Celebrating Sixty Years of the Warren Astronomical Society

The W.A.S.P.

Vol. 53, no. 4

April 2021

The Warren Astronomical Society Paper

Nova Cassiopeiae 2021

Photo: Doug Bock

Discovered by Yuji Nakamura on March 18, 2021, Nova Cassiopeiae 2021 is the topic of the American Association of Variable Star Observers (AAVSO) with Alert Notice 735 on March 19.

Fun fact: This nova is about six degrees from Tycho's supernova of 1572.

The WASP

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P.O. Box 1505
Warren, Michigan 48090-1505

Dale Thieme, Editor

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The Warren Astronomical Society, Inc., is a local, non-profit organization of amateur astronomers. The Society holds meetings on the first Monday and third Thursday of each month, starting at 7:30 p.m.

First Monday meeting:
Cranbrook: Institute of Science
1221 North Woodward Ave
Bloomfield Hills, Michigan

Third Thursday meeting:
Macomb Community College
South campus, Bldg. J, Room J221
14600 Twelve Mile Rd.
Warren, Michigan

Membership and Annual Dues

Student	Individual	Senior Citizen	for families
$17.00	$30.00	$22.00	add $7.00

Astronomical League (optional)$7.50
Send membership applications and dues to the treasurer:
c/o Warren Astronomical Society, Inc.
P.O. Box 1505
Warren, Michigan 48090-1505

Pay at the meetings

Also via PayPal (send funds to treasurer@warrenastro.org

Among the many benefits of membership are
Loaner telescopes (with deposit). See 2nd VP.
Free copy of each WASP newsletter.
Free use of Stargate Observatory.
Special interest subgroups. See chairpersons.

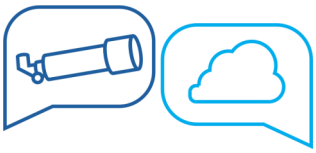
The Warren Astronomical Society Paper (WASP) is the official monthly publication of the Society.
Articles for inclusion in the WASP are strongly encouraged and should be submitted to the editor on or before the end of each month. Any format of submission is accepted. Materials can either be transmitted in person, via US Mail, or by email (publications@warrenastro.org)

Disclaimer: The articles presented herein represent the opinion of their authors and are not necessarily the opinion of the Warren Astronomical Society or this editor. The WASP reserves the right to edit or deny publication of any submission.

Stargate Observatory is owned and operated by the Society. Located on the grounds of Camp Rotary on 29 Mile Road, 1.8 miles east of Romeo Plank Road, Stargate features an 8-inch refractor telescope under a steel dome. The observatory is open according to the open house schedule published by the 2nd VP.

Snack Volunteer Schedule

The Snack Volunteer program is suspended for the duration. When it resumes, volunteers already on the list will be notified by email.



Discussion Group Meeting

Come [illegible]tronomy, space news,

CANCELLED UNTIL FURTHER NOTICE

In This Issue:

President's Field of View

It was still deep twilight, with a sky the color of slightly faded denim. A bank of ragged dove-gray clouds curled around two-thirds of the sky, yet a clear bay remained around the face of Taurus. That night the Bull had two red eyes, almost identical in color and brightness. They didn't quite fit in the field of view of my Skymaster binoculars, so after comparing the small disc of Mars with the fiery point of Aldebaran, I put the binoculars down and just admired the sight. Not rivals, as when Mars makes a pairing with Antares, but twins.

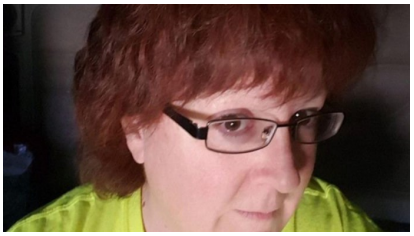
Keep looking up. It's the small moments of beauty that sustain us.

-Diane Hall
President

The Pointe aux Barques Lighthouse with Aurora. Photo by Adrian Bradley

In Memoriam

Penny Wayne



Penny Wayne, member of the W.A.S., passed away on March 11. Penny encountered us almost a decade ago on one of those second-Monday meetings in September when our Cranbrook meeting falls on the same day the Michigan Mineralogical Society convenes there at the museum. She decided we were a good lot and kept on attending meetings, often enjoying the annual MMS Gem and Fossil show at Macomb Community College in the company of fellow W.A.S. members.

First Vice President Dale Partin remembers, "She was actually more into gems than stars, but both had a 'glitter' that caught her eye." In recent years her work schedule as a truck driver interfered with meetings; Dale adds, "She was on the road pretty much every day of the week except Sunday evening and Monday. She actually lived in her truck when she was on the road… I think she arranged her schedule so she could attend our meetings at Cranbrook." She also frequently called her friends in the club to let us know about interesting moonrises and other astronomical happenings she saw out the windows of her truck. "Our meetings were one of the highlights of her life, or so it seemed," says Dale, and I agree with that. She was happy to share her knowledge on agates and the ways of American Robins and the best hidden diners along trucking routes in turn. I saved many a voicemail because she was just so *enthusiastic* about a dramatic glimpse of the moon, or the first glint of spring green in a stretch of dull parking lot grass.

Life on the road was hard and its appeal had waned for her in recent years, and then Penny's health declined during the second half of 2020, forcing a move out of state to be closer to family. The last time I spoke with her, she noted that she missed the sound of Michigan's native birds; the ones in Texas weren't as appealing. She remained a member of the club until the end.

"Perhaps now she is glittering in a better place," Dale concludes. As for me, I'll be thinking of her when the moon rises over the open road, or when the Robins enliven a short burst of spring with their song.

-Diane Hall

Letters

Photo and question.

The photo of the full moon with reflection was taken out my kitchen window.

I have a group question also. Looking at Adrian Bradley's beautiful photo, I see that he and many others drive about five hours to the north for hopefully clear skies for photography or observation. Does this mean that the Dark Sky Preserve at Lake Hudson State Rec. Area (about two hours away) and the International Dark Sky Park at Dr. T. K. Lawless Park (about three hours away) are less worthy of visiting? I would appreciate any and all observations that our readers may have.

Thank you.
Ray Bosshard

This email was forwarded to some of our astrophotographers and we got the following responses. If you want to weigh in on the question, send your response to publications@warrenastro.org and we'll print the responses in the next issue—Ed.

Moon Child

Image by Ray Bosshard
Date taken: 2/26/21

Responses to Photo and Question

While those two dark sky preserves Ray mentioned are still pretty good spots for observation, they suffer from the growing sprawl of more businesses and residences being built in the rural areas within 5-10 miles from there. As a result, astrophotographers must use a filter to block the light from those towns that creeps into our long exposures and washes out the fainter light from nebulae and galaxies.

In the thumb and further north, no such light pollution issue exists. When you have the ability to observe and image from locations out there, you can pull in light from deep space objects a lot easier. You can even see more stars in constellations naked eye, WITH a full moon in the sky.

Travel is not always affordable or desirable for everyone, which is why a lot more classic astrophotographers build a home observatory and take a lot of frames of an object to process in order to get the detail and results they want.

But I love to travel, avoid a big crowd, and see the endless horizon of the Great Lakes. Hence I travel to those darker areas.

-Adrian Bradley

Next:

Astronomy and astrophotography can be enjoyed anywhere, even in the city. You don't need to travel to observe and photograph the night sky, but doing so can help you to enjoy and appreciate it more and make processing your photos easier. Dark skies can help you observe and photograph fainter targets that are difficult to see or discern from bright locations near city lights. The darker the skies, the more you'll see. Just standing in a dark sky park and looking at the skies can be amazing, especially if you are from the city. The first time you gaze on the Milky Way under truly dark skies with the naked eye will be amazing.

I do most of my astronomy and astrophotography from my back yard. My setup weighs between 150 and 200 pounds depending on what telescope and imaging equipment I currently am running. While I don't have an observatory, I do keep my equipment set up and ready to go under a tarp. I can be up and imaging in less than 15 minutes and program my equipment to take images all night. My setup is large, heavy and takes a lot of time to move and set up, so I don't do it often, but have a couple of times. I do have a small, light setup that I can take on the road, however. I live in the thumb region of

Michigan in an area with Bortle 5 skies. The Bortle scale is a way to classify how much light pollution that an area has. Bortle 1 has the darkest of skies and Bortle 9 is inner city lights. There are no Bortle 1 regions in the lower peninsula of Michigan, but quite a few Bortle 1 sites in the upper peninsula. The two parks you mentioned are have Bortle 4 skies and there are no Bortle 3 locations in southern Michigan and you will have to drive north of I-69 to get to darker skies. Up north, there are large regions with dark skies with Bortle 3 skies and some areas of Bortle 2, which give excellent viewing. For astrophotography, the darker the sky, the less light pollution in your image and the easier it will be to post-process your images. There are tools and techniques to remove light pollution from an image, but it can be difficult to discern what is actually light pollution and what is faint signal - sometimes you throw away good light that you are trying to preserve. The darker the skies, the less you'll have to remove from your images.

Sometimes, it depends a bit on what you want to observe or photograph. For example, if you want to see the aurora borealis, it helps to go typically as far north as feasible and find a clear dark view to the north. Both Adrian and I like to go to the Pointe Aux Barques Lighthouse Park in the northern tip of the thumb near Port Austin. While it isn't an official Dark Sky Park, it does have a clear, unobstructed view to the north over Lake Huron and is located in a public park with Bortle 3, almost Bortle 2, skies. For me, it is less than a two-hour drive away. The last time I went there, the evening of the last new moon, I was planning on photographing the Milky Way, but was surprised to capture the Aurora Borealis. As soon as I got out of the car and turned off the headlights, I could easily see the Milky Way, and after I let my eyes adjust a bit, I could even see a faint aurora with the naked eye. To view comet NEOWISE this summer, I couldn't see the comet from my house due to trees, but only had to drive two miles away to a Bortle 4 cornfield with a clear view.

While it is difficult, astrophotography can be done under heavy light pollution in the city. The use of filters can be a powerful tool to help with astrophotography. Light pollution filters are used to help to block out many common forms of light pollution, while narrow band filters restrict all light except very narrow band(s) of light. I have seen amazing photos from the inner city using narrow band filters. These can be especially useful on emission nebulae. I have both light pollution filters and narrow band filters and choose to use them depending on cycle of moon and what target I'm imaging. If it is new moon, I typically don't use a filter and choose a broad-band target. Under full-moon, I'd use narrow band filters and choose to image a nebula.

Respectfully,
Dale Hollenbaugh

RETRACTION

In the lecture of the 1st, I made a sarcastic remark about my seventh grade teacher, Mr. Winston. I should not have done that, because he might have been a flawed and (now seemingly) unhappy man, he did right by me. It was one of those episodes of "social promotion" which I am now proud to advertise. Mr. Winston saved me much pain.

GM Ross

Thanks for the lunar tail article, 6 March.

A reply to John Levings, copied to Publications

I knew there was some kind of "blow off", which the future Webb Space Telescope might have to consider in its parking place, but not about density or composition.

Unhappy, I stopped reading when encountering "moon dandruff". Decline of standards. Too much frivolity for the subject, especially from the New York Times. To be fair (must I?) one could find hipster expressions in the contemporary Sky and Telescope.

Beautiful day, and wish you were here. Enjoy Fiji.

G. M. Ross

https://www.nytimes.com/2021/03/04/science/moon-tail-beam.html

W.A.S.P. Photo and Article Submissions

We'd like to see your photos and articles in the W.A.S.P. Your contribution is ESSENTIAL! —

This is YOUR publication!

Send items to: publications@warrenastro.org

Documents can be submitted in Microsoft Word (.doc or .docx), Open Office (.ods), or Text (.txt) formats, or put into the body of an email. Photos can be embedded in the document or attached to the email and should be under 2MB in size. Please include a caption for your photos, along with dates taken, and the way you 'd like your name to appear.

Observing Reports

Deep Sky

Lepus and southern Canis Major

6 March

R LEPORIS (Hind's Crimson Star): In mid-range of its cycle, crude estimate ~ 8.5. Maximum brightness per OBSERVER'S HAND. is 5.5, but carbon stars are unreliable. Very strong colour index = 4.9, per same source. Initial reaction in seeing R Lep was colour deficient. On sustained viewing its redness became periodically obvious, likely combination of low sensitivity of the eye at such light level, plus seeing. Were it not for reputation, disappointing.

COLLINDER 132

Birren's OBJECTS IN THE HEAVENS cites mag. 3.6 for this large open cluster, whilst "Wide Field Wonders" in the OBS. HAND. gives 80' across. The data are credible per this obs'n. A small number of stars spread ~ uniformly over a low mag. field. FF Canis Majoris is situated in the western plart of the cluster. Impossible to see colour for this Observer, nor for "Gentleman Jack" McCarthy when asked. Our initial reaction = not a Long Period Variable, confirmed by Burnham: FF is very low amplitude eclipsing var.

hovering around 8.0. Cr 132 is incorrectly located on the "micro-map" of CMa in Birren, p.17

COLLINDER 140

Birren: Mag. 3.5 and 42' across. Bright stars within. Magnificent in low power, right triangle of principals. First blush, a brighter cluster than 132. Due S. of Al-udra.

COMMENTARY: Both Cr objects not seen to best advantage @ latitude of S. Michigan. This handicap exaggerated by metropolitan area with significant snow albedo. Neither depicted as discrete cluster on ATLAS OF THE HEAVENS, both library and field editions. The compilers' data are probably before Collinder's work. Not in Burnham, either. Sinnott's "Pocket Atlas" plots both.

Transparency good.

5-cm. f /11 refractor with "ultra-wide field" eyepiece.

Veen Observatory, Lowell Township

Tr 7 Puppis

13-14 March

Fiasco, working from memory. Birren cites magnitude, 7.9 open cluster w/o indicating size. Sinnott "POCKET" ATLAS: very small @ less than 20 arc-min.* Cluster is on Pup-Canis Major border. Trumpler 7 not plotted on Tirion's ATLAS 2000. Working from (very) imperfect memory, observed near Omicron-2 CMa based upon examination of ATLAS ECLIPTICALIS for possible position.

Seemed to be a concentration of very faint stars S. of Omicron, so asked "Honest John" Foerch for confirmation.

Wrong! The observed feature no where near Tr 7, probably a condensation in the southern Milky Way. Subsequent examination of Sinnott confirmed the error.

4.5-in. Newtonian w/ "ultra-wide" field eye-piece. At Veen Obs'y, Lowell Township

*Generous loan from William B. Beers, Sirius Observatory.

Tr 7 Puppis

19-20 March

Reprise. Trumpler cluster doubtful, but some faint area observed in precise location. Sinnott Chart 27 plots as under 20' of arc.

Transparency fair. Puppis-C. Major border area well W. of culmination + warming air mass. Crescent Moon high in W.

57X, 4,25" f /8 Newtonian deployed on lawn of Veen Observatory. No "go-to", no drive mechanism, no slewing capability, no auto-focus with 16mm achromatic Ramsden non-parfocal Bob Watt Memorial Eyepiece purchased at Livonia swap meet.

20 - 21 March (supplemental)

Cr 132 Canis Majoris -- Birren (OBJECTS IN THE HEAVENS) gives 3.6 mag. for this large cluster, at ~ 80 arc-min. per Beckett (OBS. HAND. 2018). "beautiful sparkling of colored stars visible even during full Moon"). That 132 could not be seen aside from perhaps 2 brighter members implicates the sky quality more than very low magnification employed.

Cr 135 Pup -- This open cluster is much brighter per Birren: 2.7. -- but much farther down. Levy does not add it to "Deep Sky Gems" (OBS. HAND. 2018). Jedicke and Moffatt do not have it in "Star Clusters (same). Whitman leaves Cr 135 out of "Southern Hemisphere Splendours" (same). This lacuna is a

(Continued on page 7)

(Continued from page 6)
mystery, inviting attention long before even knowing of the Collinder objects: on the classic field edition of ATLAS OF THE HEAVENS.

Fw: Observing report 3/20/21

Wonderful dad, showing his very young boy and girl the Moon. I did not look through a telescope (of sorts) until twelve or thirteen -- belly on a side-walk because of the crummy tripod (of sorts). I did not visit a planetarion, the Mott at Flint, until pushing fifteen. My parents were very education oriented, but w/o a clue about astronomy. In Grand Rapids and Kalamazoo to-day, children have sterling opportunities to become acquainted with things celestial.

(With permission to-day.)

-----Original Message-----

From: Joe McBride
To: Gary Ross
Date: Sunday, March 21, 2021 10:05
Subject: Observing report 3/20/21

Angela and the 2 youngest kids plus Deremo. I employed the 9.25" Celestron for the near 1/2 moon at varying magnifications. The craters and Maria were cool but when I put the 10.5mm in, Bryan exclaimed that he could see cracks and used his hands to show their directions..truly excited to discover. I then showed them the red star Beetlejuice and the white star Sirius and again Bryan had to tell me the colors he saw while the image flickered...next the planet Mars which had flickering colors and (eh hem) M42....stars with smoke as described by Makenna.

Sent from my iDork

OBSERVING REPORT

Kappa CMA -- The line-of-sight "companion" immediately S.W. of primary barely visible, but some doubt. Momentary improvement of seeing probably allowed fleeting view. At approx. -33 declin. not a small consideration even when crossing meridian. About 6th mag. #2 star.

Cr 135 Pup -- This Collinder cluster was spectacular fifty years ago from south Broward Cty. with Observer looking over greater Miami. (4.25" refl'r, @ 26 degrees lat.). Still striking as an asterism @ 7X, especially with bright "interloper" Pi Puppis. 2.7 mag. (OBS. HAND., 2018) Could not see Pi with naked eye. The two 5th mag. stars very close to Pi to the N. may be cluster members, but actually 135 was not in reach of the glass given conditions.

Xi Pup -- Barely resolved this line-of-sight double star with 5th mag. companion @ S.W. Assumed easy target. Too close?

SAO 174199 Pup -- Magnitude 3.8, (Hirshfeld and Sinnott CATALOGUE). "B" class star. Sinnott ATLAS depicts companion immediately to S.E., but the glass reveals two faint stars.

Employing Bushnell 7X binoculars, not multi-coated, no gyro-stabilisation, w/o Starry Night Pro, w/o Registrax, w/o (useless) "red dot" finder, mounted with multi-articulated Boden, on wood and steel military tripod w/o auto-adjustment. At Veen Observatory.

The Sun

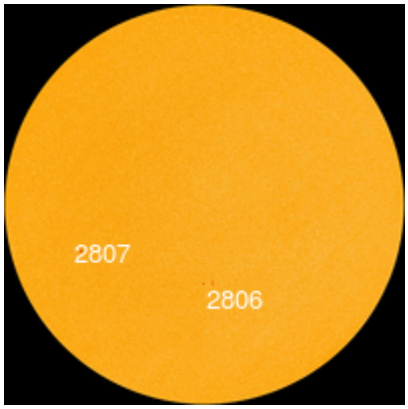
1 March
No sun-spots
Transparency excellent. Seeing poor (wind).
5-cm. f/11 refractor @ 57X

2 March
One group, six spots. One feature, much larger than the others might have been bifurcated, but there was no penumbra for it.
Transparency excellent, seeing good.
5-cm. f/11 refractor @ 57X

3 March
One group, five spots. The large spot reported previously seems to be two features, approx. equal size.
Transparency good, seeing good.
\5-cm refractor, f/11 @ 57X

6 March
No sun-spots.
Transparency excellent, seeing fair.
5-cm. f /11 refractor @ 57X

7 March
No sun-spots.
Good transparency, fair seeing.
Instrumentation as before.



03 Mar 21
New sunspot AR2807 is crackling with B- and C-class solar flares. Credit: SDO/HMI

8 March
No sun-spots
Transparency fair, seeing fair.
Instrumentation as before.

9 March
One group, one spot. Very near the limb.
Transparency fair, seeing good.
Instrumentation as before.

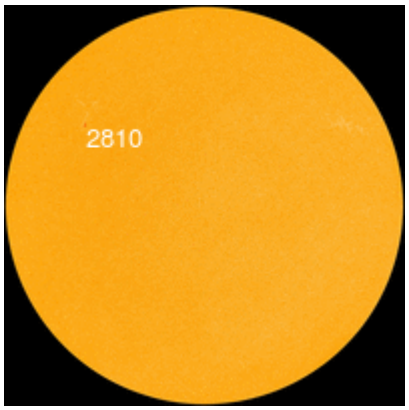
(Continued on page 8)

(Continued from page 7)

12 March 2021
One group, one spot
Transparency excellent, seeing poor.
Instrumentation as before.

14 March
No sun-spots.
Transparency fair, seeing fair.
Instrumentation as before.

17 March
One group, two spots.
Transparency fair, seeing poor.
Instrumentation as before.



19 Mar 21
Sunspot AR2810 is stable and poses no immediate threat for strong solar flares. Credit: SDO/HMI

19 March
One group, probably four spots, the primary very small.
Transparency good, seeing fair.
Instrumentation as before.

20 March
One group, one spot (difficult)
Transparency good, seeing good
Instrumentation as before.

21 March
One group, one spot. Plage easily visible.
Transparency good, seeing excellent.
Instrumentation as before.

22 March
No sun-spots
Transparency fair, seeing poor.
Instrumentation as before.

23 March
One group, one spot (rotating on)
Transparency poor, seeing good.
Instrumentation as before.

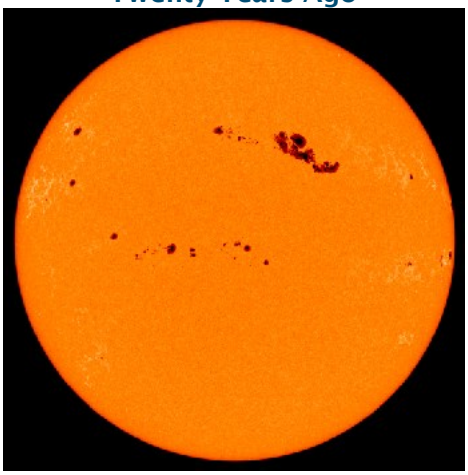
24 March
Two groups, four spots. Groups too widely separated in longitude to be one.
(No data)
5-cm. refractor @ 57X, mylar sub-diameter filter.

29 March
No sun-spots
Transparency good, seeing good
Instrumentation as before.

30 March
No sun-spots
Transparency good, seeing good.
Instrumentation as before.

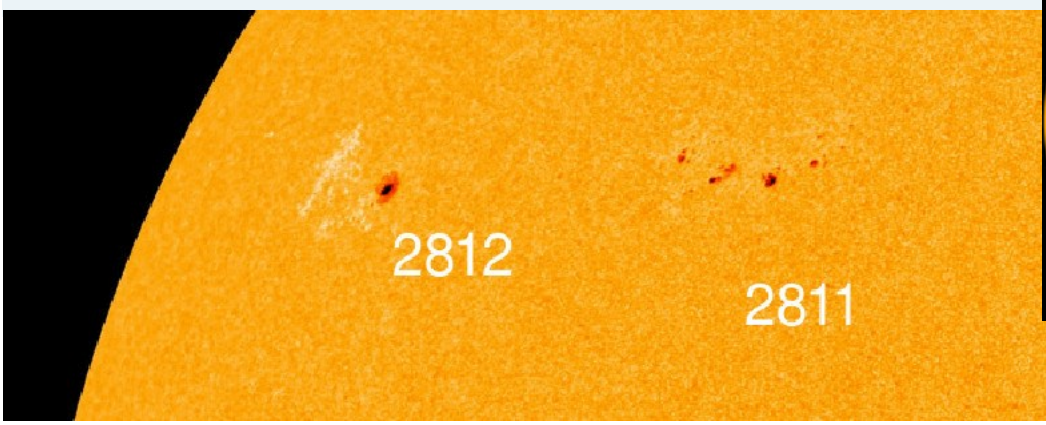
31 March
No sun-spots.
Transparency good, seeing fair. (Low)
Instrumentation as before.

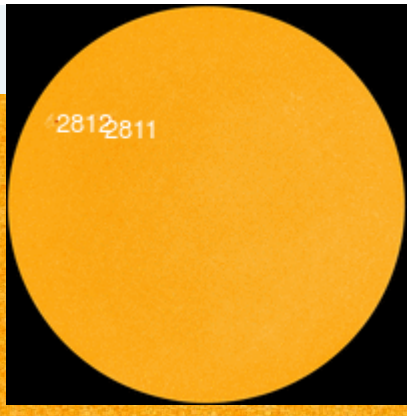
Twenty Years Ago



On March 29, 2001, AR9393 hurled a pair of CMEs directly toward Earth. The first one struck during the early hours of March 31, 2001. The leading edge of the shock front was dense (~150 protons/cc) and strongly magnetized -- traits that give rise to powerful geomagnetic disturbances. Within hours, an extreme geomagnetic storm was underway, registering the maximum value of G5 on NOAA storm scales.

Images of Sun from Spaceweather.com





24 Mar 21
These northern sunspots remain stable and quiet. Credit: SDO/HMI

M45 - The Pleiades

Image by Dale Hollenbaugh

shot over three nights 03-04-2021 to 03-06-2021
Imaging telescopes or lenses: Stellarvue SVX080T-3SV
Imaging cameras: ZWO ASI2600MC Pro
Mounts: Celestron CGX-L
Guiding telescopes or lenses: ZWO Off Axis Guider
Guiding cameras: ZWO ASI174MM Mini
Focal reducers: Stellarvue SFFX-1 Field Flattener
Filters: Optolong Clear Focusing 2"
Accessory: ZWO EAF Electronic Auto Focuser · ZWO M42 Filter Drawer · ZWO ASIair Pro

(Continued on page 10)

Caldwell 49 - Rosette Nebula in HOO

Photo by Dale Hollenbaugh

Dale says:
Photo is First Light with new Stellarvue SVX080T-3SV telescope.
single night of data 02-26-2021
29x300sec frames = 2.4 hours integration

Final photo is total of three nights of data (02/26/2021 - 03/03/2021)
108x300sec frames = 9.0 hours integration
This is my first time imaging the Rosette Nebula.
I used the Stellarvue SFFX-1 field flattener, so no reduction. D=80mm, L=480mm, F=6.0
With all of the equipment on the new scope, it was about 18 pound setup, which is a fairly heavy payload for the CEM25p mount. Guiding wasn't great, but it seemed to manage it well enough and the image looks pretty good - I only threw away two sub-frames, and one of those was because of trees in FOV.

Imaging telescopes or lenses: Stellarvue SVX080T-3SV
Imaging cameras: ZWO ASI2600MC Pro
Mounts: iOptron CEM25P
Guiding telescopes or lenses: ZWO Off Axis Guider
Guiding cameras: ZWO ASI174MM Mini
Focal reducers: Stellarvue SFFX-1 Field Flattener
Filters: Optolong L-eXtreme 2"
Accessory: ZWO EAF Electronic Auto Focuser · ZWO M42 Filter Drawer · ZWO ASIair Pro
Dates:March 3, 2021

Skyscapes

By Adrian Bradley

Have Camera, Will Travel

Remember the phrases 'break of dawn' or 'crack of dawn?'

The darker night sky is at 5am and the 'crack of dawn' happened right at 5:45am. I took the shot just as the Milky Way was yet still visible. At 6am it would be completely washed out by the approaching sun.

Now that glow in the center of both pictures, that AIN'T the sun!!! Repeat, that AIN'T the SUN!!! (Or if you prefer better grammar, 'that is not the sun!') That is actually the glow of the crescent moon that was rising ahead of the sun. I didn't take a sunrise picture because there were too many clouds and I had to get back home to start my day anyways.

Both shots taken over the coast of Lake Huron, somewhere past Port Sanilac.

Adrian's post of Facebook-Ed.

(Continued from page 11)

A trip to the thumb for the aurora with a bonus

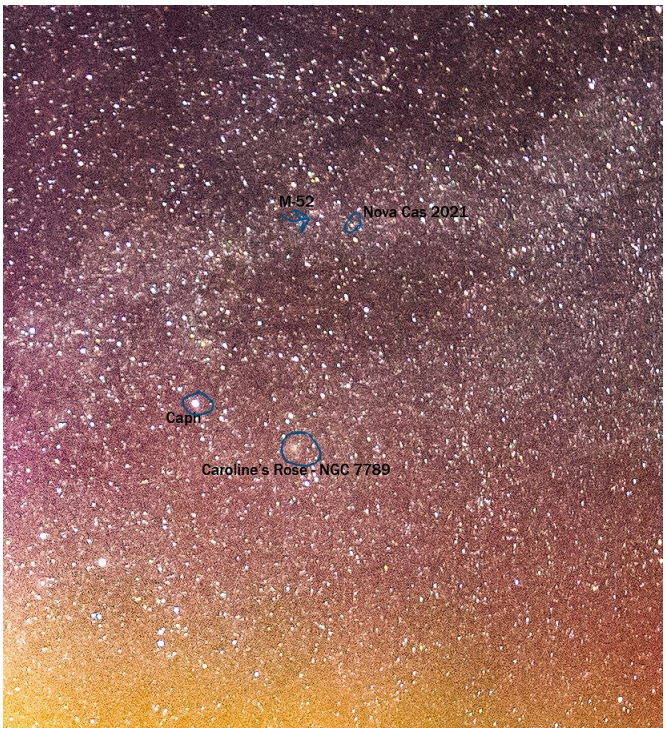
Adrian says:

"So, I'm shooting aurora in the thumb on the morning of 3/20 (Saturday)... and then news breaks that a nova (Nova Cas 2021) was brightening and visible in the region just about the middle of where I was shooting.

If you do astrophotography and you are an amateur astronomer, your own images become 'crime scenes' that can be used to find stuff you didn't realize you had. I blew up this photo and found what I believe to be an unintentional shot at this Nova. Forgive my crude labelling, but let me know if you all think I got it right.

If you look in the full picture, the stars of Casseopeia are hard to make out. But they are there, and the constellation looks like a 'W' in the middle bottom third of the photograph."

From his posting on Facebook



The View From C.W. Sirius Observatory

Messier 13


Photo: Bill Beers

Messier 13 or M13, also designated NGC 6205 and sometimes called the Great Globular Cluster in Hercules or the Hercules Globular Cluster, is a globular cluster of stars in the constellation of Hercules. M13 is about 145 light-years in diameter, and it is composed of several hundred thousand stars, the brightest of which is a red giant. M13 is about 23,000 light-years away from Earth. Edmond Halley discovered the cluster in 1714, and Charles Messier cataloged it in 1764, but it wasn't until 1779 that the single stars in this globular cluster were resolved. Compared to the stars in the neighborhood of the Sun, the stars in M13's stellar population are more than a hundred times denser. They are so densely packed together that they sometimes collide and produce new stars. M13 is visible in spring and summer months. Binoculars make the Hercules Globular Cluster look similar to a round patch of light. At least four inches of telescope aperture will allow observing the outer stars as small pinpoints of light. However, using a larger telescope, 8 - 10" range, will allow you to resolve stars further into the center of the cluster. This is one of my favorite telescope objects. If you get a chance to look at it through a large telescope, 18" or larger, you won't be disappointed. Since this is a relatively bright object, it also makes for a fairly easy astro-photo target using your DSLR camera through your telescope. I HIGHLY recommend observing M13 every chance you get!

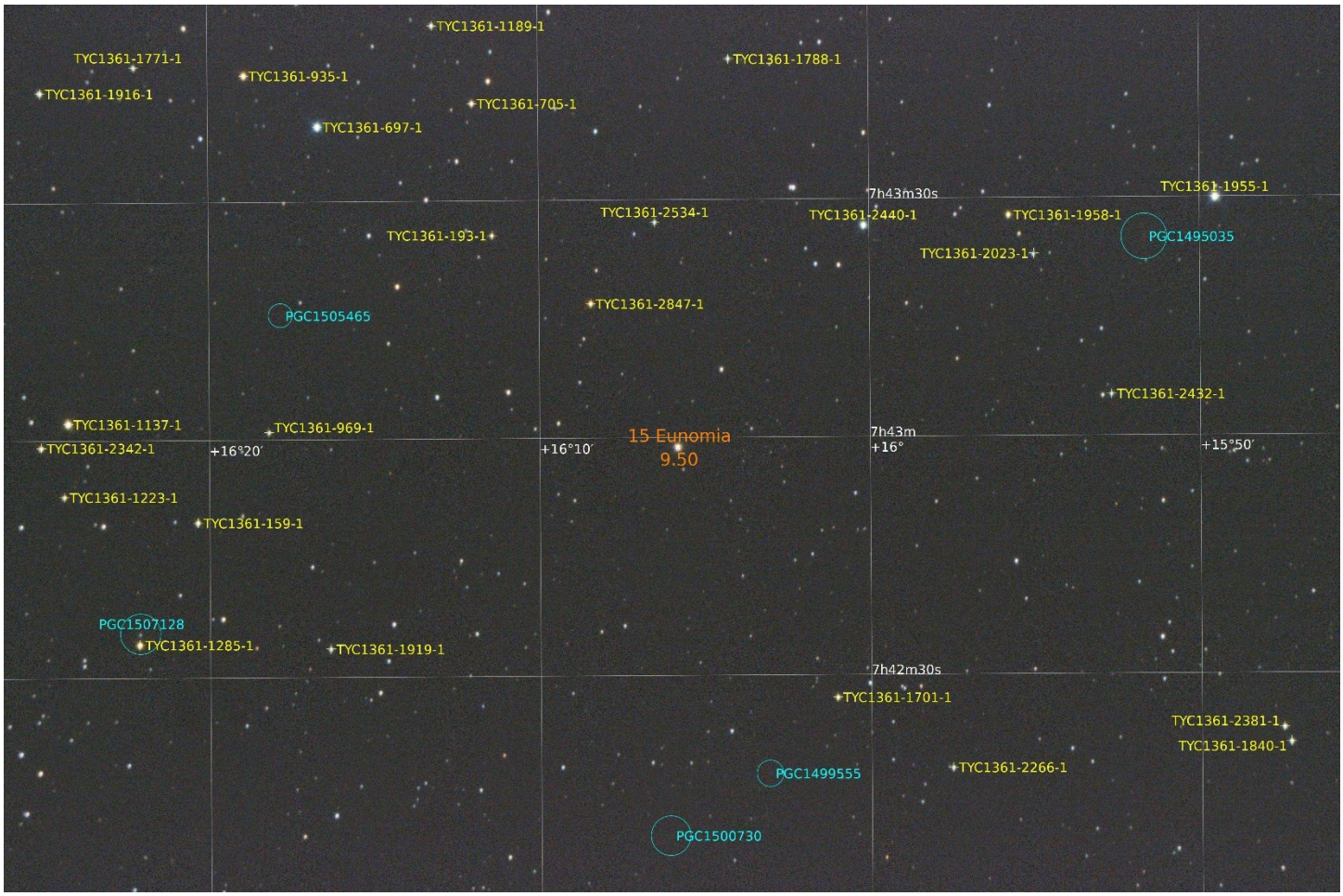
About CW Sirius Observatory:

C.W. (Cadillac West) Sirius Observatory is located 15 west of Cadillac Michigan. Owned and operated by WAS member Bill Beers. The dome is an 8' Clear Skies Inc dome which houses an 11" f/10 SCT telescope, a 102mm f/7 refractor telescope, Celestron CGEM DX mount, and uses an ASI ZWO 071 color CMOS camera, as well as a QHY8L color CCD camera. The telescope can be remotely operated from inside Bills house.

Anyone interested in learning about astrophotography, or any questions regarding equipment, or how to take astrophotos using your iPhones, or any related questions, can contact Bill at: BEEZOLL@AOL.COM

March 2021 had several clear nights which gave me a lot of opportunities for imaging.

One of those nights (March 4, 2021) I decided to go after a couple of asteroids.
15 Eunomia is a very large asteroid in the inner asteroid belt. It is the largest of the stony asteroids, and somewhere between the 8th- and 12th-largest main-belt asteroid overall. This image was plate solved in PixInsight.



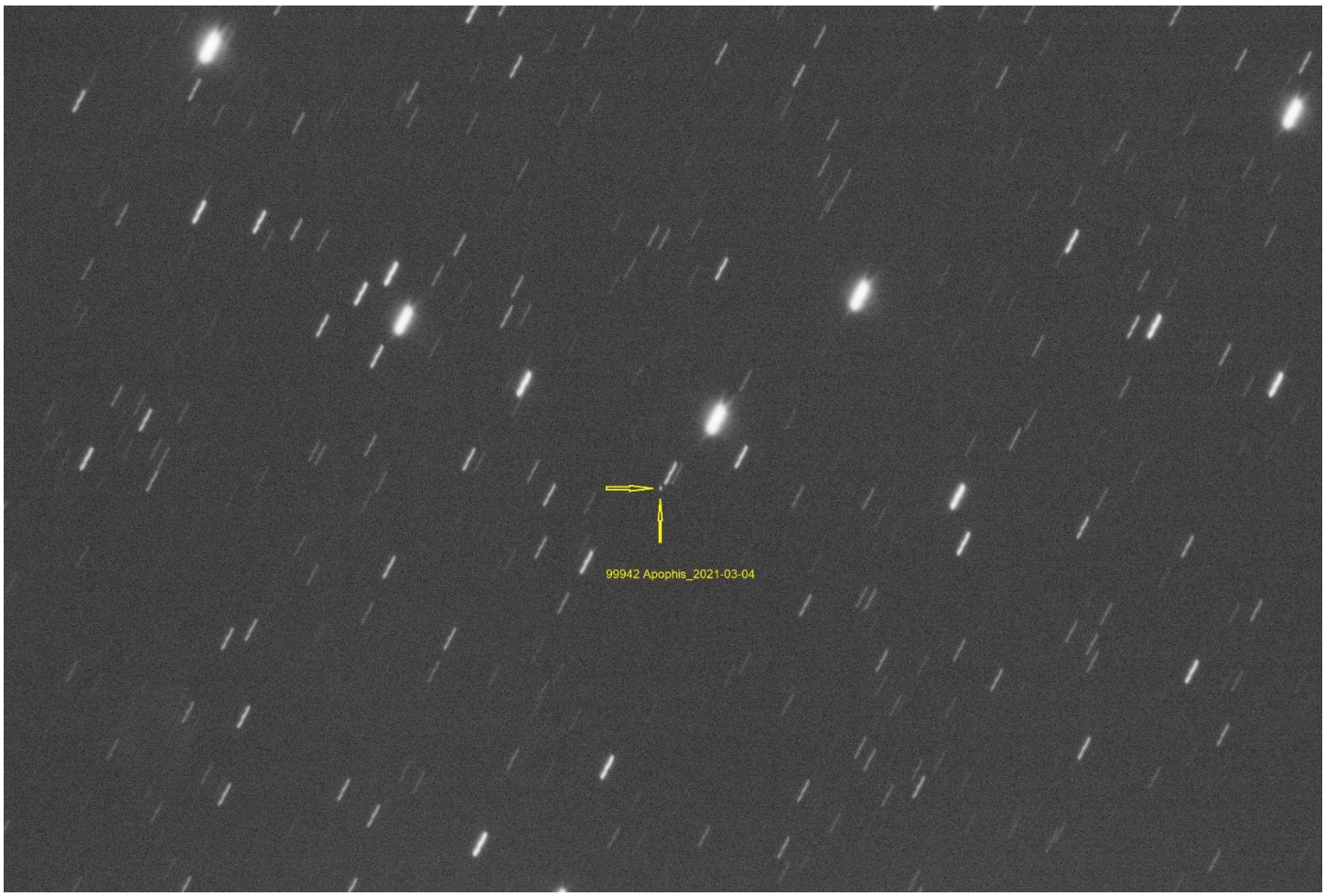
The 2nd asteroid that night was 99942 Apophis, near closest approach during this pass on March 5, 2021. It passed ~10.5 million miles from earth this time. The approximate magnitude was 16th in this image.

Apophis is a near Earth asteroid with a relatively large size (nearly 400 meters, or yards, across). It gained notoriety in 2004 when early observations suggested it might strike Earth in 2029. However, it is estimated to come close at about 20,000 miles. Apophis is not expected to strike Earth in this century.

I also made a timelapse of this asteroid from that nights imaging run. It is located on my YouTube channel @ Asteroid 99942 Apophis March 4 2021 - YouTube

(Continued on page 15)

(Continued from page 14)



All images were taken with the 10" f/8 Riche-Cretien telescope. The camera is a ZWO asi071mc PRO and the mount is a Losmandy G11.

-Doug Bock

About the Cover

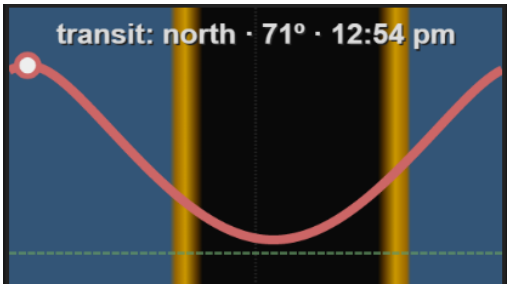
Right:
Original image

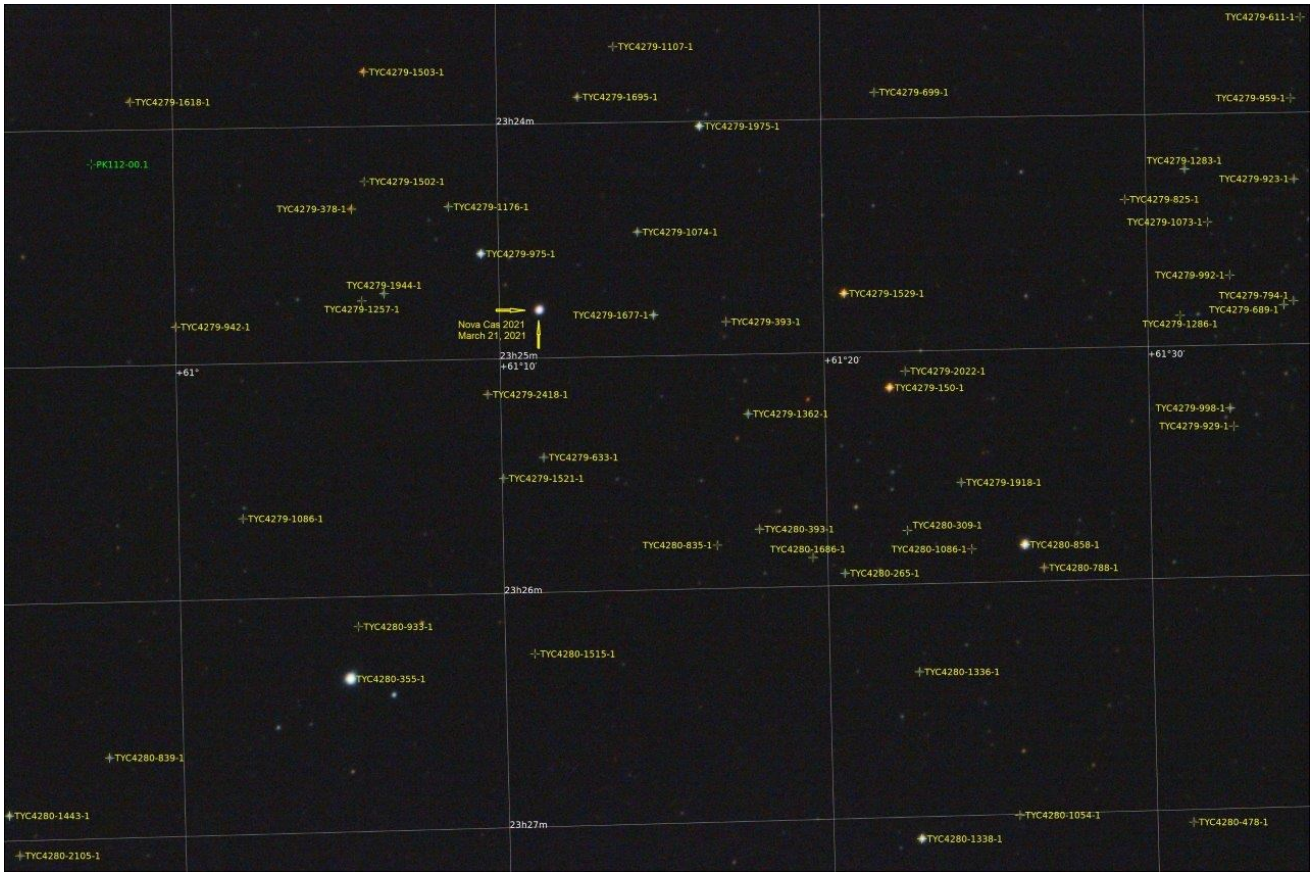
Bottom of page:
Plate solve from PixInsight.

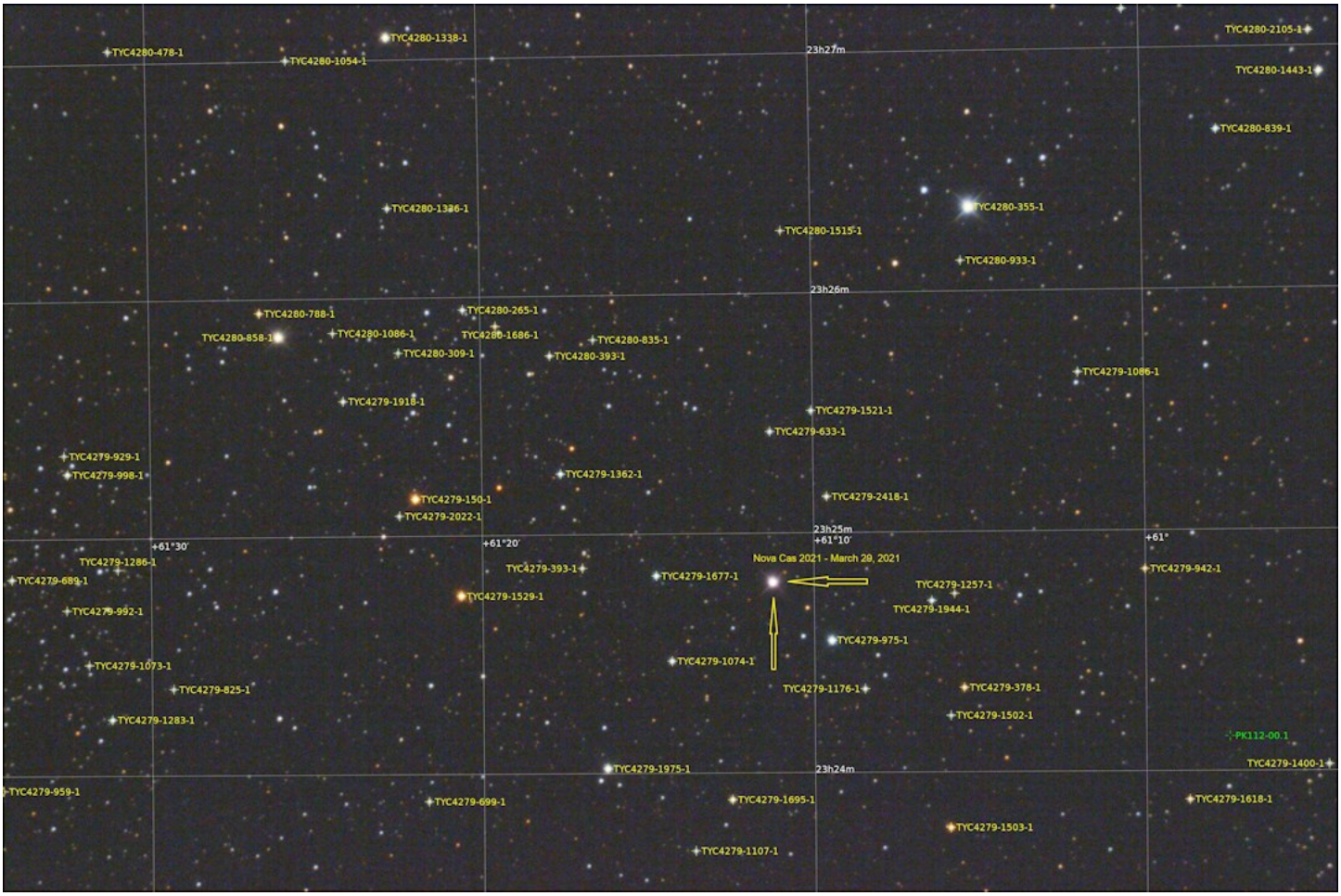
Northern Cross Observatory-March 21, 2021

Nova Cas 2021
3 x 10 second light frames, 24 darks, 50 flats
10" f/8 RC
ZWO asi071mc pro, gain 240, temp 0C
Captured the evening of the 21st, before it set below the NW wall.
It is also visible in the morning hours (chart at right.)

(Continued on page 17)







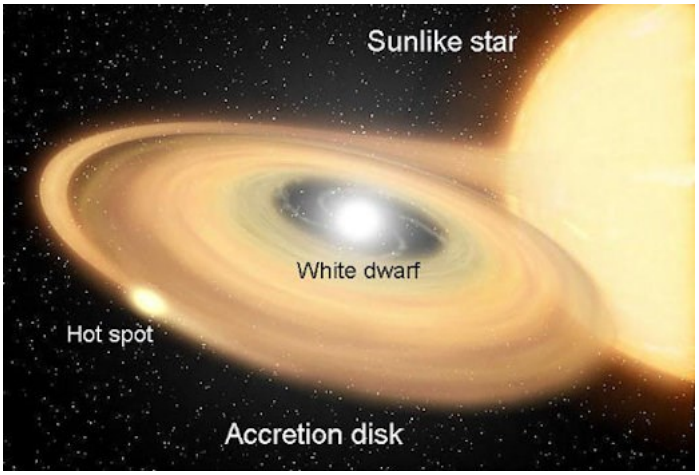
Another plate-solved image of Nova CAS 2021 by Doug Bock, taken the morning of 29-Mar-2021 around 5:00 am (30 x10 second frames.) The nova was 9.6 when discovered, 7.8 on the 19th, 7.5 on the 21st and about 7.0 on the 29th.

About Classical Novae

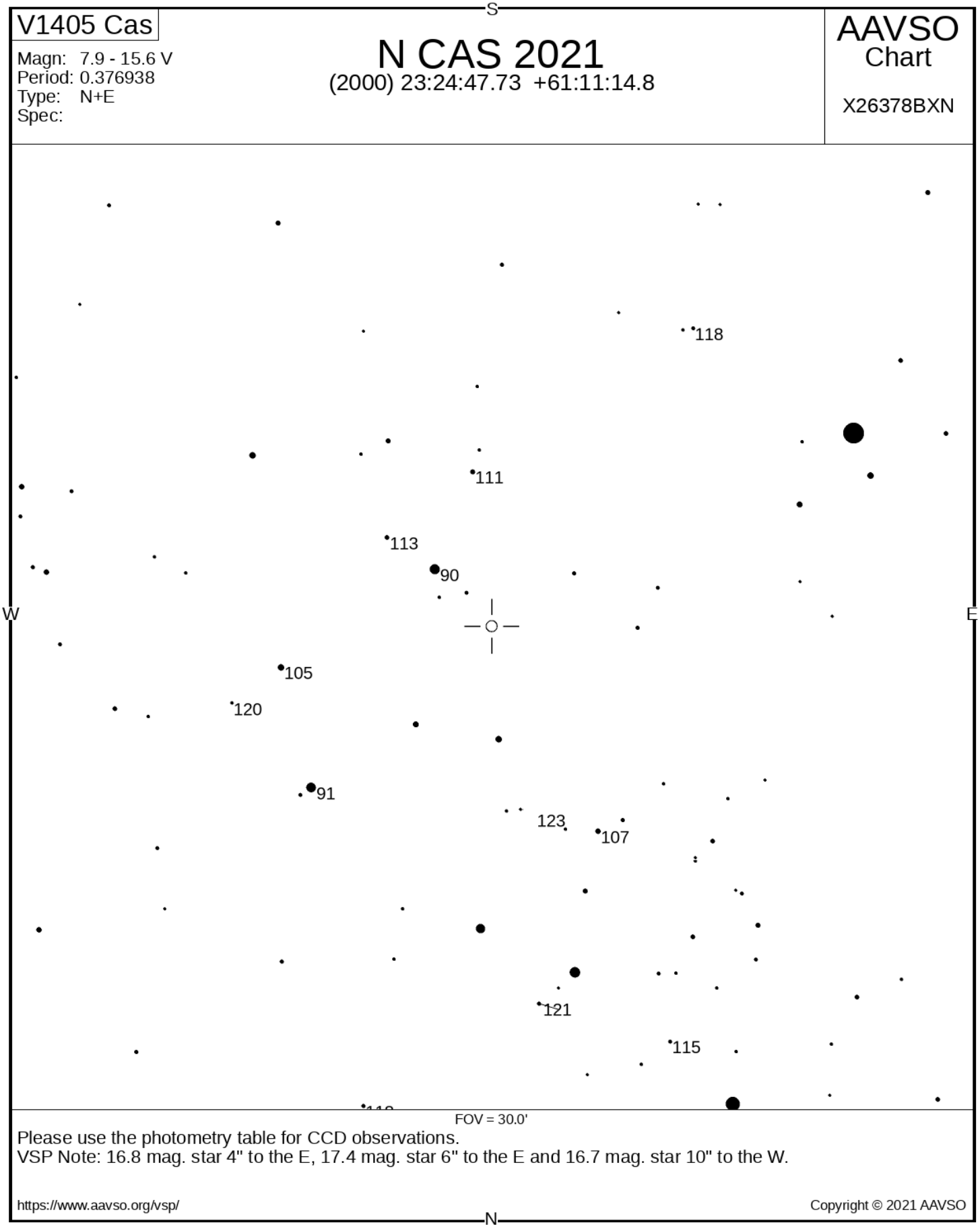
Once astronomers got their scopes on Nova CAS 2021, its true identity was sought. The AAVSO has labeled it as a classical nova, V1405 Cas. It is just 0.12" from the W Uma-class (denoted EW) eclipsing binary star CzeV3217 (close enough to be the white dwarf's victim), thus the classification of CzeV3217 has been revised from EW to N+E (nova-eclipsing) in the AAVSO database.

A classical nova occurs when a White Dwarf Star pulls off hydrogen from its companion star, a red giant or even a main sequence like our sun, and when the accumulated hydrogen compresses and heats to around 10 million Kelvin, it detonates in a nuclear fusion blast.

The material is blasted off in a rapidly expanding shell and measurements indicate this is 1600 kilometers a second, which would get you to the moon in 4 minutes.



In this illustration, the white dwarf is pulling material from the larger star on to the accretion disk which then spirals down to the dwarf's surface, where it eventually detonates in a thermonuclear explosion. This can keep occurring over and over as long as there is enough material available.
NASA / CXC / M. Weiss


V1405 Cas
Magn: 7.9 - 15.6 V
Period: 0.376938
Type: N+E
Spec:
N CAS 2021
(2000) 23:24:47.73 +61:11:14.8
AAVSO
Chart
X26378BXN
S
W
E
N
118
111
113
90
105
120
91
123
107
121
115
FOV = 30.0'
Please use the photometry table for CCD observations.
VSP Note: 16.8 mag. star 4" to the E, 17.4 mag. star 6" to the E and 16.7 mag. star 10" to the W.
https://www.aavso.org/vsp/
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Presentations

Monday, April 5, 2020
Virtual Presentations

Main Talk:

"X-ray Mysteries"

SNR Kinematics and Cluster Metallicity

By Anne Blackwell

X-rays illuminate some of the highest energy structures in the Universe. Astronomers use them to study a broad range of size of objects from single stars to the largest structures in the Universe – galaxy clusters. Each object illuminates a different mystery of the Universe. This talk will cover two in particular: the kinematics of supernova remnants (SNRs), and the missing metals in high-mass galaxy clusters.

1. SNRs are the result of violent explosions of the death of high mass stars. These explosions propel gas into the surrounding medium at tens of thousands km/s. Using statistical and spectral analysis of X-rays from SNR DEM L71, I show the discovery and explanation of an anomalous energy feature.
2. The halos of galaxy groups and clusters are made up of very hot, extended X-ray emitting baryons. We have measured metals in these halos since 1986, however we are unable to fully explain where the metals came from. The metal content in the halos of high-mass clusters is higher than what the stars in a single cluster can produce. I use X-ray spectroscopy to explain and constrain a population of stars from the early Universe that could have produced the missing metals.

Anne Blackwell is a second year graduate student in Astronomy & Astrophysics at the University of Mich-

(Continued on page 20)

Thursday, April 15 , 2020
Virtual Presentation

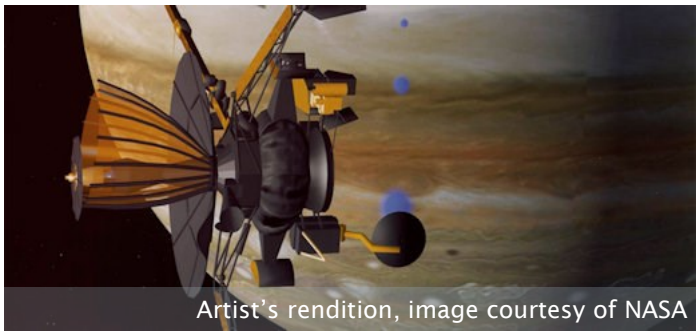
The Galileo Mission

A retrospective

By Diane Hall

Juno's glorious full-color photographs of Jupiter and the OSIRIS-Rex sample-and-return mission to an asteroid generate excitement today, but what happened to a previous long-duration visit to Jupiter, the first-ever spacecraft to drop in on an asteroid? A surprise gift of a vintage T-shirt sends Diane Hall on a journey to rediscover the highlights and hurdles of the Galileo mission to Jupiter and its moons.

Diane Hall is the current president of the Warren Astronomical Society. She is a Space Race enthusiast and intermittent movie reviewer for the WASP. Her astronomical bucket list includes seeing the gegenschein and paying a visit to the converted 747 that ferried Space Shuttles around. She actually wears the Galileo mission t-shirt even though it's the color of a yellow Hi-Liter marker.



Artist's rendition, image courtesy of NASA

WAS *Virtual* PRESENTATIONS

If you would like to present either a short talk (10-15 minutes) or a full-length talk (45-60 minutes) at a future meeting, please email Dale Partin at:

firstvp@warrenastro.org.

(Continued from page 19)

igan. She works with Dr. Joel Bregman using X-rays to study galaxy groups and cluster; specifically, the metal content of galaxy groups and clusters. In addition to research Anne is part of the Astronomy on Tap organization committee for Ann Arbor and recently joined the Dark Sky outreach program - a group committed to preserving Michigan Dark skies and education of light pollution problems and solution. In 2015 she graduated from the College of William & Mary with a degree in Physics.

Short Talk:

Of Schmidt Cameras, Comets, and Asteroid Bennu

A long friendship with Rik and Dolores Hill

By Dave Levy

A few months after relocating to southern Arizona from Canada, I received a telephone call from Rik Hill. He and his wife Dolores had also just moved to Arizona, and he was inviting me to spend a night at the 24-inch Burrell Schmidt camera atop Kitt Peak National Observatory. It was a miracle for me, and on that first night together we began a close astronomical friendship that has persisted to this day. We travelled together to the Riverside telescope makers conference in 1980 and studied the way telescopes were evolving from visual to electronic devices at that time.

We learned quickly that we both were fans of the American Association of Variable Star Observers, and in 1981 we hosted their spring meeting which I believe was the first AAVSO meeting to be held in Arizona. When Rik began working with the Catalina Sky Survey, he discovered more than twenty comets, an achievement that few in the world can aspire to. Meanwhile, Dolores became the public voice of the NASA/University of Arizona OsIRIS Rex mission to asteroid Bennu, and it was still a pleasure to understand her clear explanations of the mission's long adventure.

Even though I did not see them as much as I would have liked over the years, I still relished the times we did get together. Just before the pandemic began last year, Rik and Dolores and Wendee and I enjoyed a lunch meal together at a local restaurant. I knew that he had several copies of Bart and Priscilla Bok's precious book "The Milky Way," To help complete that part of his collection, I gave my first edition to him. The look on his face and his emotional reaction showed that the book had found a perfect home. It is a pleasure and honor for me to reminisce a bit about the friendship with a couple who have contributed so much to the Warren Astronomical Society and its efforts to look in wonder at the night sky.

David H. Levy is a Canadian astronomer and science writer who co-discovered Comet Shoemaker–Levy 9 in 1993, which collided with the planet Jupiter in 1994. Levy was born in Montreal, Quebec, Canada, in 1948. He developed an interest in astronomy at an early age. However, he pursued and received bachelor's and master's degrees in English literature. On February 28, 2010, Levy was awarded a Ph.D. from the Hebrew University of Jerusalem for his successful completion of his thesis "The Sky in Early Modern English Literature: A Study of Allusions to Celestial Events in Elizabethan and Jacobean Writing, 1572–1620.

Levy went on to discover 22 comets, either independently or with Gene and Carolyn S. Shoemaker. He has written 34 books, mostly on astronomical subjects, and provided periodic articles for Sky and Telescope magazine, as well as Parade Magazine, Sky News and, most recently, Astronomy Magazine.

January 6, 2021

Just one day after the Earth passed its closest point to the Sun in its orbit, its perihelion, the American Astronomical Society was having its annual meeting online, the United States Congress was validating the results of the 2020 national election, and Wendee and I were settling in for a civics lesson about the way the United States Government works. The day did not turn out that way.

Shortly before noon, on our television set a news ticker appeared. It announced that two buildings in Library of Congress (LC), the James Madison, and quickly afterwards the Adams and Jefferson buildings, were being evacuated. That news sent a chill through me. The LC is one of the finest libraries in the entire world. It contains more than 170 million books, of which more than thirty are books I wrote entirely or at least a foreword. It also includes all of the more than two hundred "Star Trails" columns I wrote for Sky and Telescope magazine between 1988 and 2008, and dozens more I wrote for other magazines and journals. Only the British library, with over 200 million books, is larger than the Library of Congress.

This event was personal for me. A few minutes later, when the entire Capitol complex was stormed, it was personal for all of us. All of us had reactions to this, but in addition to the feelings I shared with most of you, I had an additional feeling– specifically about the library.

How many books does it take to make a library? When I was a child in 1963, a teacher gave the best answer I've ever heard: "two books." For me, a library– any library– is every bit as priceless as a dark sky. The wisdom of the ages is contained in each library- from the LC to a child's collection. I have never gone into a library without feeling better when I exited. The idea that this magnificent collection was threatened that day was terrifying.

I have read many books over my lifetime, from *The Cat in the Hat* to my boxed set of *Lord of the the Rings*. One small treasure, Jene Lyon's Golden book *Our Sun and the Worlds Around It,* began a lifetime of stargazing. That gem, by the way, also lives in the LC. What is more, I have never encountered a really bad book. When an author places her or his thoughts on paper in a book, that book immortalizes those thoughts.

I hope that Capitol Hill and the Library of Congress are never threatened again. They belong to we the people, and stand beautifully in Washington, D.C. to govern us, teach us, and encourage us to follow our dreams and reach for the stars.

The picture is of the US Capitol I took it, May 1975, standing under the steps on the Senate side, so you see the main entrance and the House side. Photo by David Levy

Tracking and Identifying Anonymous ISON Satellites

-Brad Young, Astronomy Club of Tulsa

Amateur satellite observers, including myself, rely on symbiotic relationships that involve observations based on predictions, followed by predictions based on observations, as derived by analysis with standard models. The key data derived in this process is the 3-line element set or TLE. The TLE describes, at a certain point in time (epoch) the orbit of a satellite such that its state (position and velocity vector) at any other time can be estimated within limits of accuracy. A satellite position can then be predicted as a Right Ascension and Declination (RA/Dec) or Altitude and Azimuth (Alt/Az) in the sky, at a specific time of interest, if the observer's location in Latitude and Longitude (Lat/Long) is known.

The Russian based ISON (International Scientific Optical Network) provides a weekly update of a catalog listing manmade objects in Earth orbit for which no obvious match exists. The "ISON catalog" is maintained at http://spacedata.vimpel.ru/ As stated on that website, "Orbits with a period of over 200 minutes are mainly investigated, which basically include geostationary space objects and objects with large eccentricity orbits."

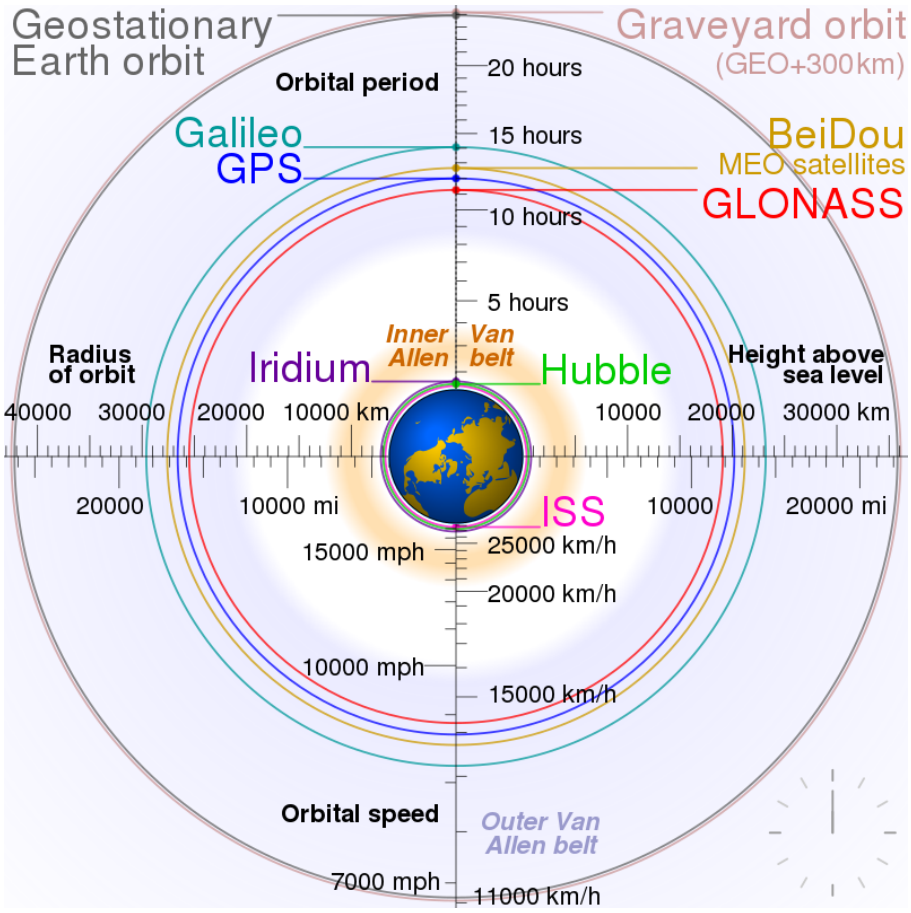
Using this resource, the services of remote telescopes, and the assistance of other amateurs involved in data analysis, and predictive methods, I have been working to identify the "anonymous" objects of this catalog. In doing so, 90 objects have been identified beyond those previously matched with other sources, and only a few objects that have been regularly trackable remain unidentified.

Artificial Satellites – Background

Artificial satellites in Earth orbit are described as one of three types (see Figure 1 below). Low Earth Orbit (LEO), Medium Earth Orbit (MEO), and High

(Continued on page 23)

FIGURE 1



ORBIT TYPE BY HEIGHT

[Source: Wikipedia]

(Continued from page 22)

Earth Orbit (HEO). There are a few other types of satellites that orbit higher than the geosynchronous belt and the graveyard orbital range, but remain in orbit around the earth, not the sun. Lunar and planetary exploration vehicles, and some space observatories are in solar orbit.

Satellite Tracking and Reporting by ISON and Others

All earth orbiting satellites are tracked by entities the world over (see Figure 2). Perhaps the most important is the U.S. Joint Space Operations Center (JSpOC) that provides a wealth of technical information at its data portal https://www.space-track.org/ about most objects on orbit. Its primary mission is Space Situational Awareness (SSA), a slate of products published to inform spacecraft operators of any collision dangers or other unforeseen problems. However, there are some satellites that are considered classified, and all or part of their data is not made public.

One of the other main entities that track satellites is ISON. As stated on the data portal, "OJSC Vimpel, which has a unique 40-years' experience in developing , testing and practical implementation of software for carrying out the various tasks associated with maintaining the catalog of artificial space objects…Hundreds of previously unknown space debris objects were found, including substantially large objects, that formed over decades of space activity, but which were not duly tracked by ground-based monitoring stations and as a result have been lost." This situation can come about from the many difficulties faced when tracking the tens of thousands of objects in orbit above us.

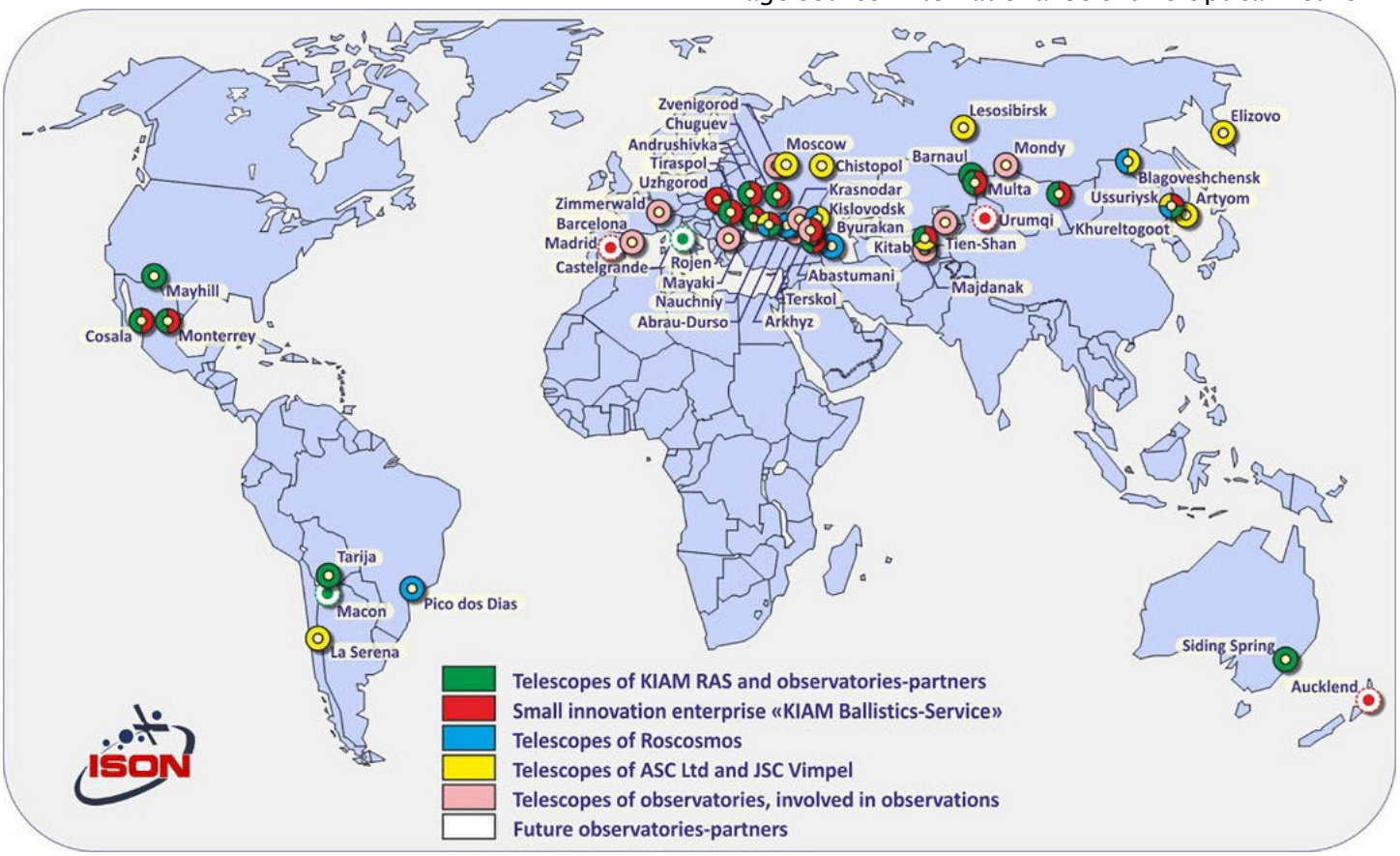
Challenges Involved with Cataloging Earth Orbiting Objects

Besides the ever-growing number of satellites, spent rocket bodies, fairings, etc. that is expected from space exploration and use, there is an ever-growing amount of debris. Unplanned debris is caused by collisions between spacecraft, both accidental and purposeful, explosions or other violent disintegration of existing objects, and the occasional strange mishap such as the tool kit once lost by a spacewalking astronaut. Since even the smallest debris can cause catastrophic damage to operational satellites or manned missions, it is imperative that spacecraft operators are aware of any objects that may threaten their assets (Space Situational Awareness). In addition, although the optical imag-

(Continued on page 24)

Figure 2

Image source: International Scientific Optical Network



(Continued from page 23)
ing equipment, radio signal receivers, and radar now used for tracking these objects are extremely sensitive, all have limits of resolution. Small objects, especially as orbital height increases, are, as one would expect, more difficult to track. Analysis of observations with standard mathematical models has long been the tool used to generate predictions of where to search for each object to maintain a current catalog. As with all models based on empirical data, these have their limitations in accuracy, precision and scope. Smaller objects, such as debris, also present issues with predicting changes to their orbits, due to their typically high area to mass (A/m) ratio. And, because their origin is often unknown, the radar profile or optical characteristics (brightness fluctuations) may be difficult to model, as the material may range in type from a piece of flat solar panel to a chunk of cylindrical metal tank. There are many perturbations that occur to the orbits of all artificial satellites. These include relatively consistent gravitational and relativistic effects due to the egg-like shape of the earth and the pull of the moon. But other variables, such as the drag of the atmosphere on LEO objects, and the pressure of solar wind, must themselves be predicted by observation and modeling (e.g. space weather). Although the models and technology behind orbital mechanics and predictive methods is mature and robust, there is still a constant need for the latest data from many sources, all compiled together to improve prediction accuracy.

The Seeds of This Project

In the end, there are a large, ever growing number of objects that appear in the ISON catalog as published by JSC Vimpel. Most of the objects have been identified with either unclassified targets that are already reported by JSpOC, or classified missions. ISON reports its matches via the datefirst.txt file, updated regularly at the JSC Vimpel data site.

Many previously unidentified objects in the ISON catalog were matched with objects tracked by hobbyists. But, as is often seen with large repositories of data, there were many remaining objects regularly followed by ISON but not identified with any known satellite.

Beginning in 2018, I set out to try to identify more objects by imaging these objects myself. The purpose was to determine if any of the remaining catalog objects would be candidates for tracking by the amateur community. I also hoped to match some of these objects with either known unclassified or classified objects already appearing in the amateur list of targets.

This proved to be as rewarding and demanding a project as I have enjoyed in forty years as an amateur astronomer. I had no experience with imaging until 2016, when I began citizen science efforts such as Target Asteroids and variable star photometry (AAVSO). By building on those experiences, using remote telescopes, and the feedback other amateurs, I began addressing a set of goals.

In February and August 2019, I published earlier versions of this article, detailing the work done and what might lay ahead for further study. This 2nd update presents a cumulative report of what has been accomplished, and how amateur tracking of ISON objects can evolve from here. The details of the methods, results, and analysis appear in the following sections.

Scope of the Study

Among the hundreds of ISON objects are most of the classified satellites tracked by hobbyists. Through the arduous efforts of many observers and analysts, most of the classified objects were correlated with ISON objects prior to this study. However, there remained a fair number of objects being routinely tracked by ISON that were reported to have standard magnitudes of 8.0 or brighter. This indicated these objects might be independently monitored by hobbyists, and perhaps identified. I had been observing ISON objects but had not systematically approached tracking them. I developed an unidentified ISON target list, widened my approach with global remote imaging, and set these goals:

1. Identify more of these anonymous ISON objects using the Space-Track and hobbyist TLE files.
2. Determine which objects are consistently trackable using equipment available to amateurs.
3. Identify origin of objects that are trackable but do not directly correlate with known objects.

Methods

Object Selection

Objects were selected based on several factors. Generally, objects with a standard magnitude of 8.0 or higher (therefore dimmer) were excluded. Several objects have been lost by ISON or I have decided to drop them from my study because of multiple failures in recovering them. Although I had previously seen several objects before beginning this study, I rejected all previous tracking due to a lack of complete records and consistent approach.

Predictions

The weekly updates provided at the JSC Vimpel data portal are osculating Keplerian elements. By main-

(Continued on page 25)

(Continued from page 24)

Image 3

```
NORAD catalog number = 40167; COSPAR Designation = 2010-042D
The TLE published by ISON for that object (as converted by cvelems):
ISON 74301                          7.5    1
1 72102U           19190.13348380 0.00000000 00000-0 00000-0 0    05
2 72102 26.2800 163.2120 7129870 35.8690 355.5716 1.93637009      13
```

taining a data file (cvnames.txt) of identified objects, the TLE set can be kept up to date as more correlations are made. Then, prediction of targets of interest proceeds as normal.

Imaging

Images of the RA/Dec expected at a certain time are made, using the remote telescope system of the site most likely to acquire the target. None of the professional level systems used herein can track satellites based on a TLE, whereas amateur scopes using systems like Argo Navis currently can do so. Therefore, a set of exposures or wide field imaging is used in case of inaccuracies in the telescope plan or TLE. Then, the images are examined for trails, indicating an object that moved during the short (typically 20-60 second) exposures.

Observations

All observations in this effort were via imaging. As described above, a list of targets was selected, and then each imaging run was selected to maximize a chance to see the object bearing in mind availability of the remote imaging location, the details of the satellite's pass in that time slot, and an observing cadence to ensure tracking was maintained.

Positional Reports

Time and image orientation, duration, and system data was provided by FITS metadata. Astronomica, a program used to "blink" sets of images to look for Near Earth Objects, minor planets, etc. was used to derive accurate plate solved images and the end points of the trail. Astronomica provides the positional data in MPC format; a utility provided by orbital analysts converted this to the IOD format used by satellite analysts.

Imaging Equipment Used

The equipment used included remote imaging telescopes available via itelescopes.net and a public observatory in Perth Australia. Pertinent details of that equipment appear in Appendix B.

Results

1. Identify more of these anonymous ISON objects using the Space-Track TLE files

103 objects were identified with known objects (classified and unclassified) during the entire run of the study so far. Overall, 477 have been matched by the efforts of analysts, and the declassification of several items on orbit. The process consisted of the following steps:

- Derive list of possible objects imaged using FindSat as usual
- Where a known object appears to be one of the anonymous ISON targets, recall the TLE of the known object at the epoch close to the ISON report and compare.

Example (Image 3):
On 7/22/2019, using telescope T12 in Australia, identified ISON Object 74301 as CHINASAT 6A r/b debris [debris from the rocket that launched a Chinese communications satellite into geosynchronous orbit]

The TLE for 40167 published by JSpOC cannot be reproduced here, but there exists one for Epoch 19190.13346878 that substantially matches the ISON TLE.

Table 1 summarizes the total objects identified by the method used. The more detailed Appendix A includes each identification unique to this study and lists basic data for both the former unknown and the now known object.

Table 1

Distribution of identified objects	
IDENTIFICATION METHOD	COUNT
OBSERVATION	95
ANALYSIS	5
DECLASSIFIED	3

2. Determine which objects are consistently trackable using equipment available to amateurs.

Several of the brighter objects have proven to be trackable, using commercially available remote imaging and other resources available to the amateur community. Most of these targets have been added to the hobbyist list. There are two remaining trackable objects, as shown on **Table 2**:

(Continued on page 26)

(Continued from page 25)

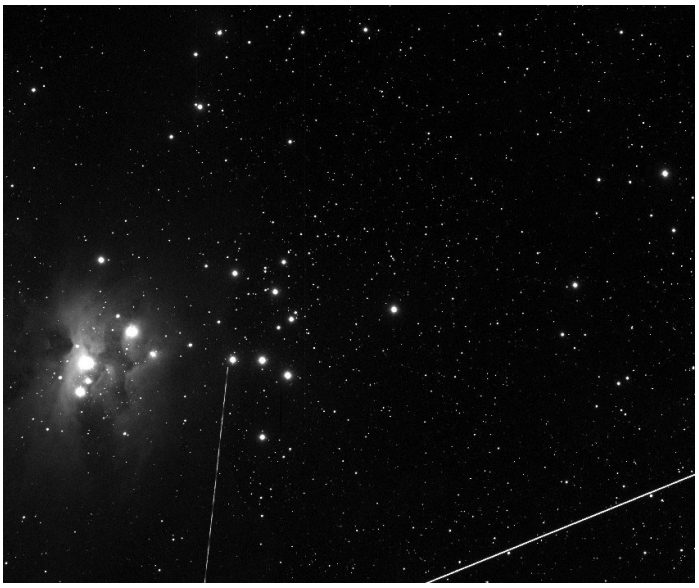
Table 2

Consistently Trackable Objects					
ISON Catalog Number	Standard Magnitude (per ISON)	Inclination (i) °	Mean Daily Motion (n)	Max Predicted Actual Magnitude	Implied Orbit
58600	5.5	5.8	2.48	8.5	GTO
141410	4.5	18	1.02	12.7	GEO

3. Identify origin of objects that are trackable but do not directly correlate with known objects

Common methods used to identify the origin of tracked orbiting objects include estimation of orbit evolution, visual characteristics, and historical launch and maneuver data (where available.)

Only the two objects above were found to be reasonably trackable, and not currently included in classfd.tle. Long-term study may lead to identification, however, both show indications, with their orbital evolution, of being debris objects.



Orion Nebula with a couple of satellites. Lower right is a Low Earth Orbit one. Image by Brad Young.

Results

Over the course of the effort, 331 anonymous objects from the ISON catalog were observed to determine ones that were trackable and potentially identifiable. 175 objects were reported with at least one set of positional data. Most of the observed objects were unclassified debris.

From Here

What the results above represent to me is the potential for amateur satellite observers to act in an important citizen science role to provide a niche service to increase the level of Space Situation Awareness by data mining between sources of orbital data. Identification of unknown objects is an exciting and challenging effort that many may find onerous. However, much like any other systematic exercise, the reward may be as much in approaching the problem and executing the plan as in the specific results. My hope is that this type of approach will foster open exchange of data, encourage amateur satellite tracking, and provide in some small way, an increase in our scientific knowledge. This project has been enlightening for me, as I had to learn or expand several astronomical skills and had the opportunity to work with some very experienced people whose proficiency in a very narrow field is astounding. I hope that this article has shed light on the exciting opportunities that await all amateur astronomers in the field of satellite observing.

Anyone who is interested in observing satellites using visual or imaging techniques, or has questions or comments, may contact me at:
allenb_young@yahoo.com

Acknowledgements

In conclusion, I would like to thank the following organizations and the people in them that have made this effort possible:

JSC Vimpel [ISON]
Seesat [Visual Satellite Observing]
Perth Observatory
TruSat

(Continued on page 27)

(Continued from page 26)

Appendix A – Identified Objects (Next two pages)

Objects identified uniquely by methods and analysis performed during this study. Does not include declassified satellites or matchups found by other analysts. I will make that info available upon request.
ISON: catalog number assigned by ISON
NORAD: catalog number assigned by JSpOC
COSPAR: International Designation number

ISON	NORAD	COSPAR	DATE ID	NAME
13501	81821	81821A	10/18/2020	Hobbyist 81821
13801	87521	87521A	9/20/2020	Hobbyist 87521
17300	87149	87149A	5/14/2020	Hobbyist 87149
33300	41699	10007R	12/17/2018	SL-12 Deb
33402	42974	10041P	9/7/2020	SL-12 Deb
33800	41675	94076J	9/21/2018	SL-12 Deb
34100	41560	08067J	2/28/2019	SL-12 Deb
34300	41641	08067M	2/28/2019	SL-12 Deb
34403	43527	10007Z	9/17/2018	SL-12 AUX MOTOR
42200	39989	08011DN	2/8/2019	BREEZE-M DEB
44401	38575	08011W	3/12/2020	BREEZE-M DEB
47403	39325	08011DC	3/5/2019	BREEZE-M DEB
51600	88216	50187A	3/29/2020	Hobbyist 88216
61900	42482	89006CJ	11/26/2018	ARIANE 2 DEB
62806	28569	89006AL	6/9/2020	Intelsat 515 deb
63001	40195	12008E	9/21/2018	CZ-3C Deb
64001	33579	93036G	1/26/2019	COSMOS 2251 DEB
65402	40197	12008G	2/28/2020	BEIDOU 11 DEB
66001	42485	89006CM	12/17/2018	ARIANE 2 DEB
66705	44980	18079BP	11/15/2020	AEHF 4 deb
67904	83999	83999A	5/17/2019	Hobbyist
69800	15227	84091B	6/18/2019	USA 4 r/b
70000	84407	84407A	1/7/2021	Hobbyist 83999
71719	44896	18079BK	6/9/2020	AEHF 4 deb
71811	44653	18079P	9/20/2020	AEHF 4 deb
73503	43949	14055C	5/23/2019	CLIO r deb
73511	44985	18079BR	7/17/2020	AEHF 4 deb
74902	40179	11077C	1/11/2021	NIGCOMSAT 1R DEB
75101	43407	13014D	11/4/2020	BREEZE-M DEB
75106	43984	14055AP	5/5/2019	CLIO r deb
75201	40187	11077L	2/5/2019	CZ-3C r deb
75400	40187	11077N	2/5/2019	CZ-3C r deb
75500	40839	11077U	9/7/2020	SL-12 deb
75510	44667	18079AD	10/5/2020	AEHF 4 deb
75603	43970	14055Z	10/20/2020	CLIO r deb
75607	44650	18079L	2/25/2020	AEHF 4 deb
75709	46641	14055CR	12/2/2020	CLIO r deb
75803	43965	14055U	9/7/2020	CLIO r deb
75909	44893	14055CJ	10/18/2020	CLIO r deb
76002	43974	14055AD	9/7/2020	CLIO r deb
76008	43954	14055H	9/11/2020	CLIO r deb
76015	44039	14055BZ	5/16/2019	CLIO r deb
76312	44690	18079BC	2/28/2020	AEHF 4 DEB

ISON	NORAD	COSPAR	DATE ID	NAME
76601	43963	14055S	3/2/2019	CLIO r deb
76609	44895	18079BJ	9/11/2020	AEHF 4 deb
77600	43972	14055AB	10/23/2020	CLIO r deb
77706	44000	14055BF	10/18/2020	CLIO r deb
77910	45475	18079BX	7/17/2020	AEHF 4 DEB
78011	45475	18079BX	9/11/2020	AEHF 4 deb
78013	44642	18079C	2/25/2020	AEHF 4 DEB
78203	46647	14055CX	10/20/2020	CLIO r deb
78207	43652	18079B	11/1/2019	AEHF 4 r
78211	44986	18079BS	3/12/2020	AEHF 4 DEB
78302	44002	14055BH	5/5/2019	CLIO r deb
78415	46668	14055CW	12/2/2020	CLIO r deb
78503	43964	14055T	3/1/2019	CLIO r deb
78515	44683	18079AV	9/27/2020	AEHF 4 DEB
78517	46869	14055EA	12/2/2020	CLIO r deb
78531	44656	18079S	12/26/2019	AEHF 4 DEB
78703	43967	14055W	5/16/2019	CLIO r deb
78902	43991	14055AW	3/2/2019	CLIO r deb
78903	44010	14055BR	9/18/2020	CLIO r deb
79014	44678	18079AQ	9/30/2020	AEHF 4 DEB
79111	44643	18079D	5/11/2020	AEHF 4 DEB
79201	43960	14055P	7/14/2019	CLIO r deb
79213	44658	18079U	10/20/2020	AEHF 4 DEB
79508	46660	18079CN	11/14/2020	AEHF 4 DEB
79601	43994	14055AZ	5/13/2019	CLIO r deb
80207	44679	18079AR	3/12/2020	AEHF 4 DEB
80404	46848	14055DD	12/2/2020	CLIO r deb
80905	45471	18079BT	10/20/2020	AEHF 4 DEB
81000	41323	12026K	3/1/2019	NIMIQ 6 deb
81103	44694	18079BG	10/18/2020	AEHF 4 deb
81301	43985	14055AQ	2/28/2019	CLIO r deb
82000	43982	14055AM	2/28/2019	CLIO r deb
82003	44680	18079AS	10/23/2020	AEHF 4 deb
82009	46603	18079CB	10/23/2020	AEHF 4 deb
82100	44012	14055BT	4/4/2019	CLIO r deb
82501	45474	18079BW	5/3/2020	AEHF 4 deb
82502	46604	18079CC	10/18/2020	AEHF 4 deb
83401	44661	18079X	9/30/2020	AEHF 4 deb
83602	44681	18079AT	8/16/2020	AEHF 4 deb
83703	46664	18079CS	10/23/2020	AEHF 4 deb
86000	44685	18079AX	7/17/2020	AEHF 4 deb
110001	43179	18013B	12/17/2018	GovSat-1R/B
136205	41544	15075E	10/5/2020	COSMOS 2513 DEB
137601	41546	15075G	1/2/2021	BREEZE-M DEB
140912	43340	18036B	4/27/2018	EAGLE
143305	44572	87096G	10/23/2020	COSMOS 1897 DEB
143549	39688	76004E	10/5/2019	CTS DEB (ARRAY)
146406	27525	02043A	11/25/2018	KALPANA 1
151101	43513	69013R	5/16/2019	TITAN 3C TRANS
154601	43283	69013D	9/30/2020	TITAN 3C TRANS
157502	43282	69013C	12/17/2018	TITAN 3C TRANS
515500	41929	15019C	5/16/2019	YZ-1 R/B

Appendix B – Equipment Used

T16 at MPC I89 COSPAR 7777 38.165653 -2.326735 5150ft, 1650m Nerpio, Spain

T9, T12 at MPC Q62 COSPAR 7778 -31.2733 149.0644 3400ft, 1122m Siding Spring, NSW, Australia

T14, T20 at MPC H06 COSPAR 7779 32.92 -105.528 7298ft, 2225m Mayhill, New Mexico USA

R-COP at MPC 323 COSPAR 7782 -32.008 116.135 984ft, 300m Perth, WA, Australia

T68 at MPC Q67 COSPAR 7784 -33.3967 149.4917 2081ft, 650m Bathurst NSW, Australia

For TXX items, refer to https://www.itelescope.net/obs-sso/

R-COP at Perth Observatory:

APERTURE: 0.4 m FOCAL LENGTH: 1850.0 mm

F-RATIO: 5.2

FILTERS: Open

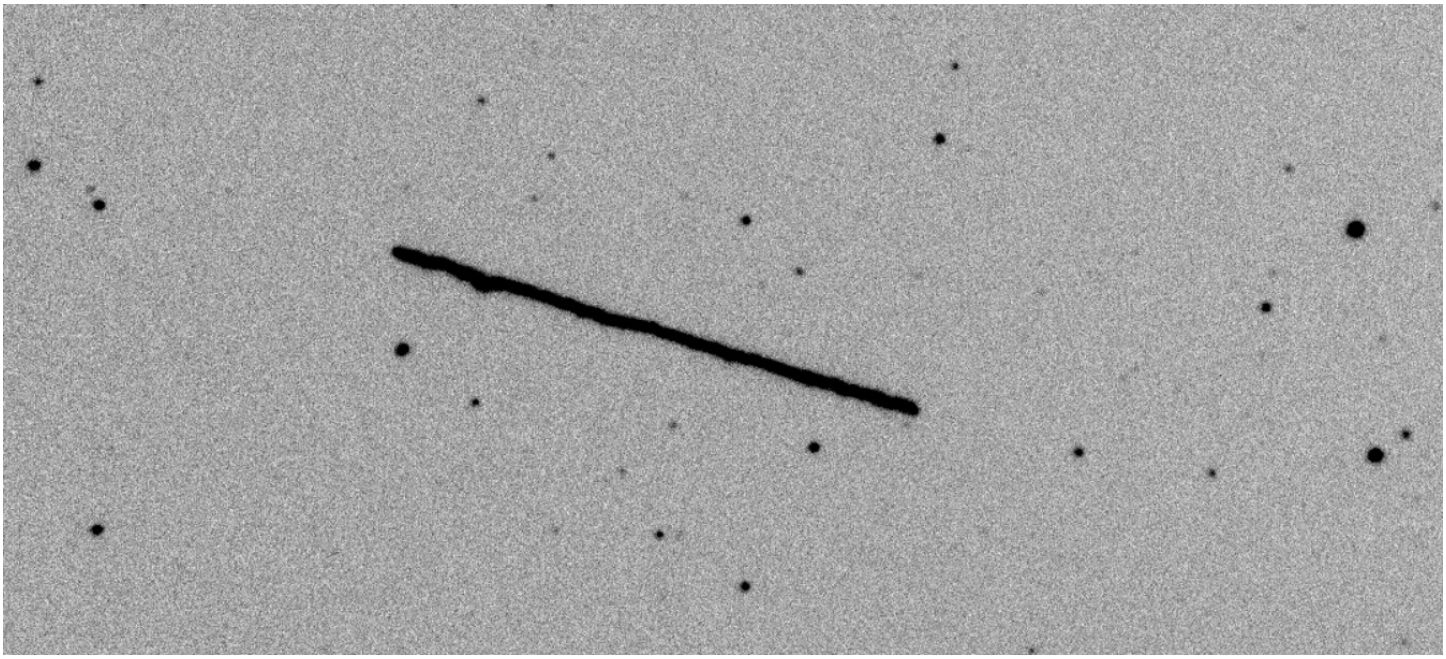
CCD SIZE: 2184 x 1472 (6 um pixels)

FOV: 27.6 x 18.6 arcmins

SITE: Perth Observatory

Right: Screenshot of ISON 150800, taken 2020-09-30. Image by Brad Young

Below: ISON 152538, 2020-08-01. Image by Brad Young

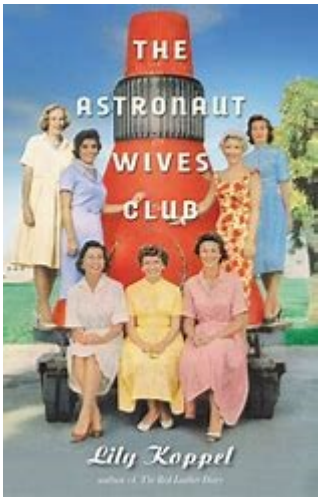


Astronaut Wives Club

https://abc.com/shows/the-astronaut-wives-club

Episode Seven: Rendezvous

Last episode, we met Ed White (Matt Lanter), the new superstar astronaut; we open this one with Ed giving a slideshow of his first-ever spacewalk to an audience that includes AstroWives. We're deep into Project Gemini now and the show does a pretty darned good job of laying out succinctly how critical long-duration flights and rendezvous are to the success of the US Moon shot. Then the generic NASA guy tells the Wives it's their job to provide all necessary uh, comforts, to the menfolk when Gemini stresses them out. Yep.



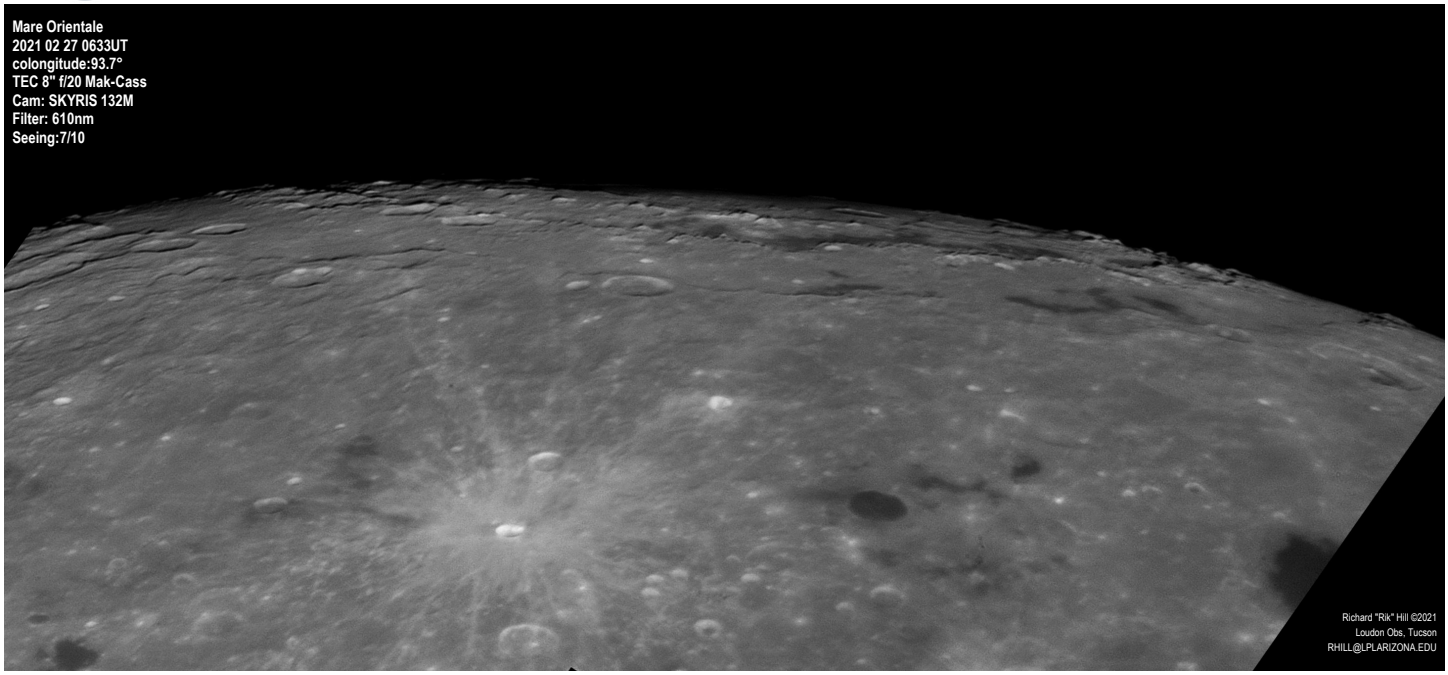
Anyway, the five AstroWives left of the original seven are now trying to keep their privileged place staked out among the horde of Pats and Marilyns newly come to the neighborhood. On the one hand, everyone envies Pat White's (Alexa Havins) trip to the Paris Air Show alongside handsome Ed. On the other hand, Marilyn Lovell (Holley Fain) is hiding a growing (hint hint) secret and Harriet Eisele (Elaine Carroll) has a critically ill child, so the original AstroWives embark on their usual round of living-room confabs to try to mitigate problems.

Grim incidents from NASA history, like the death of the original Gemini IX crew in a plane crash and the illness of little Matt Eisele, are used as the setup for improbable turns, like Lady Louise (Dominique McElligott) whizzing off to Florida in Trudy's plane to track down a junior AstroWife's errant husband, or a full-scale protest of the AstroWives and widows over shabby treatment by NASA. It's a bizarre melange of "Yeah, that's pretty much how it happened" and "No way in hell did this happen," as domestic hijinks at the Coopers bump up against queasy tragedy and a cloud of foreshadowing forms around Betty and Gus Grissom (JoAnn Garcia Swisher, Joel Johnstone). At least the air conditioner shenanigans at Marilyn See's (Nora Zehetner) place pay off now as she comes into focus as a character instead of a comic prop.

I have to say, yet again, that the whole "sisterhood is powerful" message comes at the expense of… a female supporting character, in this case a "Cape Cookie" who ended up as the til-death-did-they-part second wife of the naughty astronaut in question. Her daughter, who was adopted and raised by the astronaut, is swapped out for some random boy. Little things like this might not make a difference to the broad audience ABC was trying to reach, but to me they're telltale pieces in the weirdo contraption of this period piece that just doesn't truly know what it wants to be— melodrama? Docudrama? Sitcom? Revisionist fantasy? Are the characters multilayered or incoherent? Icy Louise and her scheming Al (Desmond Harrington) would make a fine pair of villains, especially here as one scheme pays off; Al makes a bundle on investments while the Grissoms and Coopers lose big. I don't know… in a show ABOUT these people, maybe that deserved more than an aside?

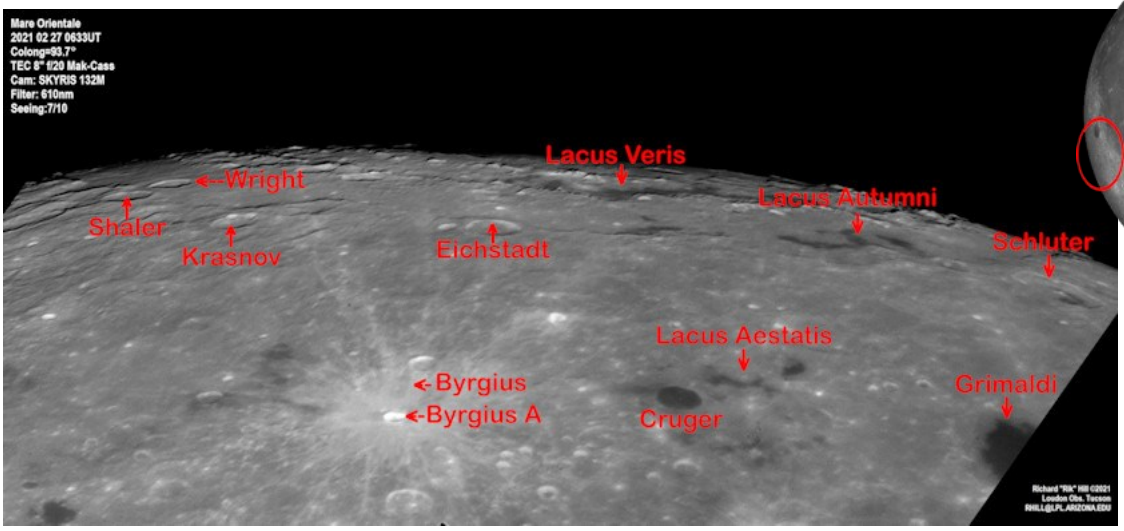
Also this felt like there was enough material for at least two eps compressed into one. Nonetheless I give it **four moons out of five.** The good parts were pretty good and the bad parts aren't even bad. Just… strange.

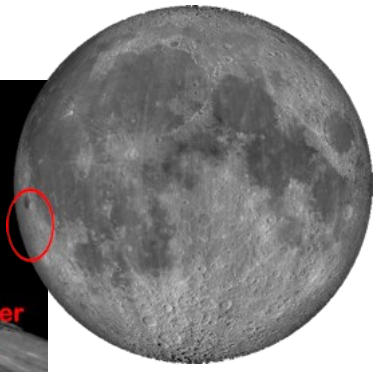
Over the Moon with Rik Hill



Good views of Mare Orientale or the Orientale basin are not frequent for Earth bound observers. This last February was a good opportunity and I made the best of it taking this montage 6 AVIs stacked into 6 images and assembled with Microsoft ICE software. But seeing the basin in even the best Earth based images takes a little work.

The Dark crater just below center of the image is Cruger (48km dia.) with Lacus Aestatis the small sinuous dark region to the right of it. The partial dark area on the right edge is Grimaldi (228km). Bright rayed crater is Byrgius A (19km) with Byrgius (90km) just above it in the rays. Above this, halfway to the limb, is Eischstadt (51km) and left of that is the smaller Krasnov (43km). These last two craters sit on a scarp called Montes Cordillera that goes off to the right of Eischstadt to an "S" shaped region called Lacus Autumni. The Montes run clear across this image from just above the crater Schlüter (92km) on the right edge of this image, to the twin craters Shaler (49km) and Wright (41km) near the left edge. These Montes are the outer "walls" of the Orientale basin. Up above Eischstadt you'll see another sinuous dark marking, Lacus Veris that winds in and around the sparkling peaks of Montes Rook that extend right and left forming a concentric inner wall to this huge basin, the largest impact feature on the moon.





Location maps by Ralph DeCew

Photos from the Kwentus collection

Identification Made

The March Photo:

The Responses:

Just saw the March issue of the WASP. The photo on page 10 shows Pete Kwentus on the left and Roger Civic on the right.
Thanks for the memories!

-Kenneth Wilson

Pete Kwentus and Roger Civic.

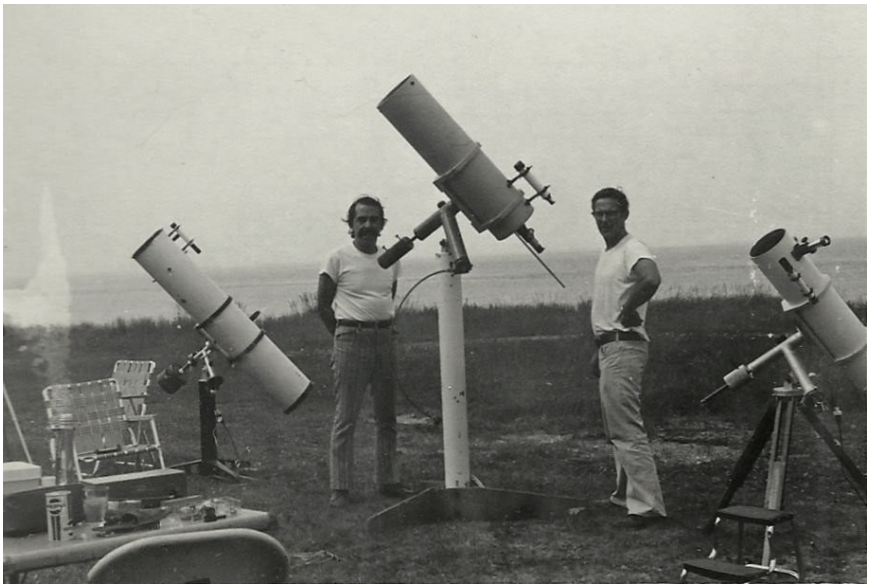
-Doug Bock

The gentleman on the right in the photo immediately below is Roger Civic.
I enjoy how this full-moustache photo of him contrasts so nicely with the sans-moustache photo of him, also in the latest edition of the WASP.

-Mark Kalinowski

And that makes it unanimous! Thank you all for the responses.

-Ed.



An action photo of the two intrepid astronomers

History S.I.G.

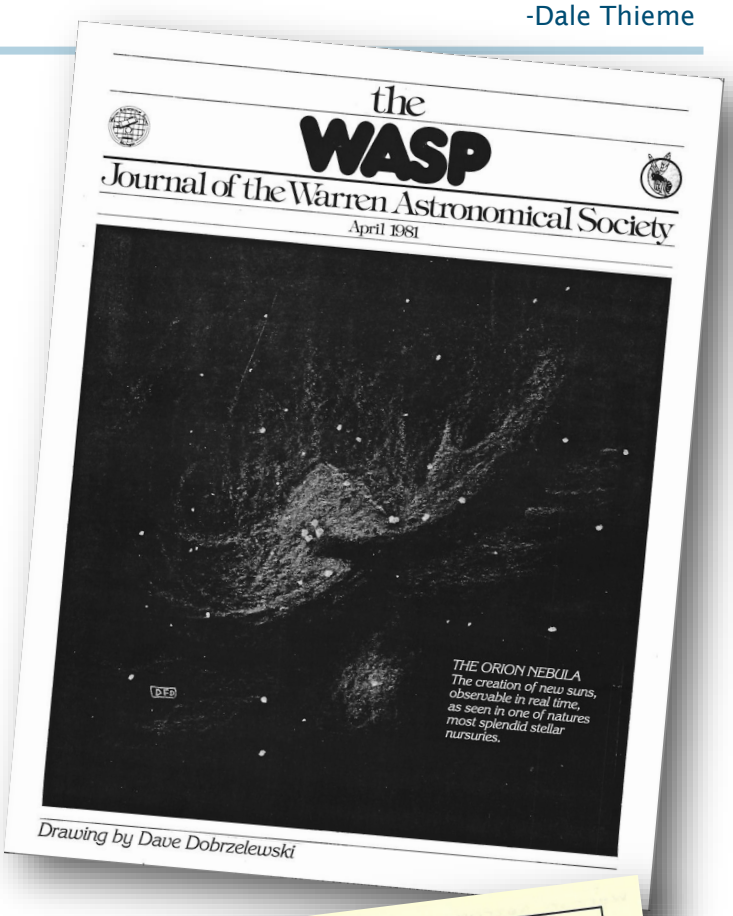
-Dale Thieme

April 1981

This issue features a pictorial (including the illustration on the front cover) "Drawings From the Sketchbook" of Dave Dobrzelewski. Louis Faix covers "New Films - Old Galaxies" in "The Apprentice Astronomers Notebook." Tackling Daylight Saving Time: "Twilight Astronomy" by Brad Vincent. This is all followed by an exploration of "The Milky Way" by Mark Bieniek.

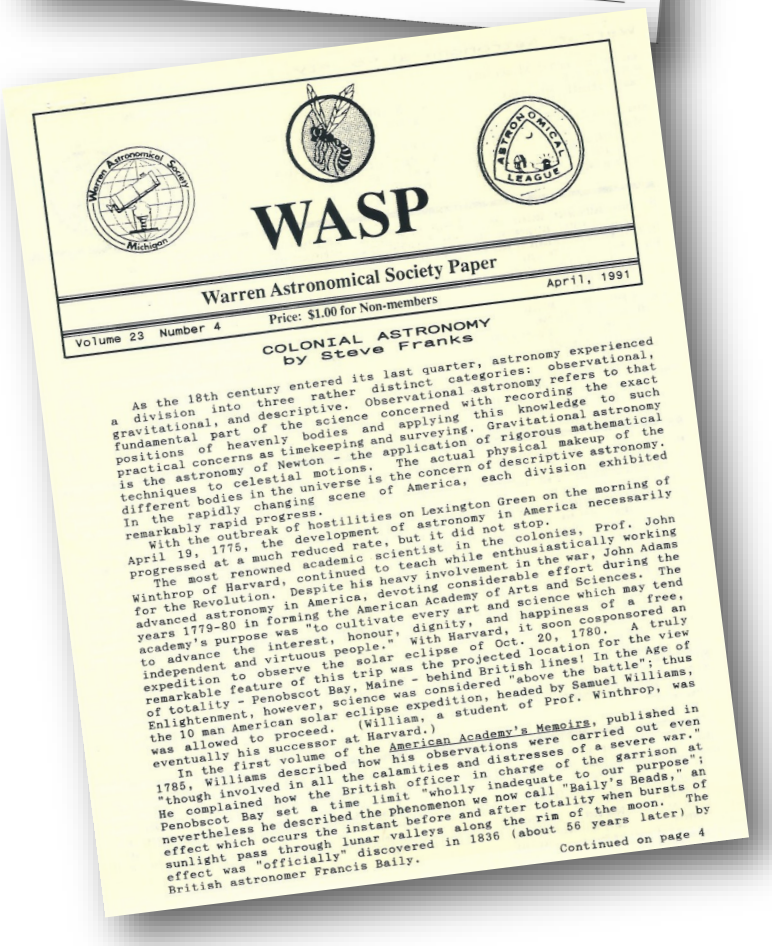
April 1991

This issue is dominated by "Colonial Astronomy" by Steve Franks, recounting the history of astronomy in colonial America. Larry Kalinowski does squeeze in a bit of "Computer Chatter" and we see a notice for an upcoming lecture by Jack Horkheimer-an April 18th WAS meeting at Cranbrook. Jack was still using the "Star Hustler" moniker at the time.



From the Scanning Room

Here's another pair of images from the Kwentus collection. From what I can see, it looks like some young astronomers are getting inoculated against "Aperture Fever". Any ideas who they might be? Send your responses to: publications@warrenastro.org.



Dale Thieme,
Chief scanner

Those were the Days

Field trip to Grand Rapids circa 2003

Above left: Jack Szymanski, right: Gary Ross

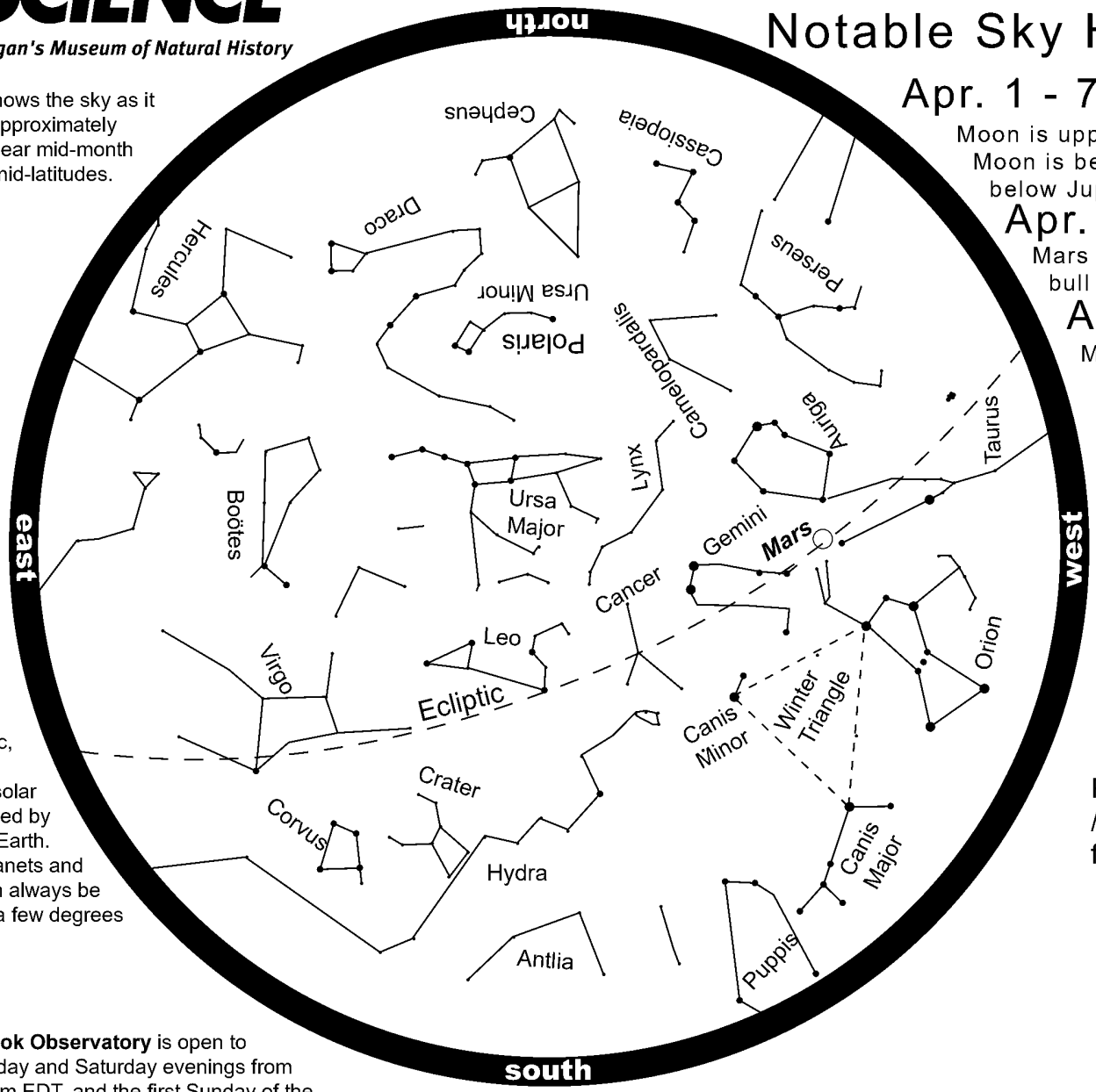
Gary Ross forwarded these pictures attached to an old email from Larry Kalinowski. Larry said, "Thought you guys would like to see some shots I took while in Grand Rapids." Gary reports that it was a convergence to work on an astro-slide show and drink, in that order. This editor is not sure how the shop tools figure in the slideshow. Jerry Persha recalled that he and Mark may have been working on fittings for the brass scope, which Jerry thinks might have been of the John A. Brashear Company manufacture.

Below left: Jerry Persha, right: Mark Christensen

CRANBROOK INSTITUTE OF SCIENCE
Michigan's Museum of Natural History

APRIL 2021
Notable Sky Happenings

This chart shows the sky as it appears at approximately 10pm EDT near mid-month at northern mid-latitudes.



What is that dashed line? It's the ecliptic, the reference plane of the solar system, defined by the Sun and Earth. The major planets and the Moon can always be found within a few degrees of this plane.

Apr. 1 - 7

Moon is upper right of Antares on the 1st (S predawn). Moon is below Saturn on the 6th (SE predawn) and below Jupiter on the 7th (ESE predawn).

Apr. 8 - 14

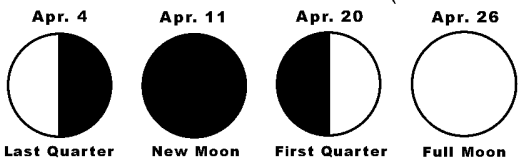
Mars is located between the horns of Taurus the bull on the 12th & 13th (W evening).

Apr. 15 - 21

Moon is below Mars on the 16th (W eve.) & upper right of Regulus on the 21st (S eve.).

Apr. 22 - 30

Lyrid meteor shower peaks the evening of the 22nd (15-20 meteors/hour). Moon is upper left of Spica on the 25th (SE eve.) and above Antares the 29th (SSW morn.).

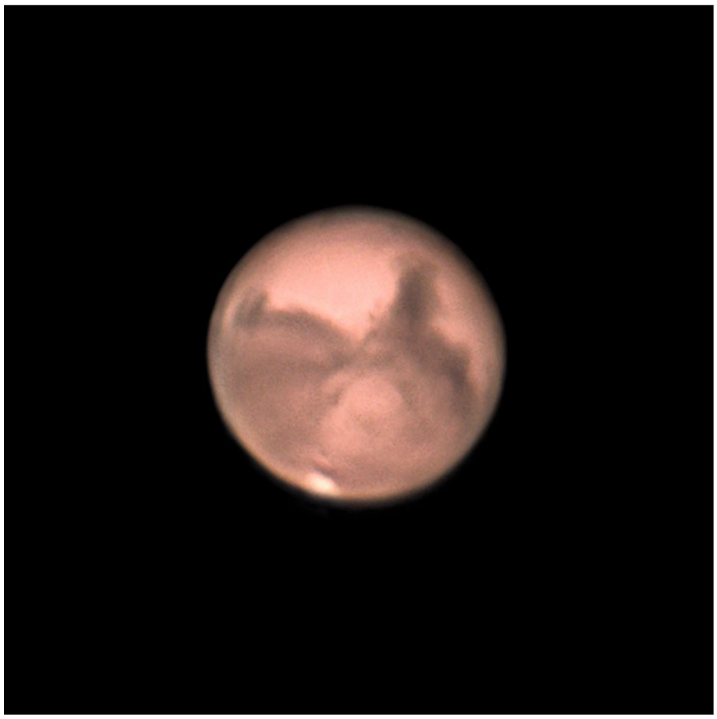


Now Showing

Please visit science.cranbrook.edu /explore/acheson-planetarium for program updates.

The Cranbrook Observatory is open to the public Friday and Saturday evenings from 8:30 - 10:00pm EDT, and the first Sunday of the month from 1:00 - 4:00pm for solar viewing. Come have a look through our 6" telescope! For observatory information visit http://science.cranbrook.edu/explore/observatory

For astronomy information visit http://science.cranbrook.edu



Dale Hollenbaugh - Mars

Dale Partin - Under the Stars with Comet NEOWISE

April 2021

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1 April Fools' Day	2 Good Friday	3
4 Easter	5 Cranbrook Virtual Meeting	6	7	8	9	10
11 New Moon	12 Yuri's Night	13 Ramadan begins	14	15 Tax Day (USA) Macomb Virtual Meet-	16	17
18	19	20	21	22 Lyrids Earth Day	23	24 Virtual Stargate
25	26 Full Moon	27 Moon at Perigee: 357379km	28	29	30	

Stargate Observatory

Special Notice

Due to the measures taken during the Covid-19 pandemic On-site Star Parties and group events are cancelled.

During this time, you are encouraged, when the skies co-operate, to join the livestream with Northern Cross Observatory on the open house schedule (4th Saturday of the month)

Past livestream are available on the Warren Astronomical Society's YouTube channel:

https://www.youtube.com/channel/UC12jUX4Gmweg6fTtUuqa8CQ

Observatory Rules:

1. Closing time depends on weather, etc.
2. May be closed one hour after opening time if no members arrive within the first hour.
3. Contact the 2nd VP for other arrangements, such as late arrival time. Call 586-909-2052.
4. An alternate person may be appointed to open.
5. Members may arrive before or stay after the scheduled open house time.
6. Dates are subject to change or cancellation depending on weather or staff availability.
7. Postings to the Yahoo Group and/or email no later than 2 hours before starting time in case of date change or cancellation.
8. It is best to call or email the 2nd VP at least 2 hours before the posted opening with any questions. Later emails may not be receivable (secondvp@warrenastro.org).
9. Generally, only strong rain or snow will prevent the open house... the plan is to be there even if it is clouded over. Often, the weather is cloudy, but it clears up as the evening progresses.

Advisory: Concerns are circulating in the amateur astronomy community about COVID-19 being passed from one person to another via contact of different persons' eyes with a telescope eyepiece. While we are not medical experts, we thought we should pass on this concern. Sharing telescopes may be considered by some to be high-risk due to the possibility of eyes touching eyepieces.

Stargate Report

Stargate observatory and the Dob shed along with all equipment are in good condition as of March 1, 2021.

There will be no open house in April as the observatory will remain closed until further notice due to the COVID-19 pandemic.

Virtual observing may be possible from Northern Cross Observatory (NCO) on April 24, 2021 weather permitting and if Doug Bock is available to host it.

Riyad I. Matti
2021 WAS 2nd VP, Observatory Chairperson

Treasurer's Report

$22,621.40 in the main account

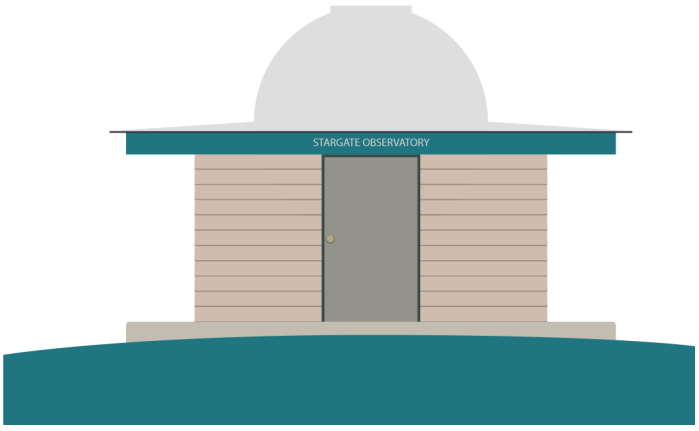
$3279.84 in the GLAAC account

$1032.36 in PayPal

Two new memberships, Scott Schneider from LTU, and a student he is sponsoring, Jonas Harrison. Both included fees for the Astronomical League

Currently 170 Paid memberships (171 if including Jonas)

Payments to W.A.S. for membership renewals or donations are possible through PayPal, ***and*** Zelle. Contact treasurer@warrenastro.org for details.



Astronomical Events for April 2021

Add one hour for Daylight Savings Time
Source:
http://www.astropixels.com/ephemeris/astrocal/astrocal2021est.html

Day	EST (h:m)	Event
01	15:49	Antares 4.9°S of Moon
01	21:41	Moon at Descending Node
04	05:02	LAST QUARTER MOON
06	03:34	Saturn 4.0°N of Moon
07	02:15	Jupiter 4.4°N of Moon
11	21:31	NEW MOON
14	12:47	Moon at Apogee: 406120 km
15	23:07	Aldebaran 5.4°S of Moon
16	00:53	Moon at Ascending Node
17	07:09	Mars 0.1°N of Moon: Occn.
18	21:00	Mercury at Superior Conjunction
19	13:18	Pollux 3.2°N of Moon
20	01:59	FIRST QUARTER MOON
20	13:25	Beehive 2.8°S of Moon
22	04:48	Regulus 4.9°S of Moon
22	07:00	Lyrid Meteor Shower
25	21:43	Spica 6.5°S of Moon
26	20:00	Mercury at Perihelion
26	22:31	FULL MOON
27	10:24	Moon at Perigee: 357379 km
29	01:07	Antares 4.8°S of Moon
29	04:17	Moon at Descending Node
30	16:00	Uranus in Conjunction with Sun

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Outreach Report

April is **Global Astronomy Month**; as I mentioned in last month's W.A.S. P., there are several astronomy and space events happening during the month:

Yuri's Night: April 12

Lyrids Meteor Shower: April 22, 23

Earth Day: April 22

Full Moon, Supermoon: April 27

What I *didn't* mention is that when searching the internet for "astronomy events in April," I saw a photo from the 2014 White House Astronomy Night with President Obama looking through a telescope. I Tweeted:

> *It would be REALLY NICE to see a return of the "White House Astronomy Night"*
>
> *I know a boatload of astronomers and volunteer NASA/JPL solar system ambassadors who would be willing to make it a national event!*

I also posted the same on the Solar System Ambassador Facebook group, and it took on a life of its own! I've since been in a Zoom meeting with a couple people from the National Science Foundation, the National Radio Astronomy Observatory and another Solar System Ambassador - I explained who I was, and the army of volunteers the W.A.S. and GLAAC have.

The take away from the meeting was:

- The NSF and NARO attendees were amazed and very pleased that there was so much interest in doing astronomy and science events.
- The White House Astronomy Night is an *invite-only* event, but we're going to poke the Biden administration to resurrect it, and (of course) offer assistance.
- Astronomy on the Mall, however, is something that we *could* be involved with - I had to laugh because it sounded *very* similar to Astronomy at the Beach, which I told them about!

I mentioned about getting various institutions on the Mall involved, and there was talk about having NASA's Visualization Studio do some Virtual Reality stuff. There's a Dark Sky park about an hour away, and the Shuttle is nearby too - the trip to DC could be a great vacation get-away in 2022! I'll keep you updated as things develop!

Member Spotlight

Ken Bertin gave his Edmond Halley presentation March 23 for the Detroit Public Library.

Adrian Bradley's aurora image was shown on Spaceweather.com on March 26th!

If you are giving presentations or doing other astronomy outreach, *please let me know!* Use this link to send me a quick email report.

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DETROIT PUBLIC LIBRARY

Business, Science & Technology

PRESENTS AN ONLINE PROGRAM

Space Ghosts

Tuesday, April 27, 2021
6:00 p.m. EDT

Comets, nebulae, and galaxies can look ghostly.

Amateur astronomer Jenny Pon shows images of ghostly-looking space objects and tells the science stories that tie them all together.

Please register:
https://dpl-space-ghosts.eventbrite.com

Link will be sent to registrants before program.

Image from the collection of Jenny Pon.

Main Library

5201 Woodward Avenue
Detroit, MI 48202
313/481-1391

www.detroitpubliclibrary.org

Aurora image used on Spaceweather.com. Photo: Adrian Bradley

Great Lakes Association of Astronomy Clubs Board Meeting

March 11, 2021 - ONLINE, 7pm

https://umich.zoom.us/j/584733345

AATB 2021: September 24/25, 2021

Call to order: 7:13 pm

Online:

1. Adrian Bradley - GLAAC President, Lowbrows
2. John Wallbank - GLAAC Vice President, Lowbrows
3. Jeff Kopmanis - GLAAC Secretary, Lowbrows
4. Brian Ottum - GLAAC Communications, Lowbrows
5. Mike Ryan - GLAAC AATB Large Telescope Manager, Ford
6. Bob Trembley - GLAAC Webmeister, Vatican Observatory Foundation, WAS
7. Bridget Harwood - MI-DNR
8. Shannon Murphy - Lowbrows/past-GLAAC
9. Marcus Clarke - Lowbrows

Discussion:

Bank Account Status
- Reimbursements will be done via PayPal from AB (WAS treasurer)
- JW has questions regarding separation of accounts at WAS

JW: word back from Bridgette @ MI-DNR
- Should be fine.
- Limits are now up to 300 persons, regardless of leave/go
- Disclaimer at registration (SM)
- Use Permit and Covid plan
- Seems likely unless there's a spike event

Non-AATB events (virtual)
- May 4 : Space Exploration (Kara Shuell) (also submitted to UM Astro Outreach)
- May 7: A Tour of the Sky (Sarah Welch, Big Rapids Comm. Library) (AB handled)
- Keep Shannon in the loop to avoid duplicates
- Shannon: Request from Farmington elementary home-schooled kids (JW will followup)

AATB 2021 - Sept 24/25 - **25th Year!!**
- **June 10** meeting will make the decision
  - May have some absent members due to a solar eclipse
  - Possible reschedule of that meeting, or a meeting out-of-band

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Event Tasks

Online

Have Speaker and Facilitator
MINIMUM of 30mins between online sessions
Possibly more interactivity for selected events
Suggestion: Kids getting involved in citizen science (BT)
Suggestion: Idea just popped into my head: an online scavenger hunt that takes players to all (or many of) the GLAAC member club websites (BT)

In-Person

Tent reservation in mid-June
At least one big tent
Good ventilation
Possible access/barricade fences to redirect to Entrance
Telescope field organization (MR)

Hybrid

Registration to limit attendance, if needed
Disclaimer of liability for Covid
Possible "shifts" by various clubs to minimize
Possibly limit telescope types to those which use optical or digital screens.
Electricity for additional electrical requirements

All:

Start lining up speakers
Vatican Observatory (Bob Trembley,Brother Guy)
WAS sources
Ford sources (Tim Campbell)
Flint Science Center
Michigan Science Center
UM Astronomy Dept
EMU Astronomy Dept (Norb Vance)
NASA - Mars topics? (Krishna's cousin)
Good participation by young women - get women-in-science speakers
Pleiades club (Girl Scouts) (JK)
Zoom licenses: possibly larger licenses for more interactivity?
Possible hot-spots from ATT/Verizon/Comcast for Zoom

Adrian Photo Show

Adjourn:

Motion to adjourn by JW, seconded by AS. Approved by unanimous vote.
Meeting Adjourned at 8:30 pm
TODO:

- Speakers for AATB (*See 4.iv.1*)
- Hot Spots from ATT/Verizon/Comcast

Comments from Zoom Chat:

1. **Bob Trembley**: The Vatican Observatory has updated the CRAP outta their website - I've been doing Podcasts for them! https://www.vaticanobservatory.org/podcast/
2. **Brian Ottum**: Over the past week we've seen a concerning upswing in cases in Michigan, as well as in counties around us. Also upswing in hospitalizations.
3. **Shannon Murphy:** Report your sky brightness estimates! https://www.globeatnight.org/

Next GLAAC Meeting: April 8, 2021 7:00 PM

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Michigan Dark Sky Update

(From emails from Sally Oey)

- **April 5-12:** Is International Dark Sky Week! We invite everyone to do something dark-sky related. Examples: the MIDS KIDS activity designed by our group; respond to one of the items below; ask your neighbor to replace the light polluting flood light; recruit new MIDS members; join/donate to the International Dark Sky Association (IDA), etc.

- **Chelsea:** Kathie Gourlay's group, Chelsea Dark Skies is official! email ChelseaDarkSkies@gmail.com for info or to join. Fly(er)ing out the gate, their revisions to the Zoning Ordinance have been reviewed by the city's consultant and they're awaiting the outcome. The ZO overhaul, including the lighting ordinance, is expected to be presented at the Planning Commission's April 20 meeting. The group has also submitted requested revisions for streetlight specs to the city planner. And, they'll be flyering certain neighborhoods and businesses with IDA brochures, complete with their own insert. If you can help with flyering, please contact them this week. Kudos to Kathie, Lynn Fox, Steve Wright, Carol Strahler, Sandy Peterson, and Meg Gower for this super effective work!

- **Scio Twp:** Supervisor Will Hathaway will discuss the Miller / Wagner roundabout with the Washtenaw County Road Commission, having learned about homeowner David Black's situation. New roundabouts in Scio will be constructed this summer. Does anyone know people who will be affected at Zeeb and Liberty? Please help us get in touch to warn them.

- **Detroit, Belle Isle:** Jerry Hasspacher attended the March 18 Belle Isle Park Advisory Committee (BIPAC) meeting and gave a brief pitch on the IDA Urban Night Sky Place initiative for the park during the public comment. His group is still awaiting an invitation from DNR to formally present to BIPAC.

- **UM:** Nicholas Poggioli has reviewed the lighting and bird-friendly sections of the UM Design Guidelines to identify ways to accomplish dark-sky compliance. Thank you, Nicholas! UM people: Could a couple people join our effort to bring these to UM facilities administration?

- **Chelsea:** Meg Gower is organizing a dark skies education program for children and youth this summer at the Chelsea District Library. One of the events will feature our MIDS KIDS activity designed by Annie Blackwell, Sophie Grillet, and Shari Thompson! Stay tuned for more info, and huge thanks to Meg.

- **Ann Arbor:** The city Planning Manager has been exploring ways to mitigate non-amortization of existing non-compliant lighting in the draft Lighting Ordinance, but says he hasn't been able to make much progress. He says he'll move the A2LO to the City Council "in the coming months".

- **UM:** The President's Commission on Carbon Neutrality has issued their Final Report, and unfortunately it doesn't say a word about light pollution and good lighting practice. These were included in an appendix to their Building Standards Analysis report, but without a formal recommendation on the issue by that subpanel, nothing was said in the PCCN report.

- Heidi Trudell shares Nationwide Standard Conservation Measures for federal construction projects from the US Fish and Wildlife Service that include dark-sky friendly lighting guidance. These guidelines can also be cited for any construction projects. Ryan Place shares a Crain's article reporting that Detroit is one of the worst cities in the US for bird deaths due to building collsions and light pollution (let us know if you want a copy). Bob Stencel shares this article about the ICC, a major builders' industry group that lobbies against green construction ordinances. And Nicholas Poggioli shares that the Smith College library renovation by Maya Lin has bird-friendly glass.

- Shannon Murphy reports that a student-oriented dark-sky monitoring project is available through an education group in Wisconsin. It would involve some electronics building and data collection/analysis, and can be linked to lakeshore and other environmental monitoring. If anyone is interested, please contact Katya Gozman, kgozman@umich.edu; or Kate Meredith, kate@glaseducation.org.

- Sophie Grillet shares that light pollution is linked to thyroid cancer according to a new study.

- The Sierra Club has just approved a comprehensive Light Pollution Policy and resource list.

- March 15 - May 31 is Safe Passage Great Lakes Days: Ann Arbor and State of Michigan ask owners of tall buildings to turn off lights to save migrating birds. As mentioned above, this is especially needed in SE Michigan. The fall dates are August 15 - October 31. Reported by Channel 4 Click on Detroit.

http://www.astro.lsa.umich.edu/~msoey/
https://sites.lsa.umich.edu/darkskies/

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Stellarium v0.21.0 was released on March 28th - there are numerous updates and features; the developers mentioned that they have published a scientific paper about the application of Stellarium in cultural astronomy: https://doi.org/10.1558/jsa.17822

-**Bob Trembley**

Meeting Minutes

BOARD MEETING

March 1, 2021

Meeting was called to order at 6:30PM by President Diane Hall via WebEx.

Officers present – Dale Partin, Riyad Matti, Mark Kedzior, Adrian Bradley, Dale Thieme, Bob Trembley (quorum present). Twelve WAS members in attendance.

Diane discussed a Dark Sky event on Belle Isle – planning for event with other individuals curtailed by pandemic – this could be a premier outreach event for the metro Detroit area, especially viewing clear, dark skies to the north over Lake St. Clair. More info on the planning stages to come . . .

Officer Reports: 1st VP Dale Partin discussed recent speakers that gave presentations at our meetings – is searching for local talent, possibly astronomy grad students to give presentations in near future.

2nd VP Riyad Matti reports that his regular inspection visit to Stargate Observatory and our Dob Shed finds them in A-OK condition – observatory still closed due to state guidelines on COVID restrictions.

Secretary Mark Kedzior reported that the February 2021 meeting minutes are posted in the March 2021 issue of the WASP.

Treasurer Adrian Bradley reported 159 paid memberships to date, with $22K in WAS account and $900 in PayPal account – will be establishing mobile banking access with Bank of America to enhance accounting for treasury related items.

Outreach – Bob Trembley reports that all recent and upcoming outreach activities by members are posted in the March 2021 WASP.

Publications – Dale Thieme reports that the March 2021 edition of the WASP is posted online on the WAS website.

Old Business

WAS website updates – Bob Trembley and Jonathan Kade will work on updating the WAS website. Riyad Matti suggested that we update certain sections on our site during this update and get them up and running instead of everything all at once.

Discussion on the calendar orders and distribution of the replacements (if requested).

New Business

Diane Hall thanked Dale Partin for stepping in at the last minute to preside over the February Macomb meeting.

Diane Hall brought up the KIG Insurance application for the WAS – it was last updated in 2017. Diane

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Hall, Dale Thieme and Adrian Bradley will provide updates to the questionnaire for KIG.

Discussion to update Board contact info on our WAS website for inquiries by interested individuals seeking information on the WAS, events and astronomy related information (telescopes, observing, etc.).

Discussion on managing WAS Virtual Presentations – Suggested goal: to have WAS Board (current officer or newly created board position) manage WebEx, Open House and YouTube presentations. Dale Thieme suggested a member/ members from our youthful ranks with tech savvy would be an ideal fit for this position. Discussion took place on other venues to present virtual meetings in place of WebEx, YouTube. At the April Board meeting, Diane Hall will place an item on the agenda regarding discussion and board vote for the WAS to purchase a one year WebEx service plan to provide a platform for WAS virtual meetings, along with further discussion on managing WAS virtual presentations.

Bob Trembley suggested to promote Astronomy month in April with a Yuri's Night, select a date and contact libraries to promote this activity.

Motion to adjourn meeting by Adrian Bradley – supported by Dale Thieme. Motion passed 7-0.

Meeting adjourned at 7:28 by President Diane Hall.

Respectfully submitted,
Mark Kedzior
Secretary

CRANBROOK *Virtual* MEETING

March 1, 2021

The meeting was called to order at 7:30PM and a welcome to all by President Diane Hall. She then reviewed the ground rules, meeting format and etiquette of this virtual meeting and presentation so as to be enjoyed by all in attendance.

(Attendance on WebEx was 34 at 8PM).

IN THE NEWS

Presented by Diane Hall (of note):

Parachute on Perseverance rover – secret message on chute in binary code seen when opened on Mars –

SpaceX – One more try – SN8 blew up -SN9 crashed – SN10 - ?

James Webb Space Telescope – Final functional test completed – projected launch October 2021 –

Images of asteroid Apophis - 300m in diameter –

Fireball in UK skies on Sunday February 28

Haley Arceneaux – youngest astronaut candidate - first with physical handicaps to train for future missions –

IN THE SKY

Presented by Diane Hall (of note):

Zodiacal Light Season – on March 4th Vesta will be in opposition at magnitude 5.8 in constellation of Leo – March 6th Mercury will be at its greatest elongation 26 degrees from Sun in morning skies – Finally, the Astronomer's Bane – aka Daylight Savings Time – will commence on Sunday March 14th (mark the date November 7 on your calendars to turn the clocks back one hour – can't wait! – MK)

OFFICER REPORTS

Diane Hall briefly discussed the Belle Isle Dark Sky WAS event in planning stages –

1st VP Dale Partin with future WAS presentations – March 18th at Macomb meeting, Bob Trembley will present "Basic Orbital Mechanics" – on April 5th at Cranbrook meeting, a short presentation on "Schmidt Cameras" by David Levy, and the main presentation by UM astronomy grad student Anne Blackwell on "Supernovas".

2nd VP Riyad Matti reported on his regular inspection of Stargate Observatory and Dob Shed at Wolcott Mill Metropark and found our facilities to be in A-OK condition. The observatory is still closed due to state guidelines on COVID restrictions.

Secretary Mark Kedzior reported that the February minutes of both the Cranbrook and Macomb meetings are in the March 2021 edition of the WASP.

Treasurer Adrian Bradley reported a balance of $22,45.49 in WAS Treasury, and a total of 159 paid memberships to date.

Outreach Director Bob Trembley reported that there were several outreach events by members that are posted in the March 2021 WASP. He also mentioned that April is Global Astronomy Month.

Publications Director Dale Thieme reported the March 2021 edition of the WASP is online. The April 2021 WASP will feature a follow-up of a previous article by Brad Young of the Tulsa Astronomy Club.

SIG REPORTS

Sun SIG – "Boring" – no sunspots of note –

Double Star SIG – Riyad Matti reports - "They're up there . . . "

History SIG – Dale Thieme has a picture ID project going on in the WASP, to identify persons in archive photos.

Astrophotography SIG – Bill Beers reported on the "Snow Moon" – Adrian Bradley with his Light

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Pillars image – stated that in dark skies you can capture more with less exposure time –

GLAAC – Adrian Bradley reports that the AATB event for 2021 is in its preliminary planning stages for a hybrid event pending state guidelines on COVID restrictions.

OBSERVING REPORTS – David Levy gave his solar observing report – saw no sunspots but a large filament on sun's surface – read poem written by 18 year old Canadian about the Challenger disaster of 1986 –

Mark Jakubisin shared image of rising moon taken at Brandenburg Park.

Dale Hollenbaugh shared 2 ½ hour image of Rosette Nebula.

SHORT PRESENTATION

Gary M. Ross presented "The Case Against Mars" –

He discussed how many missions/probes that have been sent to Mars, and gave examples of missions that should be attempted: Venus – to do atmospheric studies; Pluto (Pluto-Charon system) – do an orbital mission to continuously collect data; Titan – land crawler on surface to do further scientific studies; Mercury – land probes to do mineral analysis and seismographs for in-depth study of planet; Europa – land on surface and collect ice samples near crevices; Callisto (why so blue?) – collect soil samples and microscopic analysis; Eris and Sedna – Pluto -sized planetoids for future study; Ceres – land on surface, collect samples then return to Earth. Questions and discussion followed.

BREAK –

MAIN PRESENTATION

Dr. Gilbert V. Levin with his presentation of "Is There Life on Mars?" – Dr. Levin explained the method he developed of detecting organisms on Mars, which was based on a procedure by Louis Pasteur. This method was used on the Mars Viking Mission in 1976, landing at two sites a full hemisphere apart and collected and analyzed samples taken at each site. According to Dr. Levin, a major finding is that all elements needed for life were found on Mars.

Questions and discussion followed his presentation. Both presentations can be seen in their entirety at:

https://www.youtube.com/warrenastro

Meeting was adjourned at 9:43PM.

Respectfully submitted,
Mark Kedzior

MACOMB Virtual MEETING
March 18, 2021

The meeting was called to order at 7:30PM and a welcome to all by President Diane Hall. She then reviewed the ground rules, meeting format and etiquette of this virtual meeting and presentation so as to be enjoyed by all in attendance.

(Attendance on WebEx was 31 at 8PM).

Diane briefed the membership on discussions regarding meeting again in person, and scheduling an in-person picnic in August. Once again, this is all predicated on state mandated COVID restrictions, but with more vaccinations being administered, we are moving in the right direction to once again meet in person.

OFFICER REPORTS:

1st VP Dale Partin announced our upcoming presentation schedule:

April 5th (Cranbrook) – The main presentation by Anne Blackwell, UofM Astronomy grad student working on her doctorate, with "Supernova Remnant Kinematics and Cluster Metallicity: X-Ray Mysteries". The short presentation by David Levy, entitled "Of Schmidt Cameras, Comets, and Asteroid Bennu: A Long Friendship with Rik and Delores Hill".

April 15th (Macomb) – President Diane Hall will be presenting" The Galileo Mission".

2nd VP Riyad Matti reported that Stargate Observatory and the Dob Shed are A-OK, and hopes that with more vaccines being administered, we may be able to meet in the near future at Stargate, but the observatory remains closed due to the state mandated pandemic restrictions.

Secretary Mark Kedzior had nothing to report at this time.

Treasurer Adrian Bradley reported a balance of $21,905 in WAS Account, and $3375 in GLAAC Account. We currently have 167 paid memberships.

Outreach Chairperson Bob Trembley reports that April is Global Astronomy Month, with Yuri's Night on April 12th. Bob also reported that we had many members do outreach presentations – Ken Bertin, Bob Berta, Jonathan Kade Angelo DiDonato to name a few. Bob also asked that members send any outreach activity reports to him for his outreach report.

Publications Director Dale Thieme reports that the March WASP is still up on our website, and that the April WASP is shaping up to be another fine edition.

SPECIAL INTEREST GROUPS:

Solar – nothing to report – very little activity except for some prominences. Double Star Group –

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nothing to report as of this time.

Astrophotography – Bill Beers shared a 3 ½ hour image with one shot color CMOS camera of NGC 3628 – the "Hamburger Galaxy" – an edge-on spiral in the constellation of Leo – this object can be seen with an 8" or larger aperture in dark skies preferably.

OBSERVING REPORTS:

David Levy reports his observatory is being repaired and he is doing some variable star observing – Riyad Matti has been observing double stars with wide separation with binoculars, with many in the 4th to 5th magnitude range. Adrian Bradley shared image of the "Real Sky" Milky Way from Hwy 123, 45 minutes from Mackinac Bridge. Jonathan Kade reported that David Baranski was recognized for his Astronomical League contribution.

IN THE NEWS

Presented by Diane Hall: A report on the "cookie shape" of Oumuamua and recent hypothesis on its origin – a carbonaceous chondrite weighing 300 gr was recovered in Great Britain from fireball that flew over its skies on February 28th – former US Senator Bill Nelson may be tapped to become new administrator for NASA – an audio recording from the Perseverance rover on Mars, hearing the rover wheels and the sounds it makes rolling over the Martian terrain – a "Martian Cloud" – a white streamer approximately 1200 miles long near Arsia Mons was imaged – a supernova called the Hoinga SNR, only seen in x-ray, approximately 90x the apparent size of the full moon.

IN THE SKY

Spring Equinox begins March 20 at 5:27 AM – Lunar X, a feature that can be seen during 1st quarter phase. Best seen around 6:30PM EST on March 20 – March 24 – the Bay of Rainbows – Sinus Iridium – the "Golden Handle" is prominent lunar feature to be seen – "Two Red Eyes" – Mars will be 7 degrees from Aldebaran in Taurus.

Doug Bock showed video clip of asteroid Apophis, which was at 10.5 million miles from Earth on March 4th but will only be approximately 20,000 miles from Earth on its return in 2029.

MAIN PRESENTATION

With introduction by 1st VP Dale Partin, Outreach Chairperson Bob Trembley presented "(Very) Basic Orbital Mechanics" with visual aids from the Kerbal Space Program. His presentation covered everything you wanted to know about the workings and theory of orbital mechanics, displaying excellent graphics and computer simulations of orbital mechanics at work. One item of note in his presentation – "You can't have orbits without gravity!"

Questions and discussion followed:

You can see this presentation in its entirety on YouTube at:

https://www.youtube.com/warrenastro

Meeting was adjourned at 9:34PM.

Mark Kedzior
Secretary

Saw a Fireball?

American Meteor Society!

www.amsmeteors.org/members/fireball/report-a-fireball

Club Member Name Tags

Email publications@warrenastro.org for your personalized name tag

Space Pirate Radio

Tune in to Captains Marty Kunz and Diane Hall for live radio

Wednesday nights at 9:00 pm ET on

Astronomy.fm

McMath-Hulbert Report

Good news, the sun is finally above the trees blocking the second tower opening and we can finally see the sun again. This will allow us to continue work on the scanning spectroheliograph. Maybe we'll get images this year?

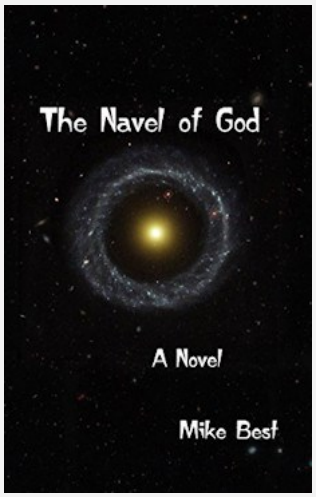
Bad news, the dome on the second tower does not rotate, the rotation motor runs, but the cable is slipping on the drive pulleys. So this is where we'll concentrate our efforts in the next few weeks.

Reorganization in the main building is done, next we'll do some serious housecleaning and window washing.

The sun's been pretty quiet although we have been seeing a few spots now and then as Solar Cycle 25 gets underway.

No plans yet for regular open houses as we're waiting for further relaxations in the covid restrictions.

And we're seeing the first skunk cabbage plants of the year! These are always the first wildflowers to appear in our swampy wooded area. Spring has sprung!



The Navel of God by Mike Best

This is not just another science fiction story. It offers action, suspense, mystery and romance. The Detroit News book editor, Andrea Wojack, awarded it 5 out of 5 stars.

> "In the case of Zack Peters, PhD Physics, things couldn't get much better. A former CIA agent and currently science advisor to the American President, he enjoys all the perks that come with the job as well as a reputation of being one of Washington's most eligible bachelors.
>
> Peters has had more than his share of adventures, friends and many of less-than-successful love affairs. His greatest adventure will begin when he discovers that some people are not who they appear to be as he finds himself the focal point of Earth's first contact with extraterrestrials."

The 419-page, 6x9-inch, paperback, draws on the author's 42-year background in astronomy. He has given more than 950 lectures, hosted 14 cable-television shows and is a frequent radio guest in the U.S. and Canada - all to an estimated audience of 80,000.

The Navel of God is the author's answer to a question posed by the late astronomer Carl Sagan's both his book and television series *Cosmos.* "How would a dispassionate observer view our stewardship to the Earth?"

For a personalized copy, send a $19.99 check made to Mike Best, 38513 Chestnut Lane, Westland, MI 48185. No additional charges for tax, handling or mailing.

Unsigned copies are available from Amazon

www.amazon.com/Navel-God-Novel-Mike-Best

The Warren Astronomical Society is a Proud Member of the Great Lakes Association of Astronomy Clubs (GLAAC)

GLAAC is an association of amateur astronomy clubs in Southeastern Michigan who have banded together to provide enjoyable, family-oriented activities that focus on astronomy and space sciences.

GLAAC Club and Society Meeting Times

Club Name & Website	City	Meeting Times
Astronomy Club at Eastern Michigan University	Ypsilanti/EMU	Every Thursday at 7:30PM in 402 Sherzer
Capital Area Astronomy Club	MSU/Abrams Planetarium	First Wednesday of each month 7:30 PM
Farmington Community Stargazers	Farmington Hills	Members: Last Tuesday of the month Public observing: 2nd Tuesday of the month
Ford Amateur Astronomy Club	Dearborn	Fourth Thursday of every month (except November and December) at 7:00 PM
McMath-Hulbert Astronomy Society	Lake Angelus	Board and paid members-First Sunday of the month Public open house—first Saturday at 11 am
Oakland Astronomy Club	Rochester	Second Sunday of every month (except May)
Seven Ponds Astronomy Club	Dryden	Monthly: generally the Saturday closest to new Moon
Sunset Astronomical Society	Bay City/Delta College Planetarium	Second Friday of every month
University Lowbrow Astronomers	Ann Arbor	Third Friday of every month
Warren Astronomical Society	Bloomfield Hills/ Cranbrook & Warren/ MCC	First Monday & third Thursday of every month 7:30 PM

GLAAC Club and Society Newsletters

Warren Astronomical Society: http://www.warrenastro.org/was/newsletter/
Oakland Astronomy Club: http://oaklandastronomy.net/
McMath-Hulbert Astronomy Club http://www.mcmathhulbert.org/solar/newsletter/
Ford Amateur Astronomy Club: http://www.fordastronomyclub.com/starstuff/index.html
Sunset Astronomical Society: http://www.sunsetastronomicalsociety.com/
University Lowbrow Astronomers: http://www.umich.edu/~lowbrows/reflections/

WAS Member Websites

Jon Blum: Astronomy at JonRosie
Bill Beers: Sirius Astro Products
Jeff MacLeod: A Life Of Entropy
Bob Trembley: Balrog's Lair
Bob Trembley: Vatican Observatory Foundation Blog

Doug Bock: https://boonhill.org
Facebook: Northern Cross Observatory https://www.facebook.com/NorthernCrossObservatory
Boon Hill and NCO Discussion https://www.facebook.com/groups/369811479741758
YouTube channel: https://www.youtube.com/channel/UC-gG8v41t39oc-bL0TgPS6w

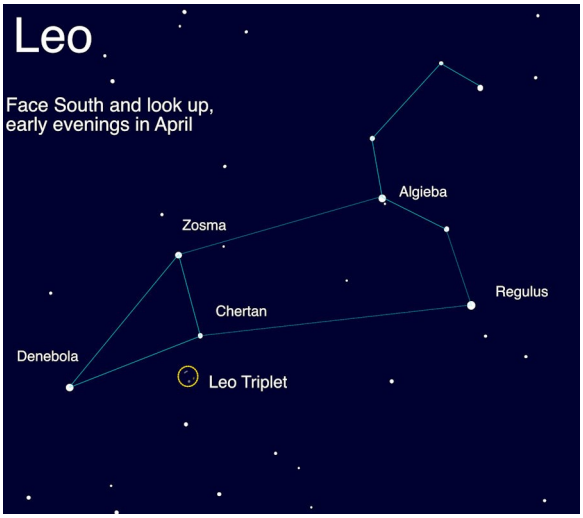
Watch the Lion: Celestial Wonders in Leo

David Prosper

Leo is a prominent sight for stargazers in April. Its famous sickle, punctuated by the bright star Regulus, draws many a beginning stargazer's eyes, inviting deeper looks into some of Leo's celestial delights, including a great double star and a famous galactic trio.

Leo's distinctive forward sickle, or "reverse question mark," is easy to spot as it climbs the skies in the southeast after sunset. If you are having a difficult time spotting the sickle, look for bright Sirius and Procyon - featured in last month's article – and complete a triangle by drawing two lines to the east, joining at the bright star Regulus, the "period" in the reverse question mark. Trailing them is a trio of bright stars forming an isosceles triangle, the brightest star in that formation named Denebola. Connecting these two patterns together forms the constellation of Leo the Lion, with the forward-facing sickle being the lion's head and mane, and the rear triangle its hindquarters. Can you see this mighty feline? It might help to imagine Leo proudly sitting up and staring straight ahead, like a celestial Sphinx.

If you peer deeper into Leo with a small telescope or binoculars, you'll find a notable double star! Look in the sickle of Leo for its second-brightest star, Algieba - also called Gamma Leonis. This star splits into two bright yellow stars with even a small magnification - you can make this "split" with binoculars, but it's more apparent with a telescope. Compare the color and intensity of these two stars - do you notice any differences? There are other multiple star systems in Leo – spend a few minutes scanning with your instrument of choice, and see what you discover.



The stars of Leo: note that you may see more or less stars, depending on your sky quality. The brightness of the Leo Triplet has been exaggerated for the purposes of the illustration - you can't see them with your unaided eye.

One of the most famous sights in Leo is the "Leo Triplet": three galaxies that appear to be close together. They are indeed gravitationally bound to one another, around 30 million light years away! You'll need a telescope to spot them, and use an eyepiece with a wide field of view to see all three galaxies at once! Look below the star Chertan to find these galaxies. Compare and contrast the appearance of each galaxy – while they are all spiral galaxies, each one is tilted at different angles to our point of view! Do they all look like spiral galaxies to you?

April is Citizen Science Month, and there are some fun Leo-related activities you can participate in! If you enjoy comparing the Triplets, the "Galaxy Zoo" project (galaxyzoo.org) could use your eyes to help classify different galaxies from sky survey data! Looking at Leo itself can even help measure light pollution: the Globe at Night project (globeatnight.org) uses Leo as their target constellation for sky quality observations from the Northern Hemisphere for their April campaign, running from April 3-12. Find and participate in many more NASA community science programs at science.nasa.gov/citizenscience. Happy observing!

Your view of the three galaxies in the Leo Triplet won't look as amazing as this image taken by the VLT Survey Telescope, unless you have a telescope with a mirror 8 feet or more in diameter! Still, even a small telescope will help your eyes pick up these three galaxies as "faint fuzzies": objects that seem blurry against a background of pinpoint stars. Let your eyes relax and experiment with observing these galaxies by looking slightly away from them, instead of looking directly at them; this is called averted vision, a handy technique that can help you see details in fainter, more nebulous objects.

Image Credit: ESO, INAF-VST, OmegaCAM; Acknowledgement: OmegaCen, Astro-WISE, Kapteyn I.