Event Horizon

Volume 25, Number 4
February 2018

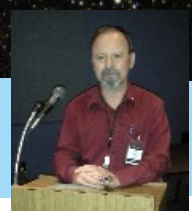
From The Editor

Thanks once again to all contributors.

New for this month is contact information for the HAA Portable Library. You can see that on Page 15 of this E.H., and it will be in subsequent E.H.'s.

Clear Skies!

Bob Christmas,
Editor
editor 'AT'
amateurastronomy.org



Chair's Report by Bernie Venasse

Family Day weekend; No Full Moon this month; the date of the Chinese New Year

Family day Weekend 16,17,18,19

This will be a great time to spend with the family and share your love of the sky. Grab your scope and head outdoors at sunset to catch a wonderful crescent moon setting shortly after the sun. Compare the views on Friday and Saturday. If you are lucky, you might catch a glimpse of Venus very low on the horizon on Saturday. After sunset, you may enjoy the wonders of the great hunter, Orion sitting high in the southern sky. Between 6 AM and sunrise you may enjoy a parade of planets. Jupiter, Mars, and Saturn will meander across the east and south skies before the sun obliterates the view! However you spend this Family Day, ENJOY !!!

No Full Moon this month is an infrequent non-event.

The length of the lunar month

The average interval between New Moons is called the mean lunar month. It is 29 days 12 hours 44 minutes. However, the length of an actual lunar month can vary

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IN THIS ISSUE:

Chair's Report (continued)

from this average figure by as much as seven hours, because the Moon's orbit around the Earth is not circular, and neither is the Earth's orbit around the Sun.

As a result of this non-circularity, the Sun and Moon move at varying speeds along the ecliptic. Sometimes, the Moon is moving faster than its average speed and the Sun is moving more slowly, so the Moon "catches up" with the Sun sooner, making a shorter lunar month. At other times, the Moon is moving more slowly than average and the Sun is moving more quickly, so the Moon "catches up" with the Sun later, making a longer lunar month.

The longest and shortest lunar months

The Belgian astronomer Jean Meeus calculated the exact dates and times of the New Moons during the period 1900 to 2100. From these times, he was able to identify the longest and shortest lunar months during those two centuries.

(Continued on page 3)

Lunar month	Days	Hours	Minutes
Shortest	29	06	35
Average	29	12	44
Longest	29	19	55

H.A.A.'s Loaner Scope Program

We at the HAA are proud of our Loaner Scope Program.

If you don't have a telescope of your own and want to make use of one for a month or so, you can borrow one of our fine loaner scopes.

Please contact Jim Wamsley, at: 905-627-4323

or e-mail Jim at:
secretary 'AT' amateurastronomy.org

and we'll gladly get one signed out for you.

HAA Helps Hamilton

To support our community, we collect non-perishable food items and cash for local food banks at our general meetings. Please bring a non-perishable food item to the meeting or a donation of cash and help us help others.

Our donations go to Hamilton Food Share, which delivers them to various food banks around the Hamilton area.
If you would like to help or have any questions about this initiative, please contact the H.A.A.

Hamilton Food Share
Hunger. It's just unacceptable.

Masthead Photo: *The Crescent Nebula (NGC 6888) in Cygnus, by Peter Wolsley.*

Taken through his 8" EdgeHD Schmidt-Cassegrain telescope with his Nikon D5300 DSLR set at ISO 1600.
Exposures: 5 x 600 seconds = 50 minutes total.

Chair's Report (continued)

Take note that the longest lunar month is four hours shorter than 30 days, so even a 30-day month such as April or June must contain at least one Full Moon. The only month which could miss a Full Moon completely is February. This is most likely to happen in a non-leap year, when February is only 28 days long, but even when it has 29 days, this is still less than the length of the shortest lunar month, so it's possible for any February to miss a Full Moon.

Februaries with no Full Moon in the 3rd Millennium

From the dates and times of all of the Full Moons in the thousand years from 2000 to 2999 inclusive there are 12,368 Full Moons, and 952 of them are in February. Since a thousand years must include a thousand Februaries, it is obvious straight away that 48 of those Februaries are missing a Full Moon. Counting the number of Full Moons which fall in February in a leap year, we find 240 of them. However, the thousand-year period from 2000 to 2999 has 243 leap years. (Remember that in the Gregorian calendar, century years are only leap years if they divide by 400, so 2100 will not be a leap year, and nor will 2200, 2300, 2500, 2600, 2700 and 2900.)

So there are 243 leap years, but only 240 of them have a Full Moon in February. This means that there will be just three leap years in which February will have no Full Moon. Those years are 2572, 2792 and 2944.

It turns out that in those three years, both January and March have two Full Moons, but that isn't surprising since a 29-day February can only miss out on a Full Moon if there is a Full Moon late on January 31st. That, in turn, means that there must have been a Full Moon in early January, and it also means that the next Full Moon must be early on the morning of March 1st, thus March will also have a Full Moon at the end of the month.

We often describe an unusual event as happening "once in a Blue Moon." This expression was first noted back in 1821 and refers to occurrences that are uncommon, though not truly rare. But what about a month with no Moon at all? That is a bit more rare than a Blue Moon (which happens on average every 3 1/2 years), and a "No-Moon" month happens about once every 19 years. The last time February didn't have a full Moon was in 1999 and then again in 1980.

Of course there will be a Moon in the sky in February — and it might even appear full — it just won't reach the moment where it's 100% astronomically "full" until March 1 (at 7:51 pm EST) on our calendar.

The date of the Chinese New Year

February 16, 2018. A rule of thumb is that Chinese New Year should be the new Moon closest to the beginning of spring (立春, lìchūn). This rule is correct most of the time, but it can fail if Lìchūn falls close to halfway between two new Moons. It failed in 1985 and again in 2015. Since Lìchūn falls around February 4, this helps explain why Chinese New Year will always fall between January 21 and February 21. It also helps explain why Chinese New Year is called the spring festival. If you have a Western calendar that indicates the phases of the Moon, this will give you an approximation of the date of Chinese New Year. But notice that the Chinese calendar uses the time of new Moon in China.

As explained above, Chinese New Year will always fall between January 21 and February 21. The tropical (or solar) year is about 365.25 days, while a synodic (or lunar) month is about 29.5 days. Hence a lunar year consisting of 12 months will be about 12 x 29.5 = 354 days. So a lunar year is about 11 days shorter than a solar year.

The December 2017 General Meeting of the HAA by Matthew Mannering

Jim Wamsley mentioned that both 8" Dobs are spoken for.

Bernie Venasse introduced the new Councilors at Large.

Barry Sherman announced that we would be running an Astro 101 session over the winter. He had a sign up sheet available for those who wish to take advantage of the talks.

The main speaker for December was *Kerry-Ann Lecky Hepburn*. The following introduction comes from the HAA website:

"My interest in astronomy started from a fairly young age. After getting my first telescope at the age of 11 and then my first serious film camera as a teenager I began to think of the possibilities of astrophotography. Over the course of more than 15 years I dabbled in it but it wasn't until the beginning of 2007 that I started to make some huge leaps in the hobby. My work has won awards and has been featured in calendars, magazines, books and online publications such as Sky News POW and NASA APOD. While enjoying this intensive hobby, I live in the Niagara region of Ontario, Canada with my husband and two children. Currently I work for The Weather Network, a weather TV station, as one of their senior meteorologists."

Any errors in the following synopsis of Kerry's presentation 'Planning for Deep Sky and Nightscape Photography' are mine. The talk covered:

- Objects of Interest
- Location
- Date/Time
- Weather
- Tools

Objects:
- Clouds add interest to eclipse/moon images.
- Conjunctions aren't affected too much by light pollution.
- Milky Way shots work far better from dark sky sites.
- Foreground interest helps to create a more artistic Milky Way shot.
- When shooting wide field shots, clouds can add interest to the shot.
- Deep sky shots require good transparency and seeing.
- Light pollution filters can help to bring out deep sky objects.

Location:
- *cleardarksky.com* provides cloud cover, transparency and seeing information for sites all over North America.
- It uses raw data from Environment Canada.
- Click on any block in the dark sky chart to see a meteorological map for cloud cover, transparency, seeing, darkness, wind, humidity or temperature.
- Transparency can be affected by smoke, pollen, cloud cover, aurora and airglow (ozone reacting with solar radiation).
- Smoke is ok when photographing the moon and planets as it acts as a filter to reduce glare.
- Shows the cloud cover directly overhead; not in the area around the location.
- The Great Lakes area general has poor seeing due to the unstable atmospherics associated with the lakes.
- Resolution restricted to 3 to 4 arcseconds.
- Use the chart to check any destination you may be headed for. It might save you a wasted trip if the sky isn't cooperating.

(Continued on page 5)

The December 2017 General Meeting of the HAA (continued)

Timing:

- The moon phase matters and new moon is required for deep sky photography.
- The full moon lights up the landscape which may be what you want.
- The time of year determines which constellations you have access to.
- The Milky Way is lower in the sky in the spring but it's a great time for galaxies.
- Summer is best for the Milky Way.
- Software such as Photopills, Photographer's Ephemeris and Stellarium can help you with the where and when for any given target.

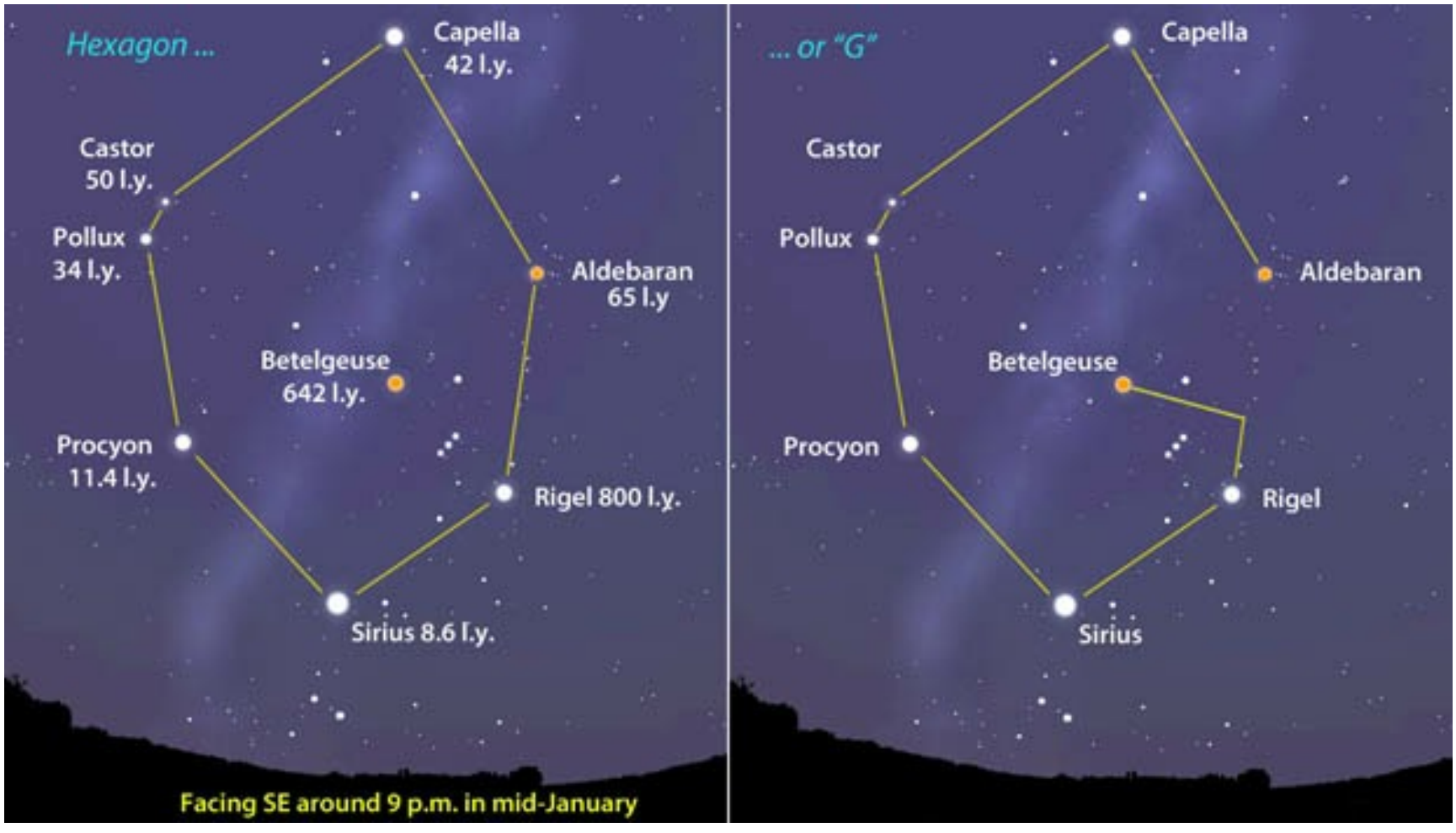
Weather:

- In the summer you have to deal with thunder and lightening, smoke, haze and dew.
- In the fall you have to deal with dew, frost, fog, rain and wind.
- In winter you have lake effect, clouds and snow to deal with.
- Spring has some of the best weather.
- Stable high pressure systems generally provide good seeing.
- The air is generally stable at dusk and dawn.
- The Weather Network uses multiple models from Canada the USA and Europe.
- They still use paper charts to generate weather front maps.
- Higher temperatures increase camera sensor noise.
- Moisture will shut you down unless you use dew heater straps.

Steve presented "The Sky This Month" after the break.

- The January 1st super moon will be bigger than the one in December.
- No grazing occultations this year.

(Continued on page 6)



The "Big G" of the winter sky from an article by Bob King in Sky and Telescope.

The December 2017 General Meeting of the HAA (continued)

- Occultations of asteroids allow researchers to determine their size and shape.
- The “Big G” in the winter sky (bottom of previous page) marks the brightest stars of Orion, Taurus, Auriga, Gemini, Canis Minor and Canis Major.
- A few targets for this time of year are the Double Cluster and the ET cluster (in Cassiopeia), the Pleiades (in Taurus), M35 (in Gemini) and M36-M38 (in Auriga).

Meeting closed at 9:50pm.

The January 2018 General Meeting of the HAA by Matthew Mannering

Jim Wamsley mentioned that both 8” Dobs will be out for an extra month.

Bernie Venasse put up a slide showing how to use your fingers and hand to measure angular distance in the sky.

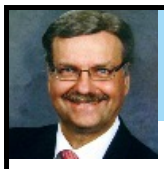
Club member Jim Wamsley was the guest speaker for this month. John Gauvreau was supposed to co-host the presentation but was unable to attend the meeting. Jim’s talk covered a portion of the Astro 101 course that the club runs once per year:

- Jim gave a brief over-view of the three basic types of telescopes; Refractor, Newtonian and Cassegrain.
- Scope focal length = scope aperture x F-ratio.
- Aperture determines the light gathering ability of the scope.
- The eyepiece determines magnification.
- Magnification = scope focal length / eyepiece focal length.
- A diagonal redirects the light path to make viewing easier.
- Focusers can be single or dual speed. Dual speed allows the user to achieve fine focus.
- Mount heads and tripods must be sturdy. An inadequate mount will lead to excessive vibration which makes viewing difficult.
- Alt/Az mounts allow up/down and left/right motions.
- EQ mounts are more advanced and have a steeper learning curve. They must be polar aligned via the polar scope in the mount.
- EQ mounts follow the arc that the stars form as they cross the sky.
- As always, try before you buy. Ask more experienced members lots of questions.

Steve presented “The Sky This Month” after the break.

- Steve was out to photograph the January 1st super moon. Bob and Matthew had also been out taking pictures.
- Look at the Pleiades and see how many star you can see naked eye.
- There was the beginning of a lunar eclipse on the morning of January 31. The moon set just after 7:30am before the eclipse became total. You had to look very low in the west to see it.
- Steve was hoping to see the Moon rise the evening of January 30. He would be near Rattlesnake Point Conservation Area at the switchback on Appleby Line. He was hoping to line up the CN Tower with the rising Moon.
- Steve briefly mentioned the total eclipse of the Sun on April 8, 2024.
- He also mentioned the solar total eclipse on July 2, 2019 visible from La Serena in Chile.

Meeting closed at 9:30pm.



The Sky This Month for February 2018 by Steve Germann

The Moon

Unfortunately, last Tuesday was cloudy and I did not see the setting Moon on Tuesday morning, for the Lunar eclipse. The next Lunar eclipse on July 27 cannot be seen from Hamilton, but we won't have to wait too long...

There is less than a year to the next one we can see... January 21, 2019, around midnight. Perfectly timed and placed for us in the Hamilton area.

The Clear Sky Chart seemed to show that out west it would be clearer, leaving hope that some members in Brantford could see it.

Let me know your observations and cloud status for discussion at our monthly meeting on February 9th.
In case you did not fly to Perth Australia to see it, here it is on Youtube, and it's actually a pretty good picture:

https://www.youtube.com/watch?v=w3HpeLVHIzI

The story of the Blue moon is a tangled one. The original definition of a Blue Moon was the third moon in a season that has 4 full moons. Sort of like the moon with no name, since the other moons of the seasons were generally named. However, that definition was missed by someone who wrote an astronomy article for Sky and Telescope in 1946, resulting in a new definition being put forward, that the Blue Moon was the second full moon in a calendar month. Still a decent definition, but it picks off the wrong full Moon most of the time.

So. After years of wrangling, it has been accepted as a second definition, and you always need to know who is talking to know which kind of Blue Moon it really is.

'They' have generalized this definition to generously accept the mistaken definition put forward in 1946 by a mistaken article in 'Sky and Telescope'. So here's the generous definition from Wikipedia:

https://en.wikipedia.org/wiki/Blue_moon

A blue moon is an additional full moon that appears in a subdivision of a year: either the third of four full moons in a season, or a second full moon in a month of the common calendar.

Double blue moons, where the Full moon happens twice in January and twice in March, are very rare, and apply only to the Blue Moon defined per month. Last time it happened was 2010. But it's happening right now. We are in the very midst of a double blue...

There will be no full Moon in February for most time zones in the world.

Stoked as we now are with Blue Moons, there will not be another until October 2020, so catch it while you can, and be sure to mention it at the office water cooler. Double blue... I think I remember something about beer having that name too.

The Wikipedia article is well written and fascinating. Worth a look.
Here's a quaint video about it at Youtube:

https://www.youtube.com/watch?v=aZcP54SANBA

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The Sky This Month for February 2018 (continued)

The Planets

This month, on the evening of our general meeting, *Vesta* is within a degree of the Moon at about at about 8 AM, but will be relatively close before sunrise and after sunset too. Take your binoculars to the meeting for a view of Vesta in a place it can be easily found. Look north of the Moon for something not star-like.

Saturn has been rising earlier and earlier and is now visible again in the pre-dawn sky. You need a telescope to see the rings of Saturn, but it's still impressively bright, forming a nice sweep with *Mars* and *Jupiter*. By 2020 Saturn and Jupiter will have a conjunction, but for this year, you will find Saturn in Sagittarius, the 'teapot' constellation. As the summer approaches, we will see Saturn become an evening object and then eventually setting before sunset, in late October.

I must admit that sometimes it takes me later than the first of the month before this article is ready, so I want to let you know about something happening in early March. *Mercury* and *Venus* will be within a degree of each other in the evening sky from about March 2 to March 5, which includes a weekend, so be sure to keep that in mind. There's a full Moon on March 1 as well.

Jupiter

Jupiter and Saturn are now less than 45 degrees apart, and over the next few years, they will slowly come closer together until 2020 when they have a closest approach.

Basically, they are both rising earlier each night. But Jupiter won't be rising at sunset until May 9th, so you are going to have to wait for it to come up in the east. Saturn rises at about 3 hours after Jupiter. On the bright side, they are comparatively high at night.

The Lunar X

Each month, the Moon gets baked by the Sun as it slowly rotates. For a few fleeting hours, the *Lunar X* is visible.

If that happens when it is night time here, then we have a chance to see it.

It is visible in binoculars, and makes a good item to note in your observing log. (Email me if you would like me to get a book for you to log your observations. I can bring them to the meeting. Estimated price $10 with tax.)

This page describes the Lunar X, first publicized in 2004. Claimed to be seen in 1974, (it had been there before, but not celebrated by anyone with a log book.)

Hence the remark about the book. If you look at the right time, it's pretty prominent.

First Quarter Moon for February is February 23rd. I spent some time searching for a timing chart.

I finally found the info, in UTC here...

https://stargazerslounge.com/topic/305707-lunar-x-2018-start-times/

But don't look at that page... the colour scheme it will hurt your eyes. Suffice it to say that March is our chance, near midnight.

(Continued on page 9)

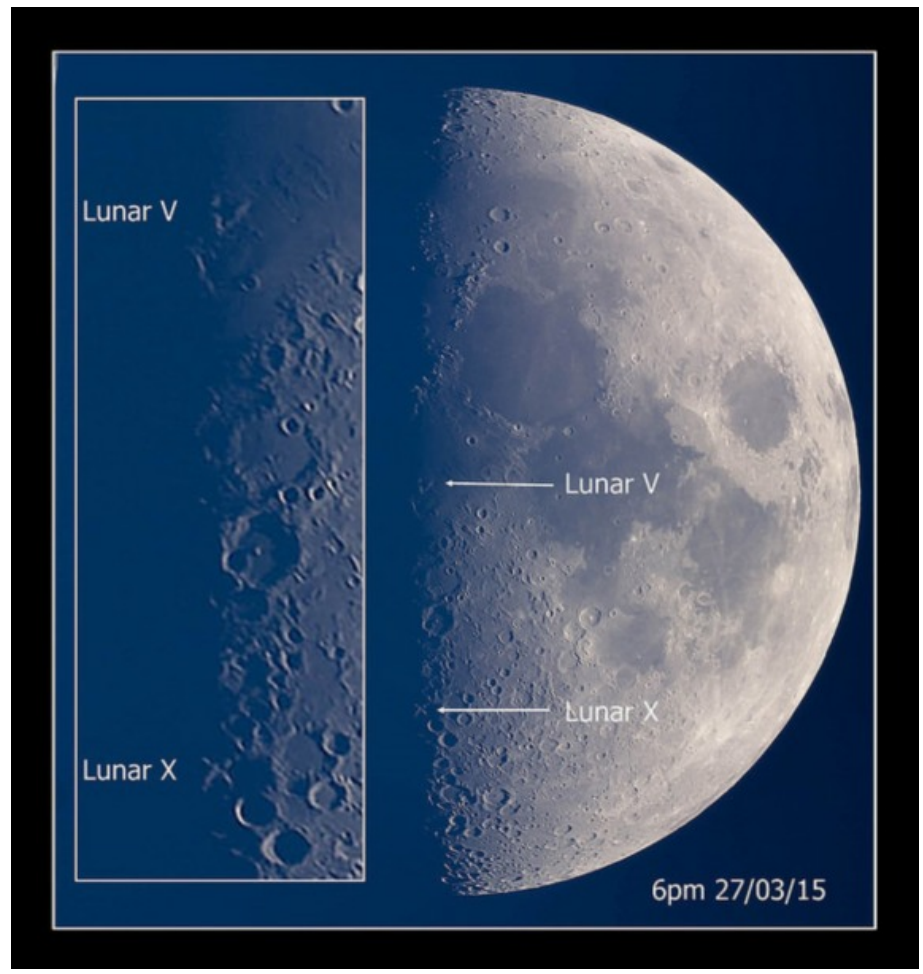
The Sky This Month for February 2018 (continued)

For reference, I list them all for the year. The Sun has to have a slightly negative altitude at the location of the crater, for the X to be visible. These were derived by approximation, but waiting for -1 degree is not the idea. It gets better over the next few hours and then gets washed out as the craters get more lit. The moon turns a bit less than half a degree per hour.

0442UT means a touch before midnight in Hamilton. The ideal UT would be about 0000 UT because then the X is starting to look prominent about 8 PM. So see the Lunar X this year, you are going to have to stay up late in March or May, or pop up at 3 AM on March 24th and point your binoculars at the Moon. Either way, you will want to be noting it in your log. Technically you could see it in the daytime and solve a lot of problems. Have a go at 4 PM on February 22, being sure to stand in a place where you are shaded so you will not scan the sun with your binoculars.

You have about 4 hours from the listed times to see it. Thanks to Dana T from Ohio for this:

Date	Time	Sun Angle at the X at this time
01/24/2018	0442UT	-.975 @ X
02/22/2018	1807UT	-1.025 @ X
03/24/2018	0657UT	-1.064 @ X
04/22/2018	1913UT	-1.082 @ X
05/22/2018	0702UT	-1.079 @ X
06/20/2018	1837UT	-1.054 @ X
07/20/2018	0614UT	-1.010 @ X
08/18/2018	1809UT	-0.956 @ X
09/17/2018	0632UT	-0.920 @ X
10/16/2018	1930UT	-0.901 @ X
11/15/2018	0859UT	-0.903 @ X
12/14/2018	2246UT	-0.935 @ X



The Lunar X and the Lunar V features.
Image credit and copyright: Mary Spicer

Another simultaneous capture, by Glenn Chaple, of the Lunar X & the Lunar V can be seen on this site:

http://www.theskyscrapers.org/lunar-x

And well, there's no full Moon in February so I cannot tell you the azimuth of Moonrise, but I can say, the the Photographer's Ephermeris is always there for you... it is at (for March 1) azimuth 76.6 degrees. trending towards due East more and more as the months pass:

https://app.photoephemeris.com/?ll=43.251615,-79.756933&center=43.2534,-79.7356&z=13&spn=0.05,0.20&dt=20180301011300-0500

(Continued on page 10)

The Sky This Month for February 2018 (continued)

The Messier Marathon

Every year around the time of New Moon in March and April (about the 15th of each this year) there is a chance to observe ALL the messier objects in a single night (weather and clouds permitting) although you need a dark site to observe the few in the early morning twilight. We are a little north of the place where you can expect to see them all.

However, you can be expected to see more than 100 of them with a goto scope (or serious starhopping) in a single night, and it is an annual tradition to celebrate the Messier Marathon with an all-nighter at the Binbrook Conservation Area.

M74 and *M77* are the first to set in the evening, and to see them you have to be set up and ready before the sunset, and know your stars. This is much easier to do in March than in April, and you need a clear western horizon.

Binbrook is adequate for this in March.

On the other end of the scale, *M70* rises very late, and in March it will be lost in the morning twilight. It is much easier to see in April.

The Messier Marathon as a grand challenge specifies one 24 hour period, but as my predecessor once pointed out, that does not necessarily mean one night. You could rise early, pick off the last few stragglers that rise near dawn, then have a full day of partying before returning to your telescope in the evening to start with M74.

The advantage of that is that you can be all done by about 3 AM and there are a few hours to spare. That's better than staying up until 7 just to see the last few.

In the past, our club members have participated in getting pledges (a few cents per item) to encourage them to see the most possible. Our club is a registered charity and tax receipts can be issued. Let me know if you need a Messier Marathon form.

So there you have it. Some things to seek and a means to seek them.

Treasurer's Report by Ann Tekatch

Treasurer's Report for January 2018 (Unaudited)

Opening balance:	$9,805.06
<u>Revenue:</u>	
50/50 Draw:	$32.25
Memberships:	$50.00
PayPal Memberships:	$185.00
Calendar Sales:	$100.00
<u>Expenses:</u>	
PayPal Fees:	$7.18
Closing Balance:	$10,165.13

This article is provided by NASA Space Place.

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Sixty Years of Observing Our Earth

By Teagan Wall

Satellites are a part of our everyday life. We use global positioning system (GPS) satellites to help us find directions. Satellite television and telephones bring us entertainment, and they connect people all over the world. Weather satellites help us create forecasts, and if there's a disaster—such as a hurricane or a large fire—they can help track what's happening. Then, communication satellites can help us warn people in harm's way.

There are many different types of satellites. Some are smaller than a shoebox, while others are bigger than a school bus. In all, there are more than 1,000 satellites orbiting Earth. With that many always around, it can be easy to take them for granted. However, we haven't always had these helpful eyes in the sky.

The United States launched its first satellite on Jan. 31, 1958. It was called Explorer 1, and it weighed in at only about 30 pounds. This little satellite carried America's first scientific instruments into space: temperature sensors, a microphone, radiation detectors and more.

Explorer 1 sent back data for four months, but remained in orbit for more than 10 years. This small, relatively simple satellite kicked off the American space age. Now, just 60 years later, we depend on satellites every day. Through these satellites, scientists have learned all sorts of things about our planet.

For example, we can now use satellites to measure the height of the land and sea with instruments called altimeters. Altimeters bounce a microwave or laser pulse off Earth and measure how long it takes to come back. Since the speed of light is known very accurately, scientists can use that measurement to calculate the height of a mountain, for example, or the changing levels of Earth's seas.

(Continued on page 12)

NASA's Space Place (continued)

Satellites also help us to study Earth's atmosphere. The atmosphere is made up of layers of gases that surround Earth. Before satellites, we had very little information about these layers. However, with satellites' view from space, NASA scientists can study how the atmosphere's layers interact with light. This tells us which gases are in the air and how much of each gas can be found in the atmosphere. Satellites also help us learn about the clouds and small particles in the atmosphere, too.

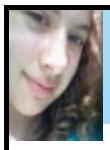
When there's an earthquake, we can use radar in satellites to figure out how much Earth has moved during a quake. In fact, satellites allow NASA scientists to observe all kinds of changes in Earth over months, years or even decades.

Satellites have also allowed us—for the first time in civilization—to have pictures of our home planet from space. Earth is big, so to take a picture of the whole thing, you need to be far away. Apollo 17 astronauts took the first photo of the whole Earth in 1972. Today, we're able to capture new pictures of our planet many times every day.

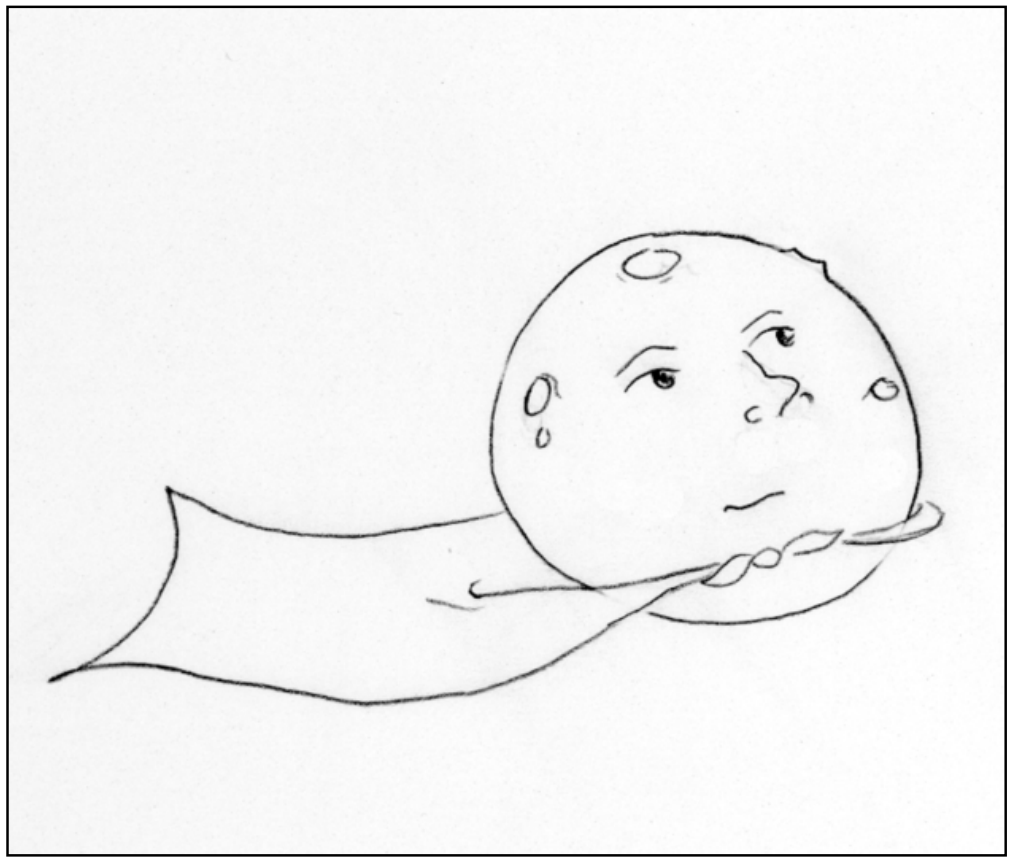
Today, many satellites are buzzing around Earth, and each one plays an important part in how we understand our planet and live life here. These satellite explorers are possible because of what we learned from our first voyage into space with Explorer 1—and the decades of hard work and scientific advances since then.

To learn more about satellites, including where they go when they die, check out NASA Space Place: https://spaceplace.nasa.gov/spacecraft-graveyard

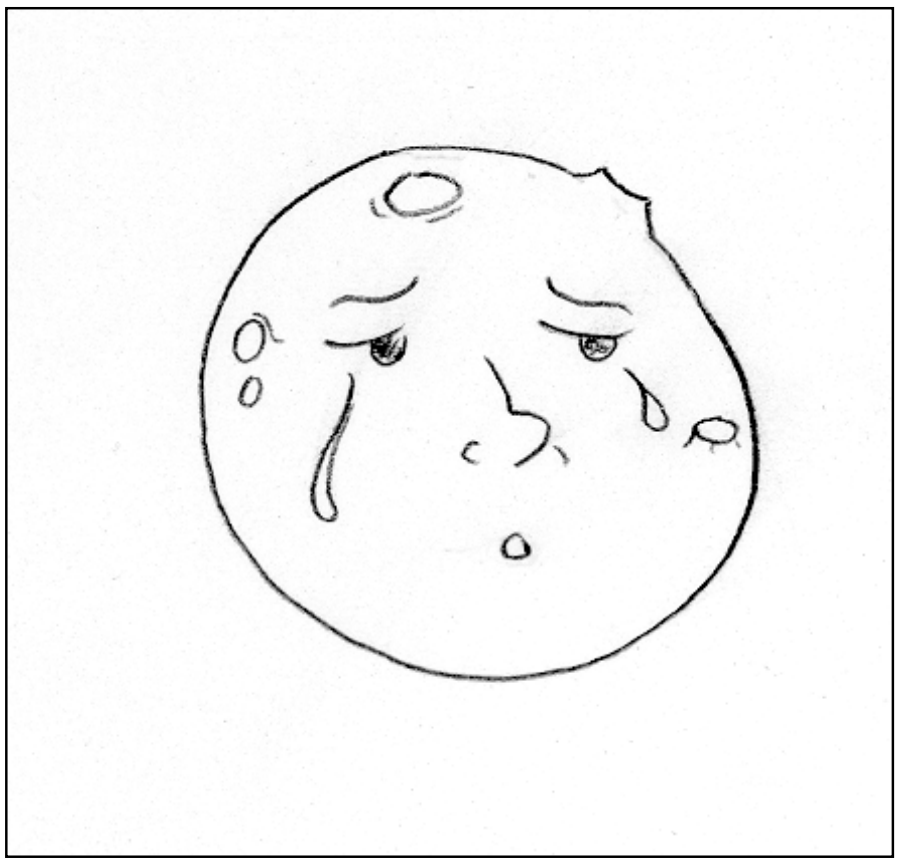
This photo shows the launch of Explorer 1 from Cape Canaveral, Fla., on Jan. 31, 1958. Explorer 1 is the small section on top of the large Jupiter-C rocket that blasted it into orbit. With the launch of Explorer 1, the United States officially entered the space age.
Image credit: NASA



Cartoon Corner by Alexandra Tekatch



Super Moon



Blue Moon

Supercalifragilisticexpialidocious Moon

Moon Images by Sylvie Gionet

Last Moon of the Year

December 31st 2017
1/80 sec; ISO 100
Program AE
Canon EOS Rebel T6i &
Ioptron CEM-25 GoTo
Equatorial Mount,
Vixen Telescope

Waning Gibbous Moon

January 6th 2018
1/25 sec; ISO 100
Program AE
Canon EOS Rebel T6i
& Ioptron CEM-25 GoTo
Equatorial Mount,
Vixen Telescope

For Sale

Orion 80 mm shorty telescope w/ dovetail mount bar and custom wooden case

Price: $175.00.

If interested, please contact ***Ed Smith*** via email at **antariesbws 'at' gmail.com**

HAA Portable Library Contact Information

E-mail: haalibrarybooks@gmail.com

William J. McCallion Planetarium

McMASTER UNIVERSITY, HAMILTON, ONTARIO

- **Public shows every Wednesday (7:00pm)**
- **Public transit available directly to McMaster campus**
- **Tickets $7 per person; private group bookings $150**
- **Different shows every week**
- **Upcoming shows include:**

  - **Feb 7: Introductory Astronomy for Kids — Galaxies**
  - **Feb 14: Ripples in the Fabric of the Universe**
  - **Feb 21: A Timeline of our Universe: From the Big Bang to the Big Freeze**
  - **Feb 28: Living in Space: A beginners guide to colonizing the stars**

- **For more details, visit**
  www.physics.mcmaster.ca/planetarium

UPCOMING EVENTS

February 9, 2018 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium.
Our guest speaker will be *Francois van Heerden* of the RASC Toronto Centre. His talk is entitled "Mallincams: For Outreach and Observing in Light Polluted Areas".

March 9, 2018 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium.

Check out the H.A.A.'s new 2024 Eclipse Countdown Page:
http://www.amateurastronomy.org/2024-solar-eclipse-countdown/

2017-2018 Council

Chair	Bernie Venasse
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Check out the H.A.A. **Website**
www.amateurastronomy.org

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Observing site for the HAA provided with the generous support of the
Binbrook Conservation Area
Come observing with the HAA and see what a great location this is for stargazing, a family day or an out-door function.
Please consider purchasing a season's pass for $79 to help support the park.
http://www.npca.ca/conservation-areas/binbrook/
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HAMILTON AMATEUR ASTRONOMERS