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THE GSO 10-INCH CLASSICAL CASSEGRAIN

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In his cover article Dr. James Dire discusses why he acquired the GSO 10-Inch Classical Cassegrain for lunar and planetary imaging. The astro image on the cover is of Jupiter which he captured on October 19, 2022. The image was created with 3300 stacked frames of video processed with AutoStakker and Photoshop.

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ATT Contributing Writers

Norm Butler has enjoyed amateur Astronomy for over 50 years and has been a regular contributor to Astronomy Technology Today. He served as an Opticalman on submarine tenders in the 70s and with AVCO in Hawaii in the early 80s working in astronomical engineering at Haleakala Observatory on Maui, chasing satellites, space shuttles, building electo-optical instrumentation and measuring cores of galaxies. After his astronomy and engineering career ended in the early 90's Norm relocated to Hong Kong, learned some Chinese mandarin and spent 16 years teaching and lecturing at the university and graduate level in Hong Kong and Shenzhen, China before retiring and now lives in Guam. His book, "Building and Using Binoscopes" (The Patrick Moore Practical Astronomy Series) was published in its second edition in 2017 and is available from Amazon.

John Crisp is the VP of Digital for The Blade/Block Communications managing software architecture. His other hobbies include the design, building and flying of experimental aircraft and radio control aircraft - his main pride and Joy is a kit built Fokker Dr-1 Triplane and has a Piper Cub (3/4 Scale that he is designing and building). His Private Pilots Certificate has been active since 1987 and photography and astrophotography are a few other passions.

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 astroimager.

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 GSO 10-INCH CLASSICAL CASSEGRAIN

By Dr. James R Dire

In 2019, I reviewed the GSO 8-inch classical Cassegrain telescope (included in this issue in a Looking Back article). In this issue I am reviewing the 10-inch model.

Laurent Cassegrain was a 17th century French Roman Catholic priest and is given credit for inventing the telescope design that carries his name. Cassegrain telescopes use a parabolic primary mirror with a hyperbolic secondary mirror. The secondary mirror directs the light through a hole in the center of the primary mirror where it comes to focus. Most Cassegrains have focal ratios (f/#) between 12 and 20.

Variations of Cassegrain telescopes have been developed over the years with names such as Schmidt-Cassegrain, Ritchey–Chrétien Cassegrain, and Dall- Kirkham Cassegrain, among others. With all these variations, the original Cassegrain design is commonly referred to as the classical Cassegrain.

While the first telescopes were refractors, the first reflector was made by Isaac Newton in the year 1688 and is referred to as a Newtonian. For more than century, the largest telescopes made were Newtonians. By the mid-nineteenth century, Cassegrains became the preferred telescope for astronomical research for several reasons. First, the focus is behind the primary mirror. So astronomers no longer had to climb ladders to get to the eyepiece as was required with large Newtonians. Secondly, the mirror design provided long focal lengths without the need for long optical tube assemblies. Cassegrains were lighter and easier to mount on clock drives.

Image 1 - Unlike the 6-inch and 8-inch version, the GSO 10-inch classical Cassegrain telescope has a truss tube design making it lighter and giving it better thermal characteristics. The trusses are made of low thermal expansion carbon fiber tubes.

Cassegrains were the main research telescope for more than a century. However in the latter half of the twentieth century, cheaper Schmidt-Cassegrains and much faster Ritchey–Chrétien Cassegrains replaced them. Cassegrains have never been available in the amateur telescope market until Guan Sheng Optical (GSO), out of Taiwan, starting manufacturing 6-, 8- and 10-inch classical Cassegrain telescopes. The 6- and 8-inch models have solid metal tubes. However, the 10-inch model is a truss tube design (**Image 1**).

I was interested in the 10-inch classical Cassegrain to do planet imaging. Planet imaging requires a long focal length. This eliminates production refractors as very few have focal lengths over 1000mm and I know of none with focal lengths greater than 2000mm. I was only looking at tele-

Image 2 - The telescope has three octagonal aluminum rings with finger holes for easily gripping the telescope for mounting and unmounting.

Image 3 -The primary mirror is center marked for use in collimation.

scopes with focal lengths greater than 3000mm. This eliminated Newtonians.

So my choices were Schmidt-Cassegrains, Ritchey-Cretiens Cassegrains and classical Cassegrains. Twelve inch and larger Schmidt-Cassegrains all have focal lengths greater than 3000mm. But with their corrector plates enclosing the optical tube assemblies, these telescopes tend to take a long time to reach thermal equilibrium. Image shift when focusing is also an issue with most Schmidt-Cassegrains. Twelve-inch models cost greater than $4000 for an optical tube assembly (OTA).

Ritchey-Cretiens Cassegrains tend to have f/8 focal ratios. To exceed 3000mm focal length requires a 16-inch model. Unfortunately, these OTAs cost around $8000. Then there is the GSO 10-inch f/12 classical Cassegrain, which at the time of this writing sold for $3200. The telescope has a 3045mm focal length. The price was in my budget, so I thought I'd give it a try for imaging planets.

The 10-inch GSO classical Cassegrain is beautifully crafted with aluminum rings and carbon fiber truss poles. **Image 2** shows the inside of the OTA. The support rings are octagonal with handgrip cutouts on four of the eight sides. The open-air design ensures that the optics will quickly come to thermal equilibrium with the surroundings. The secondary mirror assembly has three collimation screws that require a user-provided Allen wrench to adjust.

Image 3 shows the same view, except it is focused on the primary mirror. The mirror has a greater than 96 percent reflectivity - standard for production reflecting telescopes. The primary mirror is also center marked for collimation. **Image 4** shows the secondary mirror. Note the secondary mirror has ample shielding to block stray light and mitigate dew forming on the mirror. The secondary mirror is also center marked for collimation.

The telescope was in perfect collimation when I received it. I have been

Image 4 - This view shows the secondary mirror. It is well shielded and also center marked for collimation.

Image 5 - The backside of the telescope showing the focuser, cooling fans and primary mirror collimation screws.

transporting the telescope on the back seat of my Subaru (seat belted in). It has maintained its collimation perfectly since day one!

The backside of the telescope appears in **Image 5**. There are three sets of collimation screws. One set appears in the image above the GSO letters. There are also three cooling fans. The 12V jack to power the cooling fans is below the fan under the focuser (**Image 6**).

The telescope has a 3.25-inch focuser (**Image** 7) with a course-focusing knob on each side and a 10:1 fine focus knob on the right side. The drawtube has two inched of travel and is graduated in inches and centimeters. The telescope comes with two one-inch and one two-inch M117 extension rings (**Image 8**). These can be inserted in any combination between the focuser and the back of the telescope.

The telescope did not come with a shroud for the truss section. I like a shroud to cover the truss section of any of my telescopes. Shrouds help keep dew from forming on the primary mirrors, keep stray light from hitting the optics, and keep dust out of the telescopes. So I custom ordered a shroud from Shrouds by Heather (https://www.scopeshrouds.com). Heather does great work and has fast turn around time. The shroud is pictured in **Image 9**.

The telescope comes with two shoes to attach finderscopes (**Image 10**). It also comes with two Losmandy style dovetail plates; one on the top and one on the bottom of the telescope. The telescope does not come with a finderscope, a diagonal or eyepieces.

The OTA including the three focuser extension rings that weighs 38 pounds. Images 9 and 10 show the OTA with the shroud, a red dot finder, a 9x50 finder, a 2-inch diagonal and a 40mm eyepiece. The total payload weight is slightly less than 40 pounds.

I decided to test this telescope using my Celestron CGEM II mount. This mount has a 40-pound payload capacity. Visually, the mount worked great with this telescope. I polar aligned the mount, balanced the payload, and performed a six-star mount model with the hand controller. My 40mm eyepiece gives a magnification of 76x with a 0.81-degree field of view (FOV). Every object was in the eyepiece after a telescope GOTO command!

As I mentioned, I purchased this telescope for planet imaging, not for visual use. But I have been blown away at the impressive views at the eyepiece. Even with the 40mm eyepiece, stars are sharp throughout the field of view. I have noticed no coma with any of my eyepieces. The 0.81-degree FOV captures most objects I like to view, including the Moon. Extended objects, like M31, M42 and M45 will not all fit into the FOV. But with the 10-inches of aperture and 3045mm focal length, star clusters, galaxies and nebulae are awesome in this telescope.

On night of good seeing, zooming in on lunar features, especially near the terminator gives the impression of flying around the Moon in a spacecraft. With my 6.7mm eyepiece (455x) I have obtained the best views of Mars, Jupiter, and Saturn I have seen in any telescope.

Image 6 - The 12V jack for powering the mirror cooling fans is found below the focuser and lower cooling fan.

Now to discuss my initial imaging results using this telescope. First, I did not attempt deep space, long exposure photography with the scope. My CGEM II mount cannot perform well imaging with such a heavy payload. Plus an f/12 telescope is too slow for deep space imaging. So I limited myself to lunar and planetary imaging.

My imaging was done with a ZWO ASI120MC CMOS camera. I used FireCapture software to collect video images with the camera. I processed all of the images with AutoStakkert, RegiStax 6 and Adobe Photoshop. These were my first attempts at lunar and

Image 7 - The telescope comes with a 3.25-inch dual speed focuser with a graduated 2-inch drawtube.


Image 8 - The telescope comes with two 1-inch and one 2-inch M117 extension rings to enable focus with a wide range of cameras and accessories.


Image 9 - I had a custom shroud made to keep dew, stray light and dust out of the OTA when in use.

planetary imaging using video. And except for Photoshop, all of the software was new to me. While I was very happy with my initial results (shown herein), I know my results will improve with practice.

My first image was of the Moon (**Image 12**). I was able to capture a lot of structure detail in craters near the terminator. Many of the craters have central peaks (formed by lunar mass compressed from the meteor collision rebounding in the center of the crater) and in some cases the shadows of the central peaks are visible showing a cross-section of the peaks' shape! **Image 13** is another Moon photo capturing lava plains. This imaged captures myriad groove features in the plains as well as mountains and ridges.

Saturn was past opposition when I started testing the GSO Cassegrain. But I was able to produce a fairly decent shot of the ringed planet (**Image 14**). The image shows good color on Saturn's belts and zones. Some structure is visible in the A and B rings. The Cassini division is clearly seen and a hint of the Enke division, too. Note the shadow of the rings on the planet and the shadow of the planet on the back left side rings.

I next tried Jupiter when it was close to opposition (**Image 15**). Like my Saturn photo, the seeing was not the best when I conducted Jupiter imaging. All of my images were taken from southern Louisiana. Nights with great seeing are rare in this part of the country. Regardless, I was very happy with the detail in my rookie attempt at imaging Jupiter. I look forward to capturing some Galilean moon transits in the future.

Mars reached opposition four weeks before I wrote this review. Unfortunately, cloudy nights were the norm here around opposition. The one clear night I was able to image Mars (**Image 16**), the seeing was no better than 3 arcseconds. However, this was still the best image I have ever taken of Mars. The polar ice cap is clearly visible as well as a lot of surface detail.

All of the images I took with the telescope were prime focus, i.e. the camera was attached directly to the focuser. Often planetary photographers will employ 2x, 3x, 4x or 5x Barlows to increase the focal length. Many of these are using telescopes with less than 3000mm focal lengths. So my next attempt will be to increase my focal length with a good quality 2x Barlow. This is best accomplished on nights with 1-2 arcseconds seeing (or better).

Overall I am extremely happy with the performance of the GSO 10-inch classical Cassegrain. It has become one of my favorite telescopes for visual use and it has proved to be a very capable instrument of lunar and planetary imaging! ATT

Image 10 - The telescope comes with two finder shoes where I have attached a red dot finder and a 9x50 finderscope. The second Losmandy-style dovetail plate on top of the OTA can be used for attaching a guide scope.

Image 11 - The 40-pound capacity Celestron CGEM II mount handles the OTA adequately for visual use and lunar and planetary imaging. A larger capacity mount would be needed for long-exposure digital imaging.

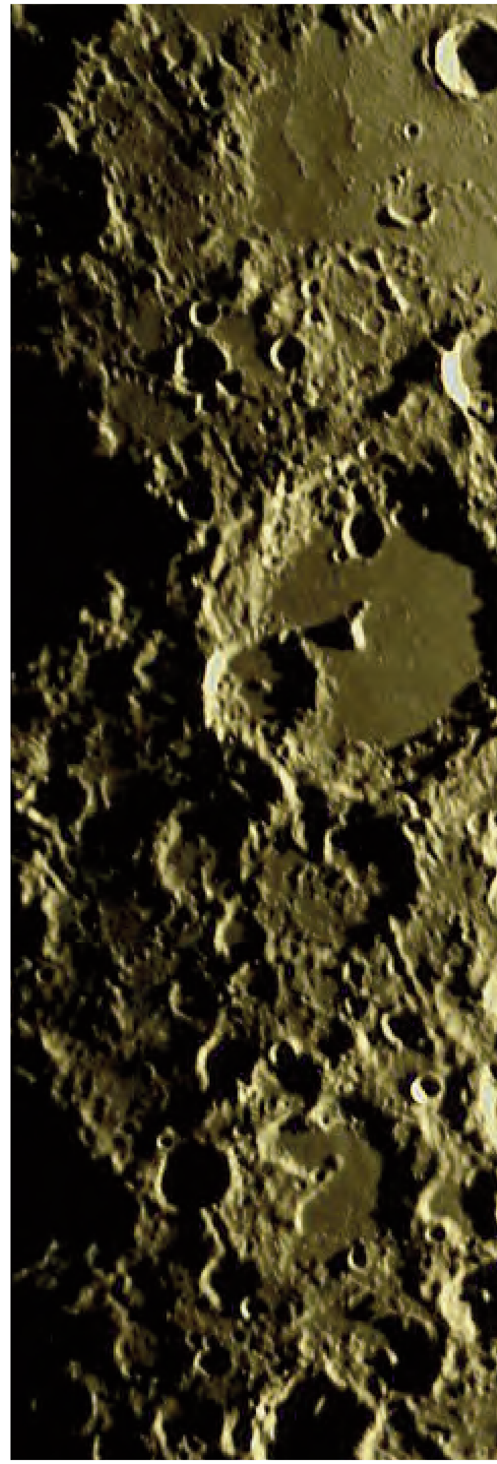
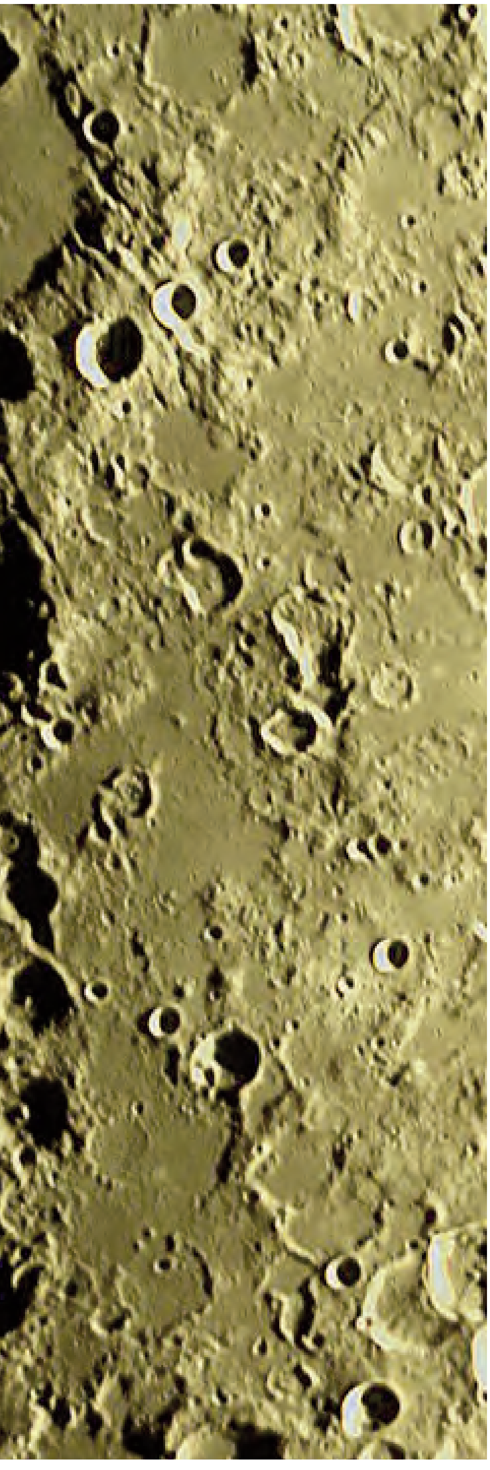


Image 12 - Crater Albategnius (slighter u
peak. The smaller crater on top of the lo
Klein. North of Albategnius is the crater
using a ZWO ASI120MC. The image is a



upper left of center) with its tall central
wer left wall of Albategnius is the Crater
Hipparchus. Taken October 2, 2022
stack of 503 video frames.

Image 13 - The small crater in the middle of the lava plane is named Triednecker. The long crack or valley running upper left to lower right on the north side of the lava plane (with a crater in the middle of it) is known as Rima Hyginus. Taken October 2, 2022 using a ZWO ASI120MC camera. The image was created by stacking 820 video framesusing a ZWO ASI120MC. The image is a stack of 503 video frames.

Image 14 - Saturn imaged under less than optimal seeing on October 2, 2022 with a ZWO ASI120MC camera. This image was made stacking ~1000 video frames

Image 15 - Jupiter captured on October 19, 2022. The image was created with 3300 stacked frames of video processed with AutoStakker and Photoshop.

Image 16 - Mars on December 15, 2022 taken with a ZWO ASI120MC camera. The image was created from a stack of 3300 0.01s video frames. Seeing was about 3 arcseconds.