The Quantum Series of Maksutov Cassegrain Telescopes

Optical Techniques, Inc. was formed by John Schneck and Robert Richardson, both former executives of Questar Corporation. Together they have a total of 30 years experience in the design, production, and sale of high-quality catadioptric telescopes and optical sub-assemblies.

The company was formed because they believed that the full capabilities of the Maksutov-Cassegrain telescope design had never been fully realized in an instrument that the average amateur could afford to purchase. Until now, if you wanted the advantages of the Maksutov-Cassegrain, you had either to fabricate it yourself (a very difficult and often unsuccessful venture), or pay a very high price for a professionally-made instrument. As a result, many people were forced to settle for the compromise performance of the more moderately priced Schmidt-Cassegrain systems.

Their goal, as realized in the Quantum Series, was to produce a high-quality Maksutov-Cassegrain telescope which remained affordable. Taking advantage of the many advances made in optical technology over the past decade and by using the latest computer programs, they developed a modern catadioptric optical system . . . a system with performance characteristics superior to those of any other commercially produced catadioptric telescope currently available.

What Constitutes Optical Excellence in a Telescope

Superior performance in an optical system results when both image contrast and resolution exist simultaneously in that system. A. E. Conrady, in his book *"Applied Optics and Optical Design", Volume II, page 627,* makes the following statement: *" . . . . . the resolution of strongly marked detail even right up to the theoretical limit is not proof of excellence; it merely proves the instrument is not bad. But, if, after bearing this test of mere resolving power, an instrument is also found to be good at showing delicate contrasts in decidedly coarser objects, then, and not till then, may it be passed as good."*

The above clearly divorces the functions of resolution and contrast. The former can be achieved with mediocre optics; the latter cannot. Detail on an object is only seen by reason of differing tonal contrasts between adjacent areas. It is the function of a telescope to faithfully reproduce these contrasts so that the faintest details can be detected and recorded.

The Quantum Optical System

The optical system utilized in the Quantum Series of Maksutov-Cassegrains has been designed to give you the maximum contrast and resolution obtainable in a commercially produced catadioptric telescope. Instead of the usual f/2 primary mirror of other compound telescopes, the Quantum's primary is of f/2.5 ratio. This results in several distinct advantages. First, the diffraction-limited field is much larger than with other current designs: a full 9 mm. in diameter for the Quantum Four, and 12 mm. for the Quantum Six. For comparison, these values are greater by a margin of over 100% than the respective specifications of current Schmidt and Maksutov-Cassegrains of comparable aperture!

Secondly, a smaller secondary-mirror spot can be employed on the inside of the Quantum's corrector plate. As a result, their central obstructions are only 33% of their clear apertures. Some competitive Schmidt-Cassegrains have central obstructions of 40% and 50%. With the larger central obstruction, these instruments image only 48% of the available light energy into the central Airy disk of a focused star image with the remaining *52%* being scattered in the surrounding diffraction rings. Clearly, these telescopes cannot reproduce the delicate tonal contrasts on a lunar or planetary disk; such detail being washed out or completely submerged by the excessive light in the diffraction rings.

The Quantum Four and Six, with their smaller central obstructions, image nearly 68% of the light into the central Airy Disk with only 32% going to the contrast-destroying diffraction rings. This significant improvement in contrast coupled with the diffraction-limited resolution previously discussed results in a catadioptric telescope with unmatched capability to reveal delicate low-contrast detail on the moon, planets, and deep-sky objects.

The Quantum Telescopes — Mounting

The enclosed photographs show the unique single-strut mounting developed for the Quantum telescopes. In addition to giving the Quantum a distinctive sculptured appearance, it allows for much greater flexibility in the design, selection, and use of accessories. It also permits more comfortable North Sky viewing and a freedom of operation you must experience to fully appreciate. Though these instruments are highly portable and light in weight, (the Quantum Four weighs 14 pounds while the Quantum Six weighs 30 pounds), they are utterly stable. To ensure this, we have incorporated huge thrust bearings on both axes which provide rigidity and damping equal or superior to that of many permanently mounted telescopes. In fact, the mechanical steadiness of the Quantum mount is established mainly by the support used under it. Even so, the optical tube assembly dismounts instantly with a single knurled knob to allow its separate use as a terrestrial telephoto lens. This also means that an astrographic camera platform can take the place of the optical barrel for wide-angle deep-sky photography.

Other features of the mounting include an electric gear-driven sidereal clock drive located in the mounting base; setting circles which can be comfortably read from a viewing position; and smooth, backlash-free, continuous 360° manual slow-motion controls in both axes. Legs are available for each instrument so that it can be operated in equatorial position from any suitable table-top or flat surfaces. Or, if you prefer, you can mount the telescope to any stable tripod through the 1/4-20 threaded socket located on the base of the mounting. *(Note to Celestron owners:* the Quantum Four will mount directly to the C-8 wedge; an accessory adapter is required for the Quantum Six.)

Optical Tube Assembly

Other controls visible in the photographs include two levers located at the rear of the telescope. One activates a built-in 1.75x Barlow lens, while the other selects the option of right-angle viewing for normal observing or straight-through for photography. For photographic work, the central cover cap at the back of the telescope is removed and a camera swivel coupling attached in its place. A camera, with the appropriate T-ring, is then attached to the coupling. Note that even with the camera attached, the eyepiece remains at its normal position. With a Quantum telescope, you are always ready to observe, with or without a camera attached!

Modern compound telescopes focus by varying the separation between their primary and secondary mirrors. In the Quantum, the movement of the primary takes place by turning a focus knob conveniently located on the right side of the barrel towards the rear. This side position makes operation positive and natural without introducing any difficulties when adding accessories which is in contrast to some instruments by other makers. One notable advance is a total absence of image shift during focusing, a problem which continues to plague every other competitive design. This means that with the Quantum, optical alignment (centering) has reached a new level of accuracy and permanence, resulting in exquisite and reliable performance.

The Quantum Four accepts standard 1¼ inch O.D. eyepieces while the Quantum Six accepts 2-inch O.D. oculars and is furnished with a 1¼-inch adapter. Rather than include several inexpensive eyepieces of indifferent quality, as is the practice of most manufacturers, we have chosen to supply a single ocular of premium quality as standard equipment. Our choice is the University Optics 16 mm. multi-coated Konig eyepiece . . . itself nearly legendary for its crystalline imaging and immense 80° apparent field. With the built-in Barlow, the 16 mm. ocular yields powers of 95x and 166x on the Quantum Four and 140x and 250x on the Quantum Six. In keeping with this kind of optical quality at the observing end of the telescope, we elected to use a precision first-surface mirror for the built-in star diagonal. Though costlier, it yields better image quality than that provided by a prism.

Other standard features of the Quantum instruments include high-transmission AR coatings on the corrector lens, and enhanced aluminum coatings on the primary, secondary, and diagonal mirrors. Each instrument is also equipped with a right-angle finder of large aperture: a 6x30 on the Quantum Four and a 8x50 on the Quantum Six. And, finally, each telescope is equipped with an instruction booklet, and fitted carrying case.

We have spared no effort to manufacture an instrument whose characteristics equal or surpass the best examples of commercially produced systems available today; and we believe that these superb telescopes, combining as they do the valuable attributes of optical perfection and mechanical excellence, will find wide and eager acceptance. Each one will come to be treasured by its user as a source of rewarding satisfaction.

QUANTUM SPECIFICATIONS

ITEM	QUANTUM FOUR	QUANTUM SIX
Clear Aperture	4"	6"
Focal Length	60", f/15	90", f/15
Resolving Power	1.14 arc sec.	.76 arc sec.
Diffraction-Limited Field	9 mm. dia.	12 mm. dia.
Central Obstruction	33 mm. (33% diam., 10% area)	50 mm. (33% diam., 10% area)
Baffle System	Double (Primary & Secondary)	Double (Primary & Secondary)
Unvignetted Field	23 mm. dia.	35 mm. dia.
Photographic Field of View	1.3° (35 mm.)	1.6° (70 mm.)
Limiting Magnitude	13.4	14.3
Near Focus	15'	30'
Primary Mirror	Pyrex, 4.65" dia., f/2.5	Pyrex, 6.65" dia., f/2.5
Corrector Lens	BK-7, 4.18" dia.	BK-7, 6.18" dia.
Coatings		
Reflective Surfaces	Enhanced Aluminum	Enhanced Aluminum
Corrective Lens	AR-MgF_2	AR-MgF_2
Barlow Lens	1.75x	1.75x
Eyepiece Holder	1.25" O.D.	2" O.D. with 1.25" adapter
Ocular	16 mm. F.L., 80° AP Field, 1.25" O.D.	16 mm. F.L., 80° AP Field, 1.25" O.D.
Power	95x and 166x	140x and 250x
Finder (Right Angle)	6x30	8x50
Mount (Type)	Single-Strut Fork	Single-Strut Fork
Dec. Thrust Bearing	3.0" dia.	4.125" dia.
Dec. Circle	3.0" dia. – 2° divisions	4.125" dia. – 2° divisions
R. A. Thrust Bearing	3.63" dia.	5" dia.
R. A. Circle	6.5" – 1°4' divisions	8.25" dia. – 1°4' divisions
R. A. Gear	4" dia.	6" dia.
Drive Motor	Synchronous 110 V, 60Hz, 2.7 watts	Synchronous 110 V, 60Hz, 2.7 watts
Height (Upright)	17.5"	25.5"
Weight	14 pounds (approx.)	30 pounds (approx.)

O.T.I. instruments are guaranteed for a period of 10 years against defects in material and workmanship, except for manual drives. Drives wear in accordance with use and will be replaced at cost of time and material. Special coatings are guaranteed for a period of 5 years.

*Prices and specifications subject to change without notice.

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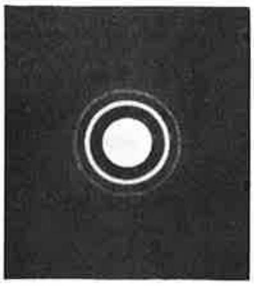
Talking About –

THE DIFFRACTION IMAGE

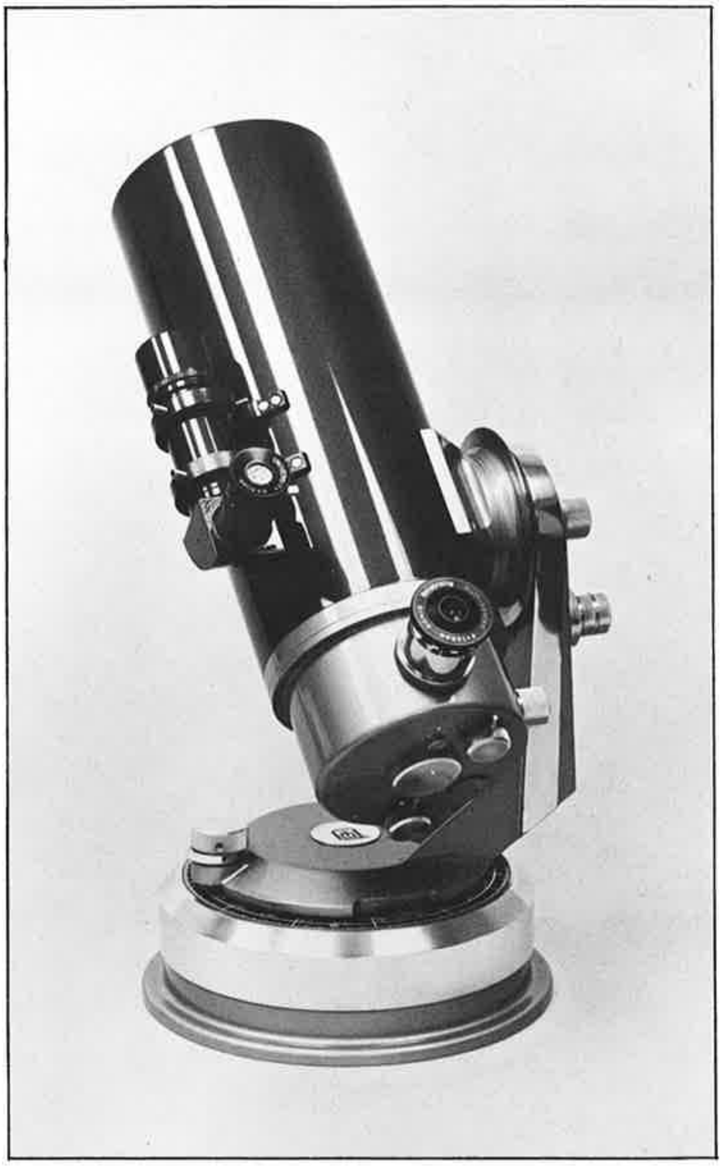
Over the past several months we have attempted, through our advertising, to describe the kind of performance you should expect from a telescope of high optical quality. During this period we have given numerous demonstrations and talked with many amateurs of varying background and interest. We found that many new to the field of astronomy were unaware of what a stellar diffraction image looks like in a telescope of good quality.

Under good seeing conditions, an in-focus real or artificial star should show a bright Airy (or central) disk surrounded by one or more evenly illuminated, concentric rings of light. The angular size of the central disk and the spacings of the rings are functions of the telescope's aperture and central obstruction, if any. The visible extent of the disk as well as the number of rings visible varies for a given instrument with the brightness of the star.



In examining the telescopes brought to us in answer to our December, 1977, advertisement in *Sky and Telescope*, we were treated to some of the most interestingly shaped diffraction images that our eyes have ever gazed upon. We saw irregularly shaped "blobs" where the Airy disk should have been and had the wonderment of viewing a variety of grotesquely shaped diffraction rings which, in one instance, assumed a "heart-shaped" configuration! While star images of this nature might be excused in a first telescope constructed by a beginner, we think them inexcusable in instruments purported to be of high quality and which are advertised as such.

Every Quantum telescope which leaves our hands will show a stellar diffraction pattern similar to the one shown above. Each will equal the resolution and contrast limits that theory prescribes for it. Why? Because every O.T.I. telescope is manufactured to the highest standards of optical quality. It's simple: quality performance requires quality optics.



QUANTUM FOUR at $990.00 **QUANTUM SIX at $1,795.00**

The mechanical and optical quality of our instruments equals or surpasses that of the best examples of commercially produced catadioptric Cassegrain telescopes available today. We do not employ any compromise in optical or mechanical design, and you obtain all the advantages of a true f/15 system. For additional information, please write for our descriptive literature.

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