Hamilton Amateur Astronomers

Event Horizon

Volume 28, Number 5
March 2021

From The Editor

A big welcome to March, Daylight Savings Time, and Spring!

There's no Eye Candy section this month, but there is nevertheless a cornucopia of fascinating columns and articles this time around.

Thanks to everyone who contributed!

Happy Reading!

Bob Christmas, Editor

editor 'AT' amateurastronomy.org

Chair's Report by John Gauvreau

Wow! The United Arab Emirates successfully put their Hope Orbiter into orbit around Mars and China also orbited their Tianwen-1 spacecraft and plan to put a rover on the surface later this year. Both were spectacular achievements and are very exciting missions. And we have already seen spectacular images returned the the U.S. rover Perseverance. At first I thought, well it's just like Curiosity, but the passing years have allowed them to upgrade Perseverance nicely and the videos that have been returned are like scenes from old sci-fi movies I watched. No, their better, because they're real!

And I have tackled something new; I am learning to stack lunar images. I have stacked deep sky images before with some success, but lunar images are completely different. It's been a lot of fun (I can say that because some have worked out for me) and although I have a long way to go, I am pleased with the early results (the same can be said of the three Mars missions!).

HAA Meetings

Last month we had a visit from Philip Groff, the Executive Director of the Royal Astronomical Society of Canada. Phil talked about the society, his time there and gave a great tour of some of the exhibits that will go into the museum when it is built.

This month we will enjoy a presentation from Tom Field, contributing editor to Sky and Telescope magazine and president of 'RSpec', a company that manufactures spectroscopes. Tom will be speaking about the amazing field of spectroscopy, which is how we learn about what stars are made of, their histories and all about the composition of the universe. Tom will be joining us from Seattle, which just shows how we can take the restrictions of the pandemic and make them work for us. Our live meetings wouldn't normally allow us to have Tom visit us from such a great distance, and we will travel farther with future speakers.

(Continued on page 2)

IN THIS ISSUE:

Chair's Report (continued)

A friendly reminder that all our meetings will be held online through the Zoom platform for the foreseeable future. If you have had any hesitation about joining in please feel free to get in touch and we will help you. And don't forget that you can always email 'zoomsupport@amateurastronomy.org' to get help joining the meeting, even once the meeting has started.

Also, since we are holding our meetings online there can be no collection for the foodbank, but don't let that stop you from contributing yourself. It doesn't matter if it comes from the club or straight from the club members; there are people in need and any donation is always welcome.

The March meeting begins at the usual time of 7:30pm on Friday March 12th. Hope to see you there!

Beginners Group

Such a fun group! I am enjoying the sessions very much and it really is nice to get to know some new members, even virtually. Jim Wamsley gave a great presentation on telescope types and last time we talked about all the different kinds of celestial objects there are that populate the universe. Upcoming are sessions on what things look like through the eyepiece, binoculars, observing conditions, eyepieces and more.

Light Pollution

The club has formed a light pollution committee. No, the committee is not out there figuring ways to make more light pollution! This industrious group is exploring ideas about how we can educate and help abate light pollution. Many thanks go to *Les Webb*, *Mario Carr*, *Paula Owen* and *Kevin Salwach* for giving their time and energy to such a worthy cause. If anyone is interested in participating you are certainly encouraged to; all your ideas will be welcomed. We have a big club and I am sure there are members out there who would have some great insights. Please feel free to get in touch.

Club Logo

Here's something else you can have input on; the banner project and the business style cards were put on hold so a decision can be made about which club logo to use. The club has used three different ones in the past; the words "Hamilton Amateur Astronomers" that has been in use since the club formed, the circular logo with the starburst in the center that you see on the front page of this newsletter and on the website, and finally the newest one, also circular, that has a crescent moon and Big Dipper on it. This came along as a special project for the club's 25th anniversary a couple of years ago. All three logos are great and have been used well in the past. Which do you want to see going into the future? Again, please feel free to contact me with your insights.

Conclusion

February was a short month and I am pleased that we will be seeing each other again so soon at our nest virtual meeting. Remember that if you can't tune in to the club Zoom meeting that you can also watch it live-streamed on YouTube, or catch it on YouTube later. Hey, why not subscribe to our YouTube channel? And tell your friends to as well. Hope to see you there!

Masthead Photo: *The Waxing Gibbous Moon of February 20, 2021,* by *John Gauvreau.*

Taken through his 90mm refractor; ISO 200; f/6.3; 1/500 second, from Hamilton, ON.

HAA Explorers by Jo Ann Salci

…A column for young astronomers - and those young at heart!

Welcome back! Last month we took a look at our home – planet Earth. This month we are going to learn more about our closest neighbour in space – the Moon!

To the Moon! (Part 1)

Let's start with an activity to help us explore! You will also see these words in the article below!

Exploring the Moon

C	R	I	N	M	O	O	S	M	T	I	D	P	D
O	C	A	K	O	E	K	E	A	R	S	E	I	C
L	R	A	N	U	L	T	P	R	G	A	K	N	N
L	O	D	V	N	I	A	A	E	A	P	C	E	A
I	O	R	S	T	L	R	H	L	I	S	O	T	A
S	I	E	N	A	A	O	S	Y	E	C	L	L	I
I	A	E	U	I	G	C	O	N	H	R	Y	O	R
O	L	A	H	N	S	K	O	U	T	A	L	M	A
N	T	A	E	S	A	S	E	E	T	T	L	H	M
A	S	T	R	O	N	A	U	T	S	E	A	I	L
A	D	L	A	S	S	A	R	R	U	R	D	S	C
V	A	N	V	C	N	N	E	A	R	S	I	D	E
A	I	A	I	D	L	S	A	O	C	N	T	A	N
L	S	U	F	A	R	S	I	D	E	M	A	R	O

ROCKS
GALILEO
TIDALLY LOCKED
ASTRONAUT
SHAPES
LAVA
MOLTEN
CRUST
SEA
FAR SIDE
MARE
NEAR SIDE
MARIA
COLLISION
THEIA
CRATERS
MOUNTAINS
LUNAR

Solution on page 6.

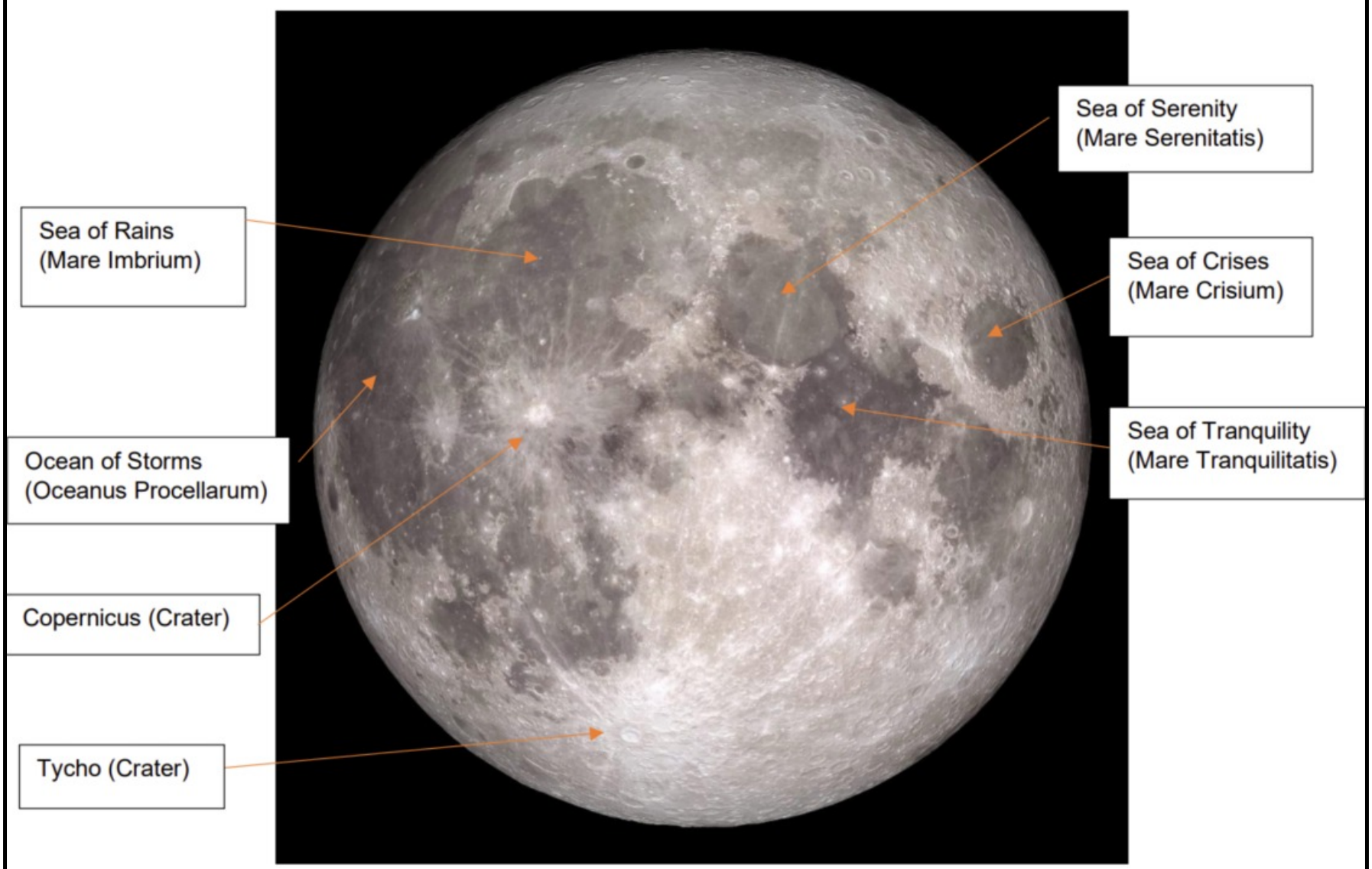
Not only is the Moon our closest neighbour in space at 384,400 kms away, it's also the only natural space object that humans have visited! Our first visit was on July 20, 1969, when astronauts first landed on the Moon. They, and astronauts and space probes that followed, have brought back Moon rocks and soil for study on Earth. These samples have helped us understand a lot about our neighbour!

(Continued on page 4)

If the Earth was a soccer ball, the Moon would be the size of an orange, at about ¼ the size of the Earth.[1] The air is thin on the Moon, so there is no weather or wind. There isn't a lot of gravity on the Moon, so you'd be able to jump pretty high! Temperatures range from -233˚C to 123˚C. The Moon reflects light from the Sun and does not give off its own light.

About 4.5 billion years ago when the Earth was still forming and soft (molten), it's believed that a smaller planet (named Theia) collided with it. This collision splashed up a big blob which became our Moon. Scientists believe this because the samples brought back from the Moon are similar to rocks on Earth. As the molten Moon was still forming it was bombarded by large and small space objects which created its many craters and mountains.

The force of some of the impacts was so strong, that lava from within the Moon oozed out and hardened into smooth, dark areas. These dark areas that we can see from Earth are called "Seas" (Maria in Latin – pronounced Mar-ee-uh) or "Sea" (Mare in Latin – pronounced Mar-ray). There's a dark area that's even named after an Ocean! What did water have to do with naming these areas? Earlier astronomers, like Galileo, didn't have very strong telescopes and thought that the dark areas were filled with water. That is why they were named "Seas". They aren't filled with water though! Ice has been found on the Moon, but only in small amounts and not enough to fill up any lunar (another name for Moon) Seas or Oceans!



This image is based on data from NASA's Lunar Reconnaissance Orbiter spacecraft.

Credit: NASA/GSFC/Arizona State University

(Continued on page 5)

These light and dark areas appear on the side of the Moon that we see from Earth and they create shapes. Our imaginations help us see many different ones: A man, a woman, a bunny, a dog, a toad…what do you see?

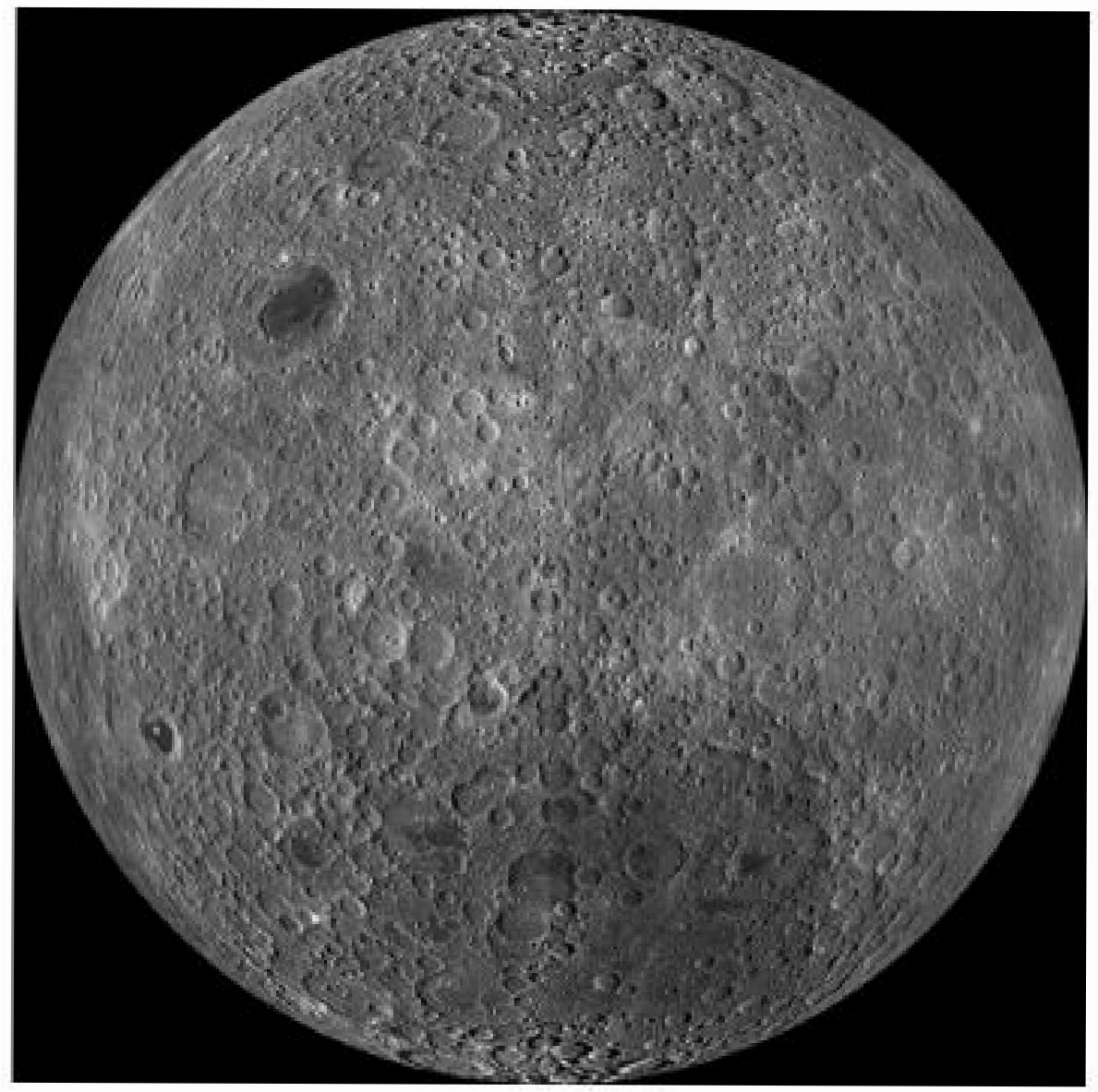


Image Credit: NASA

Why do we always see the same side of the Moon? Doesn't the Moon spin on its axis? Good questions! The Earth's gravity has pulled on the Moon for billions of years. This constant pulling has slowed the Moon's rotation on its axis. It DOES spin on its axis, but it's very slow! It takes the Moon as long to spin on its axis as it does to orbit the Earth once! The result is that the same side of the Moon is always facing us. Check out the image on the previous page that shows what this looks like. This image here on this page is what the Moon would look like to us if it didn't rotate on its axis.

So, what DOES the other side of the Moon (also called the far side) look like?

The far side has a lot of craters and only a few Maria, and looks very different from the side facing the Earth (near side). Scientists have learned that the Moon's crust on the near side is thinner, so it's believed that the lava could get to the surface more easily, creating all the Maria that we can see!

To be continued next month…the Moon will go around the Earth one time until the next article! We will explore more about the Moon and its travels around the Earth!

During March, look for the Moon in the sky:

1. Anytime you see the Moon: The Moon will have different shapes all through the month and can sometimes be seen during the day or at night (we will explore this next time). Explore the places on the Moon that are labeled in the photo on page 5. You can see many of them with your eyes and if you have binoculars, you will see them in more detail. Draw pictures of what you see. There are lots of places to explore on the Moon!

(Continued on page 6)

HAA Explorers (continued)

Things to do until next time**:

1. How to make a crater: With an adult's help, you can make your own craters!
https://www.youtube.com/watch/HTukFx17Ryg

2. Learn more about the Moon: https://spaceplace.nasa.gov/all-about-the-moon/en/

3. Check out some shapes that people see on the Moon:
https://en.wikipedia.org/wiki/Lunar_pareidolia#/media/File:Man_In_The_Moon2.png

** Check with your parents or caregivers before checking out websites.

Finally:

Why did the cow go in the spaceship?

Answer: *Because it wanted to go to the Mooooooooooooon!*

See you next month!

If you have a question you would like answered in the newsletter, please send it to education@amateurastronomy.org

1. Exploring the Night Sky. Terence Dickinson. 1997. Pg.7

Thank you to An, Br, and Mi for their review of this article! 😊

References:

Astronomy.com: Astronomy for Kids. 2019.

Essential Guide to Space. Paul Sutherland. 2016.

National Geographic Kids: Ultimate Space Atlas. 2017.

National Geographic Kids: Ultimate Explorer Field Guide: Night Sky. 2016.

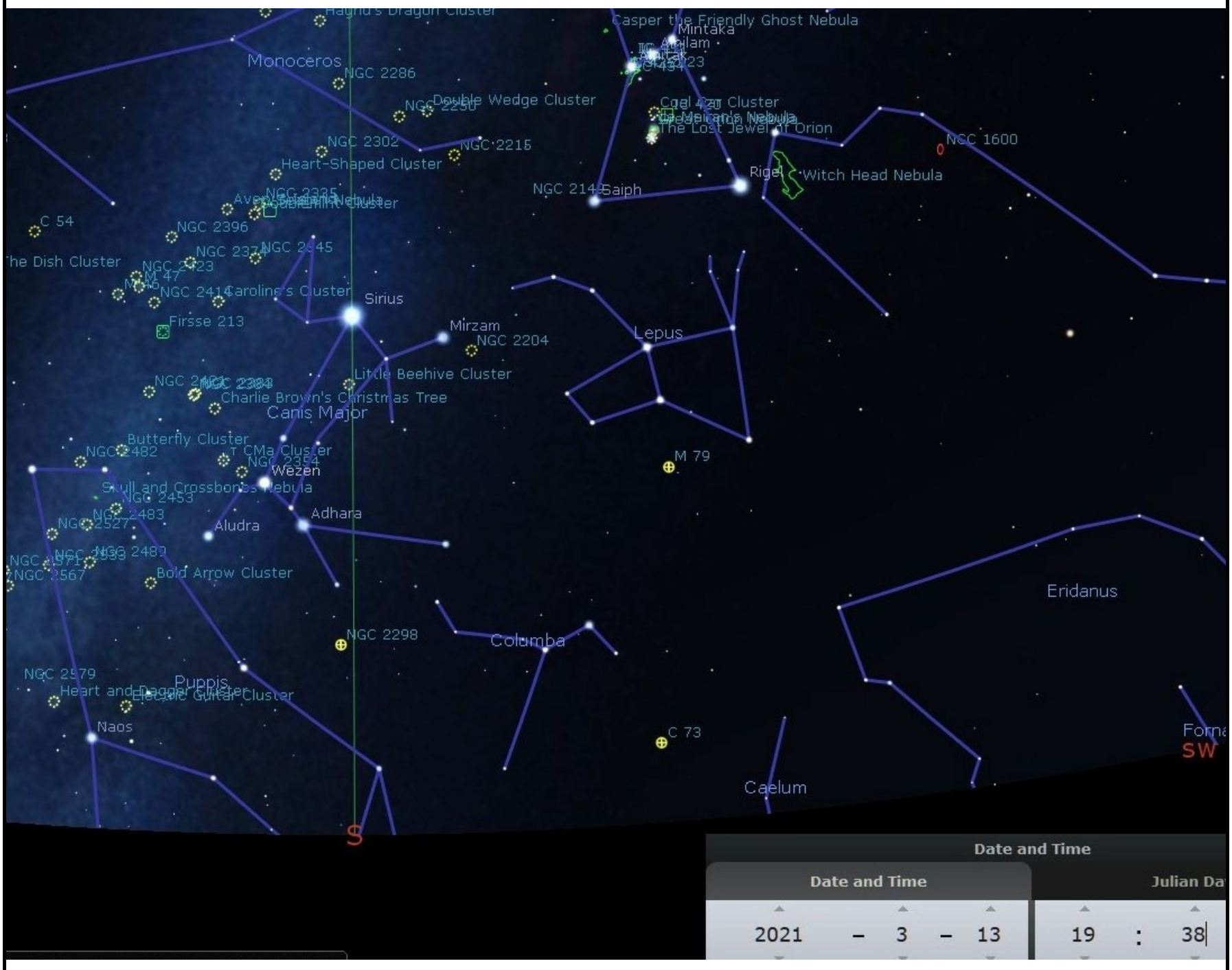
https://spaceplace.nasa.gov/all-about-the-moon/en/

Nightwatch. Terence Dickinson. 1998

thewordsearch.com *Answers*

The Sky This Month for March 2021 by Matthew Mannering

Sunday March 14th marks the beginning of *Daylight Savings Time* (DST). Remember on Saturday night to move your clocks forward one hour. The move to DST will cause a minor change to the planning of your observing schedule. Let's say on Saturday night March 13th you plan to go outside to observe the constellations at 7:40 pm.



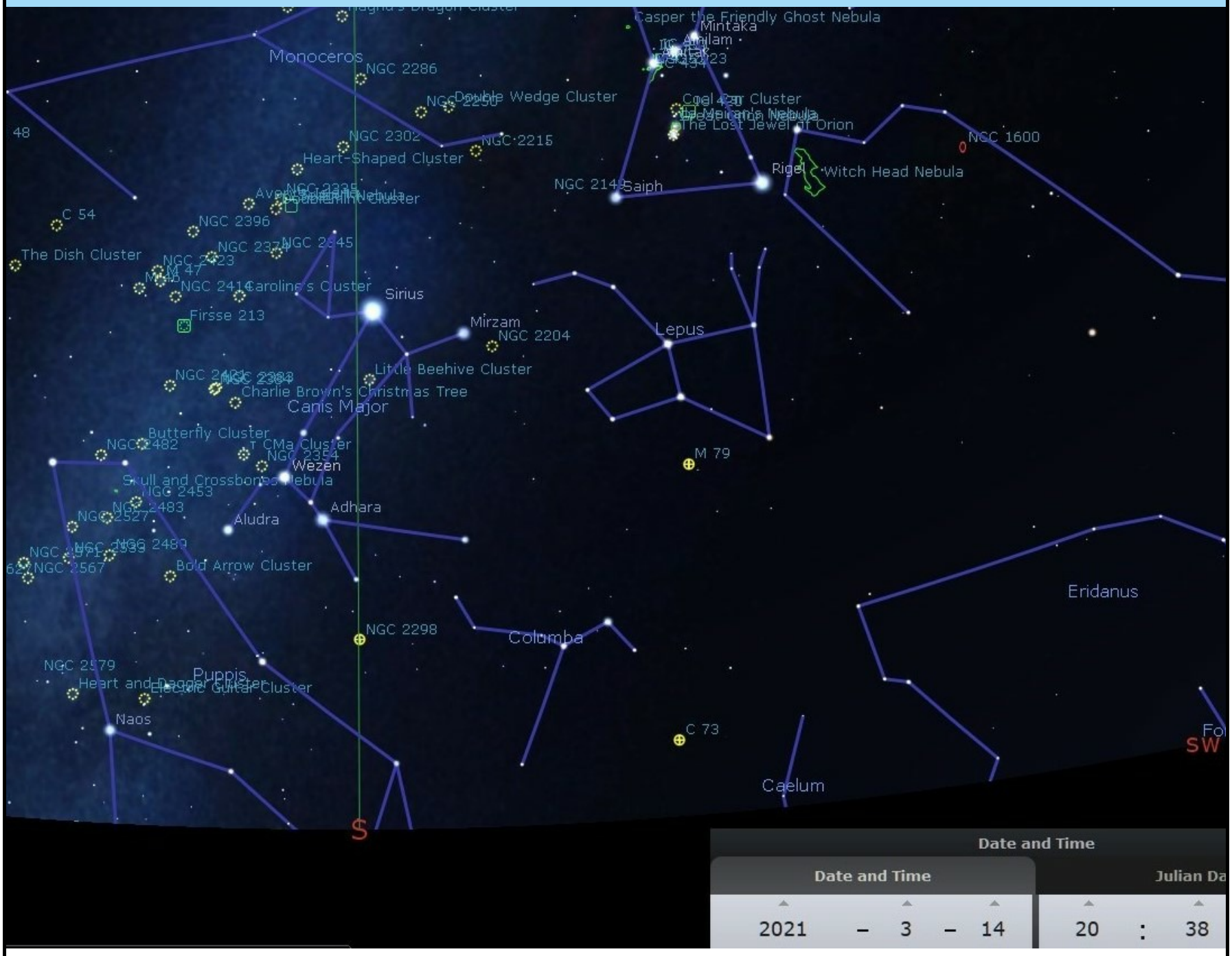
Notice that *Sirius* the Dog Star is on the green line that indicates the Meridian (which denotes due South). The next night after the change to DST you will need to head out at 8:40 pm to get the same view.

The *Vernal Equinox*, otherwise known as the official start of Spring, occurs on March 20th. Equinoxes occur at the mid points in the year between the solstices. The summer solstice (when the Sun is highest in the sky at noon) occurs around June 21st. The winter solstice (when the Sun is lowest in the sky at noon) occurs around December 21st. So, it makes sense that the spring and fall equinoxes occur in March and September.

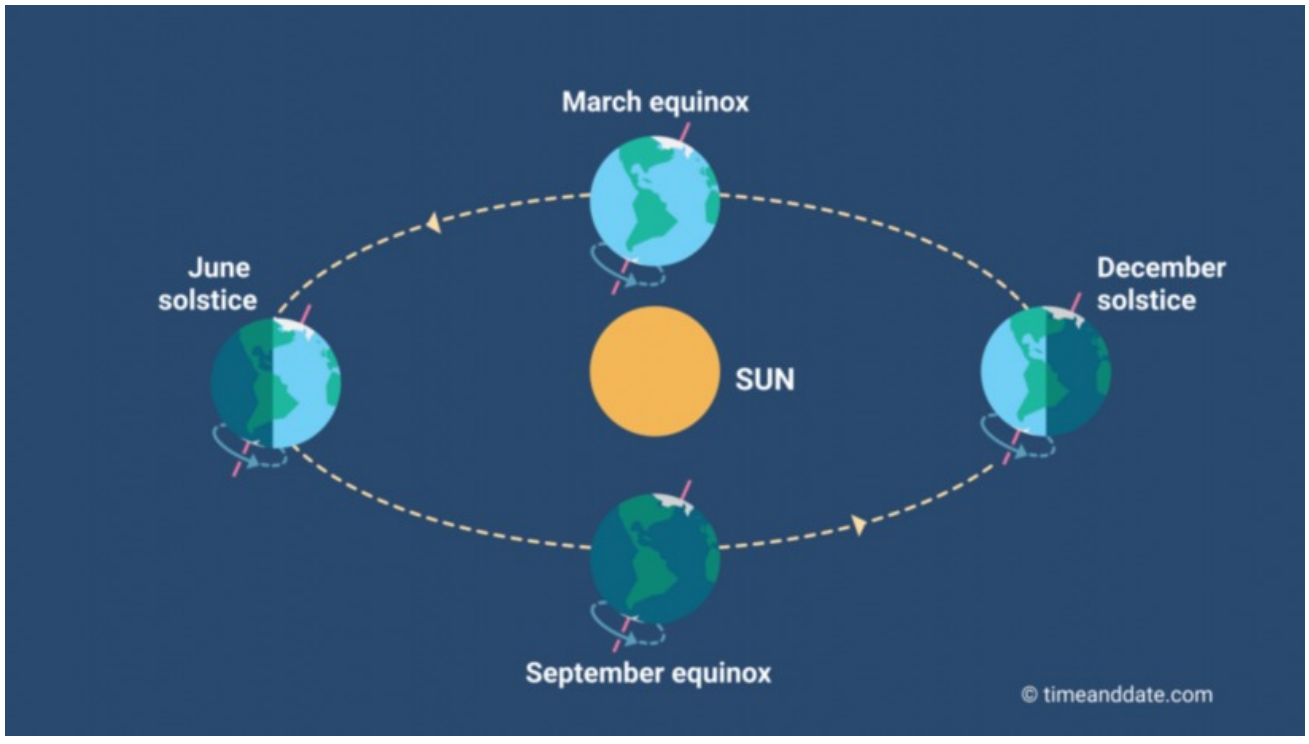
The upcoming Vernal Equinox marks the point in time at which the Sun is directly over the equator and heading north. This apparent movement of the Sun occurs for two reasons. First the Earth's axis is tilted by 23.5 degrees relative to the plane (ecliptic) of the solar system. Secondly the Earth orbits the Sun. Therefore, from our perspective in the northern hemisphere we are tilted towards the Sun in summer (June) and away from the Sun in winter (December).

(Continued on page 8)

The Sky This Month for March 2021 (continued)



So where does that leave us in spring and fall on the days of the equinoxes? The easiest way to think of the orientation of the Earth's tilt on those days is that we are exactly 'sideways' to the Sun. In other words, we are neither tilted directly away from nor toward the Sun. On those days the Sun is directly over the equator.

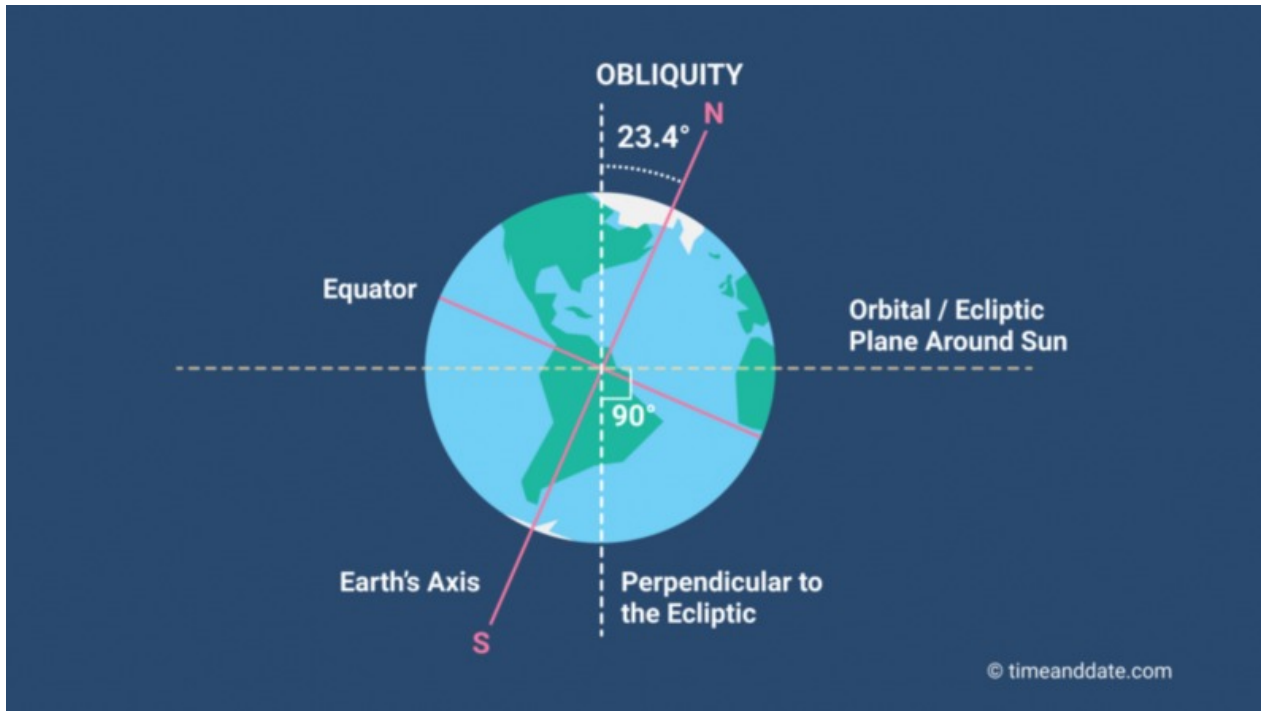


In the next illustration of the Earth's tilt at the top of the next page, you can see the intersection of the white dotted lines and the red solid lines. That intersection is the moment of equinox.

Recently I purchased a book with very good

(Continued on page 9)

The Sky This Month for March 2021 (continued)



Diagrams of Earth's Tilt Courtesy of timeanddate.com

illustrations that is a great primer for beginning astronomers. The title is *"STARFINDER the complete beginner's guide to exploring the night sky"* by the publisher 'DK'. As a bonus, it includes a very nice 28cm diameter Planisphere optimized for 35° north (close enough for use in southern Ontario). The only downside to the book is that it was published in 2013 so the phases of the Moon and location of the planets are out of date. However, the rest of the content more than makes up for that issue.

(Continued on page 10)

The Sky This Month for March 2021 (continued)

Moving on to events that will happen in March

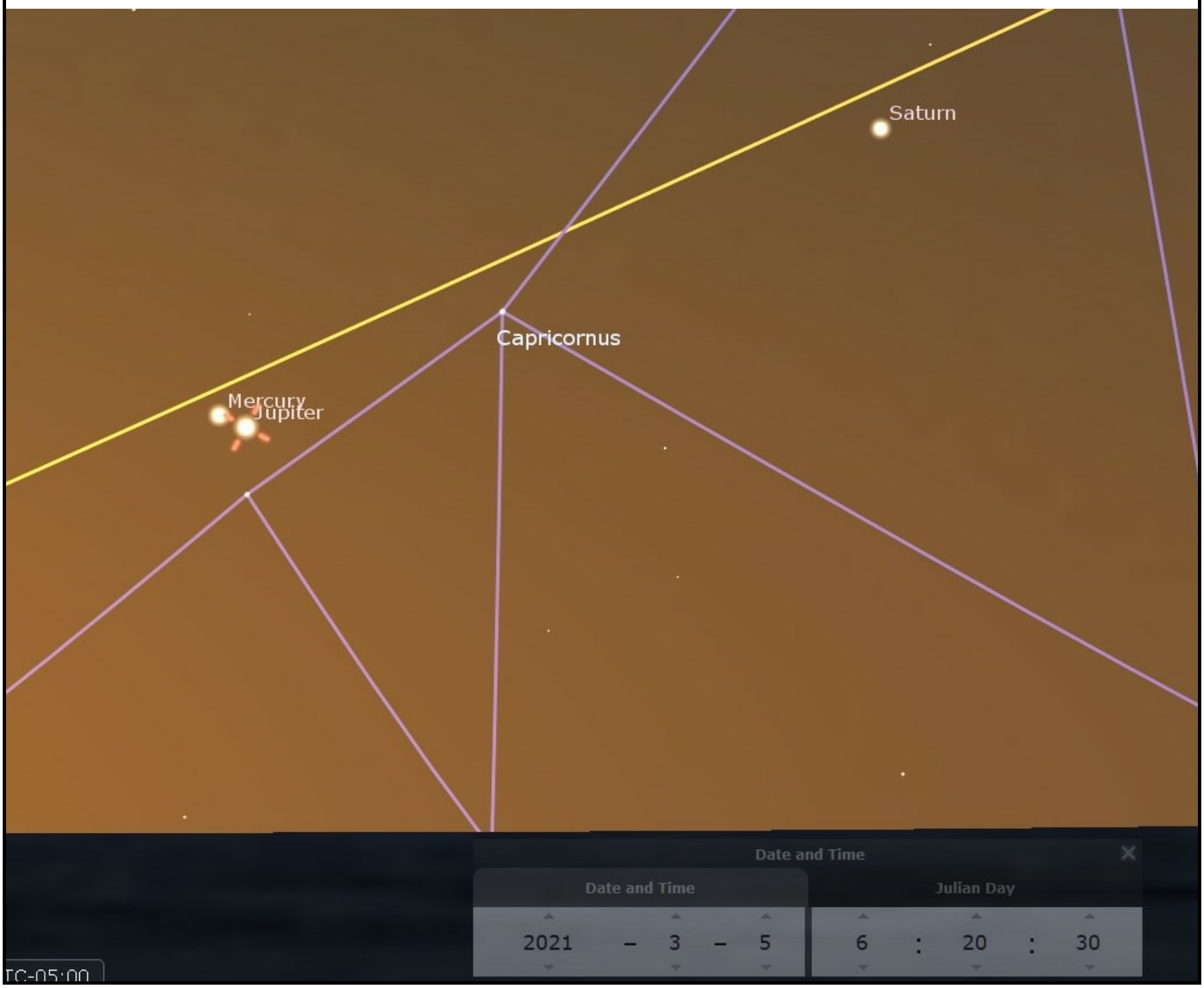
Soon *Mars* will be the only planet visible in the evening sky. *Saturn* and *Jupiter* should be back in the late evening sky in July. *Neptune* follows in August and *Uranus* in September. What this means is that most planetary events we want to observe will be in the early morning for the next few months.

March 5th at 6:20 am is a good example. On that morning *Jupiter* and *Mercury* are about 20 arcminutes apart very low in the east-southeast. The pair are only five degrees above the horizon so you will need an unobstructed view. The window to view this event is only minutes long as the Sun will soon be brightening the horizon. You need to be in place with time to spare.

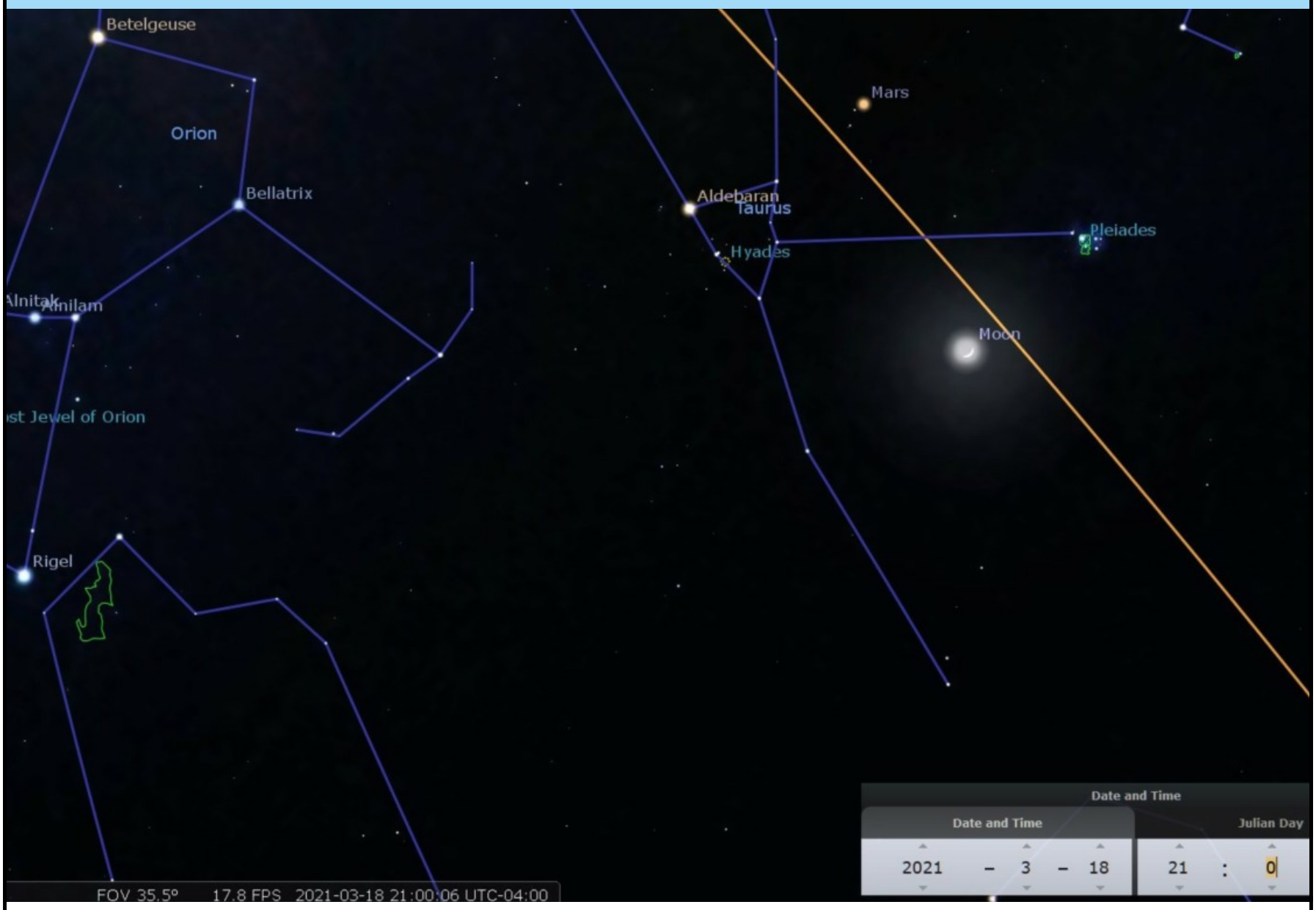
Just a few days later, on the mornings of March 9th and 10th, the waning crescent Moon joins the three planets.

The evenings of March 18th and 19th provide a very nice view of the Moon and Mars in-between the *Pleiades* and *Hyades* (see chart on page 11). Look for the Moon three degrees east of Mars on the 19th.

(Continued on page 11)



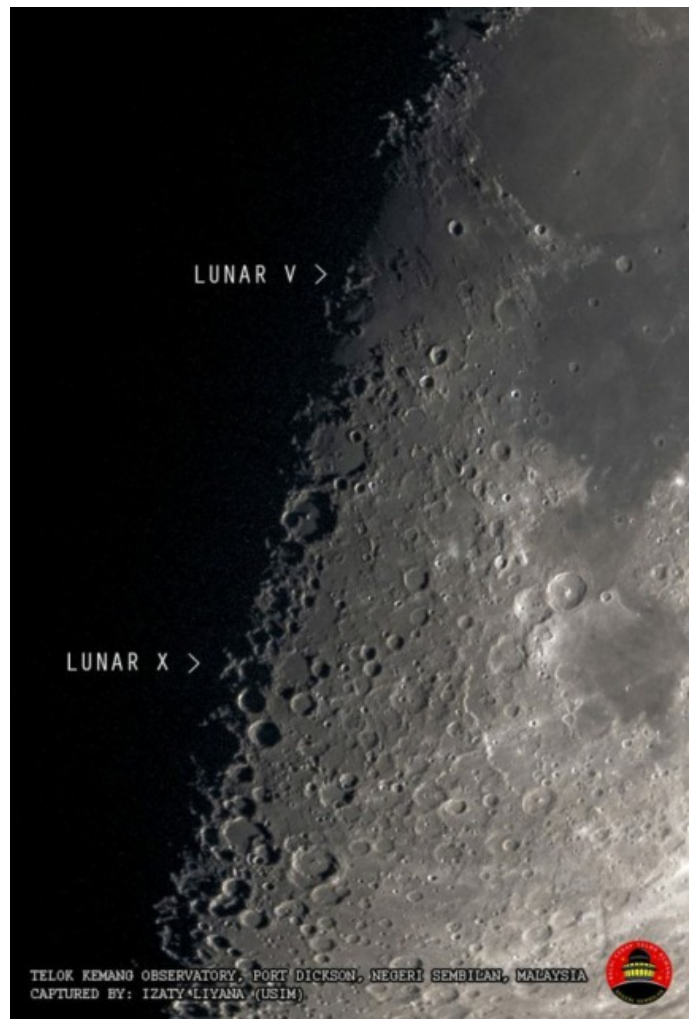
The Sky This Month for March 2021 (continued)



This and all sky charts generated using Stellarium.

The very next evening, March 20th, between 8 and 9 pm see if you can spot the *Lunar 'X'* on the terminator of the Moon. It would be nice to see some club members capture images of the 'X' and submit them for show and tell.

With spring just around the corner, it's time to clear the Covid cobwebs from your head and the actual cobwebs from your equipment. The weather is warming up and the winter and spring constellations are ripe for the picking. It's time to get outside at night and look out into the universe.



The Lunar 'X' and the Lunar 'V'

Image Credit: Izaty Liyana (USIM)

Notes from My *Virtual* Table, March 2021 by Bernie Venasse

This month at the table…
Messier marathon, International Dark Sky Week, Astronomical League Herschel Hustle, Sky Maps … Links

Messier Marathon

A Messier marathon is an attempt, usually organized by amateur astronomers, to find as many Messier objects as possible during one night. The Messier catalogue was compiled by French astronomer Charles Messier during the late 18th century and consists of 110 relatively bright deep-sky objects (galaxies, nebulae, and star clusters). – Wikipedia –

New Moon will occur on ***March 13, 2020***, which is a Saturday, and thus a weekend. So this will be the primary weekend March 13/14, with a secondary on the consequent one, March 20/21.

Info from RASC Calgary:

https://calgary.rasc.ca/downloads/MarathonTips.pdf includes great guide maps.

https://calgary.rasc.ca/darksky/messierplanner.htm

SkyNews magazine published a good guide to the marathon:

https://skynews.ca/running-the-messier-marathon/

International Dark Sky Week…. April 5-12, 2021

International Dark Sky Week, held during the week of the new moon in April, is a week during which people worldwide turn out their lights in order to observe the beauty of the night sky without light pollution. This event was founded in 2003 by high school student Jennifer Barlow of Midlothian, Virginia.

It has been endorsed by the International Dark-Sky Association, the American Astronomical Society, the Astronomical League, and Sky & Telescope. [4]

The goals of the event are to:

- Temporarily reduce light pollution and raise awareness about its effects on the night sky,
- Encourage the use of better lighting systems that direct light downward instead of into the sky, and
- Promote the study of astronomy.

Willing participants in this project turn off all unnecessary lighting indoors and outdoors sources in order to reduce light pollution of the night sky.

The International Dark-Sky Association encourages light users to take precautions against outdoor light pollution by:

- Using outdoor light only when needed
- Confine light to specific areas
- Be aware that lights need only be as bright as is necessary
- Reducing the amount of blue light emissions used
- Use of lighting that faces downward, in order to avoid over illumination, called fully shielded fixtures

(Continued on page 13)

What's Up? Webcast from Sky-Watcher at 1:00 PM Eastern

March 5, 2021… March Night Skies (2021 edition). Highlights of the March sky.

March 12, 2021… Skymax Overview. The Sky-Watcher Skymax Maksutov-Cassegrains are the ultimate take-anywhere telescopes. Despite their small dimensions they pack a powerful punch.

March 19, 2021… Outreach Events. Outreach events are a great way of bringing the hobby of astronomy to the public.

March 26, 2021… Skies Away Observatory. Bryan Cogdell is the owner of Skies Away, a new remote hosting facility in central California. We sit down and discuss what it's like creating a remote observing site, how to host your equipment and more on the Skies Away facilities.

From the Astronomical League… Herschel Hustle…

The Herschel Hustle: There are two versions of this certification. One is for anyone who attempts the Herschel Hustle. It may be downloaded directly form the Astronomical League's Downloadable Certificates web page. The second certification is for those who attempt and succeed at completing the Herschel Hustle. Information about the objects and requirements for the Herschel Hustle certification can be found on the Herschel Hustle web page. You can use the Herschel Society object checklist.

Note: NGC 4209 is unknown, but may be the star visible with NGC 4185. For the Herschel Hustle certification we are using the star.

"We are all familiar with the Messier Marathon, but there are other challenges out there awaiting those who are willing to make the effort. Sky and Telescope Magazine came up with the idea and called it the Herschel Sprint. This is our take on it.

"William Herschel was an amazing astronomer. He was able to use relatively good optics, but the mechanics of his telescopes was limited by today's standards. With his telescope, scanning only in declination, we was able to observe objects as they crossed his meridian. The goal of this challenge is to relive one special night when he discovered 74 objects in one night. To truly experience the event, use an eyepiece with a 15 to 20 arc-minute field and about 150 power. Once on the meridian, the purists will switch to manual telescope operation, only changing the declination as time progresses. To see them all will require a large telescope (14-inches or larger). Select a date when the first object transits about an hour after sunset." This year I plan to be hustling starting 21:50 on ***April 16th***. *(Continued on page 15)*

The list, courtesy of the Astronomical League website (continued on page 14):

#	NGC #	Transit Delta Time		
1	3196	0:00	=	21:50 on April 16
2	3245	0:08	=	21:58
3	3265	0:13		
4	3274	0:14		
5	3277	0:15		
6	3380	0:30		
7	3400	0:33		

Notes from My *Virtual* Table, March 2021 (continued)

#	NGC #	Transit Delta Time
8	3414	0:33
9	3418	0:33
10	3451	0:36
11	3486	0:42
12	3504	0:45
13	3510	0:46
14	3512	0:46
15	3527	0:49
16	3550	0:53
17	3552	0:53
18	3713	1:14
19	3714	1:14
20	4004	1:40
21	4008	1:40
22	4017	1:43
23	4080	1:47
24	4104	1:48
25	4131	1:51
26	4132	1:51
27	4134	1:51
28	4169	1:54
29	4173	1:54
30	4174	1:54
31	4175	1:54
32	4185	1:55
33	4196	1:56
34	4209	1:57
35	4251	2:00
36	4275	2:02
37	4278	2:02
38	4283	2:02
39	4310	2:04
40	4375	2:07

#	NGC #	Transit Delta Time
41	4393	2:08
42	4448	2:10
43	4475	2:10
44	4556	2:18
45	4559	2:18
46	4692	2:30
47	4793	2:36
48	4798	2:37
49	4816	2:38
50	4827	2:38
51	4839	2:39
52	4840	2:39
53	4841	2:39
54	4869	2:41
55	4874	2:41
56	4889	2:42
57	4892	2:42
58	4908	2:43
59	4911	2:43
60	4921	2:43
61	4923	2:43
62	4927	2:44
63	4944	2:46
64	4952	2:47
65	4957	2:47
66	4961	2:47
67	4983	2:50
68	5000	2:51
69	5032	2:55
70	5116	3:05
71	5251	3:19
72	5263	3:22
73	5958	5:21
74	6001	5:29

Notes from My *Virtual* Table, March 2021 (continued)

Sky Maps

http://skymaps.com/downloads.html

https://www.telescope.com/content.jsp?pageName=Monthly-Star-Chart

https://www.cloudynights.com/articles/cat/articles/observing-skills/free-mag-7-star-charts-r1021

https://binocularsky.com/map_select.php

Links

Astronomical League…. Astroleague.org

Homebuilt Astronomy Projects…. http://www.homebuiltastronomy.com/

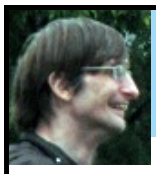
RASC Calgary Messier Planner… https://calgary.rasc.ca/darksky/messierplanner.htm

Bernie Venasse… eclipse@amateurastronomy.org

HAA Helps Hamilton

While during the pandemic, the H.A.A. hasn't been able to collect donations from our members and guests for local food banks at our general meetings, the H.A.A. has always valued its relationships with food banks in the community, particularly Hamilton Food Share.

In that spirit, we encourage you to continue making donations directly to your local food banks.



Total Solar Eclipses of Long Duration in Canada, 0-3000

by Ray Badgerow

In order to have a long duration solar eclipse, the moon must be near perigee, and the Earth near aphelion located in the tropics allowing for a maximum theoretical duration of 7m31s. All other things being equal, at temperate latitudes the theoretical maximum is 6m00s.

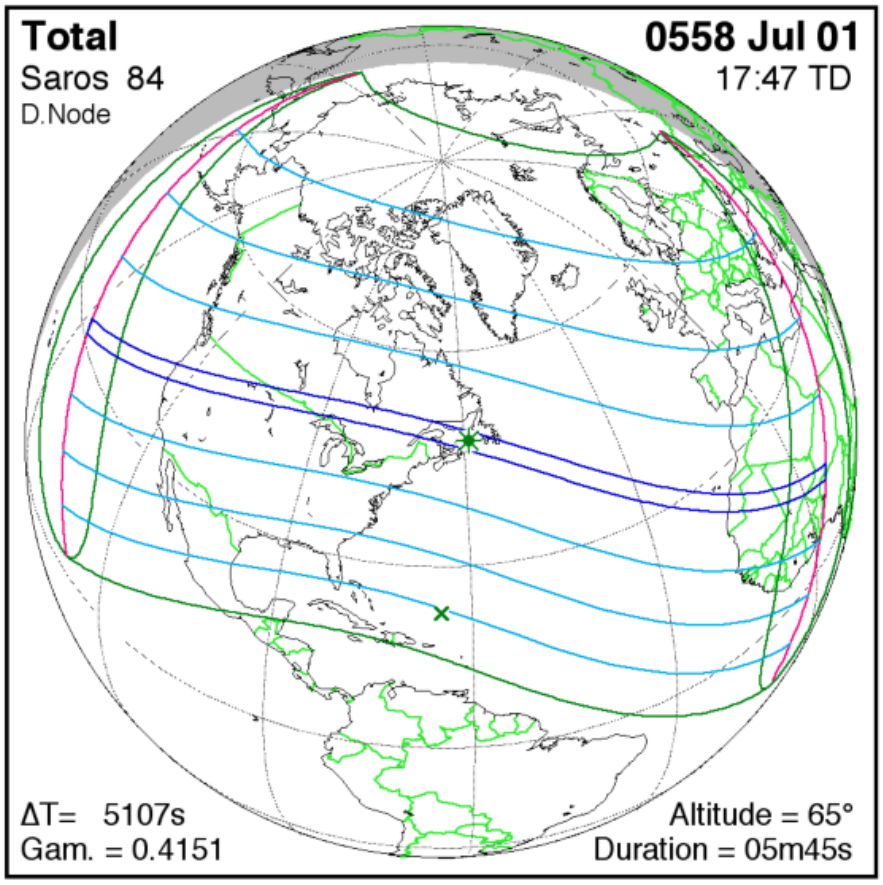
Date	Duration	Saros	Area of Visibility
558 Jul 01	5m45s	84	Man,ON,Que,NB,NFLD
858 May 16	5m30s	90	BC,AB,SK,MN,ON,QUE,NB,PEI,NFLD
1203 May 12	5m26s	115	BC,AB,MB,ON,QUE,PEI,NS,NFLD
1379 May 16	5m07s	108	ON,QUE,NB,PEI,NFLD
2690 Jun 28	5m00s	167	YK,NWT,ON,QUE,NS,NFLD

All of these eclipses occur at temperate latitudes with a moderate gamma value and have a strong horizontal component, west to east. Even though solar eclipses with a duration of 6 minutes are possible at these latitudes, the point of greatest eclipse for several eclipses are offshore, thereby depriving Canadians of a 6 minute eclipse.

Based upon my analysis of the 276 Total solar eclipses, the mean duration is 2m33s and the mean altitude of 28.6 degrees.(17 Hybrid eclipses were included in this calculation).

All images courtesy of Fred Espenak, www.eclipsewise.com.

www.EclipseWise.com/eclipse.html



EclipseWise.com Canon of Solar Eclipses
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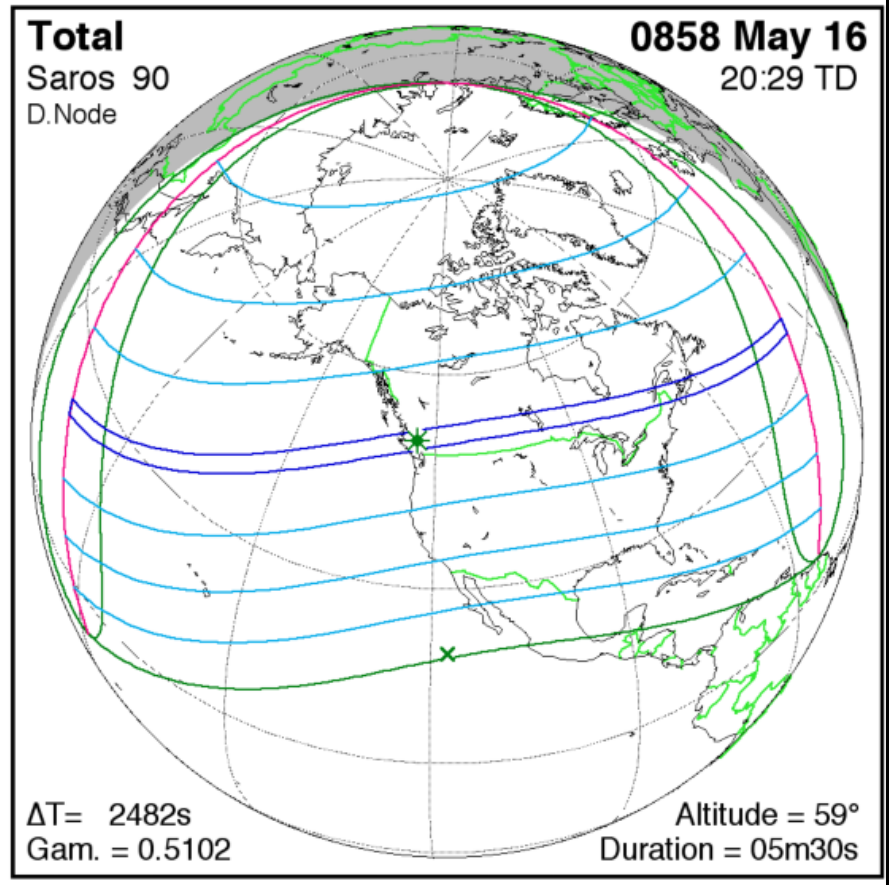
www.EclipseWise.com/eclipse.html



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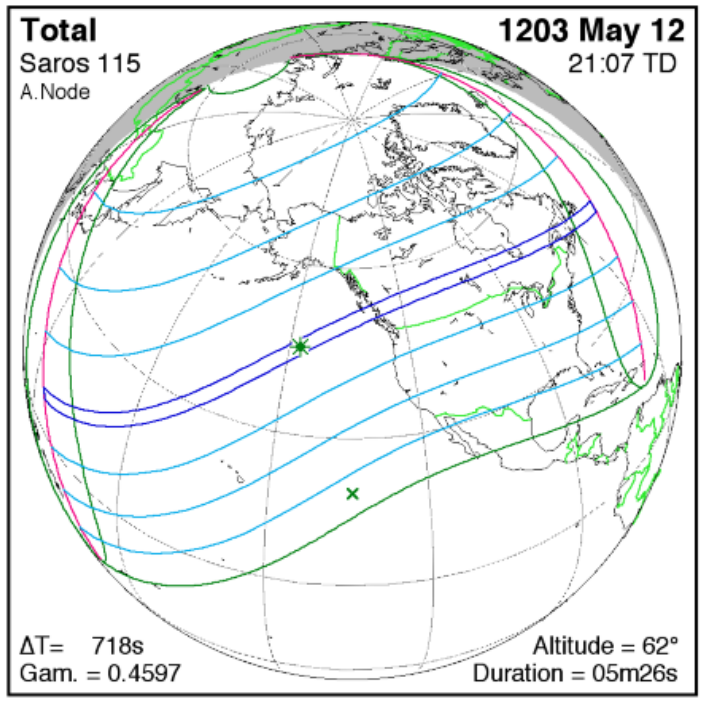
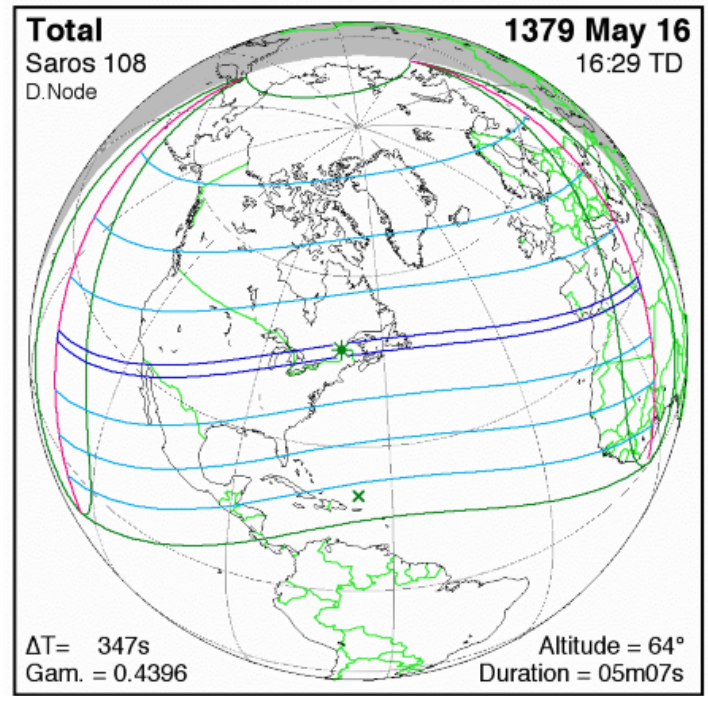
(See 6 other charts on page 17)

Total Solar Eclipses of Long Duration in Canada, 0-3000
(continued)

www.EclipseWise.com/eclipse.html



www.EclipseWise.com/eclipse.html



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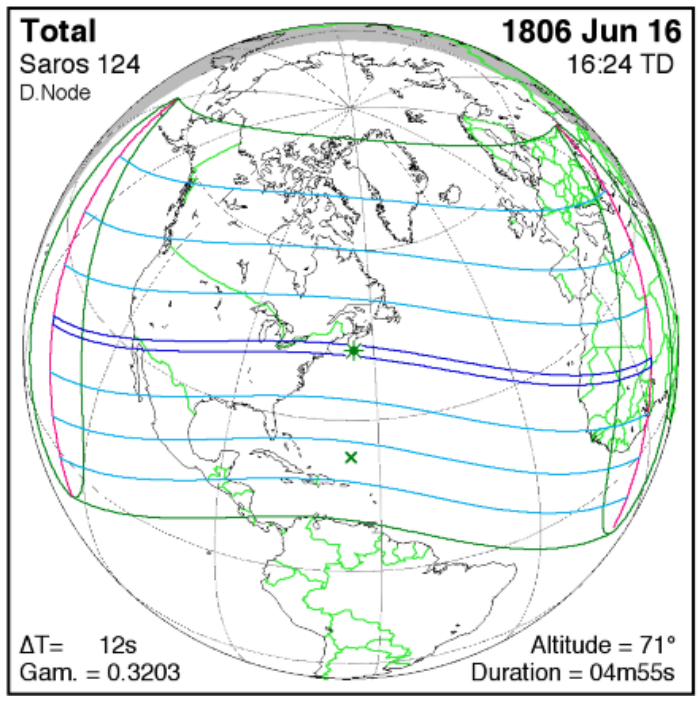

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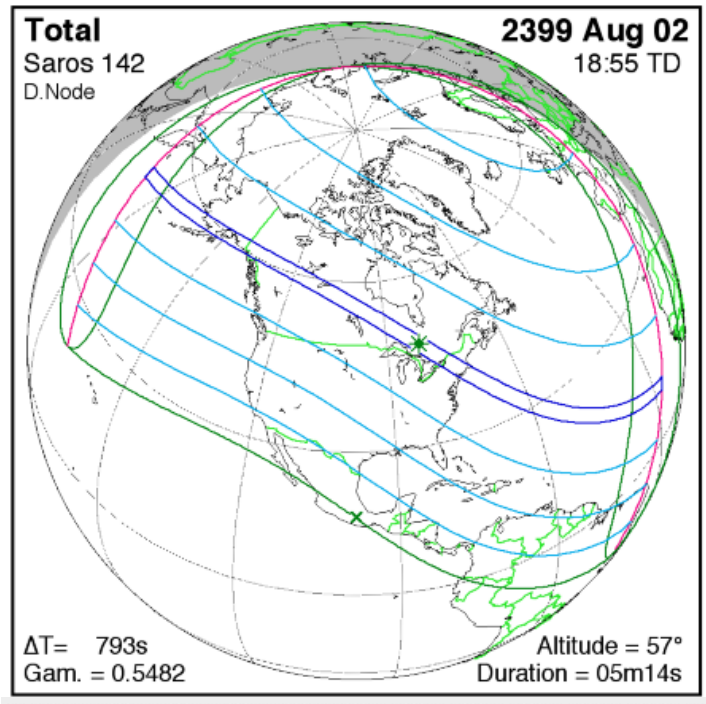
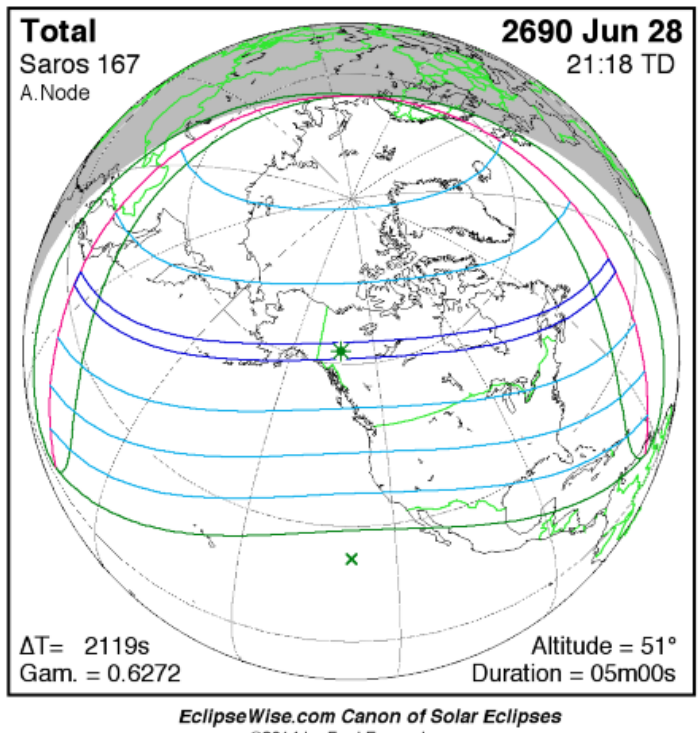


www.EclipseWise.com/eclipse.html



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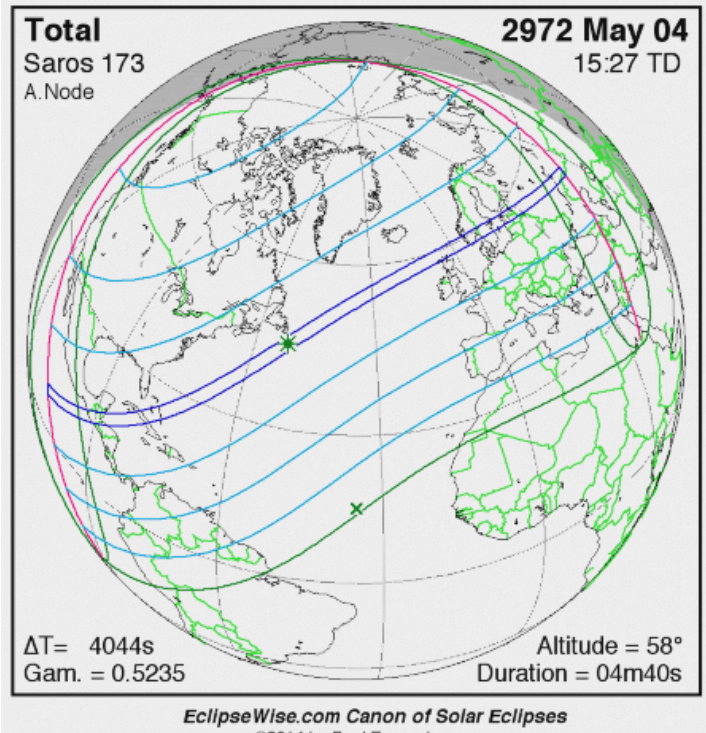

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How to Calculate Astrophoto Signal to Noise Ratio (SNR)

by Bill Tekatch

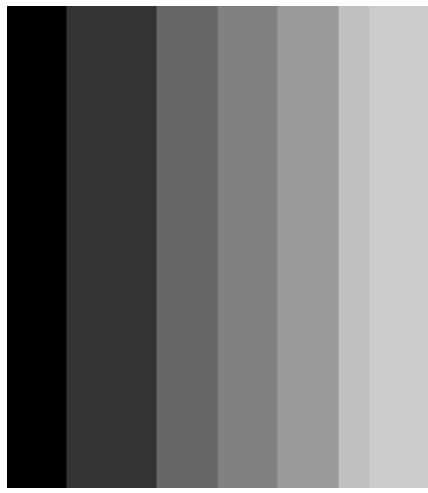
I have always looked at my astrophoto images and subjectively rated noise, star shape, and detail. To really know how good your astrophotos are, you need an objective measurement of their quality. Signal to noise ratio has always been suggested as the best measure of quality. SNR is usually only used to rate individual stars rather than the entire image. Standard deviation (SD) is the measure used in place of SNR. The problem is that the actual image, even with no noise at all, has a SD. So how can we determine what SD is from the true image and what SD is from the noise?

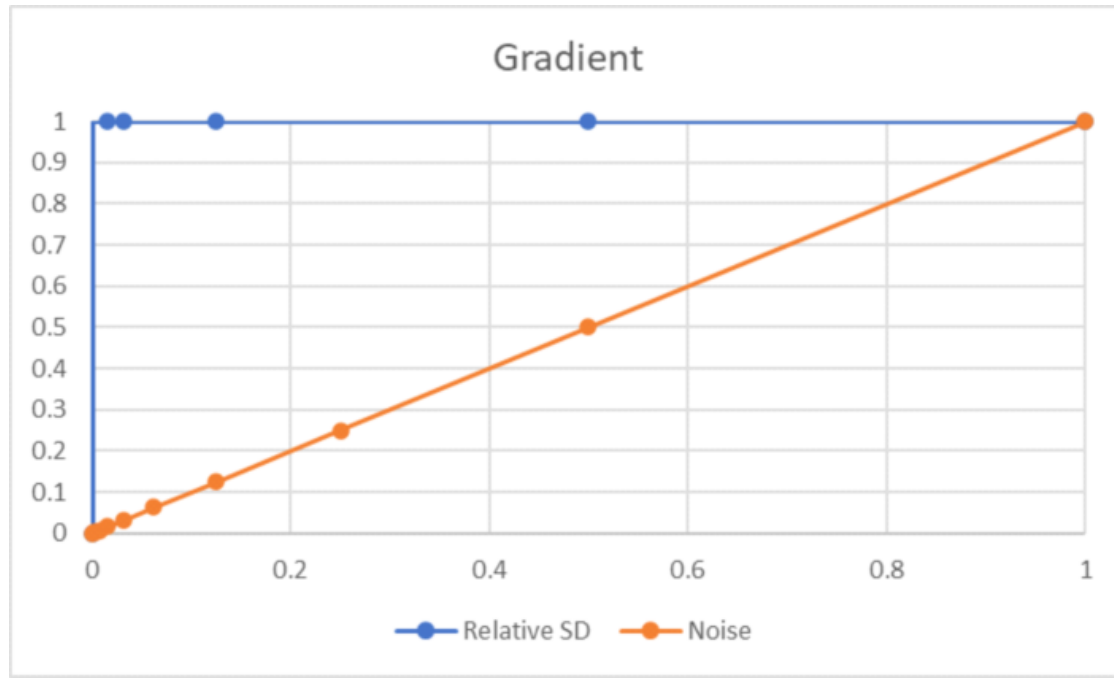
Fortunately, statistics shows that if you average four values of noise the SD will be reduced by half. Using this fact, I have developed the following simple equations to calculate SNR.

Noise SD = (Image SD – Binned Image SD) x Square Root (Number of pixels binned)

Signal SD = Image SD – Noise SD

SNR = Signal SD / Noise SD



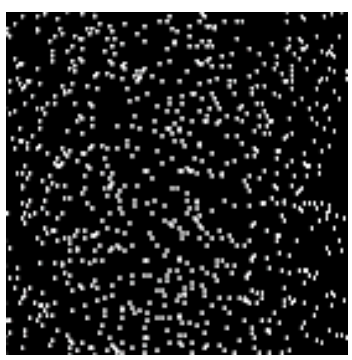


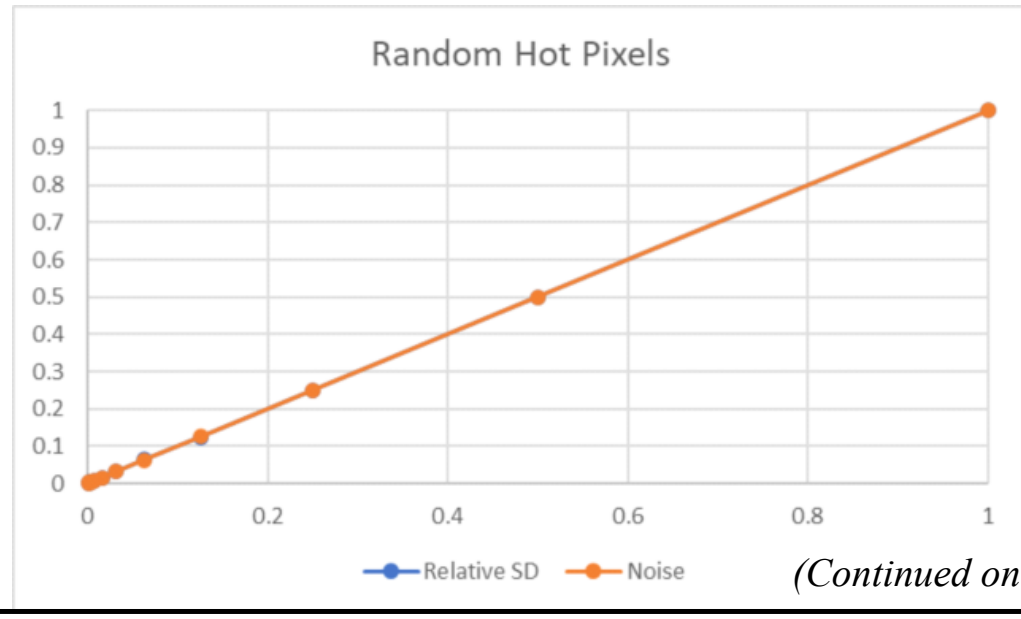
To test the equations, I have made several test images as well as using some actual astrophotos. The first is a smooth gradient which represents pure signal with no noise. The calculated SNR = 6440280.

The Y axis of the graph is the measured SD as a decimal fraction of the image SD. The X axis is the reciprocal of square root of the number of pixels binned. The space between the lower noise line and the upper relative SD line represents real information, pure signal.

I used two types of noise, the first was Random Hot Pixels. It gave a profile line that was covered by the noise reference line.

SNR = 0.0007



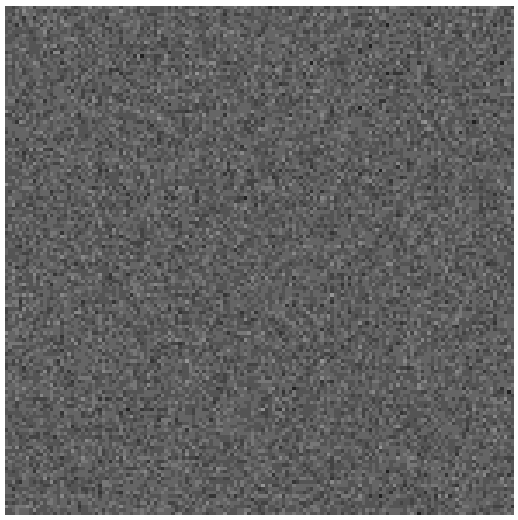


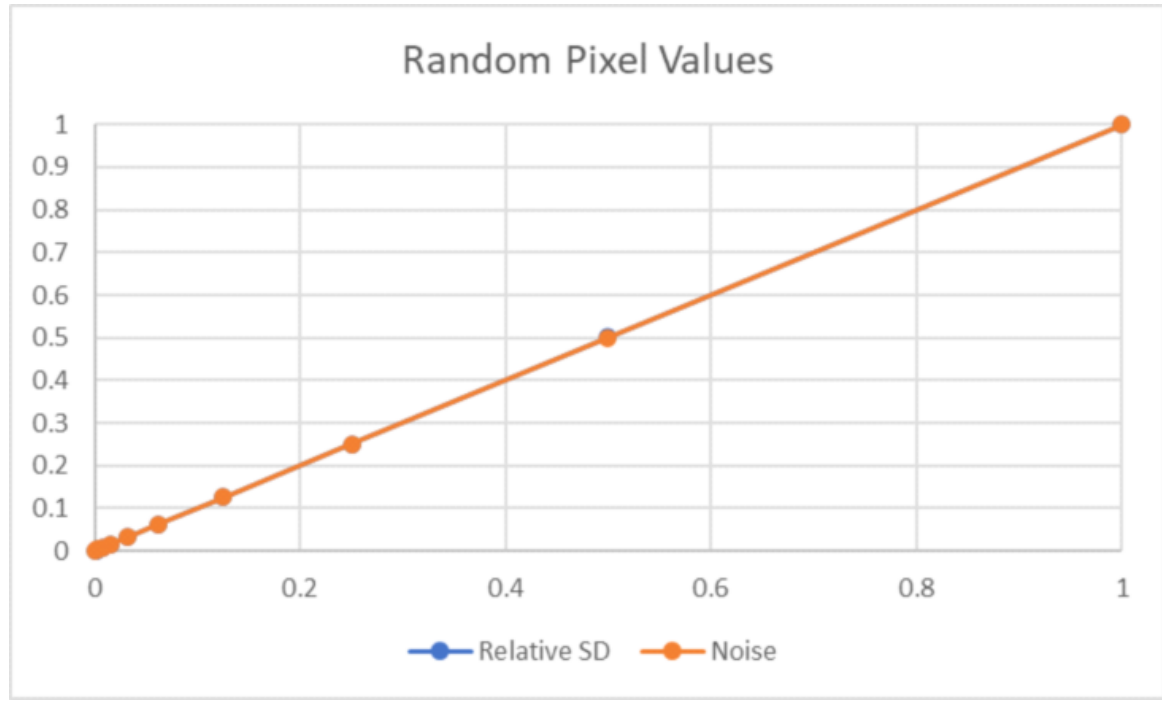
(Continued on page 19)

How to Calculate Astrophoto Signal to Noise Ratio (SNR) (continued)

The second type of noise was a standard normal distribution.

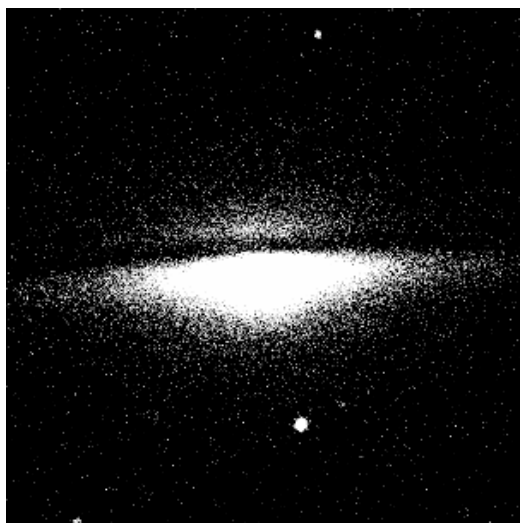
SNR = 0.0017

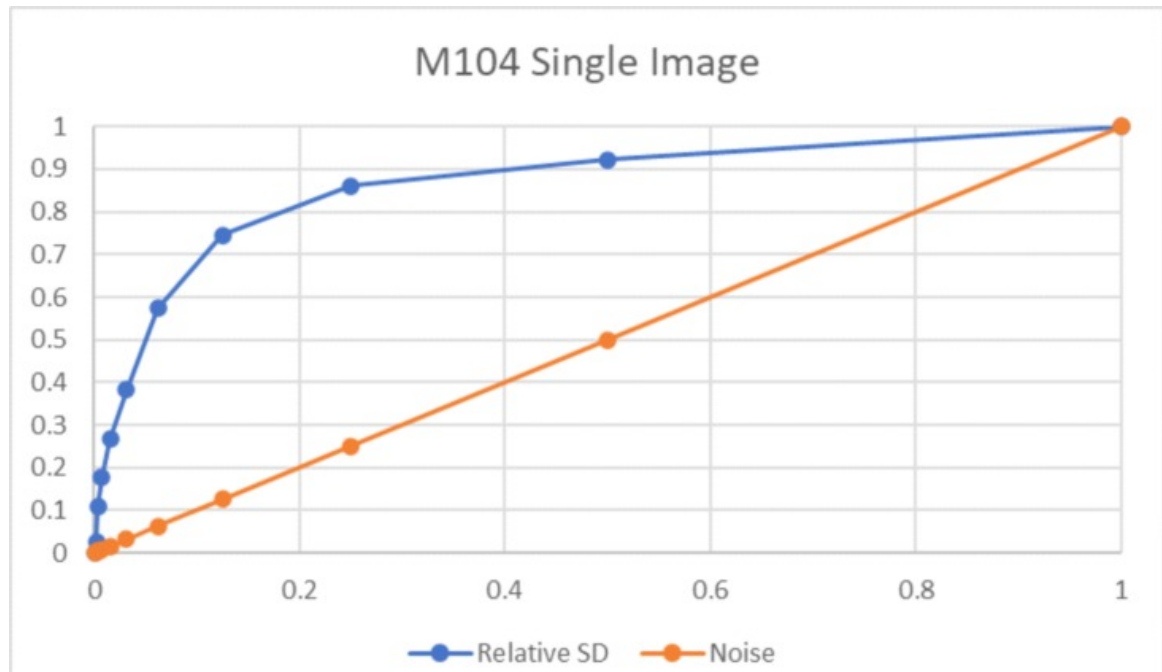




Actual single image of M104.

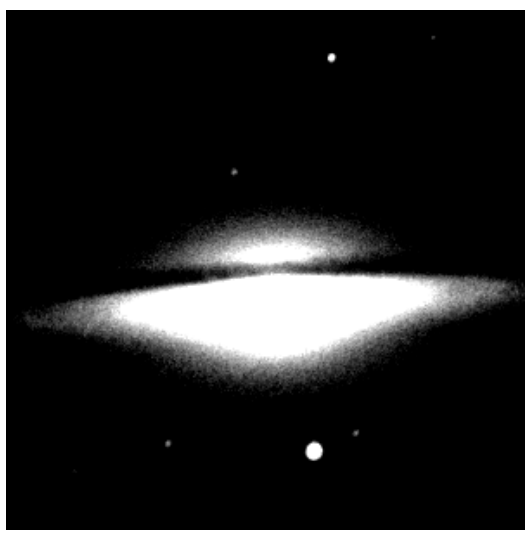
SNR = 5.38

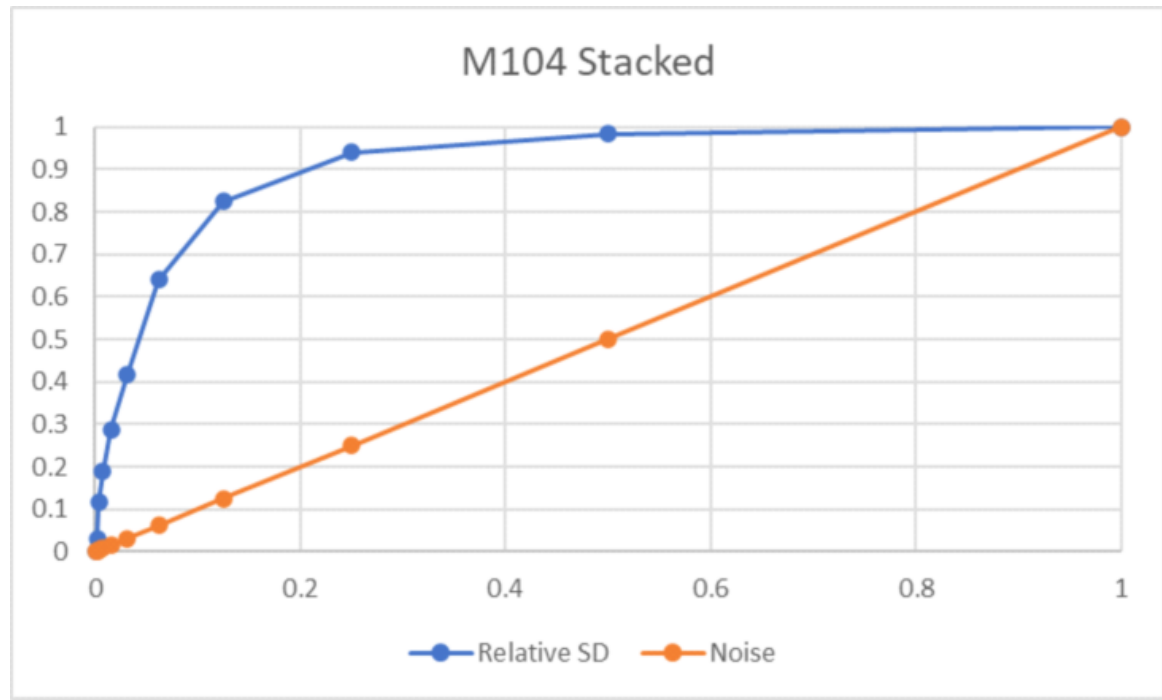




Stack of 60 M104 images.

SNR = 28.85





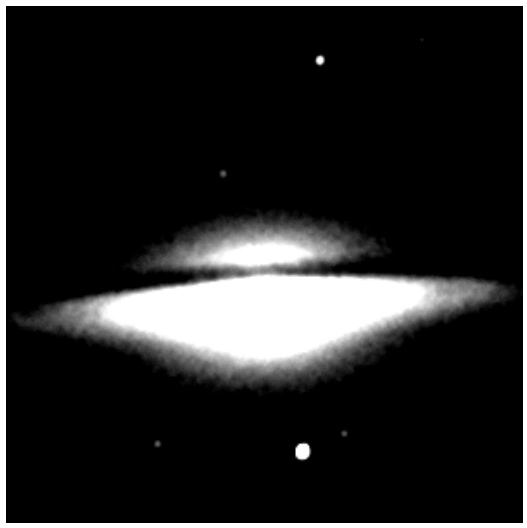
(Continued on page 20)

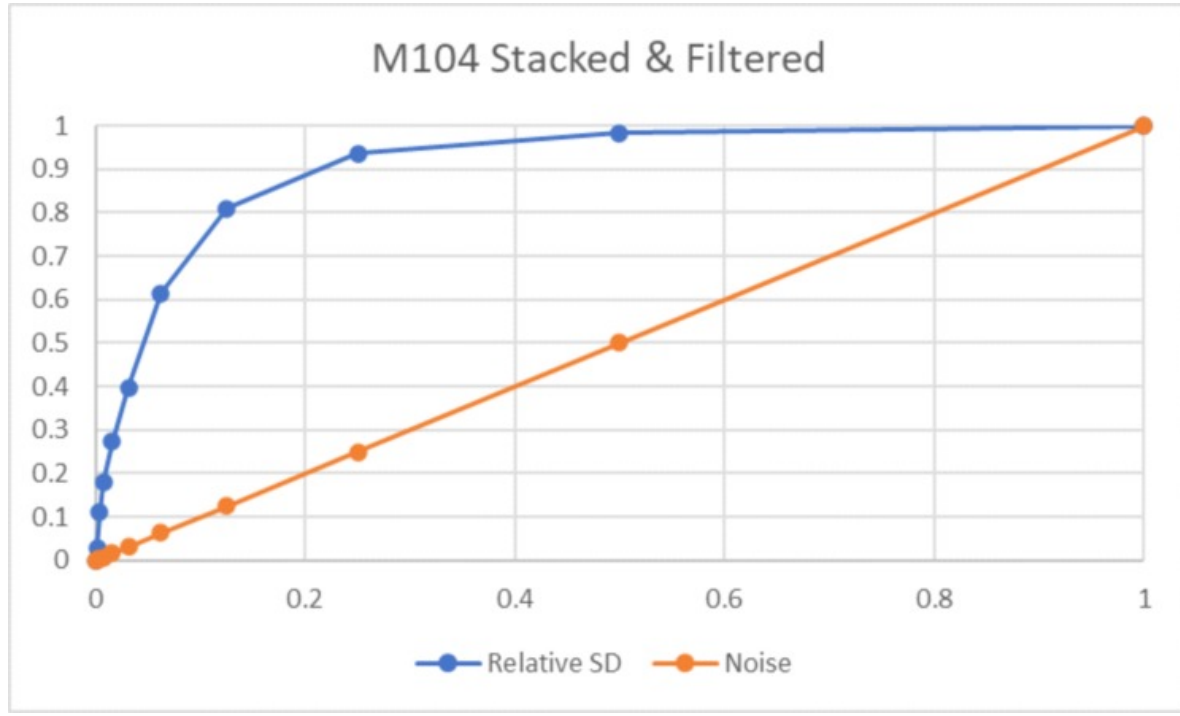
How to Calculate Astrophoto Signal to Noise Ratio (SNR) (continued)

Obviously, the extra images are not 100% efficient. If they were, the SNR would be 41.67.

M104 stacked and filtered.

SNR = 29.74

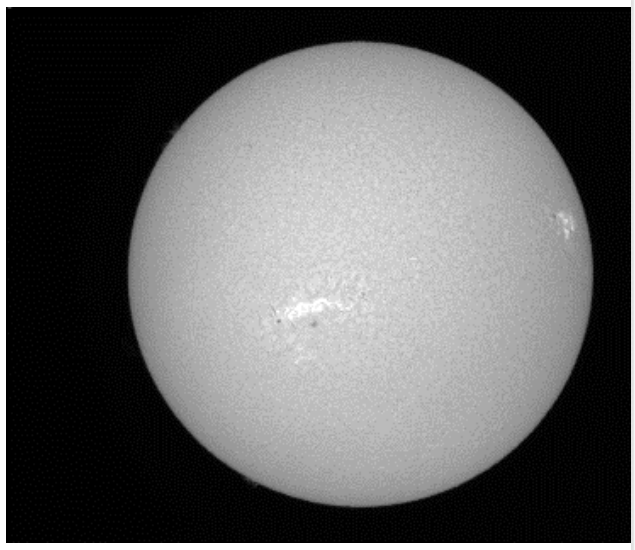


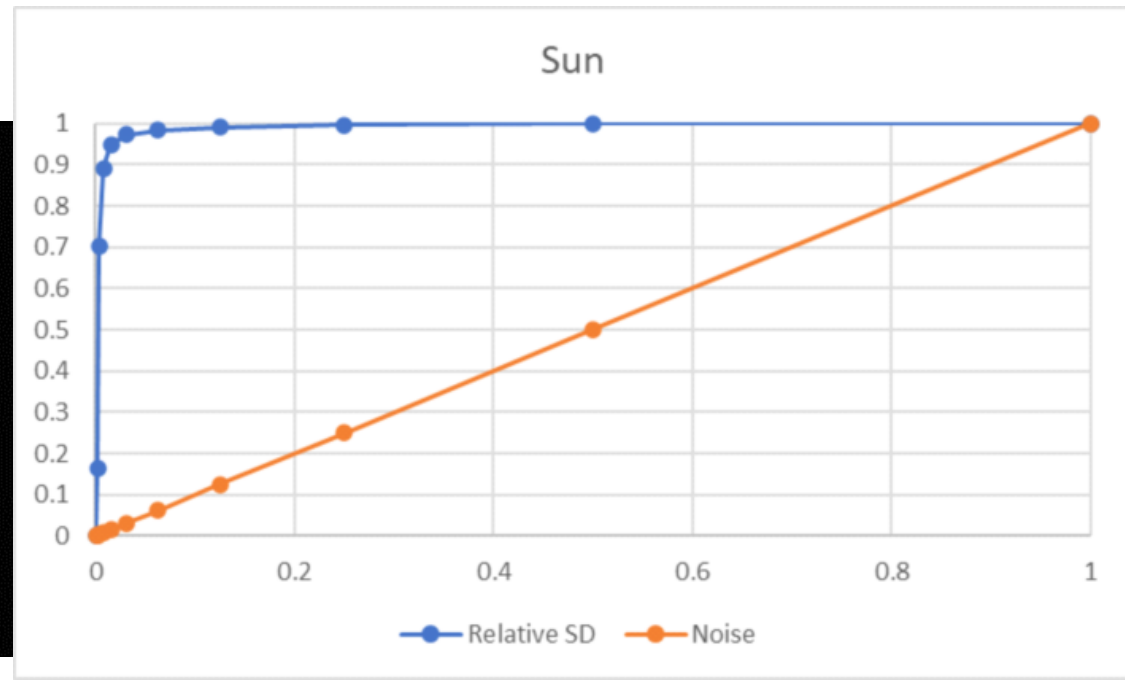


Not much of an improvement, just take another 100 images.

The Sun is very bright and gives images with a very high SNR. High SNR will be expected with most bright objects like the Sun, Moon and planets. If high camera gain is used or very short exposures, expect a lower SNR.

SNR = 413





A good SNR is 30 and excellent is 40. Depending on how you process your image(s) you may require a much higher SNR.

To do the calculations, you first need to get the measurements. I found the best software to use was the free software *ImageJ*. I used the FIJI package version of ImageJ.

Other software that has a useable BIN function are *MaxIm DL Pro*, *PRISM Pro*, and *Astronomical Image Processing for Windows AIP4WIN*. Some software that does not have the BIN function but still can use 2x2 convolve filter to obtain the measurements are *Adobe Photoshop*, *Photoshop Elements in Expert Mode*, *Affinity Photo*, and *GIMP*. The reality is that it is unpleasant with these apps and results are poorer. Just get FIJI, it is a lot easier, and gives better results.

NASA Night Sky Notes

This article is distributed by NASA Night Sky Network.

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach.

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

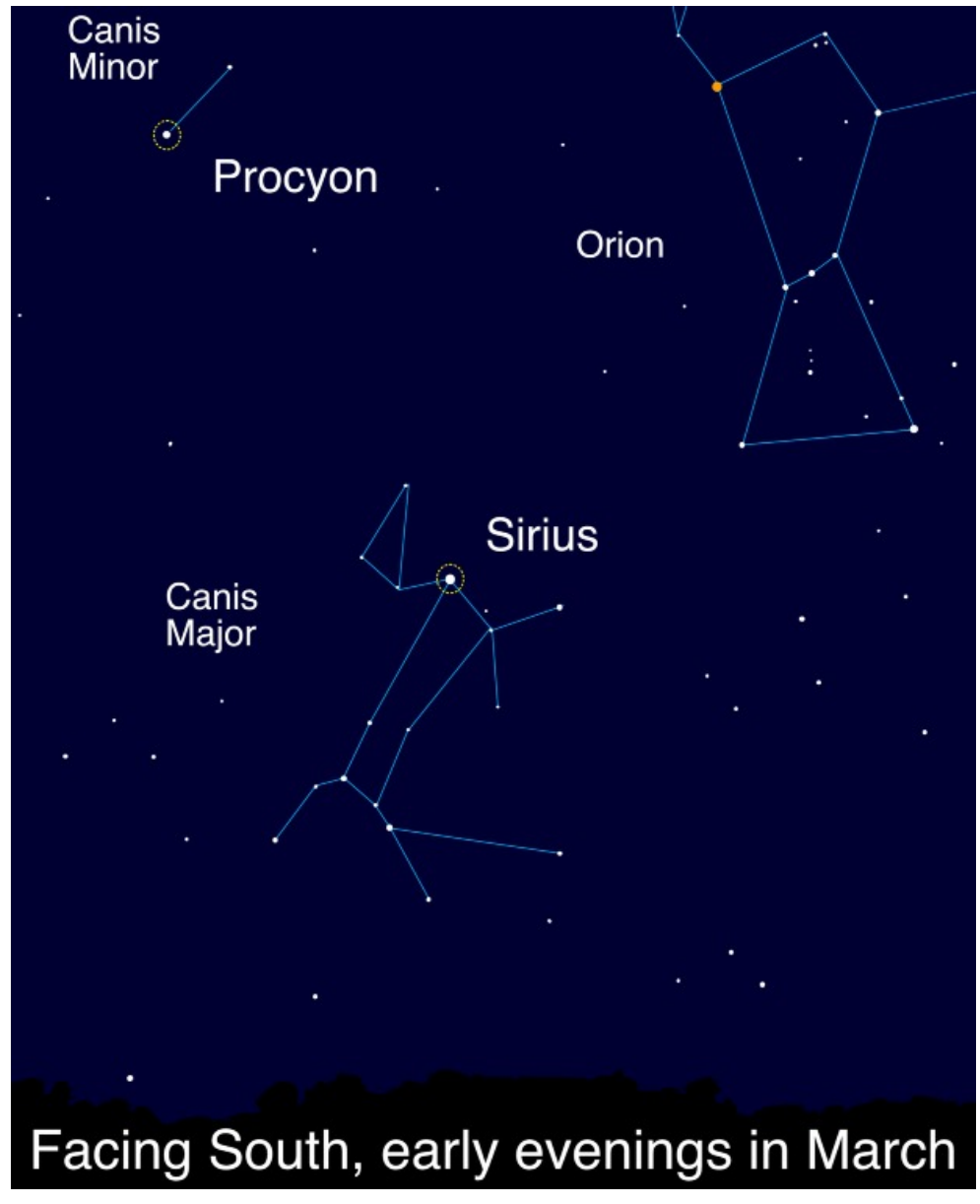
Taking the Dog Stars for a Springtime Walk: Sirius and Procyon

David Prosper

March skies feature many dazzling stars and constellations, glimmering high in the night, but two of the brightest stars are the focus of our attention this month: Sirius and Procyon, the dog stars!

Sirius is the brightest star in the nighttime sky, in large part because it is one of the closest stars to our solar system at 8.6 light years away. Compared to our Sun, Sirius possesses twice the mass and is much younger. Sirius is estimated to be several hundred million years old, just a fraction of the Sun's 4.6 billion years. Near Sirius - around the width of a hand with fingers splayed out, held away at arm's length - you'll find Procyon, the 8th brightest star in the night sky. Procyon is another one of our Sun's closest neighbors, though a little farther away than Sirius, 11.5 light years away. While less massive than Sirius, it is much older and unusually luminous for a star of its type, leading astronomers to suspect that it may "soon" – at some point millions of years from now – swell into a giant star as it nears the end of its stellar life.

(Continued on page 22)



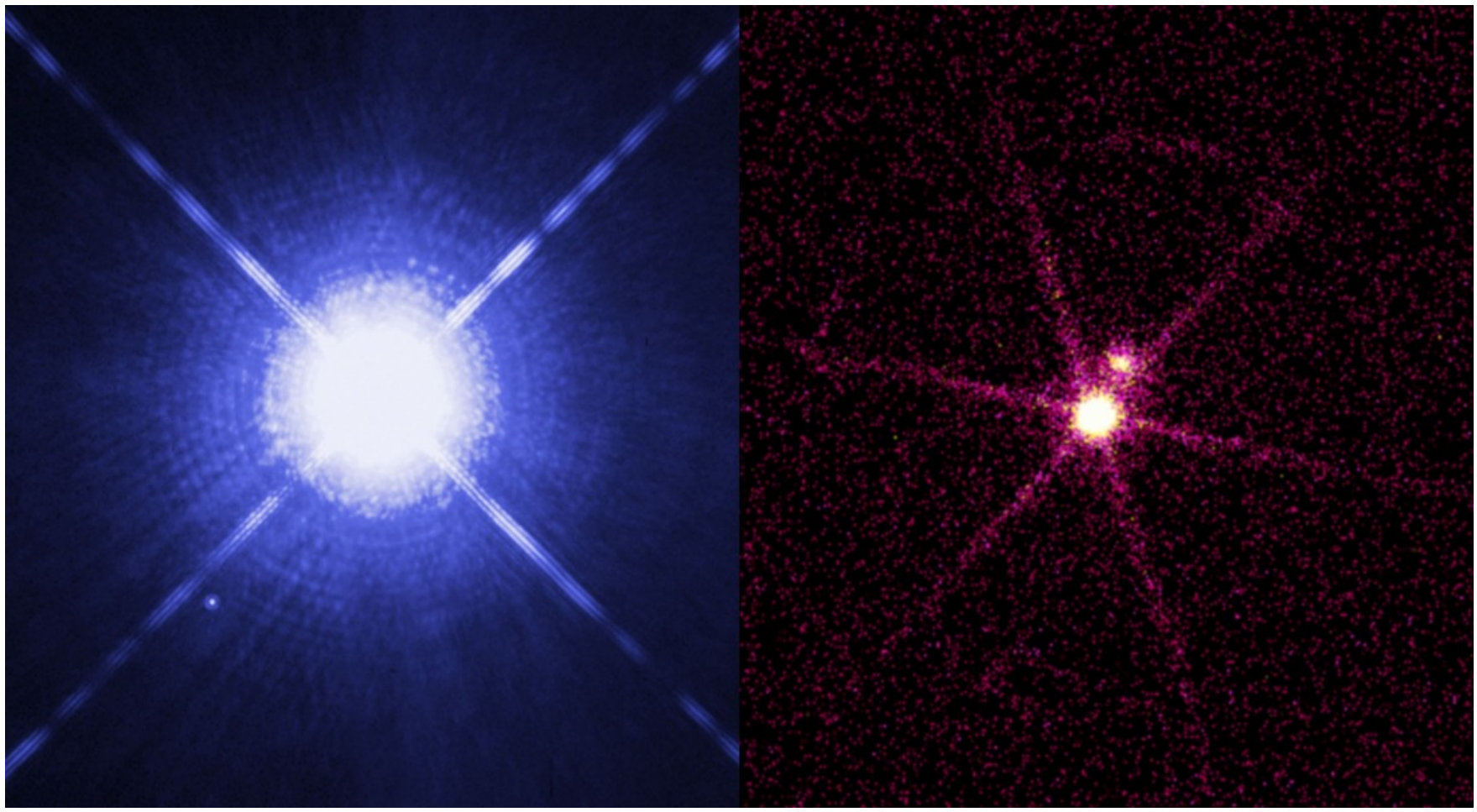
Sirius and Procyon, the loyal hunting dogs of nearby Orion the Hunter! What other stories can you imagine for these stars? Learn about "Legends in the Sky" and create your own with this activity: https://bit.ly/legendsinthesky

Image created with assistance from Stellarium.

NASA Night Sky Notes (continued)

Sirius and Procyon are nicknamed the “Dog Stars,” an apt name as they are the brightest stars in their respective constellations – Canis Major and Canis Minor – whose names translate to “Big Dog” and ”Little Dog.” Not everyone sees them as canine companions. As two of the brightest stars in the sky, they feature prominently in the sky stories of cultures around the world. Sirius also captures the imaginations of people today: when rising or setting near the horizon, its brilliance mixes with our atmosphere’s turbulence, causing the star’s light to shimmer with wildly flickering color. This vivid, eerie sight was an indication to ancient peoples of changes in the seasons, and even triggers UFO reports in the modern era!

Both of these bright stars have unseen companions: tiny, dense white dwarf stars, the remnants of supermassive companion stars. Interestingly, both of these dim companions were inferred from careful studies of their parent stars’ movements in the 1800s, before they were ever directly observed! They are a challenging observation, even with a large telescope, since their parent stars are so very bright that their light overwhelms the much dimmer light of their tiny companions. The white dwarf stars, just like their parent stars, have differences: Sirius B is younger, brighter, and more energetic than Procyon B. Careful observations of these nearby systems over hundreds of years have helped advance the fields of: astrometry, the precise measurement of stars; stellar evolution; and astroseismology, the study of the internal structure of stars via their oscillations. Discover more about our stellar neighborhood at nasa.gov!



Sirius A and B imaged by two different space telescopes, revealing dramatically different views! Hubble’s image (left) shows Sirius A shining brightly in visible light, with diminutive Sirius B a tiny dot. However, in Chandra’s image (right) tiny Sirius B is dramatically brighter in X-rays! The “Universe in a Different Light” activity highlights more surprising views of some familiar objects: http://bit.ly/different-light-nsn

NASA, ESA, H. Bond (STScI), and M. Barstow (University of Leicester) (left); NASA/SAO/CXC (right)

UPCOMING EVENTS

March 12, 2021 - 7:30 pm — Virtual Online H.A.A. Meeting for members. The meeting will be conducted on the platform Zoom. Our main speaker will be Sky & Telescope contributing editor Tom Field. Be on the lookout for an invitation e-mail with a meeting link. You may download the Zoom app for various platforms from Zoom's Download Center

Due to the COVID-19 Coronavirus pandemic, all *in-person* Hamilton Amateur Astronomers meetings are suspended until further notice.

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All active HAA members have the privilege of access to an exclusive HAA members only dark sky location.

Be on the lookout for e-mails with dark sky observing details. Space is limited.

The Harvey Garden HAA Portable Library

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