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Worth Looking Into



Optics from Cross

Mars, as observed and drawn by Charles F. Capen, Planetary Astronomer, in September, 1971, using the Lowell Observatory 31-cm. (12-inch) f/16 refractor by Alvan Clark, 10-mm. f.l. Clavé Plössl eyepiece, and Clavé orange filter.

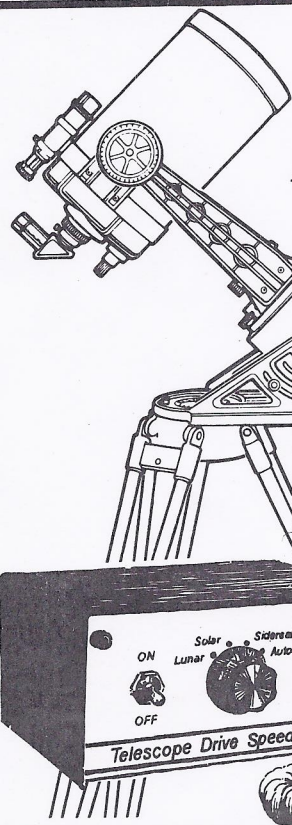
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the available light is in the rings surrounding the Airy disk.

The shrinking of the Airy disk accompanies a central obstruction is ably of little practical use. According to *Principles of Optics* by Max Born and Emil Wolf (Pergamon Press, 1959), in the limiting case of an almost wholly obscured aperture, the Airy disk shrinks to about 1 percent of its original diameter. This might be expected to improve the resolution of a 6-inch telescope (normally 0.9 seconds of arc) to about 0.6 seconds of arc by suspending a 5½-inch opaque mask over the telescope tube. The drawback of this idea, as readers who try it will see, is an intolerable enhancement of the diffraction rings. To mention the great exclusion of starlight from the telescope!

Beginners sometimes assume that the luminous rays or spikes around stars in a Newtonian or Cassegrain telescope are caused by reflection of starlight glancing off the vanes that support the secondary mirror. The telescope making books tell them *diffraction* spikes, notwithstanding. Dr. Blöte's conclusion that any diffraction effect is slight. But the French astronomer A. Danjon believed that as the stars cool off at night they become surrounded by a layer of warm air that creates spikes by *refraction*, and his colleague Couder was able to eliminate them by covering the vanes with polished aluminum. Further experiments would be of interest.

Dr. Blöte points out that the unit r_1 and r_2 in his table are equivalent to seconds of arc for a 4.5-inch telescope. It follows that we can multiply any of the values by 4.5 and divide by some aperture in inches, A , to obtain the angular radius of its diffraction pattern in seconds of arc. For the unobstructed case (and near the same for the others), the angular radius of the first dark ring is given by $5''.5/A$, and the second dark ring by $10''.0/A$.

How might this information help the observer? Consider the double star Altair and its companion for which the following data were given on page 461 of the June, 1977, issue of *Starlight*: separation 2''.6, magnitudes 0.9 and 5.1. This is normally a rather difficult pair for small telescopes, because the 4.2-magnitude difference and equality of the components correspond to a brightness ratio of 1 to 0.020, which puts the companion at very near the same intensity as the main star's bright ring (I_1 in table on page 351).

But if the companion should fall between the first or second dark ring, it would show up at high power as a small speck of light. By the relations given above, it will lie in the first dark ring when a 2.1-inch telescope is used, in the second dark ring with a 3.9-inch telescope. It ought to be easier to see with either of these apertures than with a 3-inch! Readers who test this prediction are invited to send me their reports.

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