Event Horizon

Volume 31, Number 3
January 2024

From The Editor

Here's the first edition of the Event Horizon for 2024.

There's lots in here about the upcoming Solar Eclipse in April, meteor showers, Astro 101, binary star systems, and more!

Happy New Year!

Bob Christmas,
Editor

editor 'AT'
amateurastronomy.org

Chair's Report by Sue MacLachlan

Happy New Year and Welcome to January 2024. I hope that everyone had an excellent holiday season.

In keeping with the new beginnings that a new year represents, the HAA is commencing 2024 in a new location. Of the two location options presented at the December meeting, our members overwhelmingly voted for *St. Matthew's-on-the-Plains Anglican Church*.

The new address is ***126 Plains Road East, Burlington, Ontario, L7T 2C3*** (see map at top of page 2).

The church is on the south side of Plains Road just a little east of Waterdown Road. Please drive down the east side of the church and into the parking lot. Once at the rear of the church, head to the far end of the parking lot (the west end). This is where the entrance to the church

(Continued on page 2)

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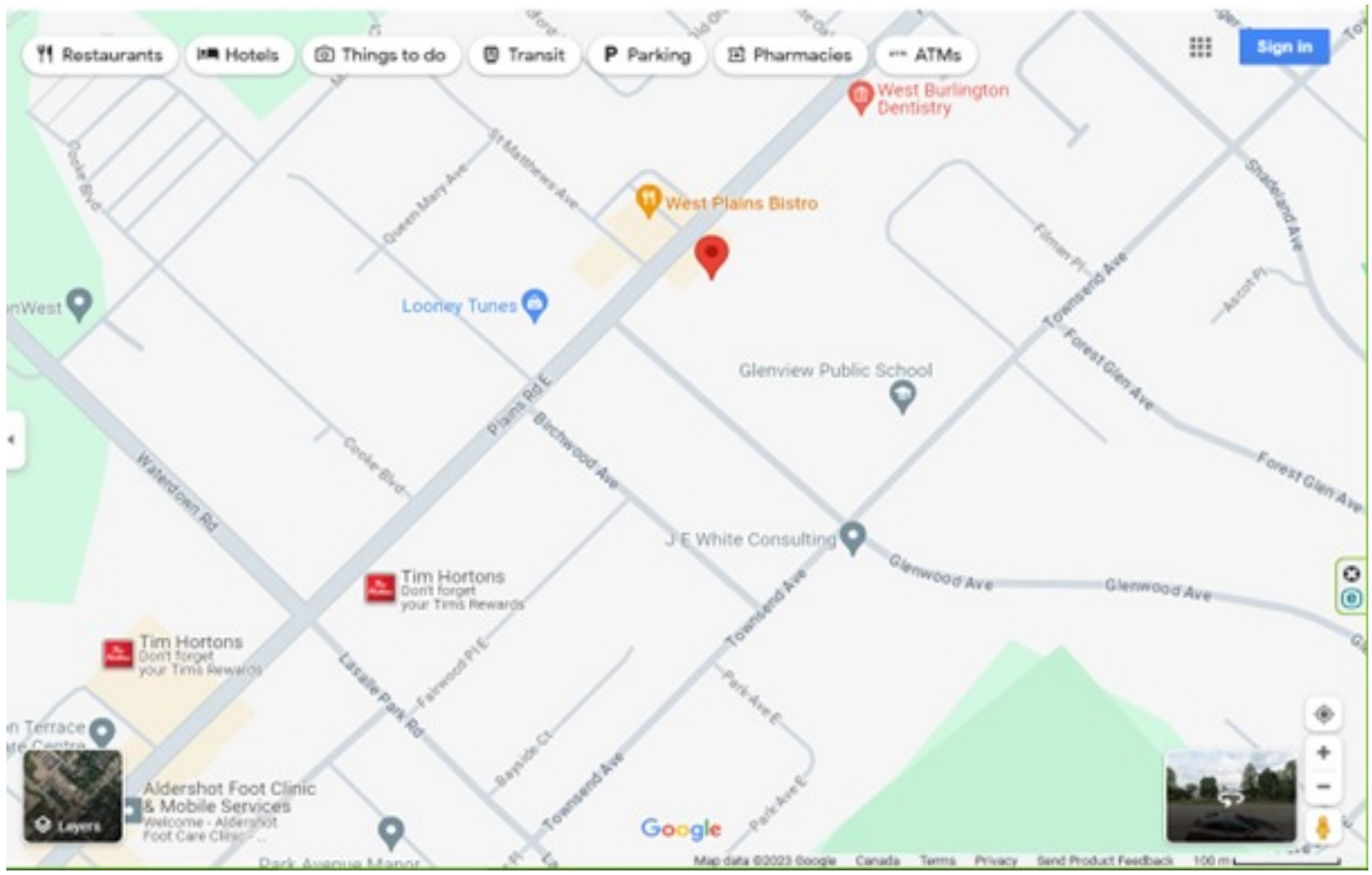
Chair's Report (continued)



St Matthew's-on-the-Plains Anglican Church (indicated with red locator)

Images generated using Google Maps

hall is. Please leave a couple of parking spaces close to the door up against the building for members who have mobility issues. These spots are not marked with a handicapped sign but are much closer to the hall entrance than the marked handicapped parking spots. The HAA flag will be outside the door and there will be a sign on the door indicating that the HAA is meeting that evening.

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HAA Helps Hamilton

The H.A.A. is once again accepting and collecting 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.

If you can't make an in-person meeting, you can make a donation directly to your local food bank.

Masthead Photo: *The Auriga Region*, by *Chris Szaban*.

Taken with a Rokinon 135mm lens and ASI294MC Pro colour camera using a dual band HA/OIII filter with 6 hours 45 minutes of integration time on November 18, 2023, from Milton, ON.

The image includes the open star clusters M36 & M38, as well as the Flaming Star Nebula, and the Tadpole Nebula.

Chair's Report (continued)

One of the changes that the new meeting location brings is that the HAA is responsible for setting up and taking down the tables and chairs. If you would like to volunteer to help out with setup, please come to the hall for 7 pm. Thank you in advance for helping out.

In other news, John Gauvreau is once again organizing the Astro 101 course. While this online course is geared towards people who are new to amateur astronomy, please remember that anyone can join in regardless of your experience. The course will begin in January and will run on every second Friday for approximately 10 sessions. If you would like more information or to the register for the course, please contact John at astro101@amateurastronomy.org

As most of you know, there will be a total solar eclipse in April 2024. The HAA council has been hard at work developing a plan for the eclipse. At our upcoming January meeting, more details will be shared about the club's plans and how you can participate.

The guest speakers for Friday January 12 are Brett Tatton and Frank Williams from the Bluewater Astronomical Society. They will be joining us through Zoom to discuss the astronomy program that they have developed for grade 6 to 8 students. I am very excited about their presentation and I am looking forward to gathering ideas that might be added HAA outreach opportunities.

Looking forward into February, the guest speaker will be Christian Sasse who is the Astronomer-in-Charge at iTelescope. iTelescope is an organization that facilitates remote imaging. Dr. Sasse will be joining us via Zoom to share innovations at iTelescope that are making it easier for amateur and professional astronomers to explore the cosmos.

I am looking forward to seeing HAA members and guests at the new location or on Zoom Friday January 12.

Clear skies,

Sue MacLachlan
chair@amateurastronomy.org

Astro 101 – The club's beginner group!

Don't know a black hole from a white dwarf? How about a planet from a planetary nebula? Wondering which end of the telescope to look through? Wondering which end is even supposed to point at the sky? Then Astro 101 is for you!

Astro 101 is a series of casual, online sessions aimed at the absolute beginner, who might be new to the club or new to the hobby.

Every year the HAA hosts Astro 101, where we talk about things like how to use a telescope, what is in the sky to look at and how to find them. The sessions are interactive and casual. This means that some experienced club members will guide us through some interesting topics, but everyone is encouraged to participate, ask questions, offer input and just talk! This is a great way to get to know the hobby and your fellow club members. Or maybe you have some insight to share with your fellow club members. Let me know and we can schedule it in. Beginners can learn a lot from other beginners.

We will begin in January and we get together online about once every two weeks. Hopefully we can even get together in person a couple of times! We will have enough sessions to get us through to late spring, and then we hope to finish with an observing session!

If this sounds like something you would like to participate in just get in touch (email address below) and we will put you on the list. Then you will get emails with links to the online sessions.

Please feel free to get in touch if you have any questions or suggestions (yes, if there is a topic you want to talk about just let me know and we will do our best).

Hope to see you there.

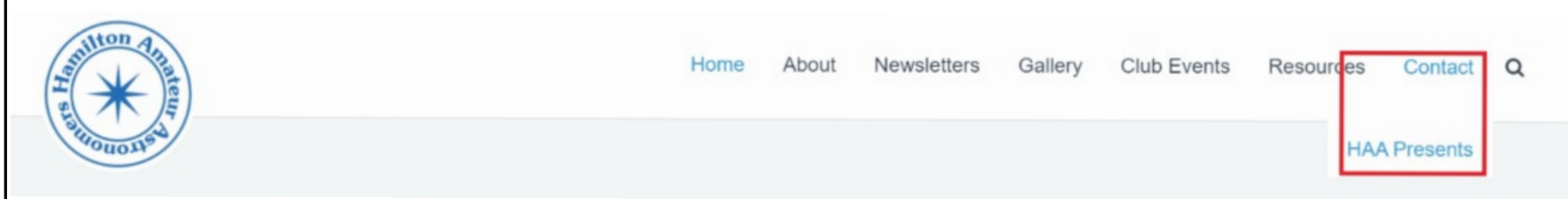
— John Gauvreau

astro101@amateurastronomy.org

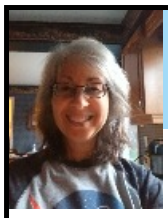
"HAA Presents"

Members of the public of any age in the GTHA can now request an in-person (once it is safe to do so) or virtual presentation from the HAA directly on our website.

Simply navigate to www.amateurastronomy.org and select "Contact" from the top menu bar and then click on "HAA Presents" (see image below). You will be presented with a request form and once all required fields are entered, click on the "Submit" button and you will see a confirmation message that your request has been successfully submitted.



Once received, our Public Education Director, Jo Ann Salci, will respond to your request within 5 business days to discuss next steps. If you have any questions, feel free to send an email to: haapresents@amateurastronomy.org.



HAA Explorers by Jo Ann Salci

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

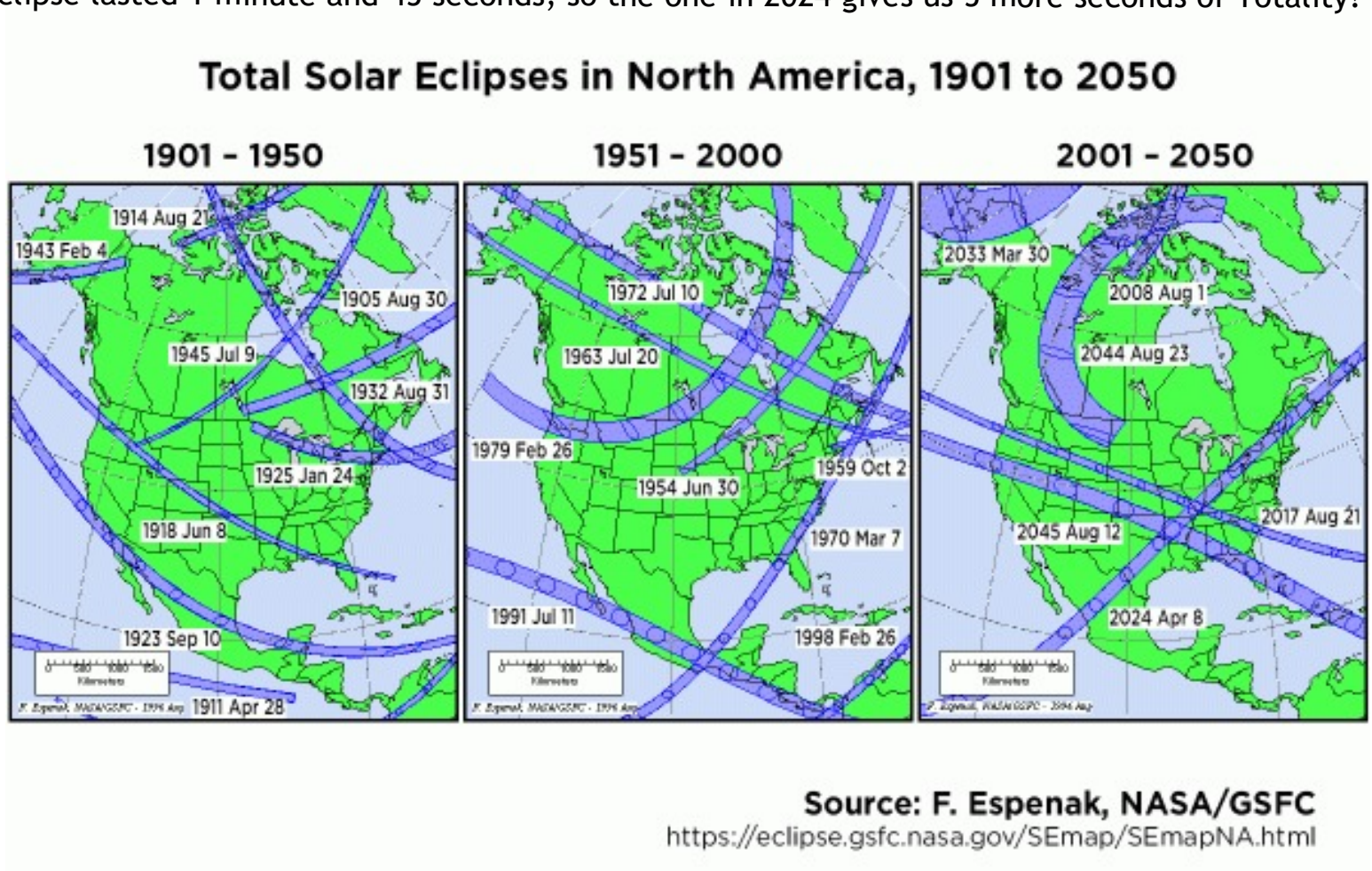
Have you heard that the Solar Eclipse on April 8th 2024 is a once in a lifetime event? Let's find out what that means!

Once in a Lifetime?!

Total Solar eclipses are the most awesome show that nature puts on for us! And we get to see one right here in our area on April 8, 2024! The last Total Solar eclipse in Hamilton, ON was on January 24, 1925! That's almost 100 years ago…

First, a Safety Warning! The Sun is so bright that even a few seconds of looking at it can cause severe damage and you could lose your eyesight. DO NOT look directly at the Sun. The same goes for adults, so make sure they know, too! Astronomers use special filters which allow them to study the Sun. We will explore more about safety in upcoming articles.

In Hamilton, Ontario, The Moon will begin covering the Sun on Monday, April 8th at 2:03 pm. It will take about 1 hour and 16 minutes to move to where it will completely cover the Sun. And then, it will only cover the Sun for ***1 minute and 50 seconds (this is called Totality)!*** And then it takes about 1 more hour and 12 minutes until the Moon has completely moved away from the Sun. So, at 4:31 pm the Total Solar Eclipse will be finished. It will have taken the Moon close to 2 ½ hours to travel across our Sun! In 1925, the eclipse lasted 1 minute and 45 seconds, so the one in 2024 gives us 5 more seconds of Totality!



So why might this be a once in a lifetime event? Solar eclipses are more common than Lunar eclipses as mentioned in last month's article and happen somewhere on Earth about every 18 months. But because the Sun's shadow on Earth is narrow at only a few hundred kilometers wide, not as many people see a Total Solar Eclipse at any given time. Many of these paths happen over Earth's oceans, which account for almost 75% of Earth's surface. AND, Total Solar Eclipses only happen on the same place on Earth rarely! In the case of Hamilton, Ontario, it has taken almost 100 years! So, if you don't travel to see these spectacular

(Continued on page 6)

sights, you may only get to see one or two of these in your lifetime! THAT is why April 8th 2024 is a very special date!

There are people that "chase" Total Solar Eclipses and travel around the world to see them. Here is a list of future Eclipses around the world over the next 10 years:
https://www.timeanddate.com/eclipse/list-total-solar.html

Less than 4 Minutes After Totality, from Hallsville, Missouri. Image Credit: Bob Christmas

In August of 2017, a number of HAA members, including myself, made their way to Hallsville, Missouri to see the Total Solar Eclipse. Here is an excerpt from an HAA article I wrote at the time. It was my first Total eclipse, and I'm looking forward to my next one!

"We eagerly watched for the shadow to come across the valley as the eclipse approached. At approximately 11:45 am Central Time, the moon began its journey across the sun. Daylight began to dim gradually. The cicadas were suddenly heard. So were the roosters! They were crowing, thinking that it was dusk! We saw bats flying as well. During totality at 1:13 pm Central time, sunset and sunrise could be seen at the same time! Daylight turned to nighttime darkness as a cooling breeze was felt by all. For over 2 minutes we experienced this cosmic event! We were in solidarity as we stood under the eclipsed sun and were in awe of our solar system's cosmic power that we were experiencing."

I DO hope you are able to enjoy the Total Solar Eclipse closer to home on April 8th. If you'd like to go to Australia to see one in 2028 or 2030, now's your chance to start planning your trip!

Things to do until next time **:

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

1. ***Watch*** this timelapse video of a Total Solar Eclipse: https://youtu.be/i2j4yJAf1Mk

2. ***Check out*** the NASA Video about the August 2017 Total Solar Eclipse. See how the eclipse was watched across the USA: https://youtu.be/21zamcOLwDM

3. ***Visit*** https://www.mreclipse.com/SEphoto/TSE2017/TSE2017galleryA.html to see a photo gallery from the 2017 Total Solar Eclipse!

(Continued on page 7)

During January, check out:

1. On January 7th around 8 pm, check out Jupiter, Saturn, the Pleiades, Aldebaran, the constellation Orion, and Sirius…all seen when facing in one direction…South!

2. On January 21st around 8pm, just 2 weeks later, see how the Moon has joined the party…and Saturn has already set?

Images generated using Stellarium

(Continued on page 8)

Once in a Lifetime

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A	T	N	C	H	A	S	E	A	T	A	A	A	T
R	H	L	A	S	E	A	R	T	H	M	R	N	I
T	T	W	S	S	O	E	M	H	A	L	I	U	L
S	L	O	R	A	E	L	L	U	N	A	R	A	A
U	E	R	N	O	O	M	A	R	E	R	A	R	T
A	V	L	P	I	T	W	A	R	R	T	R	Y	O
L	A	D	R	R	M	M	M	I	N	U	T	E	T
I	R	R	R	A	F	U	O	E	R	U	T	U	F
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P	S	T	M	N	C	O	M	M	O	N	U	D	E
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SECONDS
JANUARY
TRAVEL
CHASE
MOON
ONTARIO
SHADOW
SOLAR
MINUTE
APRIL
RARE
FUTURE
LIFETIME
FILTERS
LUNAR
HAMILTON
TOTALITY
PATH
SUN
WORLD
AUSTRALIA
COMMON
EARTH

Answers on page 19.

Finally:

I just had a once in a lifetime experience! 😉

(But I DO hope you get to see another Total Solar Eclipse!)
I won't be doing that again!!

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

Thank you to Ro for reviewing this article! 😊

References:

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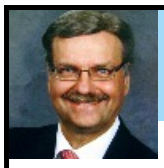


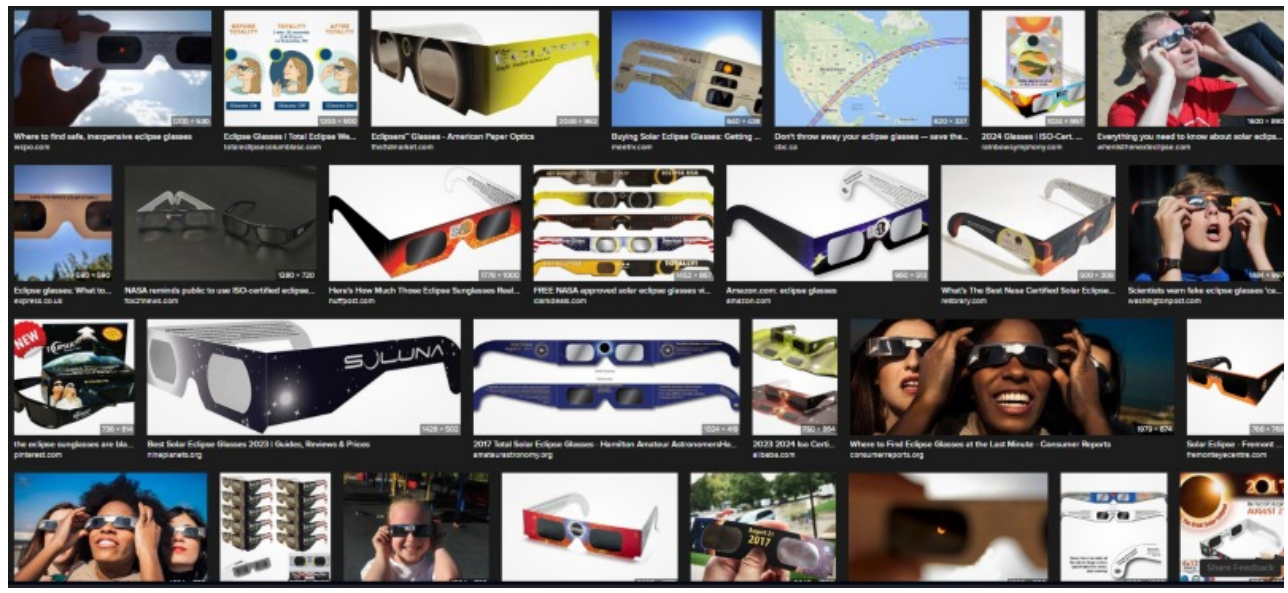
The Sky for January 2024 by Steve Germann

On New Year's Day, we begin 2024, which might well be the most astronomically aware year for North America in history, as the great eclipse of 2024 will get a lot of publicity and will pass over many population centers in USA and Canada on the way, as well as come near to many more.

This is the year of everyone's eclipse.

As amateur astronomers, we will be well prepared to witness and experience both the effect of the eclipse on the physical world, and ourselves, but also on other people. We will be called upon to answer some questions, and fortunately, there are many excellent Internet references which will be useful to refer to.

Naturally, our eclipse glasses will be kept in a safe place, ready for use. I advise you to test them on a sunny day, just to see what the un-eclipsed sun will look like, and to iron out any issues with fitting them over spectacles. Here's an image of our glasses from 2017. Do you think I could find the latest image online? Nope. Lots of others though:



Google Image Search Screengrab

The slow but precise movement of things in the sky do not wait for eclipses, and a steady stream of additional interesting astronomical phenomena will happen, even if they are somewhat 'eclipsed' in significance by the big day. For sure we need to keep up with the more quotidian events, as there is the ominous possibility of clouds on April 8, and you would not want to sweep aside 3+ months worth of astronomy in distraction, only to be disappointed by one day of clouds.

The sky, as we shall see, is remarkably interesting, even with an elephant on the calendar.

Last Month's Armchair Astronomy Challenge

For sure, none of us expect to spend April 8 2024 at 3 PM huddled around a PC looking at remote photos of someone's eclipse observations. But if we cannot get out of our armchair, that might end up being the force of habit. To break that habit, and to encourage astronomy activity, each month I have selected a challenge, of 'astronomical' significance, to encourage you to 'this time' step outside and observe it for yourself.

The Geminids meteor shower in December is actually the most fabulous meteor shower of the year. It lacks several key things to keep it uppermost in mind, the first being, it's cold in December. The most important side effect of the cold is that it's almost impossible to interest a non-astronomer (or even an armchair astronomer) in going outside to observe them. But they reward the effort handsomely if it is attempted.

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The Sky for January 2024 (continued)

I watched the sky for 10 minutes on the evening of Wednesday December 13th, and at 9:21 PM, I observed a bright slow moving yellowish meteor starting near the radiant and passing just north of the Pleiades.

I am interested to hear from others who observed a meteor at that time, and to determine whether their perception of its path or relation to stars is offset by parallax. We know the meteor paths are all essentially parallel, and therefore, basically, they each point at a different spot on the earth's surface where they would have hit if there were no atmosphere. To be able to compute that point is one aspect of determining the 3D path of the meteor, which is a touch of amateur astronomy science. Just seeing a meteor and knowing it is seen from different angles elsewhere is another potential thrill of sky-watching.

Alas, nobody has sent me any observations, however humble, and you should know, it is remarkably hard to capture meteor trails on the sky with a staring camera, as long exposures tend to brighten the stars and skyglow to the point where the smeared meteor trail for a fraction of a second can hardly be seen, and shorter exposures increase the times when the camera is not looking, and fill up the memory card pretty fast.

Adequate dew control is also essential for photographing meteor trails to have a chance of success.

Any such photos from 2 locations, however, would have actual scientific value, and I could (with some nontrivial effort) turn them into a 3D map showing where the light came from in the sky above the Earth.

If you did not see meteors, it's not too late to investigate last month's resources regarding occultations, and download the program.

I hope that many of our members will begin participating in that productive scientific pursuit.

This month's Armchair Astronomer Challenge

So second verse, same as the first.

January starts with another extremely active meteor shower, the *Quadrantids*.

Unlike the Geminids, served on a silver platter at new Moon in December, this shower's radiant is circumpolar but more northerly, and the meteors, although numerous, are significantly dimmer on average, so the count is deceptive. Despite the large number of faint meteors, the Quadrantids will also send you a decent number of fireballs. You don't need dark skies for those. A waning gibbous Moon is not helping with the count, but will not interfere with appreciation of the fireballs.

I do not have the heart to make this an armchair challenge. You would be subjected to a lot of waiting for minimal bragging rights. If you ever want to read weasel words, check out predictions of meteor showers. They are so careful to avoid any statement which may be false. All statements are qualified with remarks about 'ideal conditions' meaning, they cannot be tested.

Well.

A brightness histogram for a few previous years, is all it would take to get on the side of science, logic, and objectivity. Then you could simply cut off the dim part depending on local viewing conditions, and know what to expect.

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The Sky for January 2024 (continued)

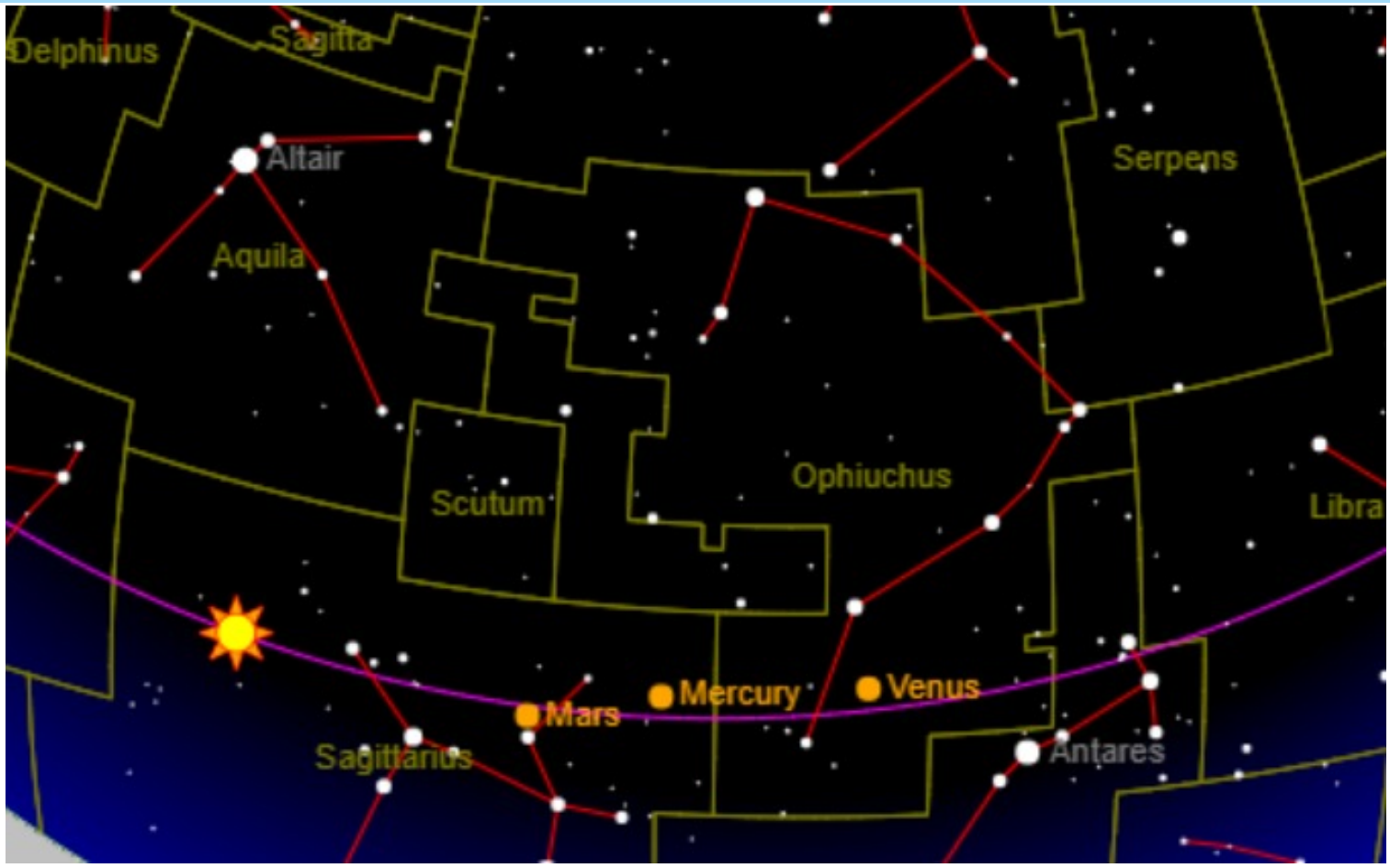


Chart generated using Heavens-Above

Therefore, our challenge moves on, to all who have yet to see *Mercury*, and to all who have yet to see *Mercury, Venus, Earth,* and *Mars* in the same view all at once.

Mercury reaches its max western elongation on January 12, and basically all month, it can be seen bright in the eastern sky just before sunrise. Now I am giving you the advantage. In the Winter, sunrise is later. So get a good look to the East on one of these clear days coming up, and notice a very bight Venus in the sky. More importantly you will see a progression of 3 bright objects, Venus, Mercury, and Mars, in that order, towards the horizon.

Above is a finder chart for Jan 13, our meeting night.

Comets

There are two 8th magnitude photographic target comets in the sky right now.

All the others will probably disappoint.

(Continued on page 12)

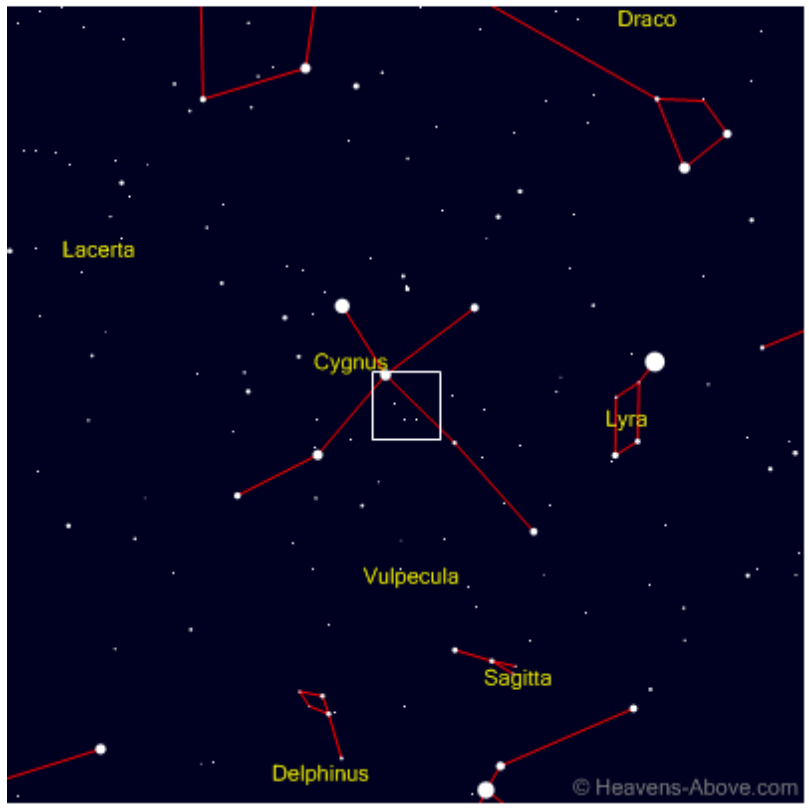
Comet	Brightness	Date of last reported observation	Angular separation from Sun	Altitude	Azimuth	Constellation
12P Pons-Brooks	8.0	2023-Dec-26	63°	-3.9°	25° (NNE)	Lyra
62P Tsuchinshan	8.1	2023-Dec-25	110°	52.9°	135° (SE)	Leo

Chart generated using Heavens-Above

The Sky for January 2024 (continued)

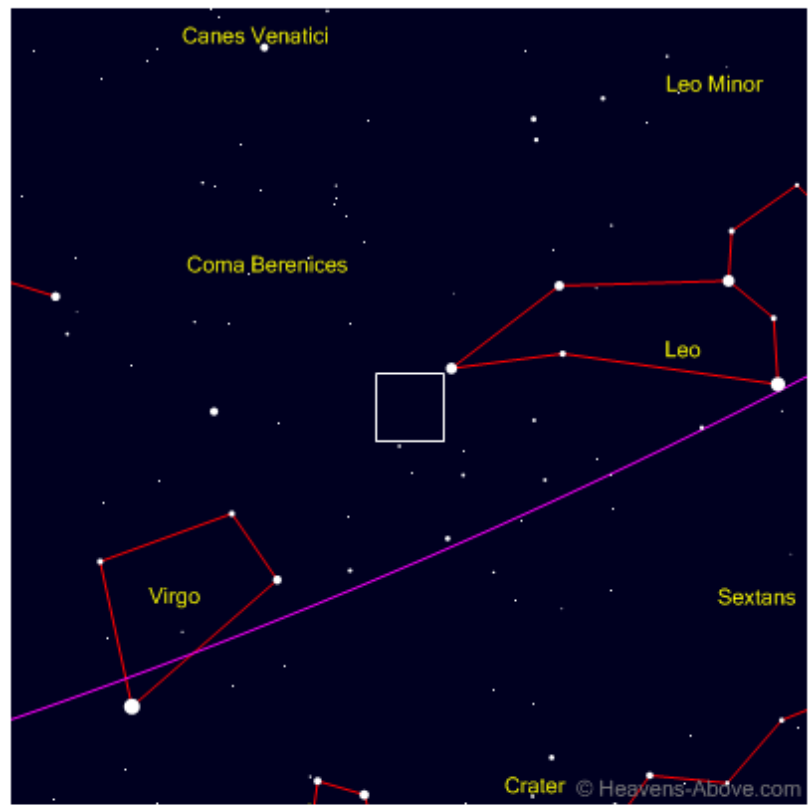
Comet 12P Pons-Brooks

Year 2024 Month January Day 13 Time 03:29:44



Comet 62P Tsuchinshan

Year 2024 Month January Day 12 Time 15:46:10



Coarse finder chart
(Field of view: 60°, Max. star mag.: 5)

Charts generated using Heavens-Above

The first one, *12P Pons-Brooks*, is in Cygnus, and there are a lot of good background objects you could frame in a photo to make a nice APOD of the comet. It is gradually moving to the left before and after the date of this chart. As always, you should use Heavens-Above.com to make your own chart when you plan to observe. But if you step outside and see Lyra or Cygnus you will know where and when to set up your camera. A 4 second exposure will not show bad star trails, but tracking is best.

Comet 62P Tsuchinshan is also moving gradually to the left in the above chart during January.

Planets

Okay here is where the sky gets interesting in an infrequent way. As mentioned, on Jan 13, the 4 innermost planets will form almost form a straight line in the MORNING sky: *Venus, Mercury, Mars, Earth*.

On top of that, so to speak, *Uranus* is still near opposition, so here is your chance to benefit from the very long very dark evenings and get some photos, and still be able to see the end of the hockey game.

Moon Phases

The New Moon in January will be on January 11th at 7 AM, but there will be no eclipse. We have to wait for April 8, 2024 for that event.

Sunrise

We are only a week past the shortest day of the year, and sunrise and sunset still reach into our work day times. Sunrise will progress from 7:51 am to about 7:36 am during the month of January, and Sunset starting at 4:54 PM will eventually be 5:29 PM at the end of the month.

(Continued on page 13)

The Sky for January 2024 (continued)

The take-home message here is, there is a LOT of darkness to make good use of!

Moonrise

As usual the Full Moon will rise in January. (There is very seldom a month without a Full Moonrise. February 2037 will be the next one, when there is a double blue moon pair that straddles February. Until then, you may depend on the Full Moon rising at least once every month.

Moonrise is northerly during the winter months, and again, Dundas lookout is of no use.

Dundurn Park, however, will work this time, as well as the beach near Hutches on Lake Ontario or any of the Burlington piers.

January Full Moon Rise Azimuth is:

Date, Time, Azimuth:

January 24, 4:05PM, 53 degrees, 75 minutes before sunset;
January 25, 5:11PM, 57.65 degrees;
January 26, 6:17PM, 63.77 degrees, probably best for photography and most convenient.

I recommend you buy the cheapest dollar store compass you can get, and stop being fooled by the Moon's azimuth. A real compass will point to magnetic north, and you need to correct it by 10 degrees here in Hamilton.

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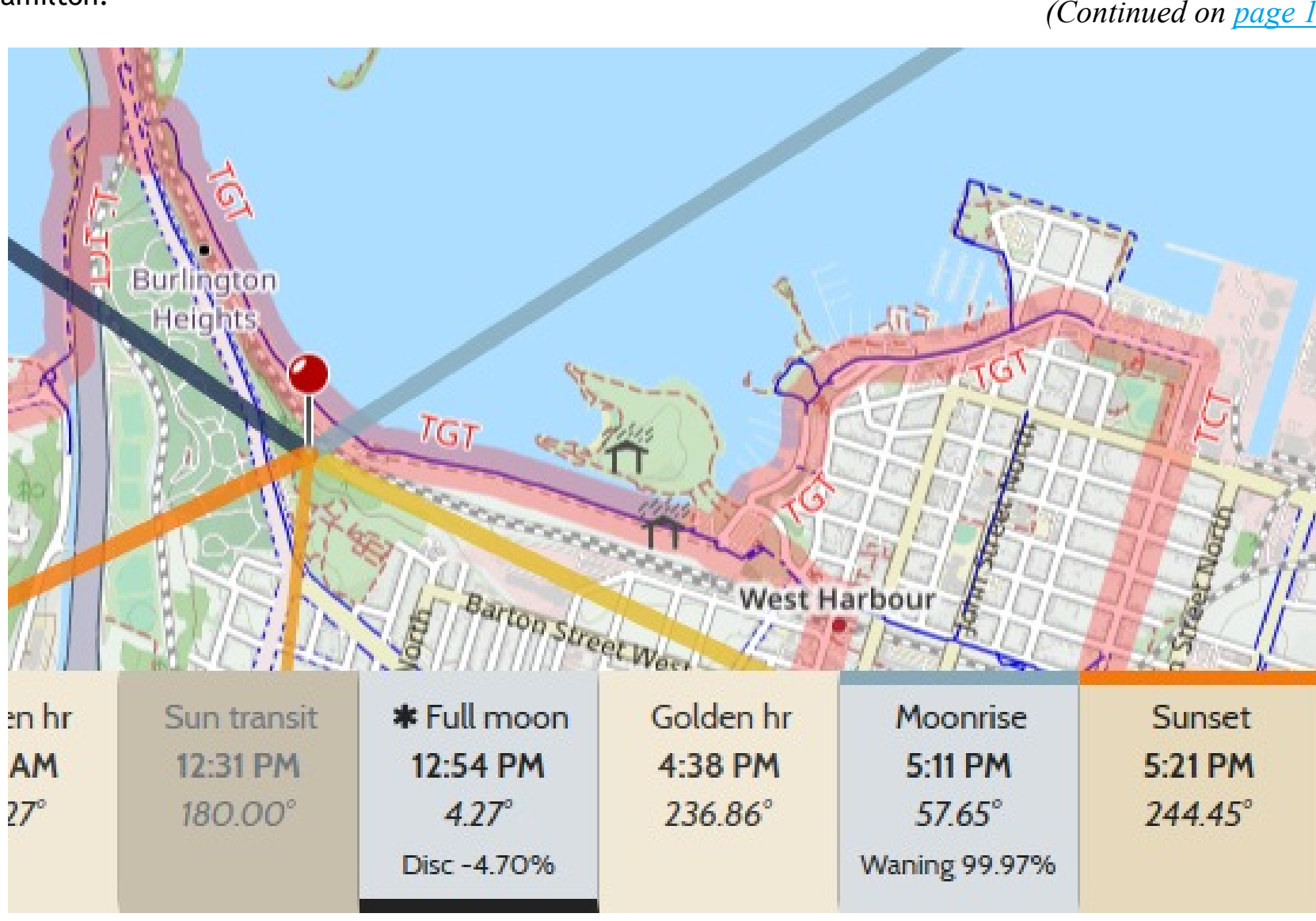


Image generated using Photographer's Ephemeris

The Sky for January 2024 (continued)

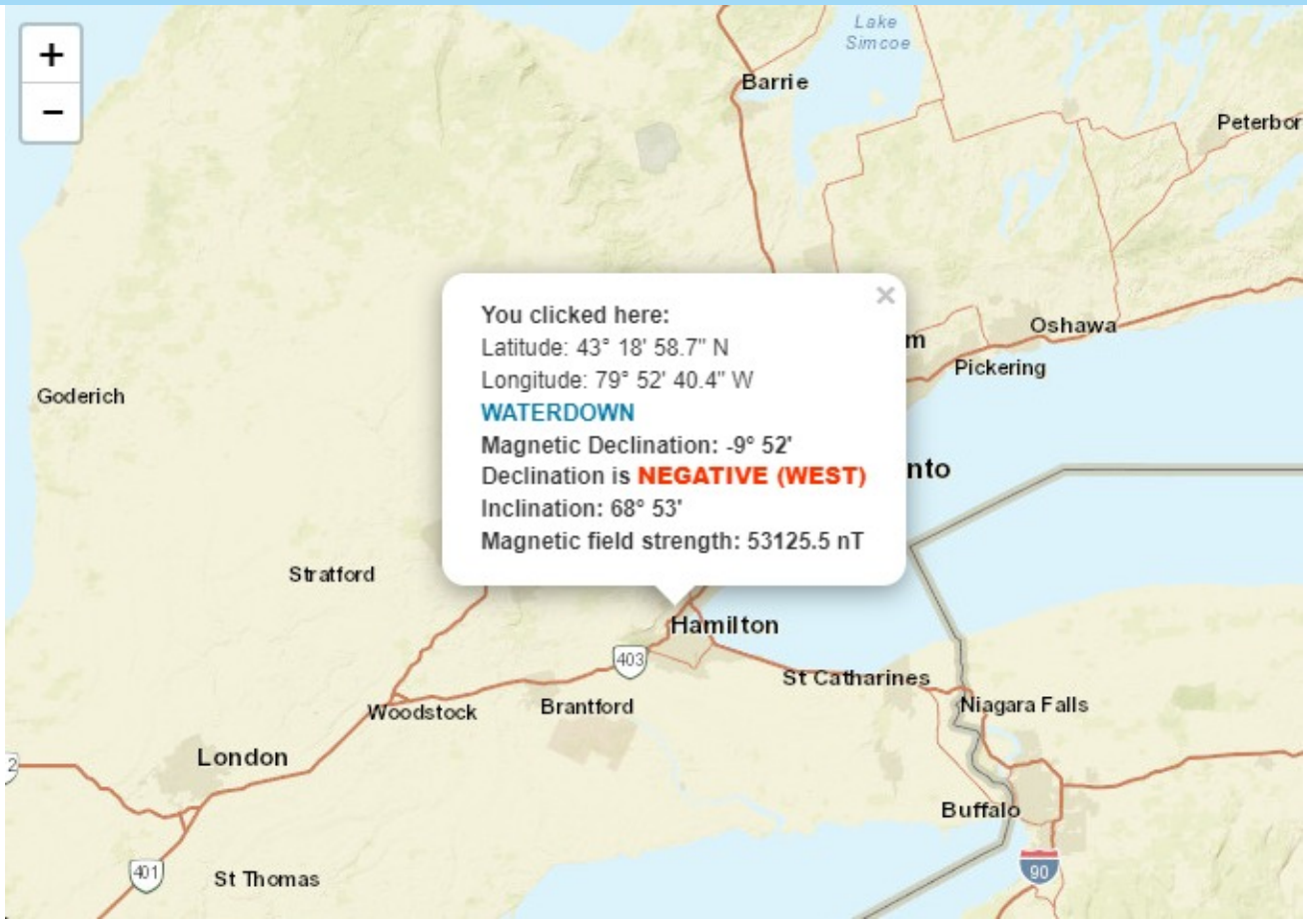


Image courtesy of magnetic-declination.com

Here's a handy chart of magnetic declinations to use if you ever need it. So your magnetic needle will point west of the celestial north pole, and to, for instance, point your camera to 64 degrees, you need to point the compass needle to 350 degrees. Alternatively, you can point the needle to north on the compass dial and point your camera to 74 degrees.

Here is a handy website:

https://www.magnetic-declination.com

I wish you clear skies and fruitful efforts, for the Month of January.

HAA Outreach Presentations with Vulnerable Sectors

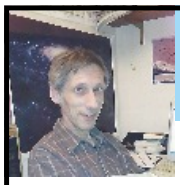
The HAA executive has created a policy for any HAA member who wishes to do outreach presentations to vulnerable sectors, which includes children under 18 years of age and vulnerable adults. This does not include our general club outreach activities.

Presentations include in-person or virtual sessions where parents/guardians may not be present. **As it is not always possible to anticipate caregiver attendance at outreach activities for children under the age of 18, or vulnerable adults, it is therefore a requirement for HAA member-volunteers who work with these vulnerable populations to complete a Police Vulnerable Sector Check**.

These can be obtained only in your region of residency. Costs vary from one area to another. They will be kept on file by the HAA Education Director. No details regarding the findings of the check will be made in any way public or viewed beyond the HAA Education Director.

The HAA will reimburse any member who wishes to do outreach presentations to vulnerable individuals, provided a receipt is submitted.

Please contact Jo Ann Salci if you have any questions about this policy and/or if you wish to put your name forward to help with outreach activities to young people! This policy is effective immediately.



Planets of Binary Star Systems Part 3 by Doug Currie

Popularity of Planets Around Binary Star Systems in Science Fiction

Binary star systems have been and continue to be very popular settings in science fiction to have planets around (probably one of the most popular and famous is the planet Tatooine in a number of the Star Wars movies).

Some Illustrations of Planets in Binary Star Systems in Science Fiction

This illustration is of a Hypothetical Rocky Planet Around a Possible Binary Star System

This is a photograph by Mark Garlick/Science Photo Library uploaded September 23rd, 2018 on the Pixels web site.
Link is:

https://pixels.com/featured/binary-star-system-mark-garlickscience-photo-library.html

The beginning of the description of this illustration on Pixels is the following:

"Binary Star System. Artwork of the two stars of a binary system seen from an alien planet. A giant blue star (upper left) is accompanied by a neutron star (centre right)."

Illustration Credit:

Mark Garlick/
Science Photo Library

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Planets of Binary Star Systems Part 3 (continued)

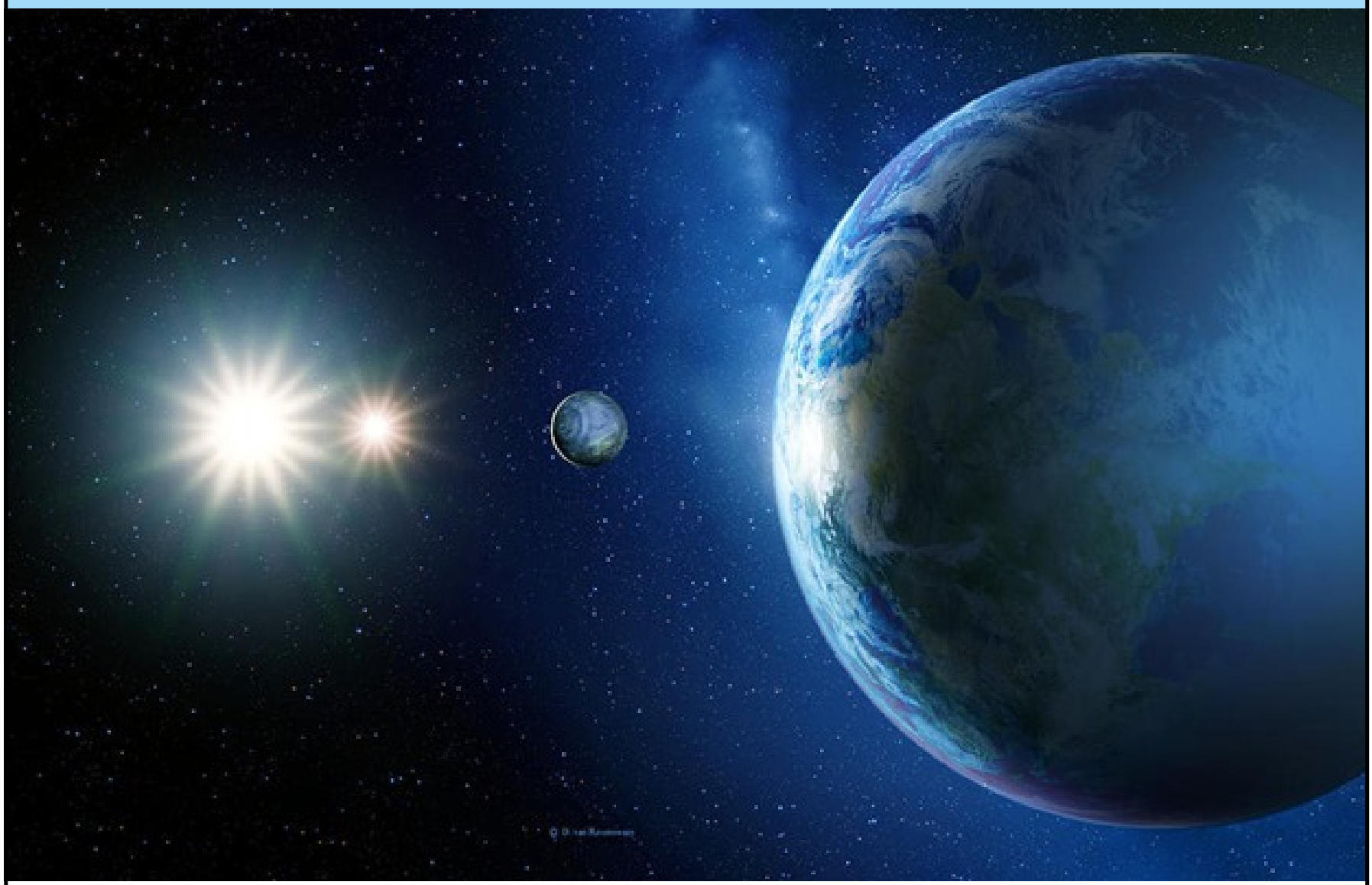

Illustration of two planets around the binary star Antares (Alpha Scorpii)

Credit: Detlev Van Ravenswaay

The title of the above illustration is “Planet Orbiting Antares”, Computer Artwork Photograph by Detlev Van Ravenswaay – Pixels

The link is:

https://pixels.com/featured/planet-orbiting-antares-computer-artwork-detlev-van-ravenswaay.html

The caption for the illustration is the following:

“Planet Orbiting Antares, Computer Artwork Alien planet. Computer artwork of a hypothetical planet (seen at centre and at right) orbiting the red supergiant star Antares (at far left). This star is seen with Antares B, a hot blue companion star to its right. Antares, or Alpha Scorpii, lies around 600 light years from Earth, in the direction of the zodiacal constellation Scorpius.”

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Planets of Binary Star Systems Part 3 (continued)

Ilustration of a Hypothetical Rocky, Perhaps Potentially Habitable Planet in a Binary Star System Around a Blue Star and Red Star

This is a Binary Star System, by MasPix on DeviantArt

The link for the above illustration is:

https://www.deviantart.com/maspix/art/A-Binary-Star-System-2-142704322

(Continued on page 18)

Planets of Binary Star Systems Part 3 (continued)

Some Nearby Examples of Binary Star System Planets

- Gliese 15 A b c B at 11.74 light years
- HD 180617 (VB 10 or GJ 752) A b B at 19.27 light years
- GJ 338 A B b at 20.64 light years
- HD 102365 A b B at 30.12 light years

Some Examples of Planets Around Bright or More Famous Binary Star Systems

- Eta Ceti A b and c at 124 light years and magnitude 3.46
- Beta Ursae Minoris A b at 131 light years and magnitude 2.07
- Gamma Cephei AB b at 46 light years and magnitude 3.21
- Gamma Leonis A b at 130 light years and magnitude 2.61
- Omicron Ursae Majoris A b at 179 light years and magnitude 3.35

Ability to Detect Planets Around Binary Star Systems (Compared to Those Around Single Stars)

It is significantly more difficult to detect planets in binary (or multiple) star systems than to detect planets in single star systems. This greater difficulty is because of the changing apparent distances of the two stars as seen from Earth, especially when they are apparently closer and any orbiting planets would have to stand out above the glare of both stars. This is definitely a factor for instance in the search for planets in the almost double star system Alpha Centauri A and B.

Range of Distance of Planets Around Stars in Binary Star Systems

The range of distances of planets around the component or components of the binary star system they orbit is for the closest ones 0.0088 Astronomical Unit (AU) for K2-22b, 0.0120 AU for TOI 732 b, 0.0143 AU for NGTS-10 b to the farthest ones from the Binary Star System they orbit at 650.0 AU for HD 106906 AB b, 1063.0 AU for SR12 AB c and 1168 AU for Ross 458 (AB) c where an AU is the average Earth Sun distance of about 93,000,000 miles.

Range of Temperature of Planets Around Binary Star Systems

The range of calculated temperatures of planets in binary star systems due especially from the radiation from the component(s) of the binary star system the planet most directly or closely orbits have the lowest of calculated temperatures for the planet GJ 414 A c at 123.3 degrees Kelvin or -149.9 degrees Centigrade, for planet K2 288 B b 226.36 degrees Kelvin or -46.6 degrees Centigrade and for planet GJ 414 A b 303.7 degrees Kelvin or about +30.5 degrees Centigrade.

Extent of Occurrence of Planets in Habitable Zone in Binary Star Systems

So far of the 53 potentially habitable planets listed in The Habitable Exoplanets Catalogue only one K2 288 B b is in the habitable zone and an earthlike mass and there are altogether the 53 planets in the Habitable Zone of any type of star system (binary, single or multiple) out of all planets (5504 at latest count in the Extrasolar Encyclopedia for September 26, 2023).

According to a journal article in 2020 with title: “Statistical Properties of Habitable Zones in Stellar Binary Systems” by Paolo Simonetti and others, there are 10 binary star systems with stars in the main sequence

(Continued on page 19)

Planets of Binary Star Systems Part 3 (continued)

that have one or more circumbinary planets, namely Kepler 16, Kepler 34, Kepler 35, Kepler 38, Kepler 47, Kepler 413, Kepler 453, Kepler 1647, Kepler 1661 and TOI 1338 from the TESS mission. From the same article, there are seven binary star systems with main sequence stars that have at least one planet namely HD 41004, HD 196885, Gamma Cephei, Gliese 86, HD 176051, Kepler 420 and HD 42936 or 17 binary star systems comprising main sequence stars that have planets in the habitable zone.

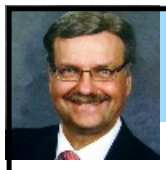
Extent and Examples of Habitable Planets in Binary Star Systems

So far of the 53 potentially habitable planets listed in the tables of potentially habitable planets on The Habitable Exoplanets Catalogue as last updated on January 5th, 2023 at:

https://phl.upr.edu/projects/habitable-exoplanets-catalogue

only one potentially habitable planet K2-288 B b orbited in a binary star system. However, there were two other potentially habitable stars that are triple star systems with at least one potentially habitable planet. These are Proxima Centauri that is a triple star system with Alpha Centauri A and B with Proxima having one potentially habitable planet orbiting it and I believe at least one other orbiting planet that is not is the habitable zone. The other potentially habitable planets orbit in the Gliese 667 system, particularly around the least massive star of that system Gliese 667 C around which star there are I believe 3 planets in its habitable zone namely Gliese 667 C c, e and f.

Word Search Answer key from page 8:



Keeping up with all the Meteor Showers by Steve Germann

This month's article will focus again on an aspect of the annually printed RASC Observers Handbook which is now better implemented via online resources.

The chosen topic for this month is *Meteor Showers*.

The handbook usually shows a list of the prominent meteor showers, some in bold type indicating special opportunities due to moon phase or historical associations with brief meteor storms or exceptionally active streams of debris in space.

Technically some showers have very low rate, but still they constitute a shower if they share a radiant and a source.

Here is the admittedly also incomplete list of showers from ***Wikipedia***: Meteor shower - Wikipedia

In terms of reading something designed to get you out under the stars...

Start with the ***Space Tourism Guide***, written in an enthusiastic encouraging format, and in the past, willing to mention even the sparsest meteor shower only a mother could love. Valerie Stimac now admits she is calling out only events with a slightly higher standard of enjoyability, and edits her monthly article relative to the preceding year: https://spacetourismguide.com/january-night-sky/

The Farmer's Almanac is also a trove of information that does not change annually

https://www.almanac.com/content/meteor-shower-calendar

I think the thing that most of these websites overlook is the rate of bright meteors.

I would stay up all night to see just one horizon to horizon fireball light up the countryside. (I saw that just once at Starfest, so statistically, that's a lot of nights for one fireball, so far).

It's all well and good to talk about a rate of detectable meteors in ideal conditions with all the lights off for a hundred km, but you come to see meteors that satisfy... and those can be seen from downtown. How many of those and when... that is going to be the reason to set up your chair and bring cocoa.

So I propose we create a new chart of meteor showers, quoting the Zenithal Hourly Rate of fireballs, above certain magnitudes. On that basis, the numbers will be much smaller, but the meteors will be real.

As of yet, I can only find anecdotal evidence on fireball frequency in any source, on paper or online. Sounds like something for the todo list.

TimeandDate.com is a stalwart source of information on any named shower, and has these useful dynamic online tools you can specify your location. It will show the sky view with the radiant at its position for that time, and you can use it to help you choose a good direction to observe.

Here is TimeAndDate's entire list of showers: Meteor Shower Calendar 2024 (timeanddate.com)

From a completeness point of view, their list shows only the popular showers.

(Continued on page 21)

Keeping up with all the Meteor Showers (continued)

For balanced reporting, and a good idea where and when the radiant will be visible (and therefore meteors can hit this side of the earth) I always use TimeandDate.com:

[Quadrantids Meteor Shower 2024 (timeanddate.com)]

Image courtesy of TimeandDate.com

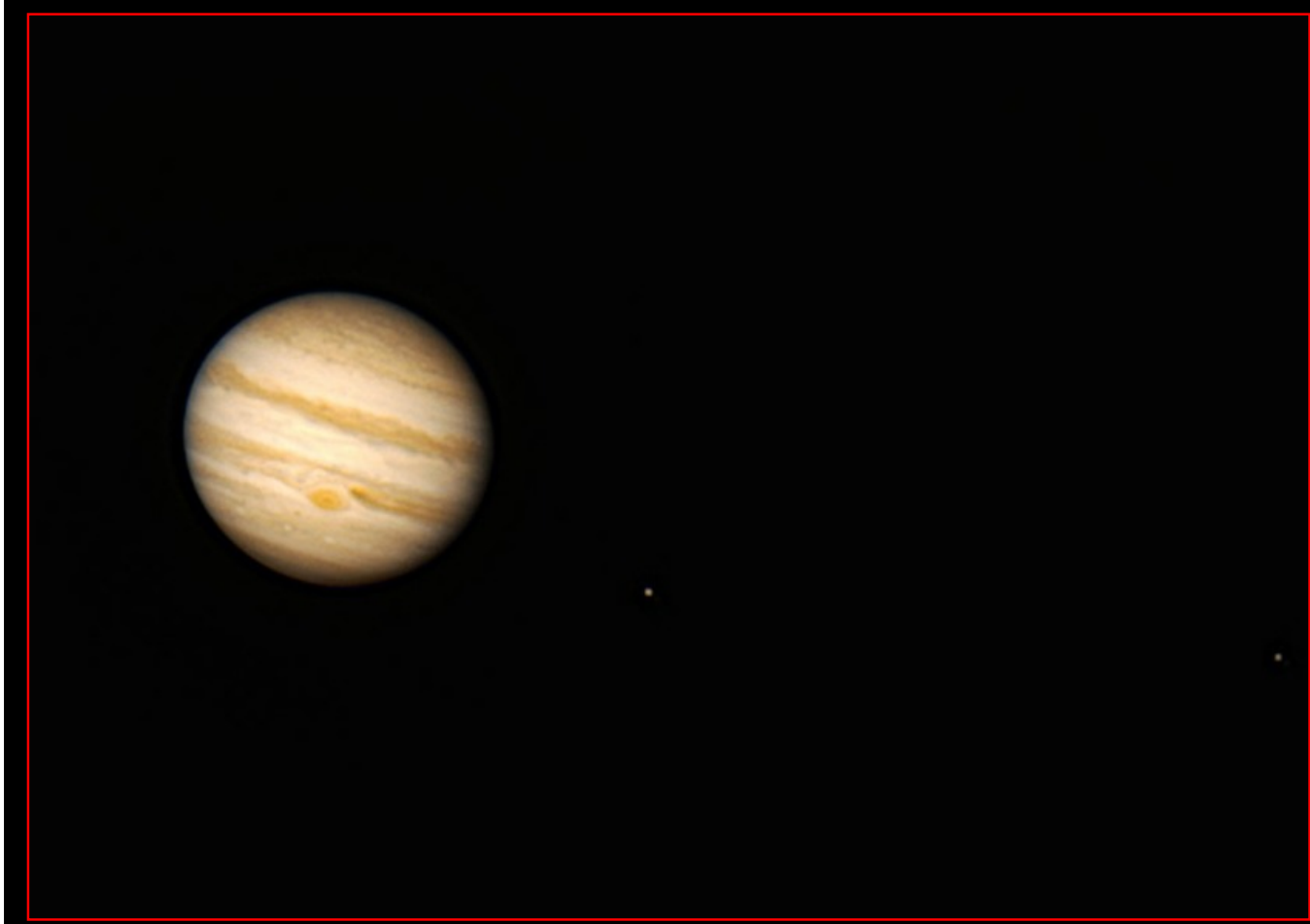
Meteors can appear anywhere on the sky, but if you look in the direction of the radiant, you will probably be able to see some fainter ones with their light more concentrated in space, as well, as see the divergent pattern they make.

So, in conclusion, I am specifically calling out all the sources of information about meteor showers as lacking in any kind of histogram of meteor brightness abundances. That's the difference between too-faint-to-see and too-good-to-miss.

Having described all these resources, I will end with one admonishment: Jan 3, 2024 is your last chance to see a shower until after the eclipse in April. Don't miss it!

Eye Candy the Members' Image Gallery

Open Cluster M52 and The Bubble Nebula (NGC 7635) in Cepheus, by **Chris Szaban**
Taken in Milton, ON, through a Celestron 6SE scope with an ASI294MC Pro colour camera.



Jupiter
on September 18, 2023, by **Chris Szaban**

Taken in Milton, ON, through a Celestron 6SE scope with a 2x barlow and an ASI294MC Pro colour camera.

William J. McCallion Planetarium

McMASTER UNIVERSITY, HAMILTON, ONTARIO

- Public shows Wednesdays and some Saturdays
- Public transit available directly to McMaster campus
- Tickets $7 per person; private group bookings $150
- Different shows every week
- Upcoming shows include:
  - Jan 24: Introductory Astronomy for Kids — Galaxies
  - Jan 31: Introductory Astronomy for Kids — Solar System
- For show times, special group shows about the April 8 Solar Eclipse, and further details, visit www.physics.mcmaster.ca/planetarium

UPCOMING EVENTS

January 12, 2024 - 7:30 pm — H.A.A. Meeting at *St. Matthew's Anglican Church, 126 Plains Rd. E., Burlington, ON.* Our main speakers will be *Brett Tatton* and *Frank Williams* of the Bluewater Astronomical Society. **This will be a "hybrid" meeting, with the attendance option of in-person or online via Facebook and Zoom.**

February 9, 2024 - 7:30 pm — H.A.A. Meeting at St. Matthew's Anglican Church.

2023-2024 Council

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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

Contact Information

E-mail: library@amateurastronomy.org