QUANTUM TELESCOPE SPECIFICATIONS

ITEM	QUANTUM FOUR	QUANTUM SIX
Clear Aperture	4"	6"
Focal Length	60", f/15	90", f/15
Resolving Power	1.14 arc sec.	0.76 arc sec.
Diffraction-Limited Field	9 mm. diam.	12 mm. diam.
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. diam.	35 mm. diam.
Photographic Field of View	1°.3 (35 mm.)	1°.6 (70 mm.)
Limiting Magnitude	13	14
Near Focus	15'	30'
Primary Mirror	Pyrex, 4.65" diam., f/2.5	Pyrex, 6.65" diam., f/2.5
Corrector Lens	BK-7, 4.18" diam.	BK-7, 6.18" diam.
Coatings		
Reflective Surfaces	Enhanced Aluminum	Enhanced Aluminum
Corrector Lens	AR-MgF_2	AR-MgF_2
Barlow Lens	1.75x	1.75x
Eyepiece Holder	1.25" I.D.	2" I.D. with 1.25" adapter
Ocular	16 mm. F.L., 80° app. Field, 1.25" O.D.	16 mm. F.L., 80° app. Field, 1.25" O.D.
Powers	95x and 166x	140x and 250x
Finder (Right Angle)	6 x 30	8 x 50
Mount (Type)	Single-Strut Fork	Single-Strut Fork
Dec. Thrust Bearing	3.0" diam.	4.125" diam.
Dec. Circle	3.0" diam. — 1° divisions	4.125" diam. — 1° divisions
R. A. Thrust Bearing	3.63" diam.	5" diam.
R. A. Circle	6.5" diam. — 1° (4m) divisions	8.25" diam. — 1° (4m) divisions
R. A. Gear	4" diam.	6" diam.
Drive Motor	Synchronous 110V, 60Hz, 2.7 watts	Synchronous 110V, 60Hz, 2.7 watts
Height (Upright)	17.5"	25.5"
Weight	14 pounds (approx.)	30 pounds (approx.)

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

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.

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.

OPTICAL TECHNIQUES, INC.

P. O. Box 275, Newtown, Pa. 18940

(215) 968-4739

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Rolling Hills, California 90274
213-541-4331

"THE 100 SERIES? MAXIMUM PERFORMANCE AT THE LOWEST POSSIBLE COST."

AN INTERVIEW WITH PAUL G. SHENKLE, SALES MANAGER

Why, with the very successful Quantum Four and Six, did O.T.I. feel compelled to develop the Quantum 100 Series?

Shenkle: Indeed, the Quantum Four and Six have been very successful; however, there is and has been a very real need for a high-quality, low-cost line of telescopes. The Quantum 100 Series instruments were developed to fill this need.

What sets the 100 Series instruments apart from the other popularly priced telescopes currently available?

Shenkle: The characteristic that distinguishes the 100 Series from the other popularly priced telescopes is high optical and mechanical quality which is essential for excellent performance. Much has been written about the theoretical superiority of one optical design over another, but this means nothing compared to the importance of superior workmanship. The ultimate worth of any telescope depends on how well it works, and this comes about only as a result of superb construction.

How was this achieved in the 100 Series?

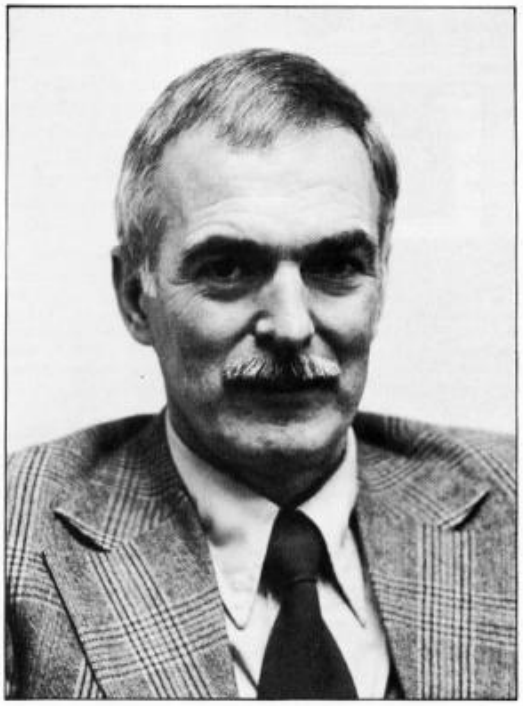
Shenkle: What we have done in the 100 Series is start with the improved design of the Maksutov-Cassegrain optics that has already proven itself in the Quantum Four and Six, and develop a mechanically simpler housing without sacrificing fundamental precision or stability of alignment. Our straightforward aim is to make unsurpassed quality and performance available at the lowest possible cost. The all-important end product, the image, is as exquisitely detailed and lucid as that produced by the more elaborate Four and Six.

Do you feel that people still care about quality?

Shenkle: The very fact that we are applying the energy and spirit of our lines to this endeavor stands as an obvious "yes" to that question. The belief that discerning individuals care very much about the value of what they do or acquire certainly motivates all of us here. And, if this interview succeeds in communicating the fundamental unity of interest between us, who build a superb instrument, and those of our readers who wish to own the very best, then I will feel very gratified.

Do you feel that the Quantum 100 Series instruments will be as successful as the Quantum Four and Six have been?

Shenkle: I am certain that the combination of superb performance with a universally adaptable design will find wide and enthusiastic acceptance among amateurs and professionals alike. We think our main problem will be to build enough of them to meet the demand. Response so far indicates this will prove to be the case.



Prices start at $460.00.

For more information on this fascinating new telescope, you are invited to write or telephone us. All of our knowledge and experience will be at your disposal.

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"... INCREDIBLE RESULTS ..." WITH THE QUANTUM SIX

The following letter is from Jose Olivarez, Director, Omnisphere Earth-Space Center, Wichita, Kansas. Mr. Olivarez is a member and past Assistant Jupiter Recorder of the Association of Lunar and Planetary Observers (ALPO).

Gentlemen:

Just a note to tell you about some of the incredible results in lunar observing that I am getting with the Quantum 6. First, the lunar image is exquisite at all powers, with no noticeable breaking down of the image at high power. Lunar crater walls and peaks appear to project up from the lunar surface in obvious relief! A friend of mine commented to me that the lunar details he was seeing through the Six looked like the relief maps of the U. S. you see in schools and offices. The image is just that great!

I had a great time observing the gibbous moon last night with some remarkable results:

1. I counted *60* craterlets on the floor of Clavius at 228x.
2. Saw the 3 larger crater pits in Archimedes at 228x (I had never seen all 3 pits before, not even with my 10-inch reflector).
3. Saw the 4 larger crater pits in Plato at 228x. The famous twin craterlets on the floor were obviously resolved.
4. The tremendous amount of detail, i.e., crinkled ridges and crater chains visible on the sloping walls of Aristoteles, Copernicus, and Bullialdus continues to amaze me. I have to keep reminding myself that I am observing with a 6-inch and not a 12- or 16-inch aperture.
5. I have also become aware of the great number of craterlets to be seen on the crater floors, in the highlands, and on crater walls! They are so clear and sharp they call out for attention.
6. To my great satisfaction, I have finally seen the "blow hole" or summit crater pit on top of the Kies 1 Dome near the crater Kies.

You may consider offering a copy of Kopal's *New Photographic Atlas of the Moon* to your 6-inch aperture customers because it is a perfect companion to the Quantum. I have determined that 99% of the detail in the earth-based high-resolution photographs in the *Atlas* is within grasp of the Six.

Well, I probably do not have to say more. I'll write to you again when I start observing Jupiter.

Sincerely,
Jose Olivarez
Omnisphere Director

QUANTUM SIX at $1,795.00

The Quantum Six is shown above, mounted on the O.T.I. folding tripod and wedge assembly. While designed expressly for the Quantum Six, it is an ideal support for the Quantum Four and other portable telescopes.

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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PERFORMANCE AND ECONOMY
THE QUANTUM 100

PERFORMANCE:

The optical systems in the Quantum series of Maksutov Cassegrain telescopes have earned an enviable reputation for superb performance whether challenged by delicate low-contrast planetary detail, subtle tonal gradations in nebulae, or the rich dustings of stars across globular clusters. Instruments in the 100 series share this capability without compromise because they incorporate the same optical elements.

ECONOMY:

Based on the concept of simplicity, the 100 series approach enables the beginner or experienced observer to acquire the highest quality equipment at the lowest possible cost and add to it as his or her requirements dictate. As an example, the electrically driven equatorial mount for the 100 is available either in self-standing tabletop form as pictured or as a compact polar axis module meant to clamp to the pan head of a sturdy tripod.

Those who appreciate mechanical integrity will find these instruments made with the solidity of a top-grade timepiece, while those who place priority on optical perfection will find at their command a system finer than that of any telescope ever manufactured, one whose exquisite imagery places the Quantum series of Maksutov Cassegrains far ahead of any others, regardless of price. By owning a 100, you place yourself with that elite group of observers who have discovered for themselves the enrichment of life which the use of only a truly great instrument can bring.

Prices start at $460.00.

For more information on this fascinating new telescope, you are invited to write or telephone us. All of our knowledge and experience will be at your disposal.

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WORDS TO THE WISE

Contrary to what you might have read or been told, a well-made 4-inch telescope reveals hundreds of stars in a bright globular cluster such as M13 under reasonably transparent conditions. A fine drawing of M13 through a 4-inch refractor at 120 power appears on page 54 in "The Messier Album" by John Mallas and Evered Kreimer, and the editor of a well-known astronomical magazine reports that he can resolve the stars in this object through a 4-inch RFT (Rich Field Telescope). Also, page 186 of Olcott and Mayall's "Field Book of the Skies" mentions resolution of M13 with a 4-inch. As builders of the world's finest catadioptric (mixed lens-mirror) instruments of 4-inch, 6-inch, and (shortly) 8-inch aperture, we can assure our customers of breathtaking views of this and other deep-sky objects. More than 800 galaxies lie within reach of the 4-inch, and the capability of its superb optics to reveal low contrast differences enables the observer to perceive subtle structure in many of them. Emission nebula showpieces, such as M42 (Orion nebula), M20 (Trifid nebula), and M8 (Lagoon nebula) appear with a rich complexity that often eludes long-exposure photography.

The Quantum Four and 100 pass all classic double star tests easily in steady air. Zeta Bootis (1.1 arc sec.) and Pi Aquilae (1.4 arc sec.) are split elegantly, and binaries of disparate magnitude such as Delta Cygni (magnitudes 3.0-6.5 and 2.2 arc sec.) show the jewel-like aspect afforded by perfect diffraction patterns.

Ample documentation exists demonstrating that even a small increase of central obstruction diameter has a serious effect on the ability of the system to reveal subtle tonal values. Contrary to the impression held by some, this doesn't mean high-contrast detail such as Cassini's division in Saturn's ring, but low-contrast features like the cloud festoons in Jupiter's equatorial zone and the delicate hues and markings in the Martian deserts. It isn't the difference in the brightness of each diffraction ring that matters (except when the obstruction exceeds 50%), but rather the transfer of energy from the Airy disk to the entire ring pattern. We grant that a novice observer might have some difficulty appreciating these changes, but as his or her skill and experience develop, such will assume due importance. After all, no one should plan to remain a beginner for long.

QUANTUM FOUR at $990.00

Exquisite performance stands as tangible evidence of value that goes beyond considerations of price. The great majority of discerning individuals who love telescopes and their images will always give optical quality and workmanship precedence over extravagant claims made for low-cost equipment. Whether you have decided to acquire your first telescope or are looking for a better one after suffering disappointment, we urge you to ally yourself with other discriminating observers by meeting with one of our representatives or dealers for side-by-side comparison of the Quantum with an instrument of any other make, regardless of size or price. This should be done on real or artificial stars as well as the moon and planets (when possible). You certainly owe this to yourself, for once you experience the lucid imagery of the Quantum series, we are sure you will come away convinced of their transcendent superiority.

For additional honest discussion and information, you are invited to write for our free descriptive literature.

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THE QUANTUM SIX
PRECISE, PORTABLE, REASONABLE IN COST

Design and construction of a catadioptric (mixed lens-mirror) Cassegrain telescope to yield performance at the level usually associated with a refractor but without the color aberration, bulk, and cost of the latter is far from easy, because a meaningful effort requires optical workmanship far better than the ¼-wave surface tolerance often sought after in all-lens objectives, as well as the mutually conflicting needs for minimum central obstruction with maximum exclusion of stray light at the focus. The Maksutov Cassegrain systems in the Quantum series have been designed and are fabricated to yield the highest image contrast obtainable in a catadioptric telescope; as a measure of our success in this endeavor, reports from our customers corroborated by our own tests have demonstrated that the instruments in this series perform with the lucidity heretofore expected only in high-quality refractors. Some would say our equipment actually outperforms them on certain classes of objects. For example, more than one Six owner has reported elongation of the images of double stars whose angular separation is 0.3 to 0.5 arc second (theoretical limit for 6-inch aperture is 0.8 arc sec.) while others describe subtle hues and planetary markings usually revealed only through much larger telescopes during the infrequent intervals when these approach their expected capabilities.

While we have your attention, we wish to refute the commonly held but mistaken belief that an f/10 or f/8 telescope performs better than an f/15 one on such deep-sky objects as nebulae and galaxies! Visually, it doesn't matter what *relative* aperture the instrument has. Visibility of an extended object of low surface brightness is established by its contrast against the night sky, which remains constant at all magnifications and focal ratios. On a night that lacks the transparency to show M33 (large galaxy in Triangulum) or M51 (the "Whirlpool" in Canes Venatici) at a given magnification through an f/15 telescope, an f/5 will also fail to reveal it. In fact, increased aperture does little or nothing to surmount poor transparency for the same reason. Experienced observers know that the most important requirement for successful deep-sky observation is a truly clear dark sky.

Under such conditions, some 2,000 galaxies alone lie within the light grasp of a 6-inch; and when such an instrument embodies the superb optical workmanship of the Quantum series, its performance on nebulae, star clusters, and galaxies is truly exciting. Fainter planetary nebulae, such as 12.2-magnitude M76 and 12-magnitude M97 (the Owl nebula) are easily seen. The Dumbbell nebula (M27) appears to float amidst a faint dusting of 12-magnitude or fainter stars.

QUANTUM SIX at $1,795.00

Comparison of the theoretical advantages of one optical design over another has resulted in steady improvement of the telescope since its beginnings some 380 years ago. However, while design certainly remains important, actual optical workmanship is more often than not responsible for tested instrumental performance. Even the best designed telescope will define poorly if its optical elements are made imprecisely and misaligned. Also, the most subtle yet damaging surface error is the presence of small-amplitude, small-period departures from figure which can take the form of annular ripples (zones) or general roughness caused by uncorrected fast polishing methods. These act to curtail ability to reveal low contrasts without influencing resolution on double stars. Thus it is quite possible for a telescope to reveal double stars quite well but fail to show lunar and planetary detail expected from an instrument of its aperture. The effective union of exceptional design with unsurpassed workmanship has earned for the Quantum series an enviable reputation for superb performance on all objects that challenge the optics of a telescope. If you would like to learn more about these beautiful instruments, you are invited to send for our literature and discuss your needs with us.

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Observational Performance
WITH ELEGANCE AND STYLE

Since we first introduced the Quantum series of Maksutov Cassegrains in this magazine two years ago this month, these superb instruments have become a new standard of telescopic excellence. Now, whenever amateur observers meet to discuss equipment and its performance, a frequently asked question about any telescope is "How does it compare to a Quantum?" We find this especially encouraging in view of our having established our company in the belief that a real need existed for reasonably priced high-quality instrumentation.

The ultimate value of any telescope lies in how well it fulfills the observer's needs and expectations, and this happens only if it produces flawless high contrast images. From our earliest beginnings, we have evaluated the Quantum series in comparison with the classic f/15 refractor because of general authoritative recognition that good examples of these unwieldy giants yield definition and contrast exceeding that available from other instruments of conventional design. In the course of star parties, meetings at amateur observatories, and private sessions involving refractors, we found the Quantum Four and Six with enhanced silver coatings to equal the light grasp and definition of the equivalent aperture f/15 doublet lenses and actually outperform them in color rendition.

Every constituent aspect of the telescopes in the Quantum series stands subservient to their development as the very finest visual systems. For example, great pains are taken to keep stray light from reaching the eyepiece. Any light not going into formation of the image does great damage to the contrast. The central obstruction afforded by the secondary mirror must remain as small as possible, for this also affects image contrast. The smoothness and precision of the main optics also deserve close attention because these qualities impress themselves on the emergent wave front to establish the information content in the image. It may yield fresh insight to realize that when we view an object through a telescope, we don't observe the object at all but its image as formed in the instrument. This constitutes the most meaningful reason to invest in equipment whose quality reveals itself through superb performance.

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

Price Increase
Effective September 1, 1979

Quantum Four at $1,085.00
Quantum Six at $1,995.00

Orders received postmarked on or before August 31, 1979, will be accepted at the current price. However, we urge you to place your order as soon as possible to ensure a reasonable delivery time.

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QUALITY REMAINS
THE MOST IMPORTANT FACTOR

Certain highly regarded telescope manufacturers would have us believe they discovered large-volume, low-cost production techniques which facilitate rapid generation and fast polishing of large optical surfaces while maintaining high quality. It is certainly true that current commercial practices employed to make optics for popularly priced binoculars and camera lenses are adequate to secure reasonably good images from these relatively low-power systems, inasmuch as the residual aberrations remain tolerable at the magnifications involved. These methods are just as applicable to large elements, but the important thing to remember is that low-power systems meet their specifications without ever approaching the accuracy needed for imagery at the diffraction limit.

No matter what impression such implied claims may produce, high-power instrument performance which is limited only by the wave nature of light has never been and may never be inexpensive, simply because high-power telescope optics must meet far more stringent requirements. In any system intended to produce highly-magnified images, the surfaces of its lenses or mirrors must follow computed design closely and possess smooth precision far greater than the optical wave fronts they are expected to handle. To achieve this, all components must be hand finished and rigorously tested even before they get assembled for *trial* as a complete telescope. No large volume production techniques exist that can yield anything beyond an approximation to the precision required for such ultimate applications.

All observers, including beginners, have the ability to evaluate the degree of finesse in the optics of any telescope. It takes no expertise or knowledge of theory, but requires just a little time, a first or second magnitude star high overhead, and a good eyepiece strong enough to provide at least 25-power per inch of aperture of the instrument. The things to hope for are perfect concentricity and roundness of the bull's-eye pattern formed by defocusing the star *slightly* while it is in the center of the field. Lack of radial symmetry indicates misalignment or coma, and the slightest departure from absolute roundness shows that one or more optical surfaces are warped or astigmatic. These are the two most damaging of the basic optical errors which, of course, makes them the easiest to detect, provided the observer uses enough magnification and refrains from going too far out of focus. The effects of the other possible errors, such as spherical aberration and small-period low-amplitude ripples or zones prove more subtle and usually lead to a general wish for better seeing when scrutinizing planetary disks, no matter how steady the air may be at the time.

QUANTUM FOUR at $1,085.00

Every instrument in the astonishing Quantum series embodies the degree of optical workmanship which equals or surpasses that of the finest examples of any commercially produced catadioptric Cassegrain telescope regardless of repute or price. For this reason, we are glad to urge all prospective first-time purchasers and even presently satisfied users of other makes to meet with one of our representatives or dealers for side-by-side comparisons. For additional, honest discussion and more information, you are invited to ask for our free literature.

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THE VALUE OF LIGHT EFFICIENCY

SPECIAL NOTICE

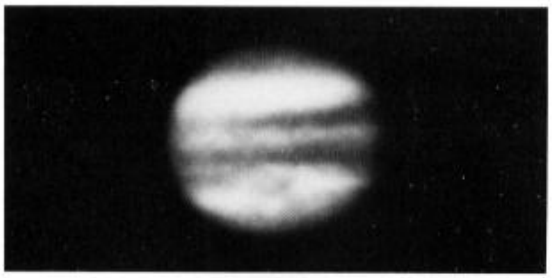
From now until January 1, 1980, we offer the valuable and effective enhanced silver coatings in a special package deal as follows:

Order a Quantum Four with the Modified Davis and Sanford Model B Tripod, and you may have the Special Coatings for just $20.00 additional.

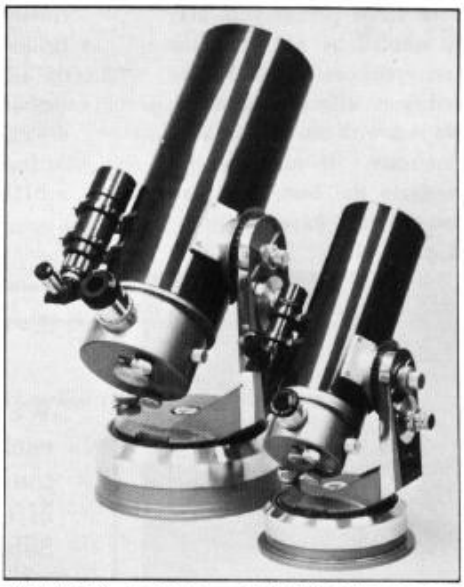
Purchase the Quantum Six with the Folding Tripod and Wedge, and the Special Coatings cost only $35.00 extra.

Wide and enthusiastic acceptance of the Maksutov system with its meniscus (dish-shaped) corrector lens has resulted from the improvement in outdoor performance it offers compared to the open-ended reflector. Closure of the tube by the corrector steadies the air within, protects the internal optics from dirt and insects, and allows a central metallized area on the lens itself to form the Cassegrain secondary, which eliminates the diffraction effects caused by the vanes needed to mount the secondary in the open layout; and last and just as important, the corrector affords the potential for considerable increase in the extent of the diffraction limited-field.

Of course, introduction of even an anti-reflection coated lens takes away around 4% of the light; and taking into account the losses on the primary and secondary mirrors plus the star diagonal usually employed, an aluminized catadioptric Cassegrain telescope transmits 61% to 63% of the light entering it. However, the modern technology that has given us improved imagery can also retrieve most of the light via enhancement of the metal coatings. This consists of deposition of a hard overcoat of a high refractive index material in a closely controlled thickness to accomplish two useful things; first, it protects the metal beneath against tarnish or cleaning abrasion, and second, the monitored depth of the film exploits the wave nature of light to bring the reflected wave fronts from the coating and overlayer together in phase like the low-frequency radiation from the woofer cone and port in a base reflex speaker enclosure. The reinforcement boosts the output over the ½ octave of interest in both cases (400 to 600 nanometers for the mirror and 40 to 60 Hz for the woofer). Silver is preferable to aluminum for enhancement, due to its greater initial reflectivity over the range for which the overlayer gets tuned in a visual system; and when applied to the primary, secondary, and diagonal, the process increases the efficiency of a Maksutov Cassegrain to 80% or better over the entire visible region, which approaches that of an equal aperture doublet refractor objective. The disadvantage of the refractor objective is the curtailed diffraction-limited bandwidth caused by inherent chromatic aberration.



This photograph of Jupiter was taken in February of 1979 on H and W VTE film with an exposure of 4 seconds. Noteworthy are the faded condition of the Red Spot, the bright oval in conjunction with it, and festoons in the Equatorial zone. No photograph, however fine, shows what the eye could have seen at that moment. Jupiter will reach opposition in late February 1980.



QUANTUM SIX at $1,995.00 **QUANTUM FOUR at $1,085.00**

The effective union of superb design with conscientious workmanship has earned for the Quantum series an enviable reputation for unsurpassed performance in all instances that challenge the optics of a telescope. If you have any questions or would like to learn more about these fine instruments, you are invited to send for our free literature and discuss your concerns with us.

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