Cassegrain Secondary Collimation Notes

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Instruction Manual

With the star or hot spot centered, de-focus the image. You will notice that the out of focus star image looks like a ring of light surrounding a dark central spot; the dark central spot is in fact the shadow of the secondary mirror. Turn the focus knob until the ring of light fills about 10% of the eyepiece field-diameter. If the dark central spot is offset in (*i.e.,* not concentric with) the ring of light, your telescope's optical system is misaligned and requires collimation.

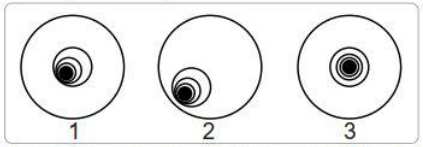


Fig. 33a: Defocused star images. Misaligned (1, 2), Aligned (3).

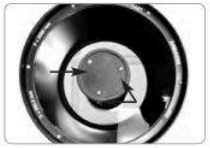


Fig. 33b: Collimation screws.

Caution:
It is recommended that you begin collimating by first ***tightening*** *the collimation screws. When you reach a point where you encounter resistance while tightening, then attempt collimation by loosening the screw(s). While loosening, be careful that you do not remove the screw(s) from the secondary mirror housing assembly.*

Follow these steps for collimation of the optical system:

a. The only adjustments possible, or necessary, on the Advanced Coma-Free Telescopes LX200-ACF models are from the three screws (***Fig. 33b***) located at the edge of the outer surface of the secondary mirror housing.
   Caution: *Do not force the three collimation screws past their normal travel and do not loosen them more than two full turns in a counterclockwise direction or the secondary mirror may come loose from its support. You will find that the adjustments are very sensitive, usually requiring only one-half turn or less to produce the desired result.*

b. While looking at the defocused star image, notice which direction the darker shadow is offset in the ring of light or notice which part of the ring is the thinnest (**Fig. 33a, 1**). Place your index finger in front of the telescope so that it touches one of the collimation set screws. You will see the shadow of your finger in the ring of light. Move your finger around the edge of the black plastic secondary mirror support until you see the shadow of the finger crossing the thinnest part of the ring of light. At this point, look at the front of the telescope where your finger is aiming. It will either be pointing directly at a set screw, or it will be between two set screws aiming at the set screw on the far side of the black plastic secondary mirror support. This is the set screw that you will adjust.

c. Using the AutoStar II's Arrow keys at the slowest slew speed, move the defocused image to the edge of the eyepiece field of view (**Fig. 33a, 2**), in the same direction as the darker shadow is offset in the ring of light.

d. Turn the set screw that you found with the pointing exercise while looking in the eyepiece. You will notice that the star image will move across the field. If while turning the defocused star image flies out of the eyepiece field, then you are turning the screw the wrong way. Turn the opposite direction and bring the image back to the center of the field.

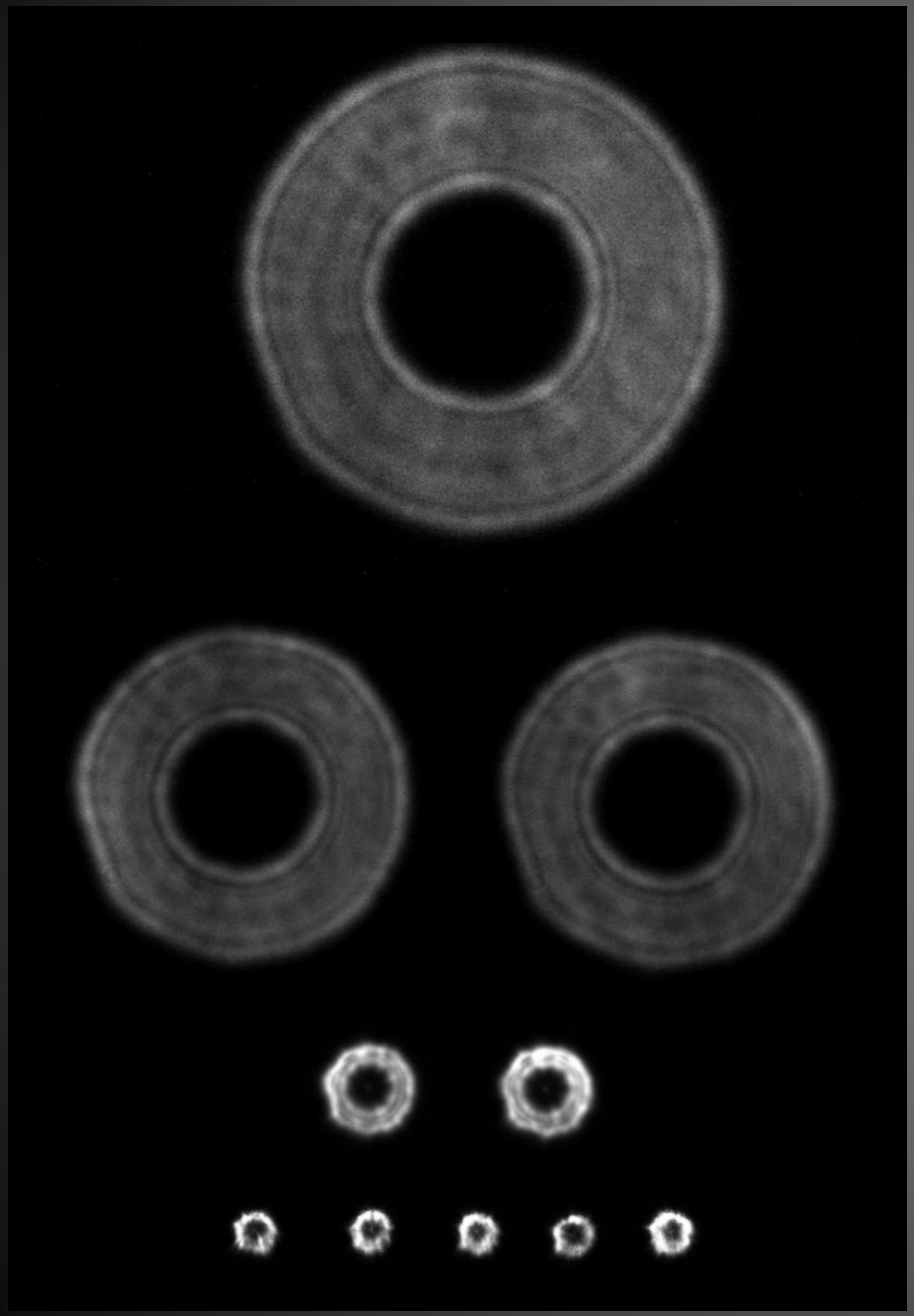
e. If the screw you are turning becomes very loose, tighten the other two screws by even amounts. If the screw you are turning gets too tight, unthread the other two by even amounts.

f. When you bring the image to center (**Fig. 33a, 3**), carefully examine the evenness of the ring of light (concentricity). If you find that the dark center is still off in the same direction, continue to make the adjustment in the original turning direction. If it is now off in the opposite direction, you have turned too far and you need to turn in the opposite direction. Always double check the image in the center of the field of the eyepiece.

g. You may find after your initial adjustment that the dark center is off in a new direction (e.g., instead of being off side-to-side it is now off in an up-and-down direction). In this case repeat steps b through f to find the new adjustment screw.

h. Now try a higher power eyepiece (e.g., 9mm or less) and repeat the above tests. Any lack of collimation at this point will require only very slight adjustments of the three set screws. You now have good collimation of the optics.

Example – Fair Collimation



- Center a bright star in the field of view using a medium power eyepiece
- Approach the focus while turning the knob counterclockwise
- Stop periodically as the image approaches the focus
- Examine the image closely as it becomes smaller and look for the centering of the image of the secondary
- Look closely for a small bright spot that appears in the center of the silhouette of the secondary
- As the image comes into focus you a bright spot form in the center (the Airy disk) and if the air is stable you will see a series of diffraction rings surrounding the Airy disk
- The rings should be concentric with the Airy disk nicely centered
- Repeat with a high power eyepiece
- In this example the collimation is off just a bit with the silhouette of the secondary being slightly elevated in the near-focus images

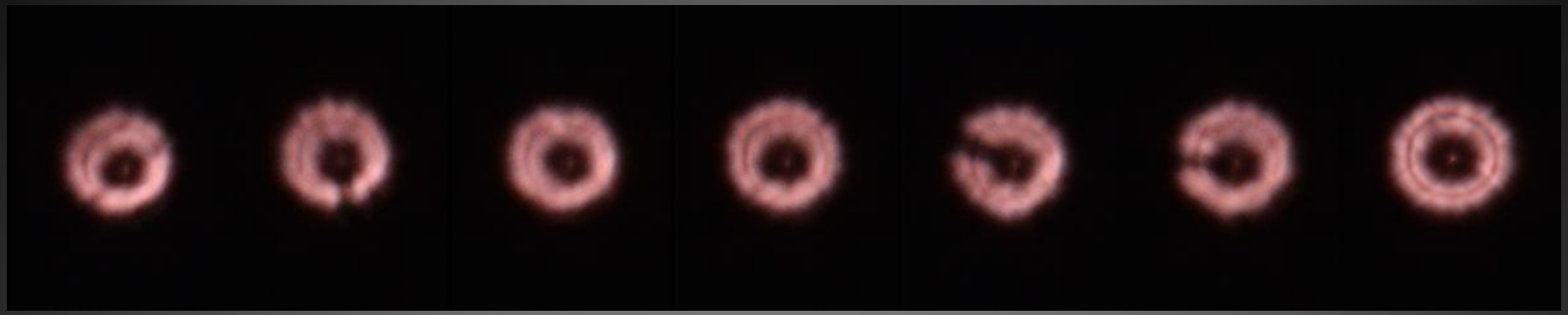
Example – Poor Collimation

- In this example the collimation is clearly off and the secondary should be adjusted
- Start by checking the collimation screws to see if they are snug; not loose and not monster tight
- This may make the collimation worse, but is an important check before you start adjusting the screws

Locating the Screw That Needs to be Adjusted

- Center the bright star as before and adjust the focus using a medium power eyepiece while turning the knob counterclockwise
- Place a ruler or something similar over the front of your scope so that it aligns with each of the screws in turn
- Look for the shadow of the ruler and select the screw that lies along the direction of the image offset
- Slightly tighten this screw, no more than 1/8th of a turn, and loosen the other two if needed
- Center the star, and check the alignment
- If the alignment improves, continue making small adjustments to all 3 screws as needed.
- If the alignment worsens, then loosen this screw and tighten the other 2

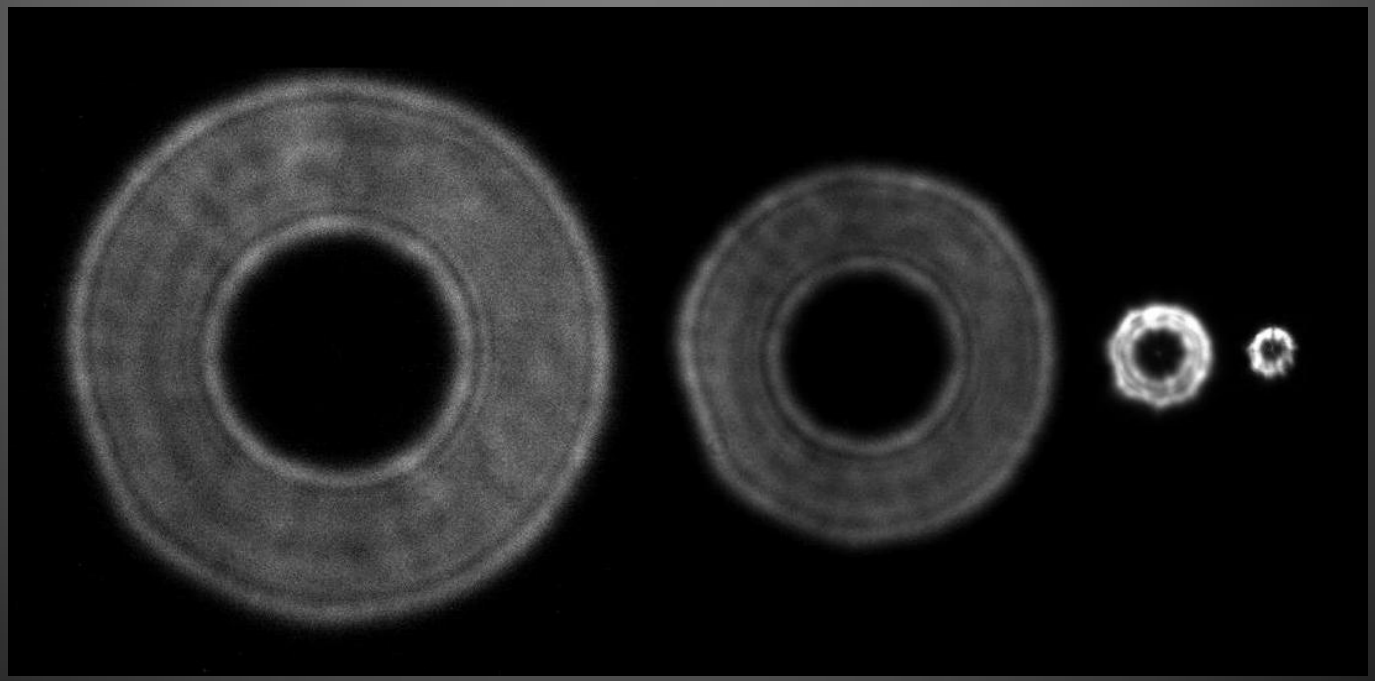
Complete Example



- This is a complete example from collimating a 10” f/6.3 Schmidt Cassegrain starting with the initial alignment on the left and progressing to the final alignment on the right
- Note the concentric bright and dark rings and the bright spot in the center. The width of the dark ring is slightly uneven, indicating the it would be improved a bit more, but this was good enough to give excellent results

Summary

- Collimating a Schmidt Cassegrain and similar telescopes is relatively simple, but it does require a light touch and attention to detail
- The alignment star must be centered in the field
- The focus should be set turning the knob counterclockwise
- Its okay to start with a large out of focus image, but you should progressively approach the focus to make progressively finer adjustments
- Use a light touch, making small adjustments and re-centering the star after every step
- Carefully tighten and loosen the adjustment screws as needed to keep all three snug
- Once complete the collimation should remain fixed unless the telescope is shaken or bumped fairly aggressively



Questions?

M13, Meade 10” f/6.3 Wide Field SCT, 80x60sec, ZWO ASI071MC