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Baffle before Star Diagonal improves Image Contrast

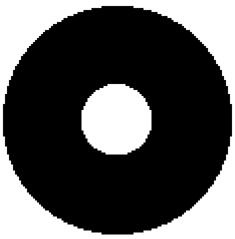
Many telescopes systems suffer from some stray light which reduces image contrast, especially when observing very faint targets close to a very bright object. The prime example is observing lunar occultations, where e.g. a magnitude 9 star is being monitored very close to the Moon. In this situation often noticeable flare can be seen even when the Moon is still well outside the field of view. Another example is observing (timing) eclipses of Jupiter's moons.

In most cases this flare is not caused by fundamental imperfections in the main telescope optics, but by reflections off the barrel and sides of the prism in the star diagonal. I have found this with three "name" brand prism diagonals (Meade, Unitron and Celestron) and also with reflections off metal components in a respectable Lumicon enhanced mirror diagonal. Clearly, while the telescopes are generally properly designed and baffled, the typical industry diagonal may not be.......!

The solution is to keep any unnecessary light out of the diagonal, and only send light to the central region of the field of view, where it is needed. For example, with an 8" f/10 SCT, a typical 10 mm eyepiece with a field lens diameter of about 8 mm has a sky field of view of 15 arc minutes (half the diameter of the Moon). However, for planetary work the observer would concentrate on only the central 1 or 2 mm of this field. A planetary or lunar occultation observer therefore needs full field illumination only across the central 2 mm region of the eyepiece field lens. We should make sure that light only travels in a narrow path through the centre of the diagonal by placing a simple baffle in the light path, just before the diagonal.

In the case of my C8, I placed a thin black cardboard disk with a central 12 mm hole at the location where the visual back bolts onto the rear cell of the telescope and this has proven remarkably effective. The diameter of the central hole can be worked out as follows:

(a) by drawing a scale diagram of the light path through the telescope from the objective to the centre of the eyepiece field stop, and then drawing in the location of the rear cell of the SCT,
(b) by calculation, using the tangent of the angle of the "cone" of light travelling from the objective to the centre of the eyepiece.
Either method will show that for an f/10 system the diameter of the light cone is always 1/10 of the distance to the eyepiece focal plane.



The example disk shown here is for the rear cell of a standard Celestron 8, and will be similar for a Meade 8" equivalent SCT. An outer disk diameter of 41 mm will suit the dimensions of the rear cell of the C8; the disk will fit in the shallow recession in the cell. The inner hole diameter of 12 mm is 2 mm larger than the minimum nominal diameter of 10 mm, which is based on an f/10 system, with the distance along the optical axis from the rear cell through the star diagonal to the focal plane of the eyepiece being 100 mm. While this example is for an SCT, the principles apply to any telescope with a star diagonal.

Remember that only the centre of the field of view is now fully illuminated and that the image brightness falls off rapidly towards the edge of wide field eyepieces. In the case of observing lunar occultations or Jupiter's moons, this fall-off is actually beneficial. However, remember to remove the baffle disk for deep sky observing sessions with long focal length eyepieces.

This zero cost disk is very effective in many systems but of course there are other, different methods to further improve image contrast in (Schmidt-Cassegrain and other) telescopes as well and they are worth investigating.

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