

THE TELESCOPE NUT

Mars is Back!



Mars will be at opposition on March 3, so this is a good time to go over the telescope features that make for optimum planetary observing, providing clear views of detailed features and colors.

Many of us own large aperture Newtonian / Dobsonian telescopes with fast focal ratios so they can suck up lots of light and you don't have to stand on a tall ladder to view through them. That's why many of us are making $f/3.6$ or even faster telescopes. However, many people think they don't perform well on planets. The truth is, if the mirror is corrected to the same criteria as the slower mirrors, they will perform just as well in the center of the field of view, and with a coma corrector, will perform just as well throughout the field of view.

There are occasions when these optics may not yield as clear a planetary image as the slower scopes, and there are ways to take care of this. First of all, the optic may not be corrected to the same degree of precision. Faster mirrors are harder to make and many people cut short the quality of the optic. Also, gulping down a huge cylinder of bad air can sometimes distort an image.

If the mirror has figure problems, such as a high RMS (Root Mean Square) or a high P-V (Peak-to-Valley) error, you can remove much of the mirror with an aperture mask. If you have a 16" mirror with a 1 wave P-V error, then masking one half the diameter not only removes some of the longitudinal physical error in the mirror, but it also makes the mirror slower requiring less perfection in order for the light to pass through the Airy disk. It's a 2-way win. It's also a three way win because you are now gulping down less turbulent air.

So here are a few ways to clean up those blurry planetary images.

1] Make sure your mirror's edge either has no turned down edge, or mask it off. If your star test shows a TDE (Turned Down Edge), then you can either tape out the outer part of the mirror, or you can paint it out, or Sharpie pen it out, or mask it with an aperture mask. Mask it or remove it far enough into the optic until your star test shows no more TDE. The three optical killers are TDE, astigmatism and spherical aberration.

2] Since planets are really, really bright, especially when compared to those fuzzy little galaxies and nebulae, you don't need all those square inches of light grasp. You can lose a lot of it and still have lots of light. So you can use a more serious aperture mask, such as a 6" hole rather than the full 16" mirror. Knocking your aperture down by a factor of 4 will also reduce your light by a factor of 16, so don't get too carried away. The ratio of aperture squared is your ratio of light grasp. Anyways, imagine a 16" mirror with a 4" minor axis secondary mirror. That means that from the edge of the mirror to the edge of the secondary mirror is 6". You can exclude the outer 1/2" of the mirror for rolled or turned down edge, so that leaves about 5 1/2". If you cut out and place in an aperture mask that has a circular hole placed so that it doesn't include the edge of your primary mirror, doesn't obstruct the secondary mirror, nor any of the spider veins, then you will have a 5 1/2" telescope with nearly three times the focal ratio. This will have the sharpness of a slow telescope, almost three times higher precision on the P-V error (if the errors were distributed evenly), and 1/9 the turbulent atmosphere. If your 16" telescope was an $f/5$, it would be like looking through a 5 1/2" $f/15$ refractor, only without the color aberrations. Another trick is to optimize the clarity by stepping the apertures down and finding the best hole size. With a 16" scope you could have a 7" mask that can take a 5" mask that can take a 4", and so on. Try them and see which yields the sharpest image for those seeing conditions.

3] Another way to clear up those images would be to remove tube currents. Telescope tubes act like chimneys, and creeping along the top of the tube is the warm air trying to rise out and escape. This damages your image of planets at high power. Open tubes help, fans within the tube help, and moving the air right in front of the mirror helps a lot too (it's a boundary layer).

4] Fast telescopes require perfect collimation. Anything less is image-destructive. Collimate first by visual inspection, then with a laser, then with a Cheshire eyepiece, and finally, the critical collimation is performed by star testing. Repeat the star test collimation about once an hour.

5] Clean optics are nice. Dust can create scatter, but not hurt clarity. If you clean the optic incorrectly, you can damage the over-coating and you will lose that clarity. A dirty mirror isn't the end of the world, you can probably keep using it and not lose detail. But it's nice to have clean optics.

6] You don't need an \$800 100° field-of-view eyepiece to look at planets. In fact, too many elements inside the eyepiece may even contribute to counter-reflections. Those old Plossls and orthoscopic eyepieces may be the ticket. *(Just don't tell your wife that you are using a \$30 eyepiece when she just let you lay out \$800 for another wide-angle!)*

...contued on page 8

TELESCOPE NUT...continued from page 4

7] Filters will bring out the details, even if subtly. Remember when Jupiter's red spot was red? It isn't now, but you can use filters to trick it into seeming like there is more contrast. Mars has dark blotches on it that can be brought out by experimenting with a variety of different colored filters. The March 3 opposition will not show the poles very well, but when the poles can be seen there are filters that can make them appear to drill a hole in the image. Blue filters should make the poles appear brighter (by making the rest of the planet darker). Yellow, orange and red filters ought to bring out the details in the subtle color differences in the red planet.

8] Jack the power up as high as your optics and clock drive can take it. The more power you have, the more information you can get. It might not be prettier, but there's information that you will be getting that otherwise you won't notice. For those short moments of clear and steady sky, high power will give you the most detail, even if just for a moment. It's amazing how 15 seconds of extreme clarity can last a lifetime in your mind.

9] Share your experiences with a buddy. A group of two or three is much more fun than being alone while observing. *(I recommend somebody with a better scope and better eyepieces, that's a good way to choose your astro-friends! Just kidding.)*

10] I don't have a tenth one, but ten seemed like a better number to stop than on nine. ☺

Clear Skies!.....Bald.