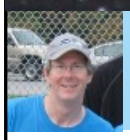
Event Horizon

Volume 29, Number 1
November 2021

Hamilton Amateur Astronomers



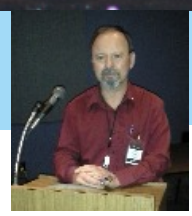
From The Editor

The start of a new HAA Membership Year ushers in a new HAA Council. And, this year, we welcome back *Bernie Venasse* as HAA Chair.

Clear Skies,

Bob Christmas, Editor

editor 'AT' amateurastronomy.org



Chair's Report by Bernie Venasse

John Gauvreau. What a tough act to follow!

John has been chairman of this club for many years. He has guided us through good times and not-so-good times and is now going to enjoy a well-deserved rest. Not to say that he is going to be idle. He has plans for the Beginners group which he will soon reveal to us. Thank you, John, for your guidance and perseverance during the past three terms chairing this wonderful club.

Welcome !!!

During my three-year break from the chair, I was able to concentrate on a few Goal Oriented Observing programs and awards as well as a few club projects. We now have an active award program which includes the Pathfinder program for newbies, the Rising Star award for novices and the Messier Program for more experienced observers. I hope to expand the program to include a Lunar

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IN THIS ISSUE:

Chair's Report (continued)

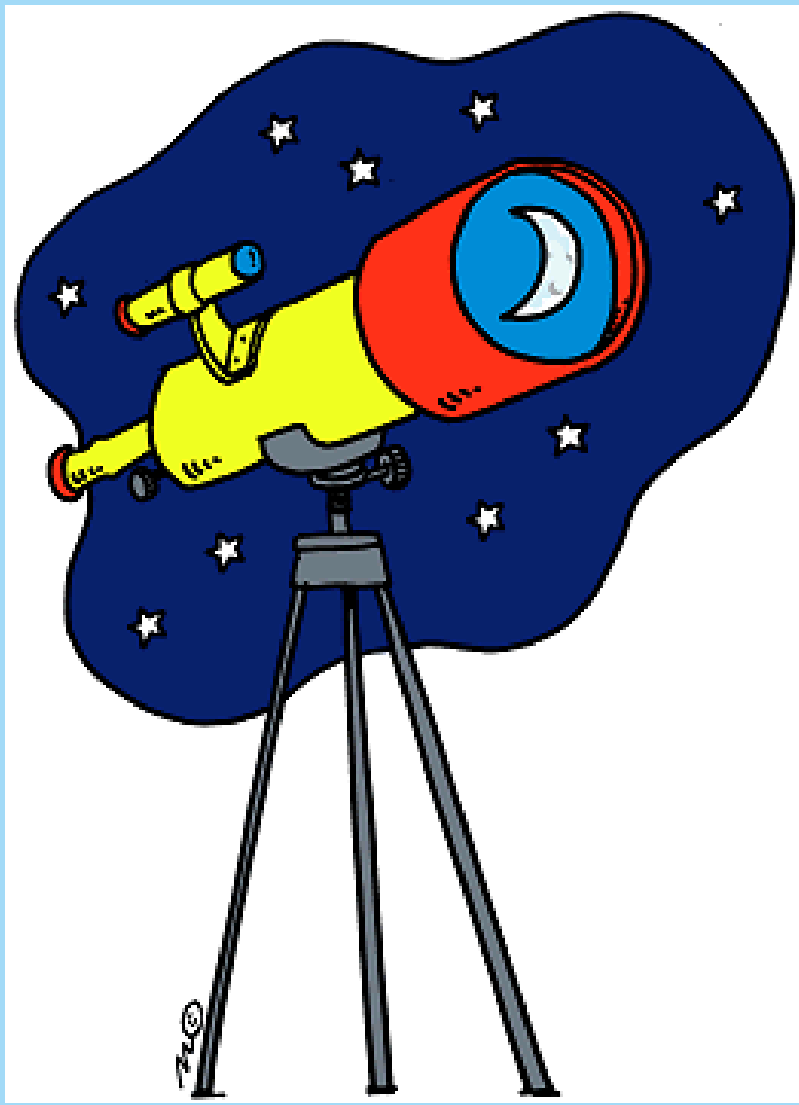
Observing award program soon. As well, several monographs are nearing completion and I look forward to having them posted on the club website.

I am looking forward to serving as Chair once again. This is an exciting time to be involved in this science. There is an almost-total Partial Lunar Eclipse on November 19th and a Total Lunar Eclipse in May 2022. In December the James Webb Space Telescope will take flight, and hopefully, we will soon be returning to face-to-face meetings – or perhaps a hybrid form of meeting.

Our 2021-2022 Council includes many returning faces and I welcome Paula Owen as our new Membership Director.

Dr. Laura Rosseau-Nepton of the Canada-France-Hawaii Telescope was our guest speaker in October. She gave us a very informative entertaining and enthusiastic presentation. Merci, Laura!

REMINDER…. Clocks go back on the 7th this month. I'm darned if I can find the store receipt so I can take mine back!



H.A.A.'s Loaner Scope Program

We at the HAA are proud of our Loaner Scope Program. It allows members who don't own a telescope to get more up close with the night sky, and it allows members to explore different types of telescopes! Paid members are welcome to borrow a telescope for one month. We have telescopes of varying expertise levels, a MallinCam, a spotter scope and various eyepieces. Please visit the HAA website for more information!

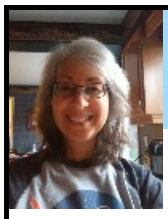
If you are interested in borrowing a telescope, please contact Melissa Whitman at

loanerscope@amateurastronomy.org.

Telescopes are loaned out on a first come basis.

Masthead Photo: *M33, the Triangulum Galaxy, October 6, 2021,* by *Bob Christmas.*

Taken with a Canon 40D through a Tamron 300mm f/2.8 telephoto lens, on a Super Polaris EQ mount. Exposures: 40 x 90 seconds @ ISO 1600; 60 minutes total. Crop of original image. North is to the left.



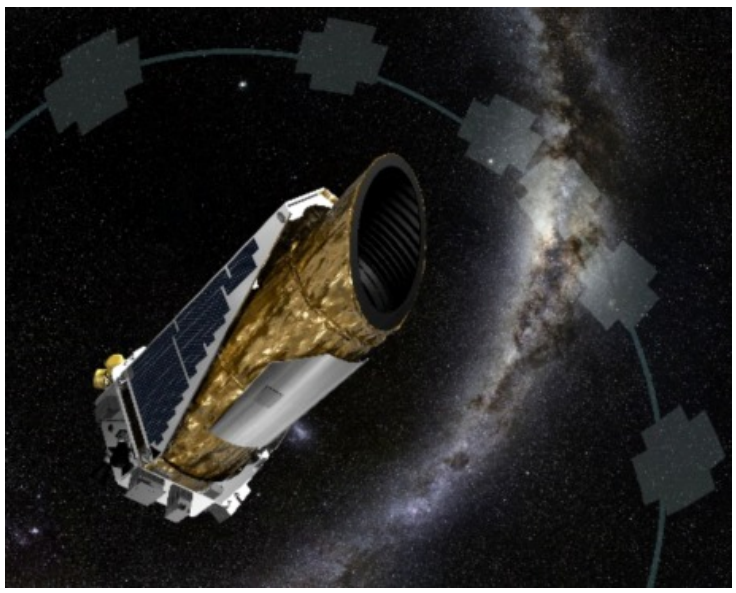
HAA Explorers by Jo Ann Salci

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

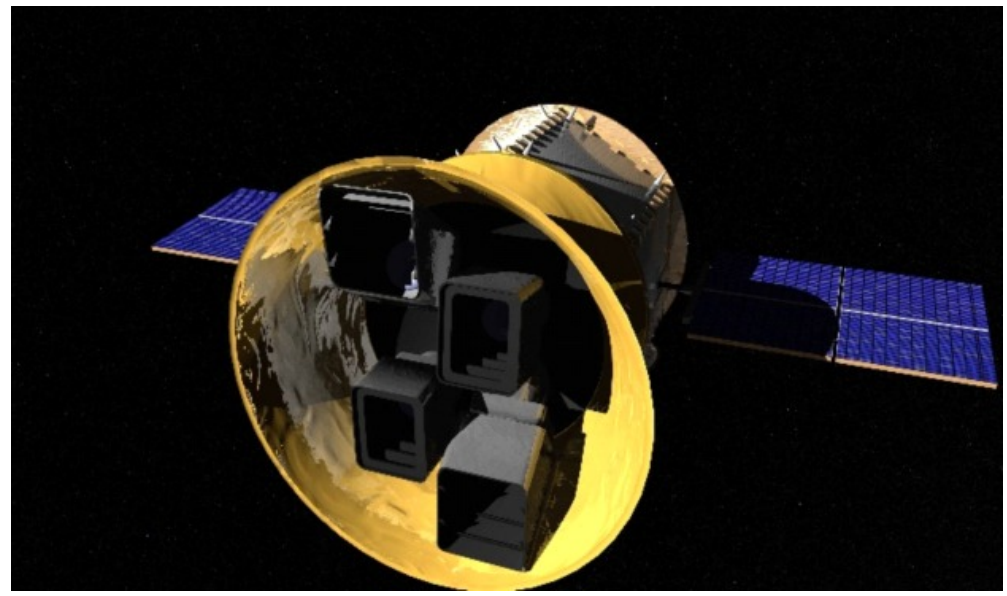
Last month we learned about our solar system which includes the planets that orbit our star, the Sun. This month we are going to explore exoplanets; planets that orbit *other* stars!

Is there another Earth out there?

The first exoplanets were discovered in the mid 1990s. Now with the help of more powerful telescopes and satellites, exoplanets are being found more easily. Exoplanets are being studied right here in Canada at The University of Montreal's Institute for Research on Exoplanets (iREX). The Kepler Mission ran from 2009 – 2018 and found thousands of exoplanets. NASA's TESS, which launched in 2018 and stands for "Transiting Exoplanet Survey Satellite", will be taking pictures of over a million stars as it looks for exoplanets.



Kepler Telescope
Image Credit: NASA



TESS
Image Credit: NASA

So why do we use telescopes such as Kepler and TESS in space? The biggest advantage is that our atmosphere doesn't get in the way of good views of space. These telescopes are very powerful and can capture a lot of detail. Watch for the launch of the James Webb telescope on December 18th, which will also be searching for exoplanets.

Exoplanets are being found in a variety of sizes, densities and types. Some are large gas giants like Jupiter and others are smaller rocky planets like Earth. Others are covered in molten lava and still others are covered in ice. Some orbit their star quickly and others are much slower. We can learn a lot about our own solar system by studying exoplanets and their stars. The hope is that one day we will find an exoplanet, or exoplanets, that have conditions suitable for life.

So far, 4,538 (as of Oct 25, 2021) exoplanets have been discovered with another 7,852 objects being studied! Although there are a few ways to find exoplanets, most are found as they pass in front of their star. This is known as a "transit".

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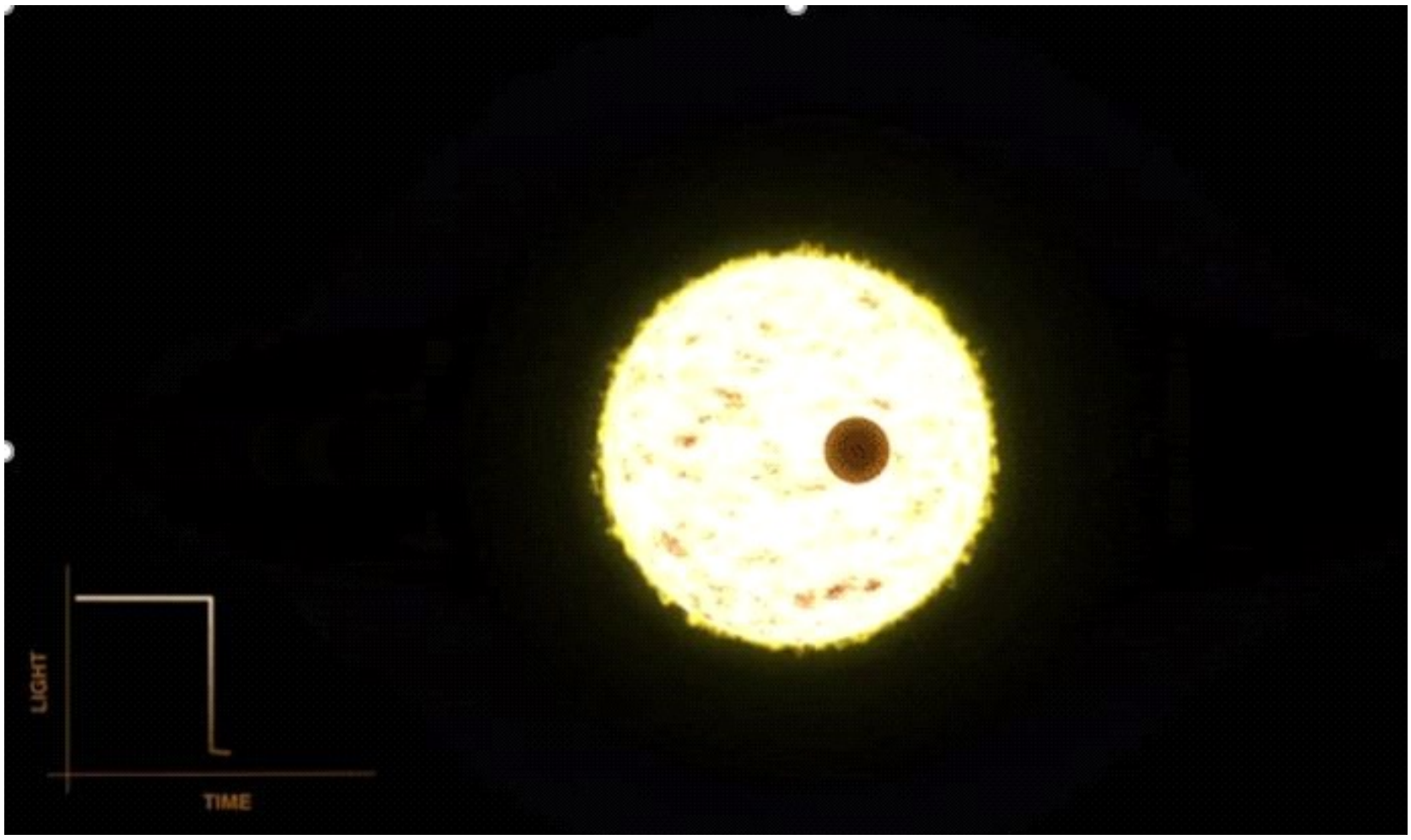

Image Credit: NASA

When an exoplanet transits its star, it blocks some of the star's light (like a solar eclipse). We can detect this dip in light which helps us find them. Not only can we find them, but we can also determine their size, how long it takes them to transit, and even what the planet's atmosphere contains. Examples of transits that occur closer to us are when Venus and Mercury transit our sun.

Ever wonder how exoplanets are named? They're usually named after the star they orbit, or the telescope, or survey that found it. Remember exoplanets Wolf 359b and Wolf 359c we learned about? Wolf was the last name of the astronomer that found the star. So, the exoplanets are named after the star. It was the 359th red dwarf star that Max Wolf found. And "b" and "c" are the order the exoplanets were found. The letter "a" isn't used because the exoplanet's star is considered as the first to be discovered. Maybe there's an exoplanet out there waiting for your name!

Things to do until next time**:

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

1. Visit https://exoplanets.nasa.gov/discovery/exoplanet-catalog/ to see the most up-to-date listing of exoplanets.

2. Visit https://spaceplace.nasa.gov/search/exoplanets/ to learn much more about exoplanets.

3. Visit https://www.nasa.gov/mission_pages/webb/main/index.html to learn more about the James Webb Space Telescope.

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HAA Explorers (continued)

In Search of Exoplanets

L	T	A	T	M	O	S	P	H	E	R	E	S	E
R	E	L	E	W	O	C	E	S	S	E	T	R	A
U	E	S	R	T	T	T	S	I	W	E	B	B	R
X	U	T	A	L	S	H	E	R	L	H	M	I	L
T	L	S	T	E	L	E	S	C	O	P	E	L	E
T	S	S	Y	R	U	C	R	E	M	N	E	E	E
T	E	R	T	R	S	P	K	L	E	O	X	E	X
B	U	S	E	A	C	U	T	E	M	T	E	O	O
P	W	S	E	L	R	L	N	T	P	R	R	T	P
E	L	O	E	E	P	S	P	E	A	A	I	A	L
R	I	N	L	L	L	E	E	N	V	N	E	A	A
L	V	A	P	F	E	L	K	L	S	S	L	T	N
E	T	I	L	L	E	T	A	S	E	I	O	C	E
E	E	X	B	S	E	N	I	R	L	T	W	T	T

IREX
MERCURY
TELESCOPE
TESS
TRANSIT
WOLF
KEPLER
WEBB
STARS
EXOPLANET
VENUS
SATELLITE
ATMOSPHERE

Thewordsearch.com

Answers on page 16.

During November, check out:

1. Wednesday, November 10th at 6:30 p.m.: See Jupiter, Saturn, the Moon and Venus in the Southern sky (see Figure 1 on page 6).

2. Friday, November 19th at 4:00 a.m. (for early birds!): A partial lunar eclipse in the Western sky (see Figure 2 on page 6).

Finally:

What did TESS say to the exoplanet's star? Answer: *You're one in a million!*

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

Thank you to Mi for reviewing this article! 😊

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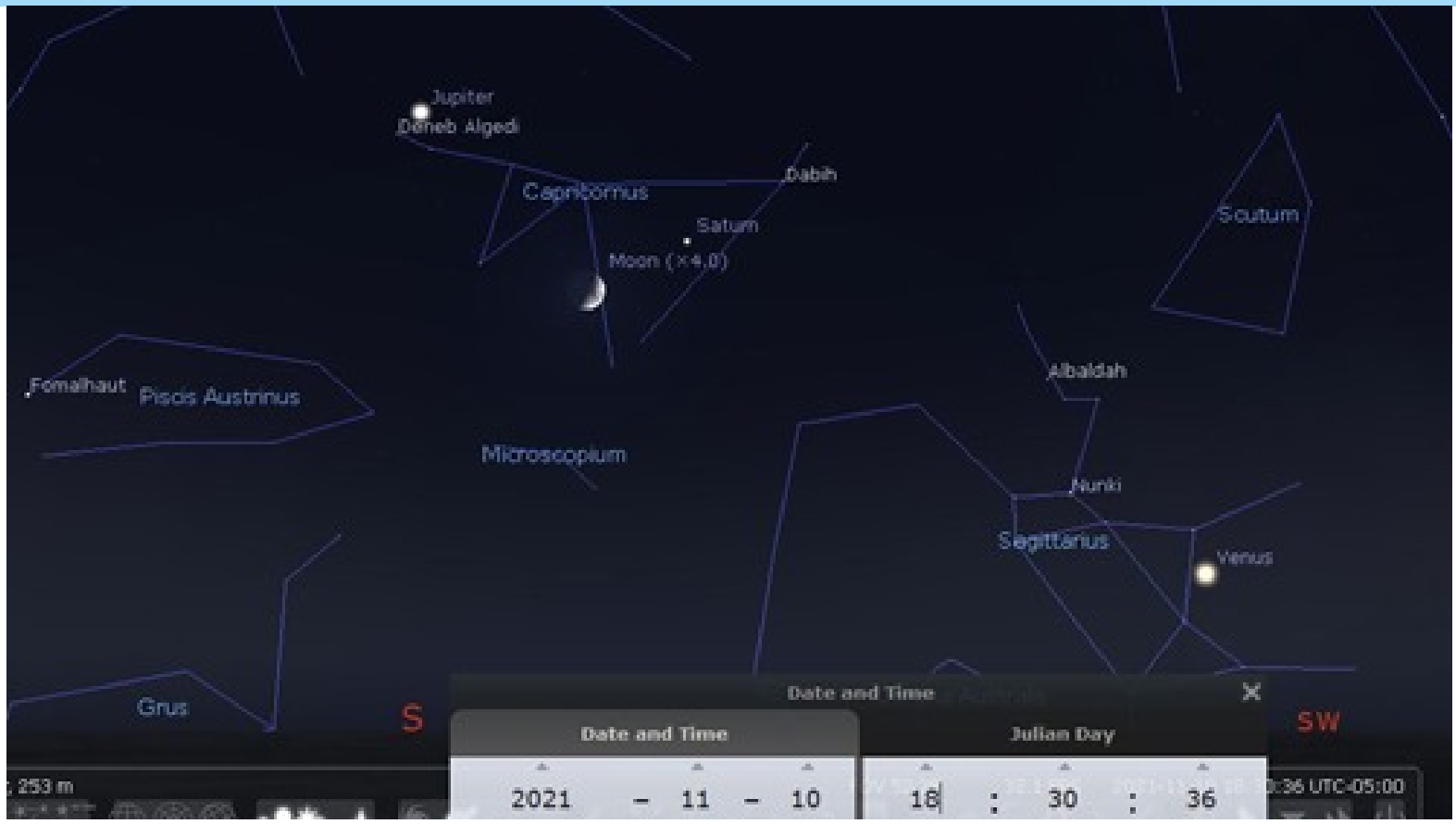


Figure 1 - Jupiter, Saturn, the Moon and Venus November 10, 2021. Image generated using Stellarium

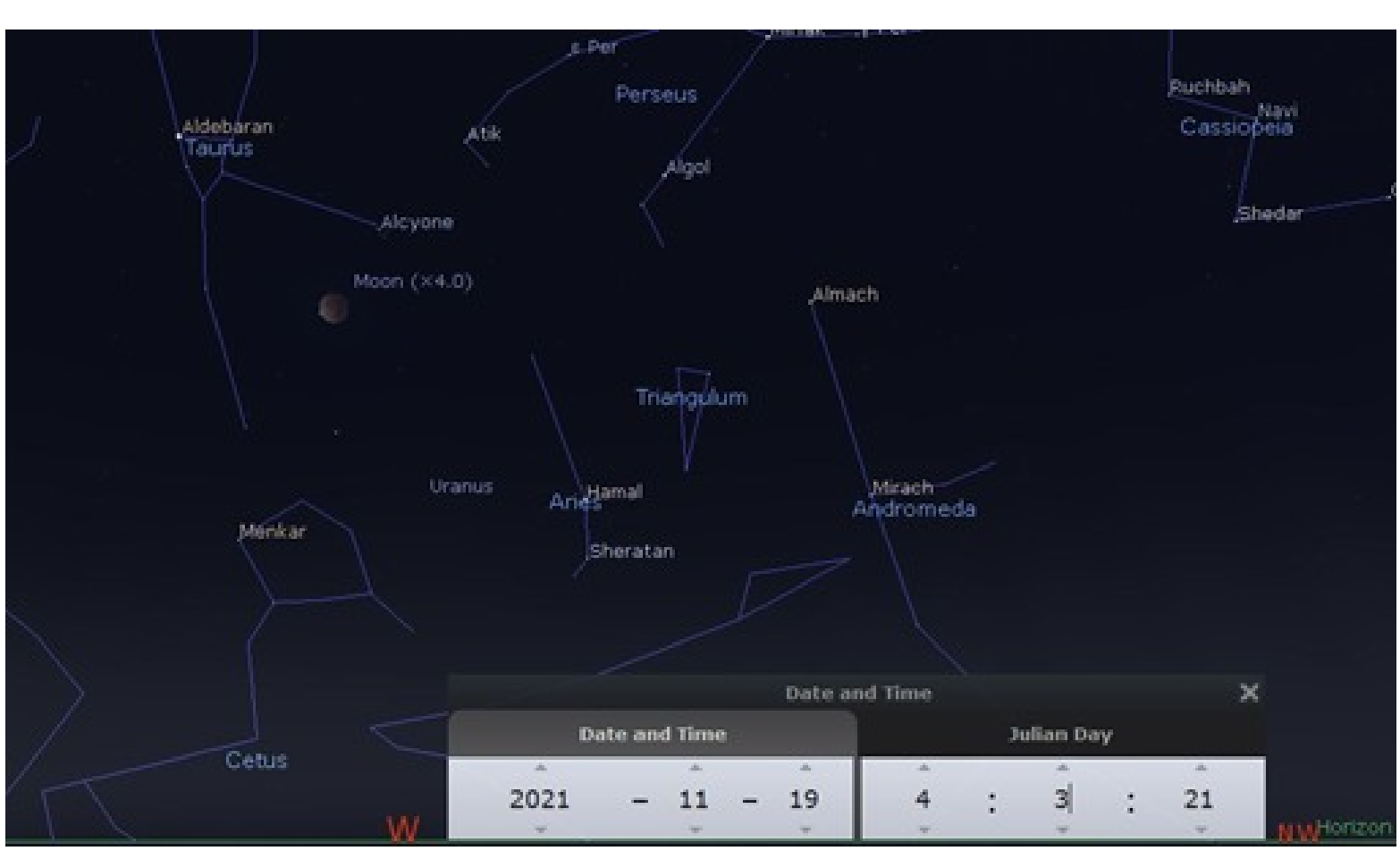


Figure 2 - Partial Lunar Eclipse November 19, 2021. Image generated using Stellarium

References:

www.NASA.gov
National Geographic Kids: Ultimate Space Atlas. 2017.
Exploring Exoplanets PPT presentation. RASC, Jenna Hinds, 2021.

The Sky This Month for November 2021 by Matthew Mannering

This month the Moon is going to put on a good show, if you can stay up all night or get up very early. On Friday November 19th, the Moon will undergo a partial eclipse that will reach maximum at 4:03 EST. 97.5% of the Moon will be within the umbra so it will take on that ruddy red colour we like to see. The Moon begins to move into the umbra at 2:18 am, reaches maximum at 4:03 am and leaves the umbra at 5:47 am. The umbra is the darkest part of the Earth's shadow. I have included a chart from 'dateandtime.com' that gives the full details of the eclipse.

This will be a great photo opportunity using just about any kind of camera and a tripod. *Bhphotovideo* has a great article that explains everything you need to know to take a great photo of the eclipse. Here is the link.

https://www.bhphotovideo.com/explora/photography/tips-and-solutions/22-tips-for-photographing-a-lunar-eclipse

The Coles Notes version for a partial eclipse that moves almost completely into the umbra, is to try the following settings as a start point for the exposure; ISO 400 at F/5.6 and 1/60 second.

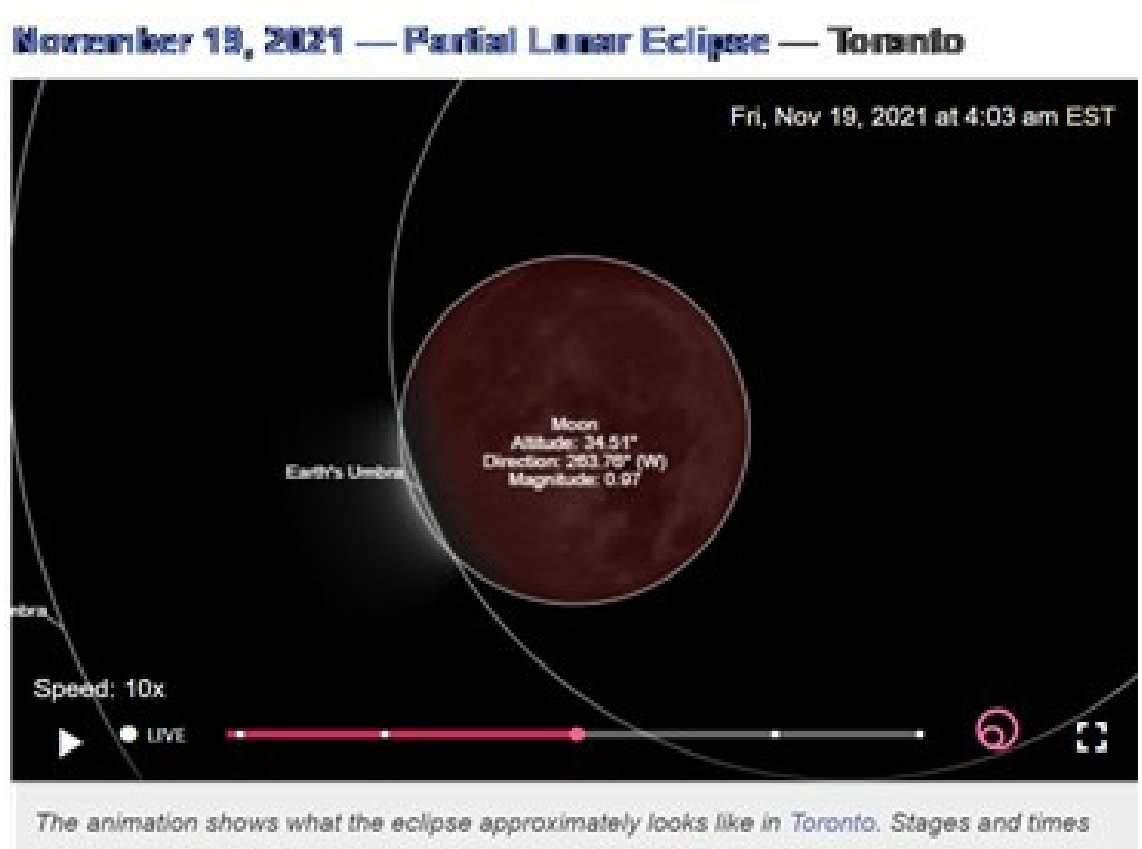
Sunday November 7th is the day we move back to *Eastern Standard Time*. Here are some events to watch out for in the month of November beginning on the 7th.

7th – 6pm the 3.5 day old Moon is placed 3.5° from Venus low in the west.

10th – 7pm the Moon is 6° from Saturn.

11th – 7pm the Moon is 5° from Jupiter.

13th – 6pm Venus will form a 3° triangle with globulars M22 and M28 low in the west.



The animation shows what the eclipse approximately looks like in Toronto. Stages and times of the eclipse are outlined below. All times are local time (EST) for Toronto.

Time	Phase	Event	Direction	Altitude
1:02 am Fri, Nov 19		Penumbral Eclipse begins The Earth's penumbra start touching the Moon's face.	213°	61.2°
2:18 am Fri, Nov 19		Partial Eclipse begins Partial moon eclipse starts - moon is getting red.	240°	51.3°
4:02 am Fri, Nov 19		Maximum Eclipse Moon is closest to the center of the shadow.	263°	34.0°
5:47 am Fri, Nov 19		Partial Eclipse ends Partial moon eclipse ends.	281°	15.9°
7:03 am Fri, Nov 19		Penumbral Eclipse ends The Earth's penumbra ends. Moon close to horizon, so make sure you have free sight to West-northwest.	293°	3.4°

13th – 9pm using binoculars, look for Neptune 4.5° above the Moon.

17th – 9:45pm using binoculars, look for Uranus 1.5° above the Moon.

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The Sky This Month for November 2021 (continued)

Jupiter and Saturn start the month due south in the evening sky. However, because of the time change on the 7th, the whole sky will appear to shift 15° further west along the ecliptic at the same time of night. At month end, Saturn will set at 9pm followed by Jupiter at 10:30pm. The reality is that the view of the planets in a telescope suffers greatly from atmospheric turbulence, especially when the planets are within 20° of the horizon. This means that by the end of November you will need to have any observations of Saturn completed by about 7pm and Jupiter by 8:30pm.

The winter constellations are almost ready to take their place in the eastern evening sky. At the beginning of November at 9pm Gemini and Orion sit on the horizon. By month end they will be well clear of the horizon along with Taurus and the Pleiades.

At mid month you can start looking for the star Tianguan in Taurus. Once you find this star, look for the Crab Nebula (M1) about 1.1° above it. The Crab at 8 arc minutes is much smaller and dimmer than pictures make it appear. It's very common for observers to have trouble seeing this nebula, so don't be too upset if you don't find it the first time.

The Ruby Star and M1 in Taurus. Image generated using Stellarium

While you are in the neighborhood, look for the 'Ruby Star' (119 Tauri; above) which is about 3° east of Tianguan. This is one of the reddest stars in the sky and at magnitude 4.3 it should be an easy catch in binoculars. Its colour can be compared to Aldebaran (also in Taurus) and the 'Garnet Star' (Mu Cephei; top of page 9) in Cepheus.

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The Sky This Month for November 2021 (continued)

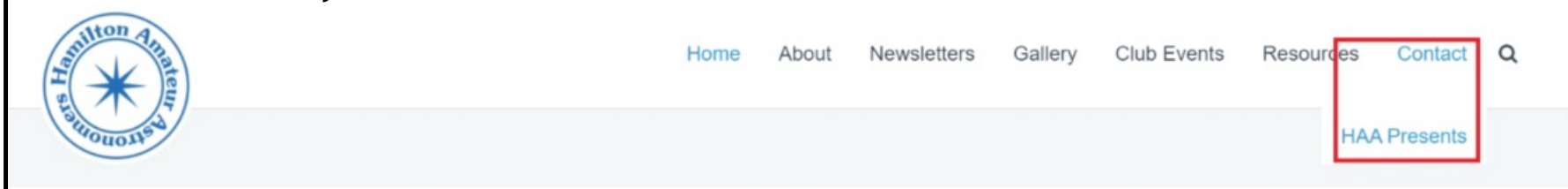
The Garnet Star in Cepheus. Image generated using Stellarium

I am really looking forward to the partial lunar eclipse this month. Of course, I would look forward to it even more if it wasn't in the dead of night. Lunar eclipses may not be extremely rare, but they are not a common sight either. Let's hope for some clear nights so that we can enjoy the Moon, Planets, red stars and the rest of the night sky.

"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.

What's Up in Awards? November 2021 by Bernie Venasse

Contents:

What's Up in Awards?

The Hamilton Amateur Astronomers Observing Programs are designed to provide direction for amateur astronomer's observations and to reward their accomplishments. A certificate is awarded when the goals of the observing program are met. The HAA offer various certificates based upon achieving specific observing goals. There is no time limit for completing the required observing but good record keeping is required. Each observer must perform all the requirements of each Observing Program themselves. However, observers are able to receive help from (an)other observer(s) as they learn to find and identify different objects. Each observer will then need to locate and observe the object on their own to meet the goals of the program. Observing logs will be submitted to and examined by the HAA Observing Programs Project Coordinator to confirm all observations before a certificate is granted.

This column tells you which objects are visible this next month for the HAA Observing Programs and other sights of interest.

HAA Rising Star Observing Award

November
Constellations: Cassiopeia
Stars: Schedar
Double stars: Almach, Mesarthim
Object Pairs: M31/M32, NGC133/NGC146, NGC436/NGC457
Messier objects: M33

December
Constellations: Taurus, Perseus
Stars: Hamal
Double stars: Alcyone
Object Pairs: NGC 1325, NGC 1332
Messier objects: M45

Pathways Observing Program

Observable this season: October, November, December
Group C,
Autumn Constellations: Find, observe, sketch: *Perseus, Cygnus, Lyra.*
Stars: Find, observe, sketch: A*lgol, Deneb, Fomalhaut.*
Asterisms: Find, observe, sketch: *Great Square, Northern Cross, Circlet.*
Planet: Any one planet that is remaining in the list.

HAA Messier Objects Observing Award

November Messier targets

This month we will search for seven more objects from the Messier Catalog. These include four globular clusters, the largest and the smallest planetary nebulas in the catalog, and a small oddity.

(Continued on page 11)

What's Up in Awards? November 2021 (continued)

M57 This smallest planetary nebula in the Messier Catalog is the famous Ring nebula in the constellation Lyra. Low power telescope views show a very small blue/green disk, not much bigger than a star. Medium to high power will magnify the size of the nebula while leaving the surrounding stars the same size, confirming you have found it.

M56 Look for a small round ball of light, slightly brighter in the center.

M27 Also known as the Dumbbell nebula, the largest planetary nebula in the Messier Catalog. This object lies in the constellation Vulpecula. In small to medium scopes it appears as a rectangular patch of light. In large scopes it may even appear round in shape with a bright rectangular, or dumbbell shaped core.

M71 Lying in Sagitta, this globular cluster appears as a faint oval hazy patch of light in a telescope.

M30 Telescopes show a small fuzzy ball of light, bright in the center fading to the edges.

M72 This is a small faint globular cluster in Aquarius. Look for a faint oval patch of light, gradually brighter towards the middle.

M73 This asterism is located near M72 in Aquarius. In a low power telescope view it looks like a very small fuzzy patch of light at first glance. When stared at it reveals itself as a small collection of stars. Medium to high power shows the view best described by Messier "cluster of three or four stars… containing very little nebulosity".

December Messier targets

This month we will view two small but bright globular clusters, two open star clusters, and the grandest galaxy in the sky along with it's two companions.

M2 This is a small, bright globular cluster in Aquarius. A low power telescope field will show a round fuzzy patch, brighter in the center and fading to the edge, in a field with no other bright objects.

M15 This globular cluster in Pegasus is very similar to M2 in size and brightness, except it is surrounded by several bright stars. Best view is through a telescope at medium to high power.

M29 This galactic cluster is a small, sparse group of stars in Cygnus. A telescope will easily resolve the members of this cluster.

M39 Dark skies will allow this large, bright cluster in Cygnus to be seen with the naked eye as a hazy patch of light. Binoculars easily resolve this cluster into it's bright and widely scattered members and provide a better view than can be seen with most telescopes.

M31 This is the famous Andromeda Galaxy, our closest galactic neighbor, and the largest, brightest galaxy to be seen in the northern sky. The ability to see M31 with the naked eye provides a good test of the darkness of your skies. M31 is so large that binoculars provide the best view, allowing the entire galaxy to be seen in one field of view. Look for an elongated patch of light, with a bright, round central core.

M32 This is an elliptical companion galaxy to M31. Through a telescope look for a slightly oval ball of fuzz in the same low power field as the core of M31.

M110 This is another elliptical companion galaxy to M31, lying on the opposite side of the core as M32. Through a telescope look for a large, oval patch of light. Although M110 is as bright as M32 it is much larger and thus has a lower surface brightness making it a difficult object in light polluted skies.

The Planets… November 2021 via (BBC) Sky at Night Magazine

Mercury Well-positioned morning planet at the start of November, rises two hours before sunrise. Mars lies nearby on 15 November.
Venus Bright evening planet, low and poorly positioned. Waxing crescent Moon nearby on 7 and 8 November.
Mars Morning object. Near Mercury on 10 and 11 November and 3.6 arcminutes from Zubenelgenubi (Alpha-2 (α2) Librae) on 22 November.

(Continued on page 12)

What's Up in Awards? November 2021 (continued)

Jupiter Evening planet. A first quarter Moon is near on 11 November.
Saturn Evening planet. A 41%-lit waxing crescent Moon is near on 10 November.
Uranus Opposition on 4 November. An almost full Moon is 1.8° south on the morning of 18 November.
Neptune Well positioned binocular planet near Phi (φ) Aquarii, reaches 30° altitude all month.

Meteor Showers via American Meteor Society

Southern Taurids

Period of activity: September 28th, 2021 to December 2nd, 2021
Peak Night: Nov 4-5, 2021

The Southern Taurids are a long-lasting shower that several peaks during its activity period. The shower is active for more than two months but rarely produces more than five shower members per hour, even at maximum activity. The Taurids (both branches) are rich in fireballs and are often responsible for increased number of fireball reports from September through November.

Shower details - ***Radiant:*** 03:35 +14.4° - ***ZHR:*** 5 - ***Velocity:*** 17.2 miles/sec (slow - 27.7km/sec)
Parent Object: 2P/Encke
Next Peak - The Southern Taurids will next peak on the Nov 4-5, 2021 night. On this night, the moon will be 0% full.

Northern Taurids

Period of activity: October 13th, 2021 to December 2nd, 2021
Peak Night: Nov 11-12, 2021

This shower is much like the Southern Taurids, just active a bit later in the year. When the two showers are active simultaneously in late October and early November, there is sometimes a notable increase in the fireball activity. There seems to be a seven year periodicity with these fireballs. 2008 and 2015 both produced remarkable fireball activity. 2022 may be the next opportunity.

Shower details - ***Radiant:*** 03:55 +22.8° - ***ZHR:*** 5 - ***Velocity:*** 18 miles/sec (slow - 30km/sec)
Parent Object: 2P/Encke
Next Peak - The Northern Taurids will next peak on the Nov 11-12, 2021 night. On this night, the moon will be 55% full.

Leonids

Period of activity: November 3rd, 2021 to December 2nd, 2021
Peak Night: Nov 17-18, 2021

The Leonids are best known for producing meteor storms in the years of 1833, 1866, 1966, 1999, and 2001. These outbursts of meteor activity are best seen when the parent object, comet 55P/Tempel-Tuttle, is near perihelion (closest approach to the sun). Yet it is not the fresh material we see from the comet, but rather debris from earlier returns that also happen to be most dense at the same time. Unfortunately, it appears that the earth will not encounter any dense clouds of debris until 2099. Therefore, when the comet returns in 2031 and 2064, there will be no meteor storms, but perhaps several good displays of Leonid activity when rates are in excess of 100 per hour. The best we can hope for now until the year 2030 is peaks of around 15 shower members per hour and perhaps an occasional weak outburst when the earth passes near a debris trail. The Leonids are often bright meteors with a high percentage of persistent trains.

(Continued on page 13)

What's Up in Awards? November 2021 (continued)

Leonids (continued)
Shower details - ***Radiant:*** 10:17 +21.6° - ***ZHR:*** 15 - ***Velocity:*** 43.5 miles/sec (swift - 70km/sec)
Parent Object: 55P/Tempel-Tuttle
Next Peak - The Leonids will next peak on the Nov 17-18, 2021 night. On this night, the moon will be 98% full.

Geminids

Period of activity: November 19th, 2021 to December 24th, 2021
Peak Night: Dec 13-14, 2021

The Geminids are usually the strongest meteor shower of the year and meteor enthusiasts are certain to circle December 13 and 14 on their calendars. This is the one major shower that provides good activity prior to midnight as the constellation of Gemini is well placed from 22:00 onward. The Geminids are often bright and intensely colored. Due to their medium-slow velocity, persistent trains are not usually seen. These meteors are also seen in the southern hemisphere, but only during the middle of the night and at a reduced rate.

Shower details - ***Radiant:*** 07:24 +32.3° - ***ZHR:*** 150 - ***Velocity:*** 21 miles/sec (medium - 34km/sec)
Parent Object: 3200 Phaethon (asteroid)
Next Peak - The Geminids will next peak on the Dec 13-14, 2021 night. On this night, the moon will be 78% full.

Ursids

Period of activity: December 13th, 2021 to December 24th, 2021
Peak Night: Dec 21-22, 2021

The Ursids are often neglected due to the fact it peaks just before Christmas and the rates are much less than the Geminds, which peaks just a week before the Ursids. Observers will normally see 5-10 Ursids per hour during the late morning hours on the date of maximum activity. There have been occasional outbursts when rates have exceeded 25 per hour. These outbursts appear unrelated to the perihelion dates of comet 8P/Tuttle. This shower is strictly a northern hemisphere event as the radiant fails to clear the horizon or does so simultaneously with the start of morning twilight as seen from the southern tropics.

Shower details - ***Radiant:*** 14:36 +75.3° - ***ZHR:*** 10 - ***Velocity:*** 20.5 miles/sec (medium - 33km/sec)
Parent Object: 8P/Tuttle
Next Peak - The Ursids will next peak on the Dec 21-22, 2021 night. On this night, the moon will be 93% full.

AAVSO Webcasts

November 6	Annual Meeting	
November 13	(1) Dr. David Turner	(2) Dr Johm Thorstensen
November 27	(1) Dr Kristine Larsen	(2) Gabriel Murawski
December 4	AAVSO-Slooh	
December 11	TBA	

Please feel free to contact me with any questions or comments at eclipse@amateurastronomy.org

— Bernie

This article is distributed by NASA Night Sky Network.

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

Measure the Night Sky

David Prosper

Fall and winter months bring longer nights, and with these earlier evenings, even the youngest astronomers can get stargazing. One of the handiest things you can teach a new astronomer is how to measure the sky – and if you haven't yet learned yourself, it's easier than you think!

Astronomers measure the sky using degrees, minutes, and seconds as units. These may sound more like terms for measuring time - and that's a good catch! – but today we are focused on measuring ***angular distance***. **Degrees** are largest, and are each made up of 60 **minutes**, and each minute is made up of 60 **seconds**. To start, go outside and imagine yourself in the center of a massive sphere, with yourself at the center, extending out to the stars: appropriately enough, this is called the **celestial sphere**. A circle contains 360 degrees, so if you have a good view of the horizon all around you, you can slowly spin around exactly once to see what 360 degrees looks like, since you are in effect drawing a circle from inside out, with yourself at the center! Now break up that circle into quarters, starting from due North; each quarter measures 90 degrees, equal to the distance between each cardinal direction! It measures 90 degrees between due North and due East, and a full 180 degrees along the horizon between due North and due South. Now, switch from a horizontal circle to a vertical one, extending above and below your head. Look straight above your head: this point is called the *zenith*, the highest point in the sky. Now look down toward the horizon; it measures 90 degrees from the zenith to the horizon. You now have some basic measurements for your sky.

Use a combination of your fingers held at arm's length, along with notable objects in the night sky, to make smaller measurements. A full Moon measures about half a degree in width - or 1/2 of your pinky finger, since each pinky measures 1 degree. The three stars of Orion's Belt create a line about 3 degrees long. The famed "Dig Dipper" asterism is a great reference for Northern Hemisphere observers, since it's circumpolar and visible all night for many. The Dipper's "Pointer Stars," Dubhe and Merak, have 5.5 degrees between them - roughly three middle fingers wide. The entire asterism stretches 25 degrees from Dubhe to Alkaid - roughly the space between your outstretched thumb and pinky. On the other end of the scale, can you split Mizar and Alcor? They are separated by 12 *arc minutes* - about 1/5 the width of your pinky.

Keep practicing to build advanced star-hopping skills. How far away is Polaris from the pointer stars of the Big Dipper? Between Spica and Arcturus? Missions like Gaia and Hipparcos measure tiny differences in the angular distance between stars, at an extremely fine level. Precise measurement of the heavens is known as astrometry. Discover more about how we measure the universe, and the missions that do so, at nasa.gov.

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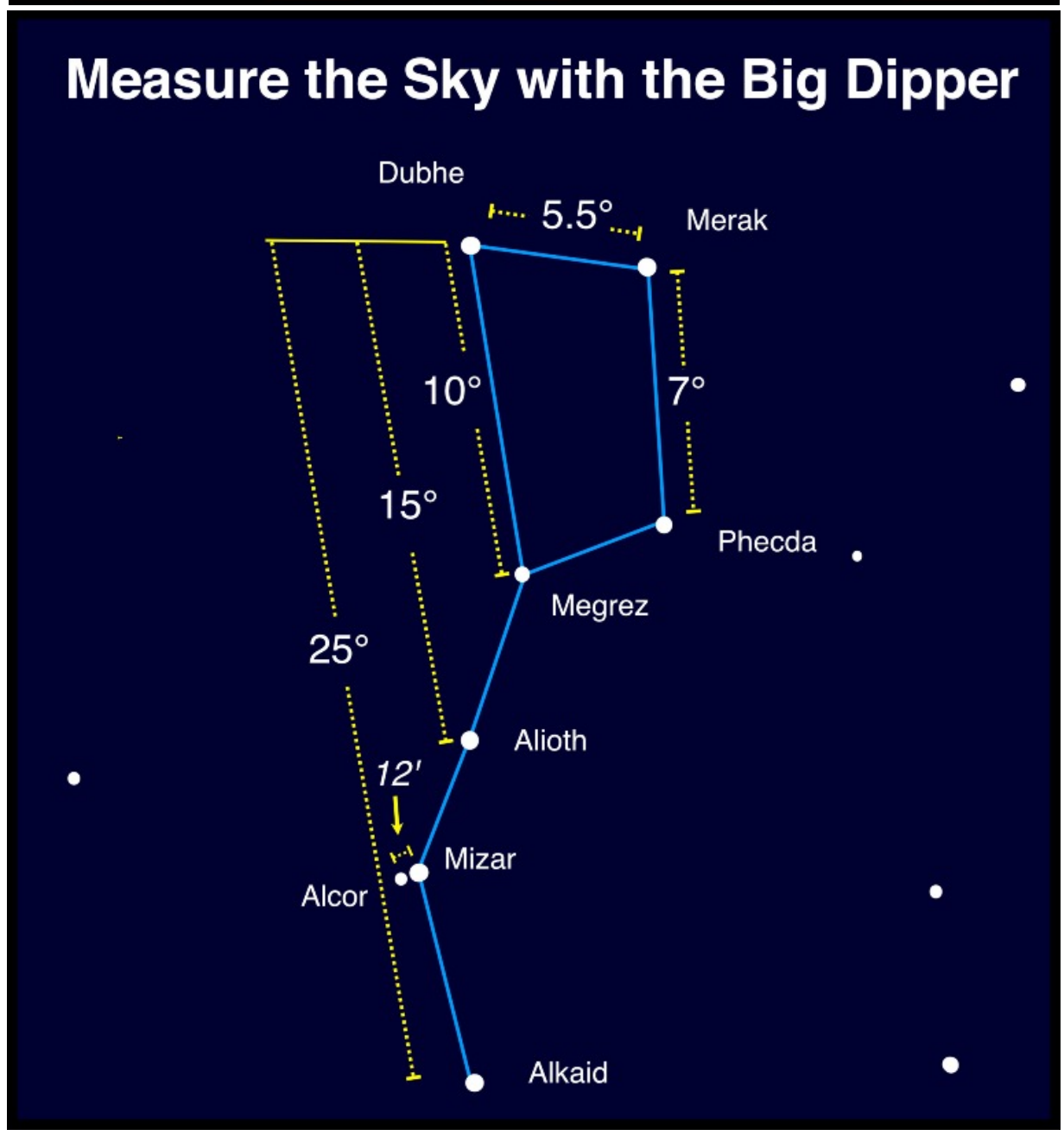

Image created with assistance from Stellarium

Word Search Answers:

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.

UPCOMING EVENTS

November 12, 2021 - 7:30 pm — Virtual Online H.A.A. Meeting. Our main speaker will be *Simon Poole*, First VP of the Royal Astronomical Society of Canada (and president of the RASC Calgary Centre). *Topic:* The voyages of Nicolas de Lacaille, an 18th century French astronomer who catalogued southern hemisphere stars and constellations.

Due to the COVID-19 Coronavirus pandemic, the meeting will be conducted on the platform Zoom. 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.

We hope to return to in-person meetings very soon!

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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