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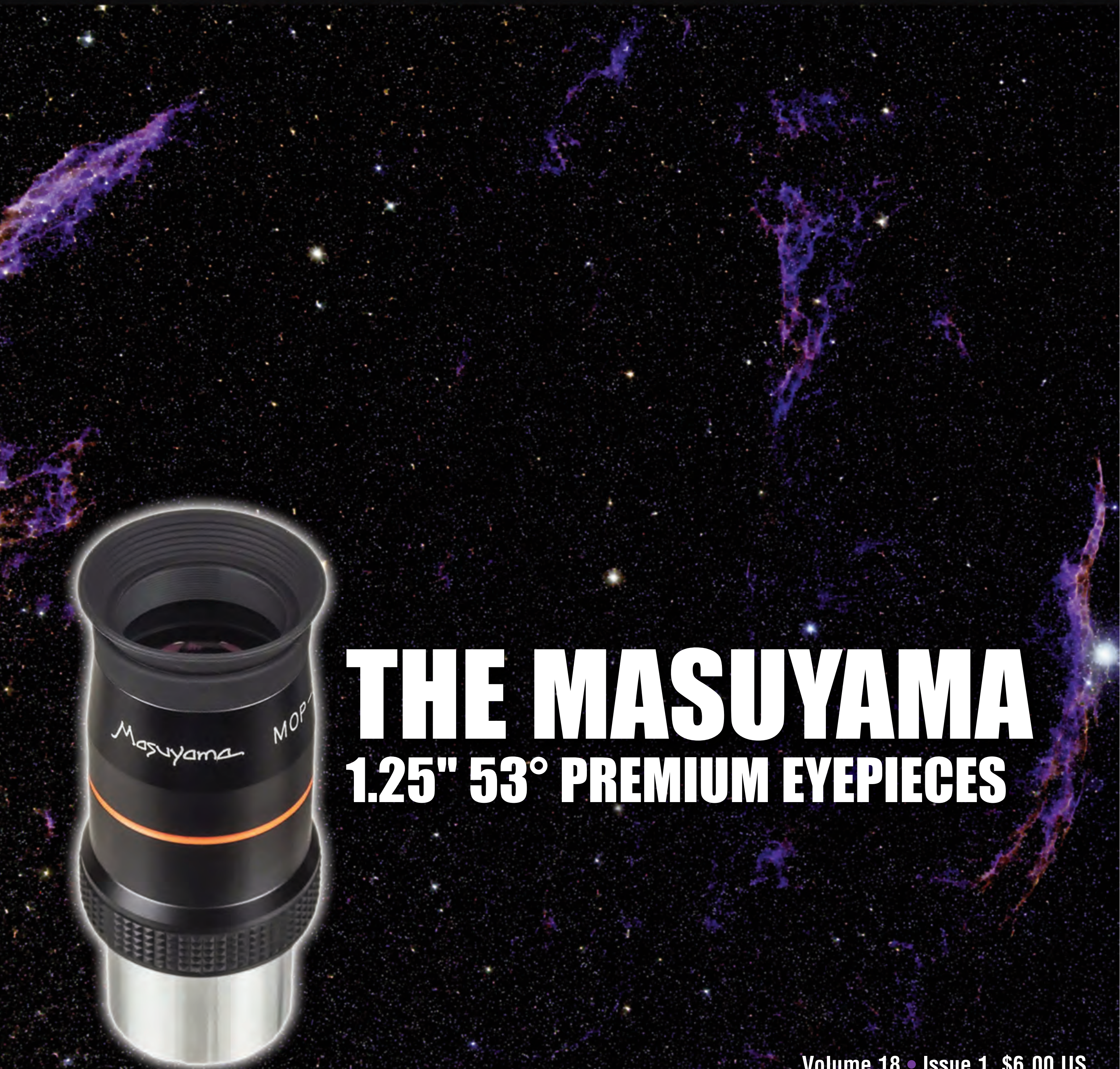

THE MASUYAMA
1.25" 53° PREMIUM EYEPIECES

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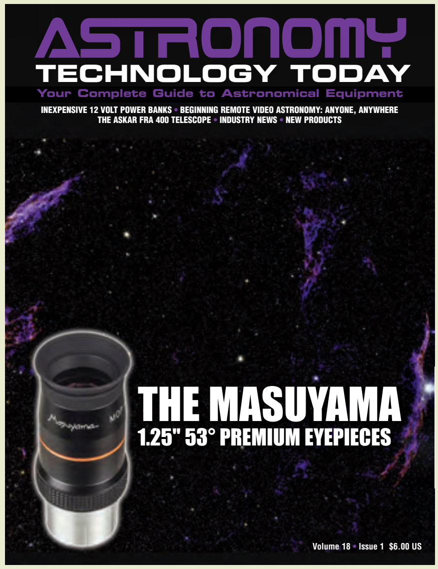
Cover Article - Page 47

In his cover article Dr. James Dire discusses how the Masuyama Ortho Plössl (MOP) eyepieces carry on the tradition of Japanese made optics containing some of the best glass made in the world. The astro image was taken by Dr. Dire using the Askar FRA 400 and is a three-hour exposure of the Veil Nebula taken with a focal reducer and SBIG ST-8300C CCD camera.



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ATT Contributing Writers

Dr. James Dire has a M.S. degree in physics from the University of Central Florida and M.A. and Ph.D. degrees from The Johns Hopkins University, both in planetary science. He has been a professor of chemistry, physics and astronomy and an administrator at several colleges and universities. He has played a key role in several observatory projects including the Powell Observatory in Louisburg, KS, which houses a 30-inch (0.75-m) Newtonian; the Naval Academy observatory with an 8-inch (0.20-m) Alvin Clark refractor; and he built the Coast Guard Academy Astronomical Observatory in Stonington, CT, which houses a 20-inch (0.51-m) Ritchey Chrétien Cassegrain. Dire is a seasoned visual observer and veteran astro-imager.

Matt Harmston is an educational researcher whose appetite for the heavens has been whetted by increasing aperture over the years. More recently, Matt has immersed himself in video astronomy - a means of probing deeper into the night sky while making astronomy accessible to all ages and abilities. With this technology readily available, Matt is considering a career as a sleep-deprivation research subject.

Curtis Macchioni is a physicist who spent most of his career in Silicon Valley working on magnetic data storage technology. Now retired he enjoys the extra time under the night sky and writing about astronomy equipment and methods on his web site www.californiaskys.com and producing astronomy helpful videos on his YouTube channel “Astronomy Tips and Reviews with Curtis.” He hopes to attend many of the major star parties across the country over the coming years.

Stuart Parkerson has been the publisher of Astronomy Technology Today since its inception in 2006. While working primarily in the background of the company’s magazine and website business operations, he has recently taken a more active role in contributing content covering industry news and other company centric topics.

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Industry News/New Products

THE MASUYAMA 1.25" 53° PREMIUM EYEPIECES

These eyepieces are made with some of the best glass I have seen in eyepieces.

By Dr. James R. Dire

The eyepiece is an integral part of any telescope system. Its purpose is to magnify the real image formed by an objective. To get the best experience out of a telescope, quality eyepieces must be used. The eyepiece design affects the magnification, image brightness, field flatness, and aberrations of these systems.

As with different telescope designs, eyepiece designs trade one advantage for another in an effort to optimize the eyepiece for a specific telescope type. As an example, I have a very expensive 82-degree fields-of-view eyepiece set. I found that the 26mm eyepiece works great in a f/6 Newtonian telescope, but doesn't perform as well in a short focal length refractor.

Early telescopes had a single element objective lens with a single element eyepiece. These optical systems suffered severely from chromatic and other aberrations. As doublet and triplet telescope objective lenses were designed, eyepieces improved in design, too. It would make no sense to remove aberrations from the objective lens without doing the same for the eyepiece.

Christian and Constantijn Huygens made one of the first two element eyepieces in 1662. Their eyepieces contained two plano-convex lenses separated by a small air gap. They discovered that keeping the lenses apart improved chromatic aberration.

The Ramsden design was another of the early two lens eyepieces. It was designed by the 18th century British optician Jesse Ramsden. The eyepieces consist of two identical plano-convex lenses with their convex faces pointing towards each other, instead of in the same direction as in Huygens eyepieces. They are separated by a distance of two thirds of the focal length of either lens. While these eyepieces were much better than single element eyepieces, they still left a lot to be desired.

Interestingly, both Huygens and Ramsden eyepieces were still manufactured in the 20th century and were often the eyepieces packaged with commercial telescopes. I still have several of them. I only use them for solar projections as they handle the heat from unfiltered telescopes better than other eyepieces that have no air gaps between the elements.

In 1849, Carl Kellner replaced one of the plano-convex lenses in a Ramsden eyepiece with an achromatic doublet. This three-element eyepiece was much better

Image 1 – The Masuyama eyepieces were shipped in a box with an ample supply of Styrofoam peanuts to keep them safe during transport.

Image 2 – Each eyepiece came in a nicely accented box wrapped in sealed plastic to keep out moisture during shipping.

Image 3 – There are eight eyepieces in the Masuyama Ortho Plössl (MOP) series: 30mm, 25mm, 20mm, 15mm, 12.5mm, 10mm, 7.5mm and 5mm.

at correcting color and other distortions, especially when used with short focal ratio refractors. They also provided a much larger field of view (40-50 degrees) than Ramsdens or Huygens eyepieces.

In 1860, Georg Simon Plössl, an Austrian optician, invented the eyepiece that bears his name. This four-element eyepiece was made by putting together two achromatic doublets with different focal lengths. This design yielded an eyepiece with a 50-degree field of view (FOV). It was even better than previous designs at correcting false color fringing. But because of internal reflections, the glare was worse. Therefore, Plössl eyepieces were not very popular in the 19th century.

Other early eyepiece designs had names like Erfle, König, and Orthoscopic. The German physicist Ernst Karl Abbe invented the Orthoscopic eyepiece in 1880. It is sometimes called an Abbe eyepiece. It consists of a cemented triplet field lens and a plano-convex lens. This combination provides good correction for chromatic aberration, spherical aberration, coma, and distortion, all at reasonable cost. Orthoscopic eyepieces have a FOV between 35 and 50 degrees, and good eye relief. This was my favorite design for many years, and I still like them for viewing double stars and planets.

The König was designed in 1915 by Albert König, a German optician. It is essentially a simplified Orthoscopic with a 55-degree FOV. The design allows for high power and had the largest eye relief until 1979 when Al Nagler started making his eyepieces.

Heinrich Erfle developed wide FOV eyepieces in 1917 for military use. These eyepieces consist of five elements comprising two achromatic doublets, with a convex singlet element sandwiched in between. This resulted in a 60-degree FOV. They suffered from astigmatism and ghosting. Erfle spent most of his career as an optician for Carl Zeiss.

Plössls made a big comeback in the 1980s due to their simple design, low cost and the new use of lens coatings that reduced internal reflections. In the 1980s, they were the most popular sold eyepiece design and are still sold today as entry-level eyepieces.

Al Naglar founded Tele Vue Optics in 1979 and started making high-end eye-

Image 4 – Each eyepiece comes sealed in plastic inside the box with padding to protect them during shipping.

Image 5 – The MOP eyepieces all have 1.25 inch barrels. They are black with orange trim. Each eyepiece has a serrated grip region. The 7.5mm and 5mm are labeled on the top versus the side.

pieces. In the 1990s his eyepiece designs starting becoming very popular. They contained 6-8 elements and had 82-degree FOVs. These multi-element eyepieces started a revolution in telescope eyepieces that continues today.

Many of the eyepieces I owned decades ago were made in Japan. The Japanese are known for manufacturing some of the best telescope glass in the world. In addition, almost all of my refractors have objectives made with Japanese glass! Beside use in telescopes, the world's leading glassmakers in Japan supply the lenses made for Canon, Nikon, Sony and other-make cameras.

Recently, I was offered the opportunity to review some high quality Masuyama eyepieces shipped to me by Astro Hutech out of California. These eyepieces are named after Japanese optician Ichiharu Masuyama, who made eyepieces for Nikon in the 1940s. Around 1951, he founded the optical company Ohi Kohki.

Dr. Masuyama designed many of the finest Japanese eyepieces of the 1960s and 1970s. Dr. Masuyama even designed the 100mm focal-length eyepiece used for visual observing at the historic 60-inch telescope at Mount Wilson Observatory in California.

The company continued to manufacture several coveted eyepiece designs in the 1980s, including Plössls and Masuyama eyepieces, which were similar to Orthoscopics. After the 1980s, they went many decades without manufacturing telescope eyepieces. But now they are back!

The eyepieces were packaged and shipped carefully to prevent damage. **Image 1** shows the box they came in, es-

Image 6 – The 30mm Masuyama Ortho Plössl was compared to a 40mm Orion Opilux and Meade 32mm Super Plössl eyepieces.

sentially smothered in Styrofoam peanuts! Each eyepiece box was sealed in plastic (**Image 2**). There are eight focal lengths in this series (**Image 3**): 30mm, 25mm, 20mm, 15mm, 12.5mm, 10mm, 7.5mm and 5mm. Inside the boxes, they were sealed in another layer of plastic (**Image 4**). The shipping box could have been submerged in a pool and the eyepiece boxes and their contents would be perfectly dry!

The Masuyama Ortho Plössl (MOP) eyepieces are designed by Ohi Kohki Co., Ltd. in Japan. The optical design incorporates five fully-multicoated lens elements in three groups. This series of eyepieces have a 53-degree FOV and come with 1.25-inch barrels. The eyepieces are black with a nice orange stripe for accent (**Image 5**). Each size comes with a serrated ring to make gripping easy, especially if wearing gloves.

I pulled out every 1.25-inch eyepiece I owned, plus a few 2-inch models, to test against the MOP eyepieces. I only compared the MOP eyepieces to eyepieces I purchased for under $200, since each MOP eyepiece sells for under $200 ($179-$189 at the time of this writing).

I tested the eyepieces with three telescopes: a 70mm f/6 triplet refractor, a 250mm f/12 classical Cassegrain, and a 132mm f/7 triplet refractor. Unfortunately, I don't currently own a fast Newtonian. It would have been interesting to compare the eyepieces with a fast Newtonian, too.

Image 6 shows the 30mm MOP with two other long focal length eyepieces I compared it to (a 40mm Orion Optilux and a Meade 32mm Super Plössl.) A top view of the three eyepieces appears in **Image 7** showing the diameter of the top glass element in each. The 32mm Super

Image 7 – A top view of the 30mm Masuyama Ortho Plössl, the Orion Opilux, and the Meade 32mm Super Plössl eyepieces showing the glass in each.

Image 8 – The 25mm and 20mm were compared to a 25mm Plössl and a 24mm 68° Explore Scientific eyepieces.

Image 9 – A top view of the 25mm MOP, the 20mm MOP, the 25mm Plössl, and the 24mm 68° Explore Scientific eyepieces. All four have approximately the same diameter opening.

Image 10 – The author compared the 15mm MOP and the 12.5mm MOP (not shown) to a 15mm Plössl and a 14mm Explore Scientific 82° eyepiece.

Plössl and the 30mm MOP had virtually identical true fields of view and eye relief.

The 40mm Orion Optilux has a similar eye relief with a 62-degree FOV. I use this eyepiece for wide FOV visual use with my 250mm f/12 Cassegrain. Wide field is relative as this eyepiece provides 75x magnification and a 0.83 degree true FOV in this long focal length instrument.

I compared the three eyepieces in the 132mm Apo by pointing at the Double Cluster in Perseus (NGC869 and 884). The seeing was under two arcminutes and the sky transparency was above average. NGC884 has some bright red stars and several blue stars to compare color. All three eyepieces had pinpoint stars through the FOV.

The 40mm Orion Optilux and the 30mm MOP had considerably better contrast and color. The best contrast and color were seen in the Masuyama 30mm eyepiece. I found the same to be true when using the three eyepieces to view the Andromeda Galaxy (M31). The galaxy was brightest in the Orion Op-

Image 11 – There is a vast difference in the diameter of the glass in the15mm MOP, the 15mm Plössl and the 14mm Explore Scientific 82° eyepiece.

Image 12 – The 10mm Masuyama Ortho Plössl was compared to a 10mm Plössl and a 9.7mm Meade Super Plössl.

tilux, but not by much over the 30mm MOP.

Next, I compared the 25mm and 20mm MOP eyepieces with a generic 25mm Plössl and a 24mm Explore Scientific 68-degree eyepiece (**Image 8**). A top view of the eyepieces is shown in **Image 9**. They all appear to have the same diameter opening. The ES 24mm is a beefier eyepiece with more elements. Its larger diameter midsection may be the result of larger diameter middle elements, which only use their center regions to pass through light to avoid edge aberrations. I compared all four eyepieces in my 250mm f/12 Cassegrain.

Again, I spied the Double Cluster in Perseus with the four eyepieces, as well as Jupiter. The ES 68-degree eyepiece had the best eye relief, but the MOP eyepieces had the best color correction, the best contrast and the best over-all color for Jupiter. The two MOP eyepieces and the ES 68-degree eyepiece were all greatly better than the Plössl.

The next set of eyepieces I compared in the 250mm Cassegrain are shown in **Image 10 and Image 11**. This group contains the 15mm MOP, 12.5mm MOP, a 15mm Plössl and a 14mm Explore Scientific 82-degree eyepiece. For these I pointed the telescope at the Ring Nebula (M57) and Saturn. You'll notice in Image 11, the ES eyepiece has the largest diam-

Image 13 – The top view of the 10mm MOP, 10 mm Plössl, and the 9.7mm Meade Super Plössl for comparison.

Image 14 – The final comparison was the 7.5mm and 5mm MOP eyepieces with a 6.7mm Explore Scientific 6.7mm 82° eyepiece.

eter glass in the opening and the Plössl has the smallest. Comparing these eyepieces, I'd have to say it was a tie between the Masuyama and Explore Scientific eyepiece for the best color correction, contrast and object colors.

I wanted to compare the shorter focal length eyepieces with my 70mm f/6 Apo since it only has a 420mm focal length. When I view with it, I need short focal length eyepieces to get decent magnification, especially for planets. First, I compared the 10mm MOP eyepiece with a 10mm Plössl and a Meade 9.7 Super Plössl. These are shown in **Image 12 and Image 13**.

My targets for this comparison were M15, M27, Jupiter and Saturn. With the 70mm telescope, I could not resolve Globular Cluster M15 into individual stars with any of these eyepieces. In each it appeared as a round white blob. But I could make out the dumbbell shape for M27. Even though these eyepieces provided a magnification around 42x, the belts and zones on Jupiter were well resolved. On Saturn, the rings were splendid, and the Cassini gap came in and out with the fluctuating seeing. The 10mm MOP was by far the best eyepiece in this grouping for sharpness, color and contrast, especially on the planets.

Next, I compared the 5mm and 7.5mm MOP eyepieces with a 6.7mm Explore Scientific 82-dgree eyepiece. All three are shown in **Image 14**. The 6.7mm ES had considerably more glass by number of elements, mass and volume. I viewed Jupiter, Saturn and the Double-Double (Epsilon Lyrae) with all three in the 70mm Apo. They could all split Epsilon Lyra and had excellent contrast and color on the planets.

For my last test, I popped the 5mm MOP in my 250mm f/12 Cassegrain and then in my 132mm f/6.5 Apo to look at Jupiter. This eyepiece provided 600x magnification in the reflector and 185x in the refractor.

It probably wouldn't surprise avid visual astronomer when I say the view of Jupiter was better in the smaller refractor than the large reflector. Refractors tend to outperform reflectors for splitting double stars and viewing planets. The reason is the spider and secondary mirrors in Cassegrains and Newtonians diffract light, which distorts the view. I would have to say the view of Jupiter in my 132mm Apo with the 5mm Masuyama was the best view of Jupiter I have ever seen. I saw more detail in the belts and zones than I ever imagined I could see visually.

To Close

The Masuyama Ortho Plössl (MOP) eyepieces carry on the tradition of Japanese-made optics containing the best glass made in the world. These 53-degree FOV eyepieces are lightweight, well-constructed and provide excellent sharp and high contrast views. They render superb color. Anyone searching for 1.25-inch eyepieces that cost under $200 each should put these eyepieces on their short list! ATT