mirror wing nuts until you are getting exactly the same view from each side of the mirror/tube. You will find that when you have reached the correct position of your mirror's collimation that any view from one side of the edge of the tube, is identical to a view at 180 degrees opposite.

It sound complicated but it really is a simple operation once you try it.

At this stage you will probably find your mirror is pretty much collimated to begin with, unless, some twiddling has been going on before hand. Unless you achieve symmetry here, no amount of trying to collimate on a star will be possible. Most collimation problems by far occur with the secondary mirror's position and attitude. Achieve a good symmetry with the primary and the following will be that much easier.

Up to this point there has been no need to look into the eyepiece draw tube. If you have tried to collimate your primary mirror by looking into the draw tube you have probably got it wrong because any positional errors in your secondary will affect the main mirrors orientation, and so on……..

The secondary mirror has several positional axes, all of which have to be within reasonably tight tolerances. The mirror can rotate towards you, away from you, tilt towards you and away from you and move up or down the telescopes optical axis (the main mirror's axis). To discus all these here will take far too much time and text so, I am assuming that you are seeing concentric `circles' of your eye, you MUST do this in daylight or the final collimation is impossible.

Once you have achieved this view (may differ a little in certain models), theoretically you will view correctly collimated images, but, unfortunately, to achieve the above is very difficult without considerable practice. Don't worry if you can't get it exactly as the pic, any small differences you will remove in the star collimation.

Star collimation:

Point your telescope at a bright star and have approximately a 25mm eyepiece in the draw tube. Focus the star, if OK, use a much higher power eyepiece, minimum 10mm. If it focuses to a symmetrical point, enjoy your evenings viewing and read no further. If you are seeing a flare to one side of the focused star image some collimation is needed.

Assuming you have a flare to one side carry out the following: Put your low power eyepiece in and defocus inside the telescopes focal point until you see a `Polo mint' image occupying about 10% of your field of view. If your collimation is a way out the `hole' will be off center. Here is where your apprentice comes in again. You need to adjust the three screws around the edge of the central part of your spider, the section that holds your secondary mirror and it's holder. Very carefully ask your assistant to unscrew any of the screws about 1/8th of a turn whilst you are looking at the out of focus image. The object of the exercise here is to move the image in your field of view in the direction of the thickest part of the `mint' If the adjustment of the chosen screw is moving your image in the wrong direction, move it back to its original position and then select the correct screw(s) to achieve this motion of the out of focus image in the required direction. I say screws because you only have options of 120-degree movement by adjusting any one screw, two screws may need adjusting by various amounts to achieve the correct direction. Careful here, very small amounts are needed.

When you have moved the out of focus image in the required direction, try refocusing the telescope and you will see an immediate improvement in the reduction of flaring. Continue with the 25mm eyepiece until all looks symmetrical. Then, repeat the procedure with a higher power eyepiece. Eventually you will be able to collimate your telescope with this method in a couple of minutes. When the hole in the mint is central, a focused image should show you pin sharp images. Do not expect to see small pin sharp images of very bright stars, there is so much light from them condensed into a very small disc that your eye cannot cope, this causes the sparkly effect. To test your telescope for final collimation, try about a third magnitude star.

In daylight following this procedure you can look into your focus mount draw tube and make a mental note of what it looks like, the relationships of eye reflection etc., etc. You will probably see that perfect symmetry is not present. The reason for this is that there is an added tolerance on the secondary's dimensions, which will allow correct optical collimation within a `band' of some positions of your secondary. It is possible to achieve both visual symmetry and optical symmetry (collimation) but it will take considerable practice and achieve virtually no difference in the telescope's performance.

I appreciate purists will frown on the last sentence above and several others, but, this is about getting you outside looking at sharp, symmetrical star images and fine planetary detail, it is not intended as a lesson in optical physics and engineering. Experience in collimating will allow you to check in seconds as to whether your telescope, or anyone else's, is correctly collimated. In a short period of time you will appreciate the difference a well-collimated telescope makes to the quality of star images, and, you will strive to get just that bit better collimation, and hence, performance out of your telescope.

If anyone needs any elaboration on any of the above points, feel free.

Good viewing!

Regards

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