Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 28, No. 12 ***Three-Time*** *Winner of the Astronomical League's Mabel Sterns Award ☼ 2006, 2009 & 2016* *December 2020*

In This Issue

Best Wishes for a Safe and Happy New Year!

Membership Renewals Due

12/2020	Bogusch Damerau DellaPenna Moynihan O'Leary Sigler-Quick
01/2021	Kellerman Kovacs McElwee
02/2021	Kraynik Murphy Ruggeri Tronel

December 2020 Dates

7th • Last Quarter Moon, 7:36 p.m. EST

13th • The Geminid meteor shower peaks

14th • New Moon, 11:16 a.m. EST

21st • Winter solstice, 5:02 a.m. EST

21st • First Quarter Moon, 6:41 p.m. EST

21st • Jupiter and Saturn are separated by only 0.1° low in the southwest

29th • Full Moon, the Full Long Night Moon or the Moon before Yule, 10:28 p.m. EST

CCAS Annual Holiday Party

Join us on Tuesday, December 8, 2020, for the annual CCAS Holiday Party. This year, as has been the case for many things, we'll be celebrating a little differently than in previous years.

As with our monthly meetings, we'll come together ONLINE via Zoom starting at 7:30 P.M. EST. The evening promises to be a lot of fun with an ugly holiday sweater contest, an astronomy quiz, and a CCAS Year in Review slideshow. Look for an email from CCAS Treasurer & Observing Chair Don Knabb with a Zoom link in the coming days.

Autumn / Winter Society Events

December 2020

8th • CCAS Annual Holiday Party, ONLINE via Zoom starting at 7:30 P.M. EST. Ugly holiday sweater contest, astronomy quiz, and CCAS Year in Review slideshow.

13th-14th • Geminid Meteor shower peaks with approximately 75 meteors per hour. Look to the northeast for the point of origin of the shower.

20th • Open call for articles and photographs for the January 2021 edition of Observations.

21st • Winter Solstice, 5:02 A.M. EST, marking the first day of winter in the Northern Hemisphere.

26th • Deadline for newsletter submissions for the January 2021 edition of Observations.

January 2021

12th • CCAS Monthly Meeting, ONLINE via Zoom. The meeting starts at 7:30 p.m. Eric Jensen, PhD, Professor of Astronomy and Planetary Science, Swarthmore University. His presentation is entitled "New Exoplanet Discoveries from NASA's TESS Mission."

14th • The von Kármán Lecture Series: Spacecraft Origami. Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

20th • Open call for articles and photographs for the February 2021 edition of Observations.

26th • Deadline for newsletter submissions for the February 2021 edition of Observations.

Minutes from the November 10, 2020, CCAS Monthly Meeting

by Bea Mazziotti, CCAS Secretary

- Dave Hockenberry welcomed members and guests to the November 2020 CCAS meeting. Zoom and YouTube were the platforms and 49 attended. The meeting was held on the 3rd Tuesday and at 5PM in order to accommodate our guest speaker's location in The Netherlands.
- After a brief introduction, club Program Chair Bruce Ruggeri introduced Dr. Giovanna Tenetti. Dr. Tenetti is Head of the Astrophysics Group, UC London Department of Physics and Astronomy, and Director of the London Centre for Space Exochemistry Data. Her presentation was titled "Brave New Worlds: The Exoplanets in our Galaxy and the ESA (European Space Agency) Project Ariel Mission." As late as 1990, the know planets were only those in our solar system. After 9 years in deep space Kepler revealed that there are billions of hidden planets, more planets than even stars—a remarkable and intriguing discovery. Ensuing space missions, including K-2, Gaia, Tess, and CHEOPS, continue to find and explore these other worlds looking for clues as to their potential habitability. To date, NASA has the number of exoplanets at 4300+ and counting. NASA estimates that half of stars similar to our sun could have rocky planets similar to our earth orbiting them.
- Dr. Tinetti is the principal investigator of Ariel, ESA's upcoming 2028 mission to further study and characterize the chemical and thermal properties of the targeted exoplanets. She is also co-founder and co-director of Blue Skies Space, a pioneering UK company taking a private-sector approach to fund lower cost exoplanet exploration and accessibility to the data derived from these explorations. Their first mission, Twinkle, is scheduled to launch in 2023.
- After Dr. Tenetti's presentation Don Knabb took us on a quick tour of the November17th night sky, including the wonderful Pleiades. Andromeda galaxy and the Perseus double cluster. He also informed members that on the December solstice, 12/21/20, Jupiter and Saturn will be so close as to appear to be colliding. They will create a super bright point of light and will look like a 'double planet' for the first time since the Middle Ages.
- The CCAS holiday party will be on Zoom on 12/8/20 at 7 PM. Good cheer, holiday spirits and festive garb are on the agenda.

January 2021 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on January 12, 2020, starting at 7:30 p.m. The meeting will be held ONLINE via Zoom.us. Guest Speaker: Eric Jensen, PhD, Professor of Astronomy and Planetary Science, Swarthmore University – "New Exoplanet Discoveries from NASA's TESS Mission."

On February 9, 2021, our guest speaker will be Dr. Sarah Dodson, Associate Professor of Physics and Astronomy, University of Delaware. Her presentation is entitled "Enceladus and Titan – A Dance of Two Saturnian Moons."

Then on March 9, 2021, John Conrad, CCAS member and NASA Solar System Ambassador will present "The James Webb Space Telescope and Other IR Missions."

Another CCAS member and NASA Solar System Ambassador, Dennis O'Leary, will present" NASA Robotic Missions: An Update on New Horizons,

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Capturing Mars During the 2020 Opposition

by CCAS Member Frank Angelini

From the Way Back Machine

I remember the first time I read *War of the Worlds*. I was maybe eight years old and I had recently visited the Franklin Institute, which included a program about the red planet, presented by the Fels Planetarium. This was before the days of color TV, computers, and Hubble, so one's impression of the Moon, planets and other celestial objects was from pictures in books (comic and otherwise), newspaper stories and possibly hearsay. But the description provided by H. G. Wells in his 1898 novel is the one that formed my conception of Mars for a very long time.

> "…*During the opposition of 1894, a great light was seen on the illuminated part of the disk. . . men like Schiaparelli watched the red planet—it is odd, by- the-bye, that for count - less centuries Mars has been the star of war—but failed to interpret the fluctuating appearances of the markings they mapped so well. All that time the Martians must have been getting ready…"* From *War of the Worlds,* H. G. Wells, 1898

Fast-forward to the 21st Century, super computers, cell phones, etc., just a click away from vivid, full color photos of the surface of Mars compliments of NASA. No imagination necessary, what you see is the real McCoy, sans giant octopus-like Martians.

Mars in the Eyepiece

I don't remember where or when I first looked at Mars through the eyepiece of a telescope. However, I'm sure I wasn't impressed. There's a good reason why. Mars is small! Mars has a diameter about 53% of Earth's and a surface area of 38%. The distance between Earth and Mars varies according the orbits of each. Because these orbits are elliptical, the distance between the two planets varies greatly. Mars Opposition occurs when the Earth catches up to Mars in their respective orbits and is placed in between the Sun and Mars. The Sun and Mars appear on opposite sides of the Earth. So, from our viewpoint, Mars rises in the east as the Sun sets in the west and remains visible all night long. Mars Opposition occurs about every 26 months.

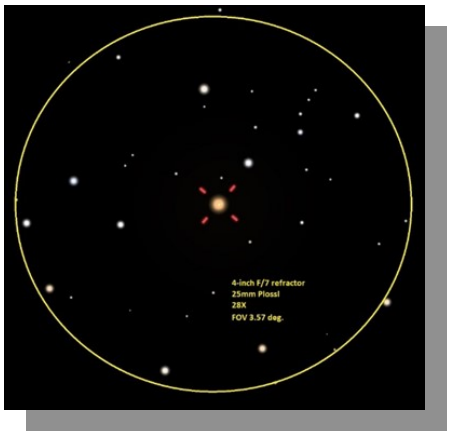

Fig. 1A

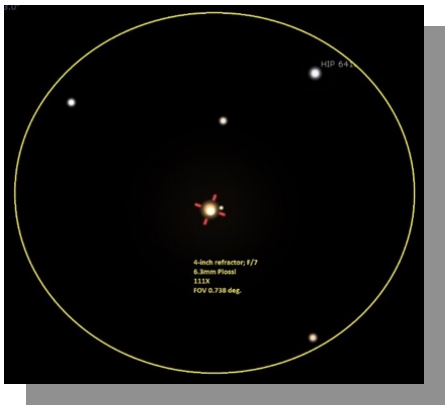

Fig. 1B

Stellarium simulation of Mars in eyepiece of 100mm refractor at F/7

Close Mars Oppositions occur every 15 to 17 years, when Earth passes between Mars and the Sun around the time of Mars' perihelion. For example, in 2003, the distance between Earth and Mars was less than 35 million miles—the closest the two planets had been in 60,000 years! Mars grew to an impressive 25 seconds of arc in apparent diameter and was at its brightest magnitude, -2.8! For comparison, during an average opposition year, Mars can be as far as 62 million miles from Earth.

During this year's opposition which occurred on October 13, Mars reached a maximum apparent size of 22.3 seconds of arc at a magnitude of -2.6.

After opposition, Mars will continue to recede from Earth's orbit and its size will appear smaller during future oppositions until 2027, when the cycle repeats.

Using the software program, ***Stellarium***, we can simulate how objects will appear in the eyepiece of a telescope. As an example, we will use a refractor with an aperture of 100 mm, and focal length of 700mm. Fig. 1A shows what Mars would look like in a 25mm eyepiece. Although one rule of thumb suggests that the maximum magnification a telescope can achieve is equal to 50 times it's aperture in inches, this relationship usually fails due to less than perfect seeing conditions. I prefer to use 25 - 30 times aperture as a more practical estimate. In this case 30 times 4-inches equals 120.

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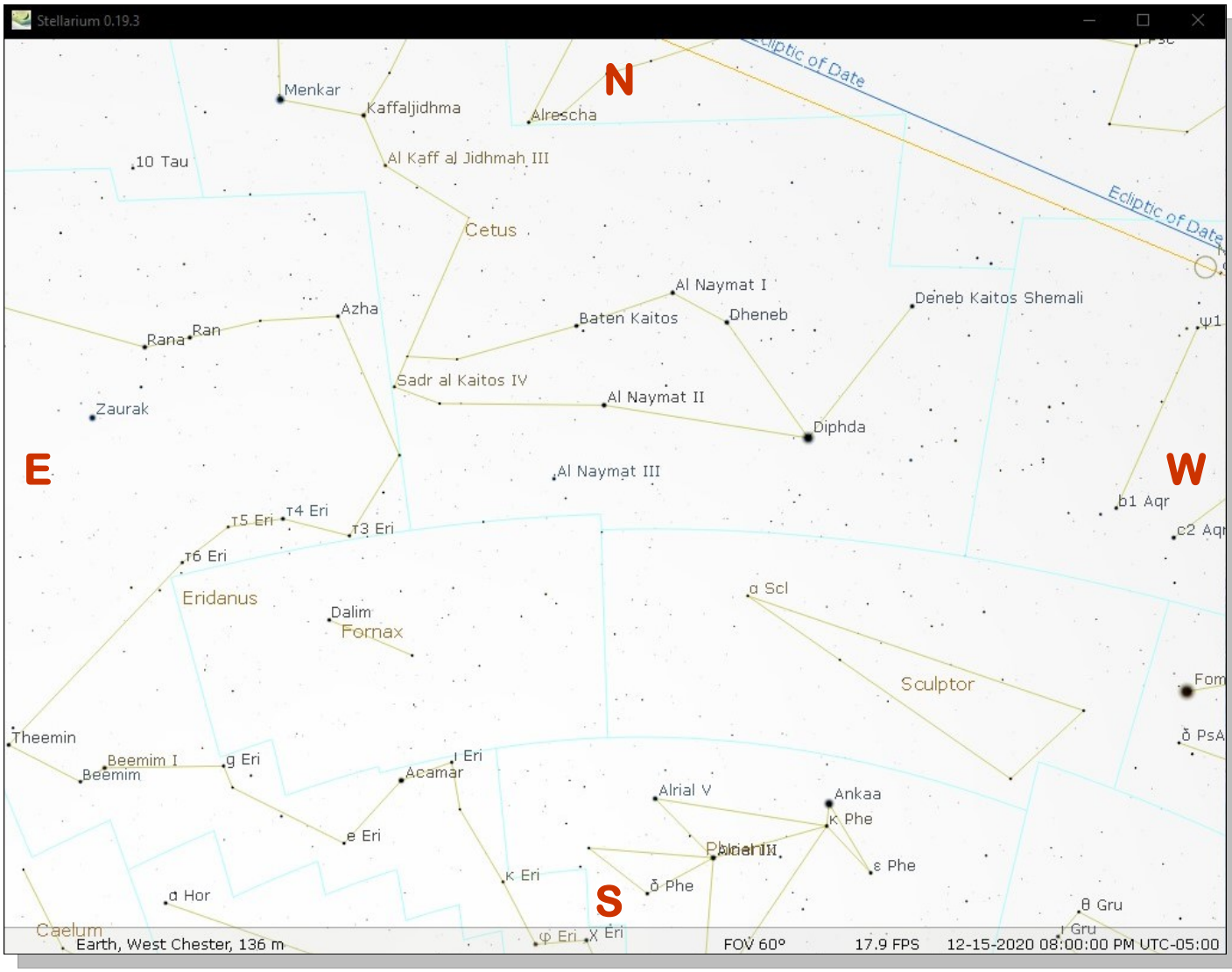
The Sky Over Chester County

December 15, 2020 at 8:00 p.m. ET

Note: This screen capture is taken from Stellarium, the free planetarium software available for download at www.stellarium.org.



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
12/01/2020	6:35 a.m. EST	7:05 a.m. EST	4:37 p.m. EST	5:07 p.m. EST	9h 32m 16s
12/15/2020	6:46 a.m. EST	7:17 a.m. EST	4:38 p.m. EST	5:08 p.m. EST	9h 21m 01s
12/31/2020	6:53 a.m. EST	7:24 a.m. EST	4:47 p.m. EST	5:17 p.m. EST	9h 23m 24s

Moon Phases					
Last Quarter	12/07/2020	7:36 p.m. EST	New Moon	12/14/2020	11:16 a.m. EST
First Quarter	12/21/2020	6:41 p.m. EST	Full Moon	12/29/2020	10:28 p.m. EST

December 2020 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

7	**Last Quarter Moon, 7:36 p.m.**
13	**The Geminid meteor shower peaks**
14	**New Moon and total solar eclipse visible in the southern hemisphere**
16/17	**The Moon passes close to Jupiter and Saturn**
21	**Winter solstice, 5:02 a.m.**
21	**First Quarter Moon and the Lunar X is visible at 11 p.m.**
21	**Jupiter and Saturn are separated by only 0.1° low in the southwest**
23	**The Lunar Straight Wall is visible**
23	**The Moon is near Mars**
29	**Full Moon, the Full Long Night Moon or the Moon before Yule, 10:28 p.m.**

The best sights this month: December 21st is a day of astronomical delights, like an early Christmas present! Jupiter and Saturn are only 0.1° apart low in the southwest as the sky darkens. This is their closest conjunction in 800 years! The 21st is also the day of the Winter solstice. But wait – there's more! At 11:00 p.m. the elusive Lunar X is visible! Earlier in the month the Geminid meteor shower peaks on December 13th and with no Moon to interfere this could be an amazing meteor shower.

Mercury: Mercury is not easily observed during December since it passes behind the Sun on the 20th.

Venus: Our sister planet rises about an hour and a half before the Sun and shines brightly in the pre-dawn sky at magnitude -3.9.

Mars: The red planet is high in the sky through December but is fading as we pull ahead in our race around the Sun. This is the last month for good telescopic observation, so take a look before Mars falls further behind the Earth.

Jupiter: As mentioned in the best sights of the month, Jupiter and Saturn are less than 0.1° apart on December 21st. From the 12th to the 29th they will be within 1° of each other. On the 21st the gas giants will be 14° above the horizon 45 minutes after sunset, so set up early to see this amazing sight in your telescope or binoculars. The last time these planets were this close was in the year 1226!

Saturn: Saturn continues to follow Jupiter across the sky during December.

Uranus and Neptune: Uranus and Neptune are best observed as soon as the sky is fully dark when they are still fairly high in the sky.

The Moon: Full Moon is on December 29th. This is the Full Cold Moon; or the Full Long Night Moon. It is also sometimes called the Moon before Yule. The term Long Night Moon is appropriate because the midwinter night is indeed long, and because the Moon is above the horizon for a long time. The midwinter full Moon has a high trajectory across the sky because it is opposite a low Sun. Native Canadians called this the Chief Moon or the Elder Moon.

A total solar eclipse occurs at the time of New Moon on December 14th, but it is only visible in the southern hemisphere, and travel in the club jet is restricted due to the pandemic.

Constellations: Ah, December skies! It's cold enough to be quite clear, but not the freezing, bone chilling cold of January and February. It seems odd to go outside after sunset and still see the Summer Triangle, but indeed there it is diving into the west. Look to the east and you will see the constellations that make it worth dressing warmly and spending some time outside during the cold December nights. Bright Capella in Auriga is high in the east to the upper left of the "V" of Taurus the Bull. Just behind Taurus is Orion the Hunter, the most easily recognized constellation of the winter months.

Messier/deep sky: There is so much to see in the December sky you won't be lacking targets if Santa brought you any new astronomy equipment! If it is not too cold, there is a long list of beautiful objects in easy reach of even a small telescope or any pair of binoculars. First look for the Andromeda galaxy high in the south, then head east to the three open clusters in Auriga. Use a low power eyepiece in your telescope and zoom in to the Pleiades, although they are better captured in binoculars. Then look nearly straight up and find the Double Cluster

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Capturing Mars (Cont'd)

(Continued from page 3)

Fig. 1B shows what Mars would look like using a 6.3mm eyepiece, giving a magnification of 111X. The field of view (FOV) is based on the design of the eyepiece, in this case a Plossl type. Notice the lack of field stars in Fig. 1B. This is due to the reduction in FOV which is inversely proportional to the magnification. So the FOV in Fig. 1B is 28/111 times the FOV of Fig. 1A, approx. 24.2%.

So, this exercise demonstrates just how small Mars appears, even at opposition. Traditionally, astronomers specializing in planetary observations preferred telescopes with long focal lengths. So, many older observatories had refractors with very long focal lengths. For example, the large refractor at The University of Chicago's, Yerkes Observatory has an objective lens 40 inches in diameter and a focal length of 62 feet. This yields a focal ratio of F/18. We can return to Stellarium and simulate how Mars would appear in this famous scope.

Fig. 2 shows the effect of long focal length on the apparent size of an object. Using a 25mm Plossl eyepiece yields a magnification of 731.5X, but the extremely small field of view of 0.0957 deg. During periods of excellent seeing, astronomers would use either Barlow lenses or eyepiece projection to compose even larger images of Mars and the other planets and take photographs using glass plates and later modern emulsion film. Later, with the advent of the PC and CCD cameras other options became available.

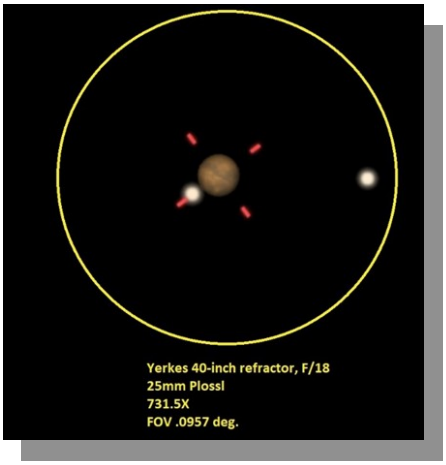

Fig. 2. Stellarium simulation of Mars in eyepiece of 40-inch Yerkes refractor at F/18

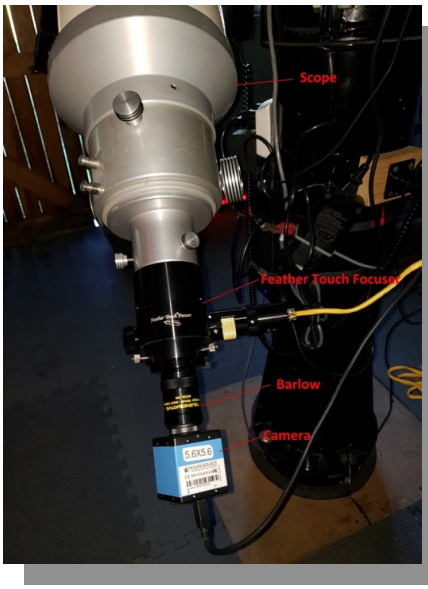

Fig. 3. Imaging Train

Imaging the Planets – How it's done

In recent years, the availability of modestly priced digital cameras, powerful image processing software and microprocessor-controlled telescope mounts has brought astrophotography within the grasp of the serious amateur astronomer. Depending on the intended target, galaxies nebulae, planetary objects like the Moon, planets, and asteroids, the aspiring astrophotographer would select his optical instrument and assemble an imaging train.

The system described here was configured for planetary imaging, and includes:

Scope

The Scope used for these observations is an APM, Apochromatic Refractor with an aperture of 180mm and focal length of 1620mm. The F/9 optics were designed by Thomas Bach, of the US. The lenses were ground, polished and coated then placed in an air spaced cell by Carl Zeiss Co. of Jenna, East Germany in the early 1990's. APM of Cologne, Germany assembled this scope along with 20 others of varying aperture and focal length.

Mount

A Paramount, ME II, German Equatorial Mount produced by Software Bisque of Golden CO carries the scope and imaging train. All functions such as tracking, guiding, and focusing are achieved through TheSkyX Professional Software.

Focuser

A Starlight Instruments Feather Touch Focuser with focus motor was used.

Imaging Camera

An Imaging Source DFK 21AU618 Color Camera was used to capture all the video frames of Mars. This camera is ideally suited to color astrophotography when very fast image sequences need to be captured. The camera uses IC Capture.AS, a comprehensive software package to capture lossless and uncompressed images sequences and write them to disk as AVI

Capturing Mars (Cont'd)

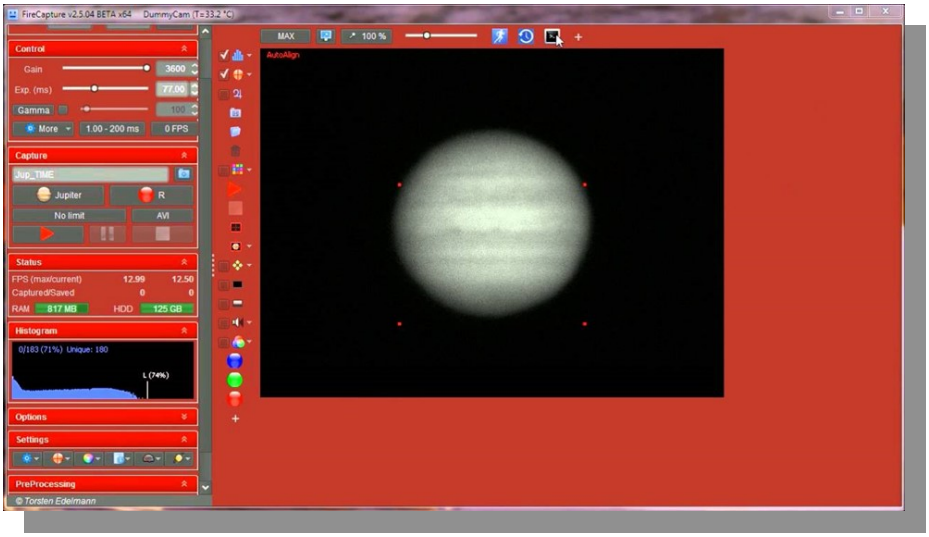

Fig. 4. Fire Capture – Main Screen

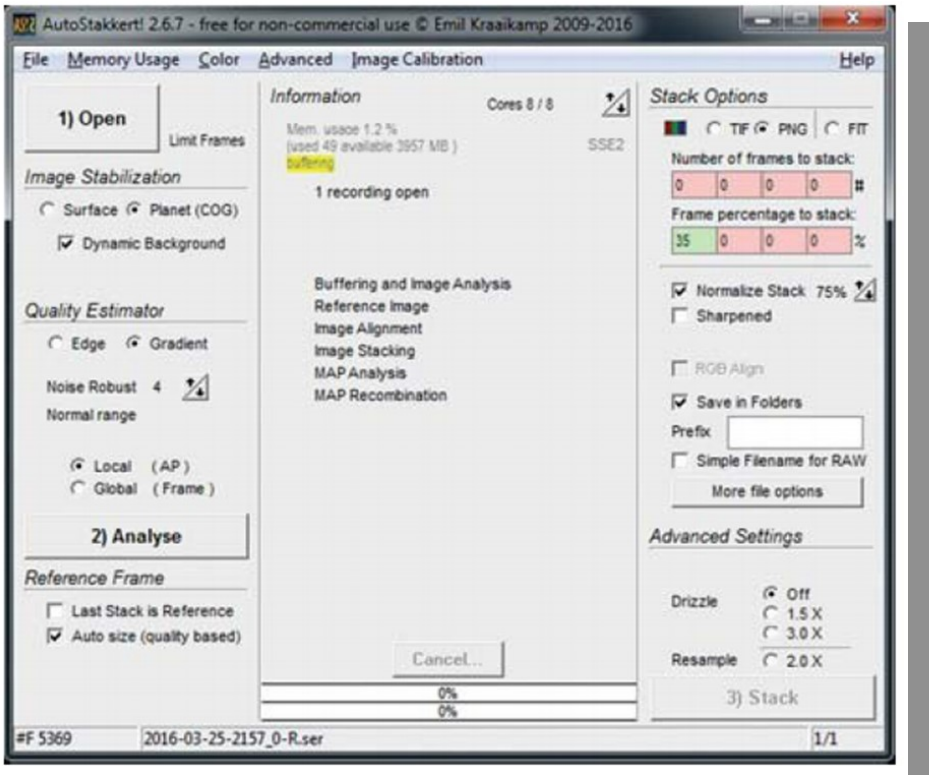

Fig. 5. AutoStakkert – Main Screen

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files. This camera utilizes the Sony ICX618AQA progressive scan CCD chip which has a resolution of 640 x 480 pixels and a frame rate of 60 fps. A Televue 2.5X Barlow was used to increase image size.

These components, generally described as the imaging train are shown in Fig. 3.

Software

Fire Capture is a software program which manages the acquisition of images by capturing all the digital video frames detected by a digital video camera. By taking short videos of the Moon or planets, you can create a composite image from the individual frames in the video. A twenty second AVI video, using a camera operating at 60 frames per second, can yield 1200 individual frames. That's a lot of images to process, but a PC can easily handle this by selecting the best frames, aligning them and stacking them into a composite image. Fire Capture has an easy to use GUI (graphical user interface), which allows the user to adjust all of the variables necessary for optimal image capture, such as frame rate, exposure, gamma, total capture time, total capture file size, etc. AVI files are saved to the HD where they are available for the next operation.

AutoStakkert - Image Stacking follows image capture and involves an evaluation of many thousands of video frames. I used AutoStakkert for this stage of the workflow. AutoStakkert reads the AVI file generated by Fire Capture, stacks the frames, and writes a single image file. That image file can then be further processed by programs like Registax6-Wavelets, to produce a much sharper picture.

Sharpening and Noise Reduction was accomplished by using **Registrax6-Wavelets**. Wavelets processing allows for very fine adjustment in image detail. Once you have a stacked an image, you have the option to further improve it (sharpening and noise reduction) by using the

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Capturing Mars (Cont'd)

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wavelets. Fig. 5A and 5B show an example of a stacked image of the Moon taken with a C11 and Nikon D7000 DSLR, using a 2.5X Barlow, a 3000 frame video was captured by Fire Capture. This was first loaded into AutoStakkert and then RegiStax6, using default options, and keeping 80% of the best frames for the stacking operation. The resulting image, Fig. 5A, is still quite blurry.

RegiStax6 wavelet-based sharpening was used to improve the picture. The video frames of the Moon, all contain distortions due to the atmosphere, noise in the optical train, etc. Much of the distortion has been minimized during the stacking process, but some of these effects are still visible, hence the blurry image. What we want is to recover as much of the original "signal" as possible minus these distortions. Wavelets help us to "decompose" the signal for different scales. Then it is up to the user to adjust a specific scale, so the "true" signal is exposed. This operation is more of an art than a science. Using the wavelets engine in Registax6 is more of a trial and error exercise. Results depend upon one's opinion of what looks "good" as shown in Fig. 5B. This is all very subjective!

All software programs used in this project are free for noncommercial users.

My First Attempt at Planetary Imaging

Planetary imaging does not require image calibration used in photographing deep sky objects like galaxies, nebulae, or star clusters. Video frames were captured without taking dark, flat, or bias frames.

Fig. 5A Stacked AVI of the Moon prior to wavelet sharpening

Fig. 5B. Stacked AVI of the Moon after wavelet sharpening

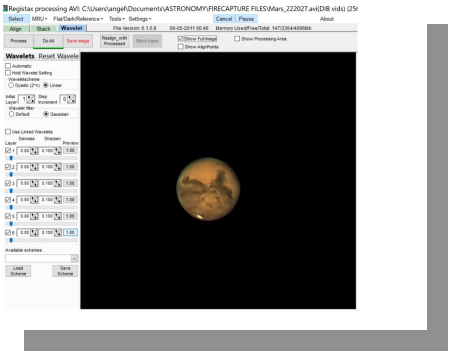

Fig. 6 Registax-6 Wavelets Screen (prior to sharpening)

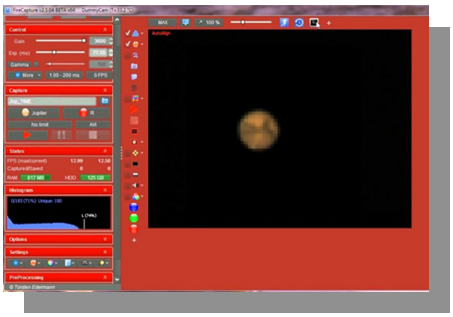

Fig. 7. Screen Shot of Fire Capture during Video Recording

Finding Mars was easy. I slewed to a bright star near Mars and used my Bahtinov mask to get a baseline for the focuser. I then used TheSkyX focusing routine to get minimum FWHM.

With Mars centered in the FOV in Fire Capture, I began capturing frames. I started with short (30 second) captures. This was my first attempt at using Fire Capture and I wanted to try several recording times.

With a maximum frame rate of 60fps, the Imaging Source camera was capturing approximately 1800 frames in 30 seconds. I stopped recording after three or four 30-second files were recorded. I played back these initial recordings and adjusted the program settings for better sensitivity. I also adjusted the image frame by cropping out most of the black sky surrounding Mars. Framing a planet maximizes planetary data and minimizes file size.

In total, I spent about three hours setting up and tweaking Fire Capture and perhaps one hour of actual recording, including over 20 files which averaged 3-minutes in length. Fig. 7 is a screen shot of Fire Capture as I attempt to record a Mars video.

Later, I was able to sort through the recordings and load the files into AutoStakkert for evaluation. This program allows you to open multiple AVI files. It then examines the frames in each file and selects the best quality frames based on the users priority. For example, you can have AutoStakkert select the best 50 or 100 or 1000 frames or by percentage, 10, 30, or 50 percent of frames. After some practice, it's easy to select the best candidate frames for stacking. Once the frames were aligned

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Observing (Cont'd)

(Continued from page 5)

in Perseus. And of course, don't miss M42, the Orion Nebula, which is a truly awesome telescopic object.

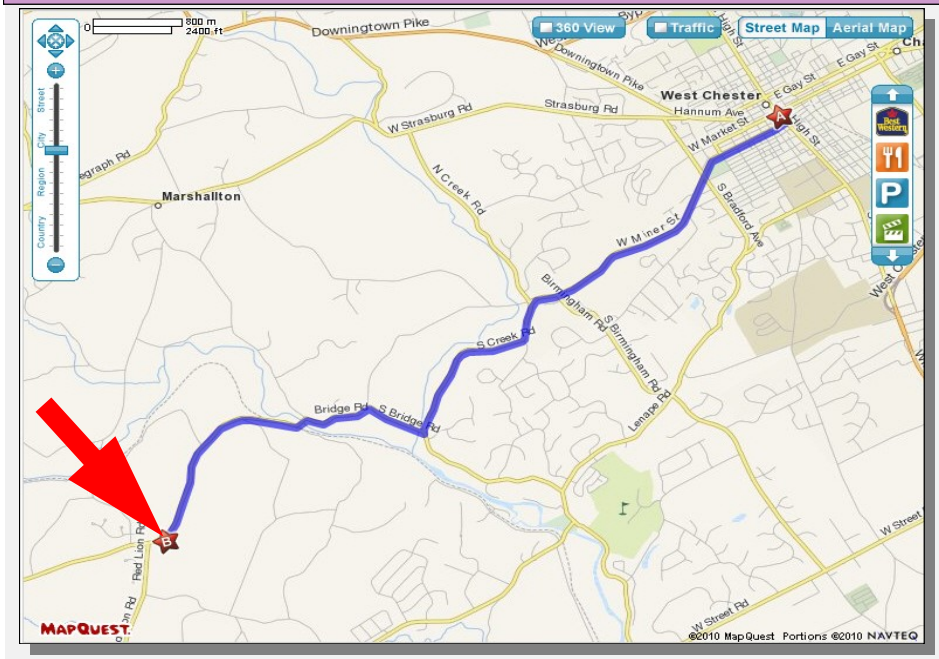
Comets: There are no bright comets visible during December.

Meteor showers: The Geminid meteor shower, one of the most reliable meteor showers of the year, peaks on the night of December 13/14. The best viewing is after 11:00 p.m. on the 13th through the early morning hours of the 14th. Over 100 "shooting stars" per hour are possible from this shower. The Moon is absent from the sky so we should have a great show!

Classic La Para

by Nicholas La Para

CCAS Directions



Brandywine Red Clay Alliance
1760 Unionville Wawaset Rd
West Chester, PA 19382
(610) 793-1090
http://brandywinewatershed.org/

BRC was founded in 1945 and is committed to promoting and protecting the natural resources of the Brandywine Valley through educational programs and demonstrations for all ages.

Brandywine Red Clay Alliance

The monthly observing sessions (held February through November) are held at the Myrick Conservation Center of the Brandywine Red Clay Alliance.

To get to the Myrick Conservation Center from West Chester, go south on High Street in West Chester past the Courthouse. At the next traffic light, turn right on Miner Street, which is also PA Rt. 842. Follow Rt. 842 for about 6 miles. To get to the observing site at the BRC property, turn left off Route 842 into the parking lot by the office: look for the signs to the office along Route 842. From that parking lot, go left through the gate and drive up the farm lane about 800 feet to the top of the hill. The observing area is on the right.

If you arrive after dark, *please turn off your headlights and just use parking lights* as you come up the hill (so you don't ruin other observers' night vision).

Looking Up: The Geminid Meteor Shower

by Don Knabb, CCAS Treasurer & Observing Chair

Image credit: NASA/MSFC/Danielle Moser, NASA's Meteoroid Environment Office

Watching meteors is a great cold weather astronomy activity. You can set up a lounge chair, dress warmly and lay back with a blanket to keep you warm. You do not need to set up a telescope or handle cold eyepieces. The best winter meteor shower, and right up there with the summer Perseid meteor shower, is the Geminids.

This year the shower peaks at 8 p.m. on December 13th. For the best show, wait until at least 11:00 p.m. for the shower's radiant to get reasonably high in the sky. And this year the Moon will be completely absent from the sky so we have the chance for a great show. Normally the best viewing is around 2 a.m. but the shower will be active well before then.

The Geminids, which peak during mid-December each year, are considered to be one of the best and most reliable annual meteor showers. The Geminids did not start out that way. The Geminids first began appearing in the mid-1800s. However, the first showers were not noteworthy with only 10 - 20 meteors seen per hour. Since that time, the Geminids have grown to become one of the major showers of the year. During its peak, 120 Geminid meteors can be seen per hour under perfect conditions. The Geminids are bright and fast meteors and tend to be yellow in color.

To view the Geminids, find an area without lights and away from trees or anything that blocks your view of the sky. Come prepared for winter temperatures with a sleeping bag, blanket and a lounge chair. Lie

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Looking Up (Cont'd)

(Continued from page 10)

back with your feet facing south and look up, taking in as much of the sky as possible. After about 30 minutes in the dark, your eyes will adapt and you will begin to see meteors. Be patient -- the show will last until dawn, so you have plenty of time to catch a "shooting star".

Meteors come from leftover comet particles and bits from asteroids. When these objects come around the sun, they leave a dusty trail behind them. Every year the Earth passes through these debris trails, which allows the bits to collide with our atmosphere where they disintegrate to create fiery and colorful streaks in the sky.

The Geminids originate from an asteroid: 3200 Phaethon. Asteroid 3200 Phaethon takes 1.4 years to orbit the Sun. It is possible that Phaethon is a "dead comet" or a new kind of object being discussed by astronomers called a "rock comet."

3200 Phaethon was discovered on Oct., 11 1983 by the Infrared Astronomical Satellite. Due to its close approach to the sun, Phaethon is named after the character of Greek myth who drove the sun-god Helios' chariot. Phaethon is a small asteroid—its diameter measures only 3.17 miles across. It was astronomer Fred Whipple who realized that Phaethon is the source for the Geminid meteors.

Their radiant - the point in the sky from which the Geminids appear to come from - is the constellation Gemini, the "Twins." The constellation of Gemini is also where we get the name for the shower: Geminids. Although the meteors will appear to stream away from Gemini, they can appear all across the sky. For best results, you should look slightly away from Gemini so that you can see meteors with longer "tails" as they streak by; staring directly at Gemini will just show you meteors that don't travel very far.

On the previous page is a "fish eye" composite image from NASA showing over 100 meteors from the 2014 Geminid shower.

So bundle up and enjoy this wonderful nighttime show!

Information credits:

- https://en.wikipedia.org/wiki/Geminids
- https://www.space.com/34921-geminid-meteor-shower-guide.html
- https://solarsystem.nasa.gov/asteroids-comets-and-meteors/meteors-and-meteorites/geminids/in-depth/

Capturing Mars (Cont'd)

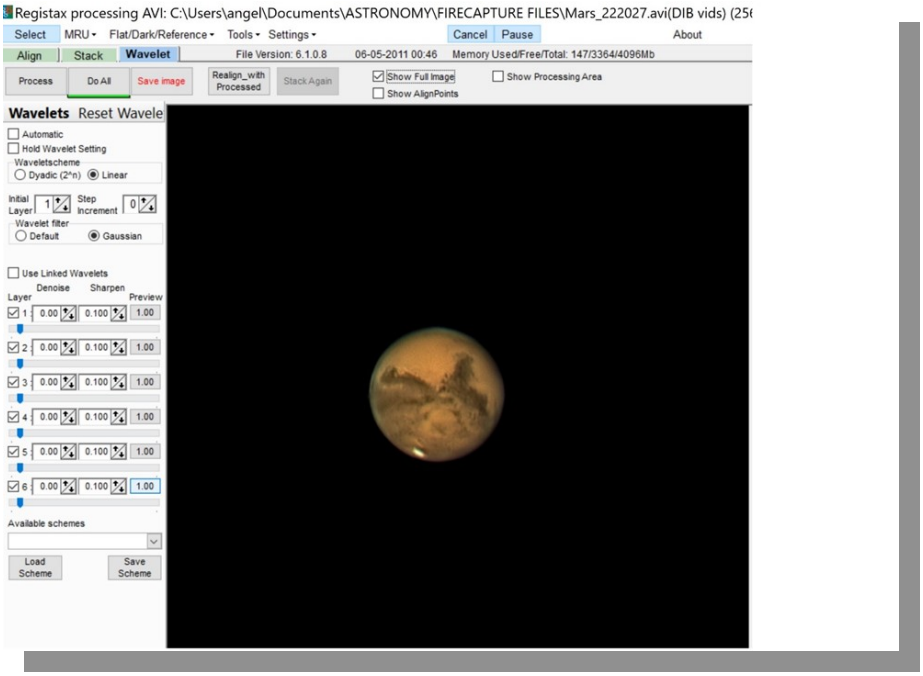


Fig. 8. Mars following Wavelet Transform in Registax6

(Continued from page 8)

and stacked, I instructed AutoStakkert to send the resulting file to Registax6 for wavelet sharpening.

The unsharpened image is shown in Fig. 6. As explained previously, by manipulating the individual wavelet filters it is possible to sharpen the stacked composite image developed in AutoStakkert.

The results of wavelet sharpening are shown in Figs. 8 and 9. Further attempts at sharpening beyond what was achieved here did not bear fruit. In fact, when I attempted to push the wavelet processing the only result was

(Continued on page 13)

NASA Night Sky Notes: Visitors to Both Jupiter and Saturn

by David Prosper

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach.

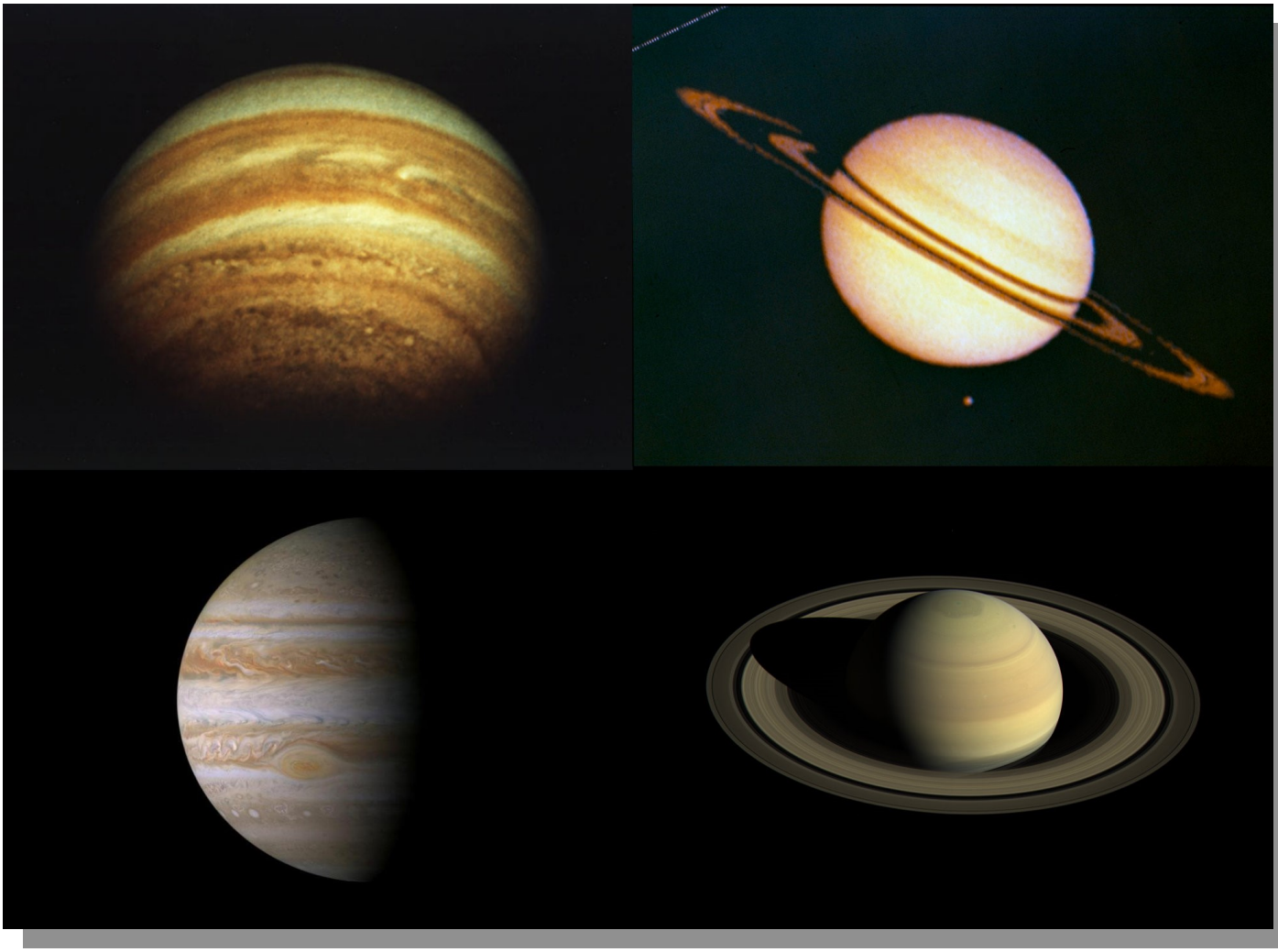
Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

Have you observed Jupiter and Saturn moving closer to each other over the past few months? On December 21, the two worlds will be at their closest, around 1/5 of a full Moon apart! While the two gas giants may *appear* close, in reality they are hundreds of millions of miles apart. Despite this vast distance, a select few missions have visited

both worlds by using a gravity assist from giant Jupiter to slingshot them towards Saturn, saving time and fuel.

Pioneer 11 was the first mission to visit both worlds! Launched in 1973, the probe flew past Jupiter in late 1974, passing just 26,400 miles above its stormy clouds. In 1979, it became the first spacecraft to encounter Saturn. Pioneer 11 took the first up-close photos of Saturn and its satellites, and made many exciting discoveries, including the detections of its magnetic field and a faint "F" ring, before departing Saturn and eventually, the solar system.

(Continued on page 13)



The difference in technology between generations of space probes can be stunning! The top two photos of Jupiter and Saturn were taken by Pioneer 11 in 1974 (Jupiter) and 1979 (Saturn); the bottom two were taken by Cassini in 2000 (Jupiter) and 2016 (Saturn). What kinds of photos await us from future generations of deep space explorers?

Night Sky Notes (Cont'd)

(Continued from page 12)

The Voyager missions quickly followed up, taking a "Grand Tour" of the four largest and most distant planets in our solar system. Both probes were launched within two weeks of each other in 1977. Voyager 1 flew past Jupiter in March 1979, discovering Jupiter's faint ring and two new moons, along with active volcanoes on Io's surface! The probe then flew past Saturn in November 1980, discovering five new moons, a new "G" ring, mysterious ring "spokes," and "shepherd moons" shaping the rings. After a brief encounter with Titan revealed evidence of complex organic chemistry and liquid on the moon's frigid surface, Voyager 1 was flung out of the plane of the solar system. Following close behind, Voyager 2 took detailed photos of Jupiter's moons and cloud tops in July 1979. Flying past Saturn in August 1981, Voyager 2 measured the thickness of Saturn's rings and took detailed photos of many of its moons. This second explorer then captured images of Uranus and Neptune before leaving our solar system.

Cassini-Huygens was the last mission to visit both worlds. Launched in 1997, the mission flew past Jupiter in late 2000 and took incredibly detailed photos of its stormy atmosphere and faint rings. Cassini entered into Saturn's orbit on July 1, 2004. The Huygens probe separated from Cassini, landing on Titan to become the first probe in the outer solar system. Cassini discovered geysers on Enceladus, fine details in Saturn's rings, many more moons and "moonlets," the changing oceans of Titan, and seasonal changes on Saturn itself. After revolutionizing our understanding of the Saturnian system, Cassini's mission ended with a fiery plunge into its atmosphere on September 15, 2017.

What's next for the exploration of the outer worlds of our solar system? While Juno is currently in orbit around Jupiter, there are more missions in development to study the moons of Jupiter and Saturn. Discover more about future NASA missions to the outer worlds of our solar system at nasa.gov.

Capturing Mars (Cont'd)

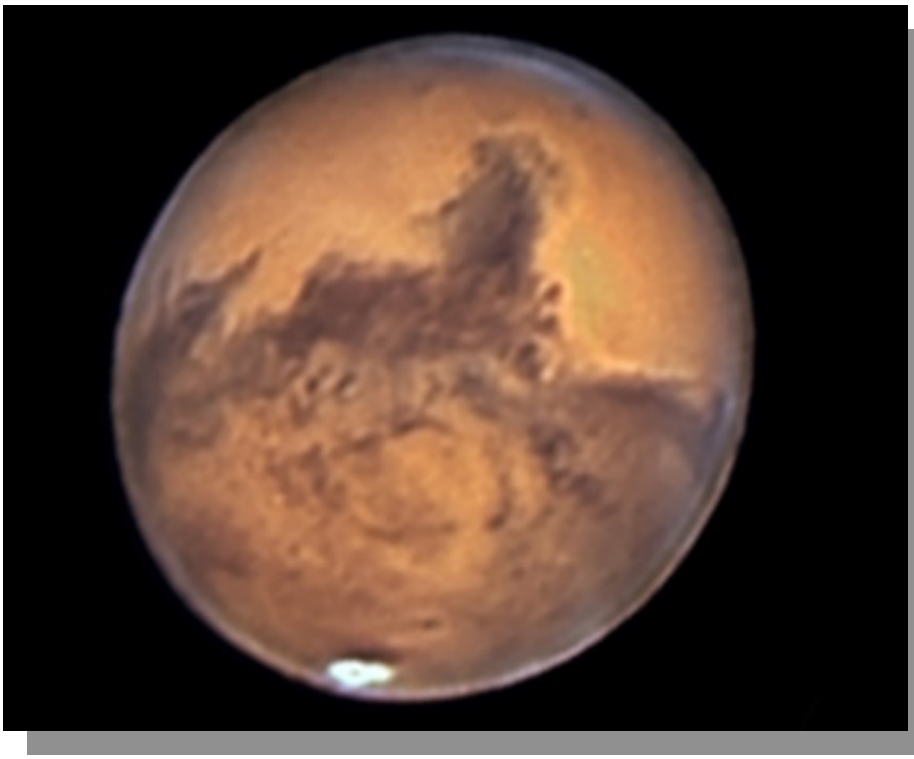


Fig. 9. Mars at Opposition 10-13-2020 01:07 EDT

(Continued from page 11)

additional noise.

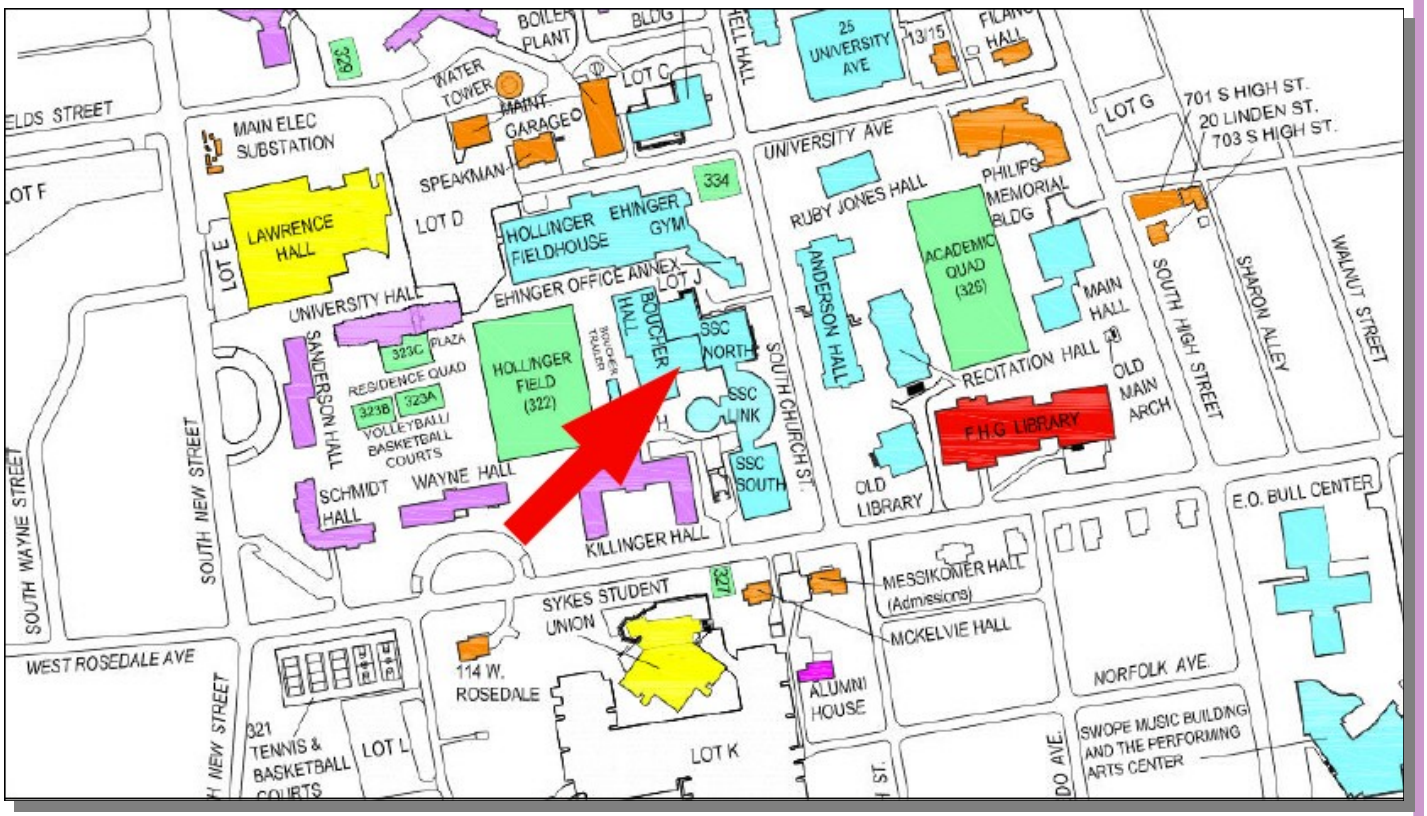
I'm sure that with additional practice my planetary images will improve. Nothing can replace more and better data which results in a higher signal to noise ratio. In the future, I will try longer captures, which will result in large files, and hopefully a higher percentage of high quality frames. Turbulence in the upper atmosphere did contribute to image distortion. Better seeing conditions would also improve results. I can only wait and hope.

All things considered; I am very satisfied with my first attempt at imaging Mars.

CCAS Directions

West Chester University Campus

The monthly meetings (September through May) are held in Room 112 in Merion Science Center (formerly the Boucher Building), attached to the Schmucker Science Center. The Schmucker Science Center is located at the corner of S. Church St & W. Rosedale Ave. Parking is generally available across Rosedale in the Sykes Student Union parking lot (Lot K).



Upcoming Meetings (Cont'd)

(Continued from page 2)

Insight, Perseverance, and Juno" at our meeting on April 13, 2020.

Please note that inclement weather or changes in speakers' schedules may affect the program. In the event there is a change, CCAS members will be notified via e-mail with as much advance notice as possible.

As for future meetings, we are looking for presenters for our 2021-2022 season and beyond. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

CCAS Membership Information and Society Financials

Treasurer's Report

by Don Knabb

Nov. 2020 Financial Summary

Beginning Balance	$878
Deposits	$298
Disbursements	-$78
Ending Balance	$1,098

New Member Welcome!

Welcome new CCAS members Janis Romer from Pottstown, PA, Laura Watson & Gary Metts from Coatesville, PA, Tom DeAngelo from Chester Springs, PA, and Joe Orso from Glen Mills, PA. We're glad you decided to join us under the stars! Clear skies to you!

Membership Renewals

You can renew your CCAS membership by writing a check payable to "Chester County Astronomical Society" and sending it to our Treasurer:

Don Knabb
988 Meadowview Lane
West Chester PA 19382

The current dues amounts are listed in the *CCAS Information Directory*. Consult the table of contents for the directory's page number in this month's edition of the newsletter.

CCAS Information Directory

Join the Fight for Dark Skies!

You can help fight light pollution, conserve energy, and save the night sky for everyone to use and enjoy. Join the nonprofit International Dark-Sky Association (IDA) today. Individual memberships start at $30.00 for one year. Send to:

International Dark-Sky Association
3225 North First Avenue
Tucson, AZ 85719

Phone: **520-293-3198**
Fax: **520-293-3192**
E-mail: **ida@darksky.org**

For more information, including links to helpful information sheets, visit the IDA web site at:

http://www.darksky.org

Dark-Sky Website for PA

PENNSYLVANIA OUTDOOR LIGHTING COUNCIL

The Pennsylvania Outdoor Lighting Council has lots of good information on safe, efficient outdoor security lights at their web site:

http://www.POLCouncil.org

Find out about Lyme Disease!

Anyone who spends much time outdoors, whether you're stargazing, or gardening, or whatever, needs to know about Lyme Disease and how to prevent it. You can learn about it at:

http://www.LymePA.org

Take the time to learn about this health threat and how to protect yourself and your family. It is truly "time well spent"!

Good Outdoor Lighting Websites

One of the biggest problems we face in trying to reduce light pollution from poorly designed light fixtures is easy access to good ones. When you convince someone, a neighbor or even yourself, to replace bad fixtures, where do you go for good lighting fixtures? Check out these sites and pass this information on to others. Help reclaim the stars! And save energy at the same time!

Starry Night Lights

Light pollution from poor quality outdoor lighting wastes billions of dollars and vast quantities of valuable natural resources annually. It also robs us of our heritage of star-filled skies. Starry Night Lights is committed to fighting light pollution. The company offers the widest selection of ordinance compliant, night sky friendly and neighbor friendly outdoor lighting for your home or business. Starry Night Lights is located in Park City, Utah.

Phone: **877-604-7377**
Fax: **877-313-2889**

http://www.starrynightlights.com

★ ★ ★ ★ ★

LIGHTHOUSE OUTDOOR LIGHTING

Lighthouse Outdoor Lighting is a dedicated lifetime corporate member of the International Dark-Sky Association. Lighthouse's products are designed to reduce or eliminate the negative effects outdoor lighting can have while still providing the light you need at night.

Phone: **484-291-1084**

https://www.lighthouse-lights.com/landscape-lighting-design/pa-west-chester/

Local Astronomy-Related Stores

Listing retail sites in this newsletter does not imply endorsement of any kind by our organization. This information is provided only as a service to our members and the general public.

Skies UNLIMITED

Skies Unlimited is a retailer of telescopes, binoculars, eyepieces and telescope accessories from Meade, Celestron, Televue, Orion, Stellarvue, Takahashi, Vixen, Losmandy and more.

Skies Unlimited
Suburbia Shopping Center
52 Glocker Way
Pottstown, PA 19465

Phone: **610-327-3500** or **888-947-2673**
Fax: **610-327-3553**

http://www.skiesunlimited.net

★ ★ ★ ★ ★

Spectrum Scientifics
Quality Science Products for All Ages

Located in Manayunk, Spectrum Scientifics educates and entertains customers with an array of telescopes, microscopes, binoculars, science toys, magnets, labware, scales, science instruments, chemistry sets, and much more.

4403 Main Street
Philadelphia, PA 19127

Phone: **215-667-8309**
Fax: **215-965-1524**

Hours:
Tuesday thru Saturday: 10AM to 6PM
Sunday and Monday: 11AM to 5PM

http://www.spectrum-scientifics.com

CCAS Information Directory

CCAS Lending Telescopes

Contact Don Knabb to make arrangements to borrow one of the Society's lending telescopes. CCAS members can borrow a lending telescope for a month at a time; longer if no one else wants to borrow it after you. Don's phone number is 610-436-5702.

CCAS Lending Library

Contact our Librarian, Barb Knabb, to make arrangements to borrow one of the books in the CCAS lending library. Copies of the catalog are available at CCAS meetings, and on the CCAS website. Barb's phone number is 610-436-5702.

Contributing to *Observations*

Contributions of articles relating to astronomy and space exploration are always welcome. If you have a computer, and an Internet connection, you can attach the file to an e-mail message and send it to: **newsletter@ccas.us**

Or mail the contribution, typed or handwritten, to:

Dr. John C. Hepler
21103 Striper Run
Rock Hall, MD 21661

CCAS Newsletters via E-mail

You can receive the monthly newsletter (in full color!) via e-mail. All you need is a PC or Mac with an Internet e-mail connection. To get more information about how this works, send an e-mail request to Dr. John Hepler, the newsletter editor, at: **newsletter@ccas.us**.

CCAS Website

Dr. John Hepler is the Society's Webmaster. You can check out our Website at:

http://www.ccas.us

Dr. Hepler welcomes any additions to the site by Society members. The contributions can be of any astronomy subject or object, or can be related to space exploration. The only requirement is that it is your own work—no copyrighted material! Give your contributions to Dr. Hepler at (410) 639-4329 or e-mail to webmaster@ccas.us

CCAS Purpose

The Chester County Astronomical Society was formed in September 1993, with the cooperation of West Chester University, as a non-profit organization dedicated to the education and enjoyment of astronomy for the general public. The Society holds meetings (with speakers) and observing sessions once a month. Anyone who is interested in astronomy or would like to learn about astronomy is welcome to attend meetings and become a member of the Society. The Society also provides telescopes and expertise for "nights out" for school, scout, and other civic groups.

CCAS Executive Committee

For further information on membership or society activities you may call:

President:	Dave Hockenberry 610-558-4248
Vice President:	Pete Kellerman 610-873-0162
ALCor, Observing, & Treasurer:	Don Knabb 610-436-5702
Secretary:	Beatrice Mazziotta 610-933-2128
Librarian:	Barb Knabb 610-436-5702
Program:	Bruce Ruggeri 484-883-5092
Education:	Don Knabb 610-436-5702 Dennis O'Leary 610-701-8042
Webmaster & Newsletter:	John Hepler 410-639-4329
Public Relations:	Ann Miller 610-558-4248

CCAS Membership Information

The present membership rates are as follows:

REGULAR MEMBER……$25/year
SENIOR MEMBER…….$10/year
STUDENT MEMBER……..$ 5/year
JUNIOR MEMBER……..$ 5/year
FAMILY MEMBER…….$35/year

Membership Renewals

Check the Membership Renewals on the front of each issue of *Observations* to see if it is time to renew. If you need to renew, you can mail your check, made out to "Chester County Astronomical Society," to:

Don Knabb
988 Meadowview Lane
West Chester PA 19382-2178

Phone: **610-436-5702**
e-mail: **treasurer@ccas.us**

*Sky & Tel*escope Magazine

The club membership subscription cost for *Sky and Telescope* magazine has increased to **$43.95**. This is still a good saving from the regular rate of **$54.95**.

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just go to the Sky and Telescope website and select "Magazine", then under the FAQs you can subscribe at the club rate.

https://skyandtelescope.org/subscribe/

If you have **any** questions call Don Knabb at 610-436-5702.

Astronomy Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **$34.00** which is much less than the individual subscription price of **$42.95** (or $60.00 for two years).

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just call customer service at 877-246-4835 and request the club rate for your new subscription or renewal.