

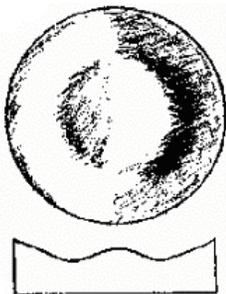
ATM Journal 10: - Zeroing in on the Perfect Paraboloid

By Gordon Tulloch, RASC Winnipeg

As mentioned in previous installments, one of the most finicky parts of creating a telescope mirror is figuring – in other words, making the surface of the mirror into a true paraboloid that will satisfy the $\frac{1}{4}$ wave Rayleigh Criterion and provide excellent images at the eyepiece. Too often, this is a significant challenge for most amateurs and in some cases, an insurmountable one. There is hope, even for those who abandon the chase – there are many optical shops that will refigure a mirror for a fraction of the cost of buying a premium mirror.

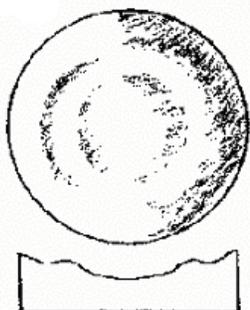
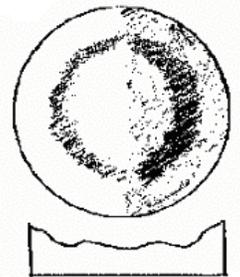
However, we're do-it-yourselfers so let's see how we can fix that imperfect paraboloid. I'll assume here that you have ground, polished, and done some figuring on your mirror, and discover via a Foucault test with a Couder mask or Ronchi test that you've not achieved an acceptable figure. Now what?

In the below diagrams, you see three mirrors as they appear during a Foucault test. Below this image, you see the actual (if greatly exaggerated) cross section of the mirror – remember, we're dealing in millions of an inch here so there's not a lot of change to be made.

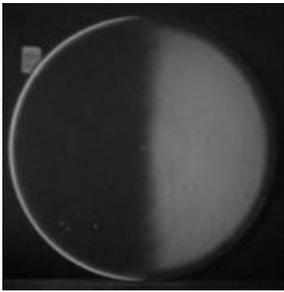


In the first example, we have a central bump, where the centre of the mirror is higher than the surrounding areas. To fix this, we need to go back to polishing to bring the entire surface back to a sphere, making sure we're using 1/3rd Centre over Centre strokes with even pressure. Also, check the pitch lap to ensure that your channels are open and that you have good contact during pressing. An hour of polishing and a short figuring session should correct this issue.

In the picture at right, you see the opposite problem, a depression in the middle of the mirror with a depressed channel around one of the zones. This can be caused by problems with your lap as well – this can also be fixed by returning to a sphere and refiguring, but if you've spent a lot of time on the mirror, you can also try saving this figuring attempt by creating a sub-diameter lap and polishing only in the zone where the ridge is apparent. Advice should be sought on the ATM list as to what diameter lap would be most effective.



A similar issue that's a little easier to fix is one or more raised ridges on the mirror – again, check your lap and make sure it's in perfect contact, then use a chordal stroke with the tool centred over the radius where the ridge occurs. Do an even number of turns around the mirror for a short while, then check the result when the mirror cools.



In this picture, you see an actual Foucaultgram of a mirror with a Turned Down Edge (TDE), one of the most persistently devastating problems encountered by the amateur mirror maker – most of the mirror has an excellent figure, but the outside edge of the mirror is lower than the rest. The Ronchi test reveals TDE as little hooks at the ends of the bands. You can determine the exact extent of TDE by masking off a portion of the mirror's edge until the hooks disappear. TDE is often not very deep, but because of the narrowness of the zone, looks precipitous. This can be extremely difficult to fix. If TDE is mild, ignoring it and continuing with standard parabolizing strokes can make it disappear. If TDE is strong, a small lap concentrated at the roll over point, or start of the Ronchi band hooks, is the standard fix.

If the portion of the mirror that is turned down is minimal (as in the picture) one solution is to simply mask off the edge of the mirror with some non-reflecting material and use the mirror as is. This will preserve your efforts on the rest of the mirror while ensuring the TDE is not causing problems.

A similar problem, rolled edges, results from insufficient parabolization at the edge of the mirror. The solution for this is to move the parabolizing out to the edge by using a sub-diameter tool and long W-shaped strokes to focus the effort to the edge.

These are just some of the issues that ATMs can experience during figuring of a mirror. I have found that using Ronchi testing during figuring allows the mirror maker to visually see what impact a particular technique is having on a mirror. Since a Ronchi test is not quantitative, you can use a Foucault test with a Couder mask as your last step to determine exactly what your mirror profile looks like to see how close you are to finishing.

As always, you can rely on the ATM mailing list for advice. For more info see www.atmlist.net.

News In a Minute

At the October meeting we elected three new Councilors: Ralph Croning, Marlene Wallace and Stephen Smyth. At the October 24 council meeting Mike Stephens was appointed Treasurer. Welcome aboard!

There is now a Clear Sky Clock for Spruce Woods. Thanks to Sandy, Tim, Mark and Joe for getting that for us.

Winnicentrics is available on the website in the members section. If you would rather not receive the paper version, please let the editor know at wgail@mts.net and save the club the cost of printing and postage.

Our annual mid-winter, post-holiday potluck supper will be held on January 22 at Jay Anderson's house. Mark your calendars!