Event Horizon

Volume 24, Number 3
January 2017

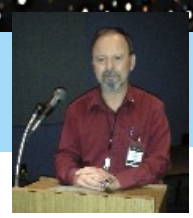
From The Editor

As 2017 starts, what better way to kick it off than to enjoy another edition of the Event Horizon!

Happy Reading, and Clear Skies!

Bob Christmas, Editor

editor 'AT' amateurastronomy.org



Chair's Report by Bernie Venasse

Happy New Year !!!

Welcome to 2017. The year of many exciting things to come.

We had our Christmas Coffee and Treats this past December meeting. Our thanks go out to Denise for spearheading the organization of the event and to all the good elves that assisted!!! This will likely be repeated again in December 2017 so plan on attending…. Yummies!

Our telescope giveaway winner was Sunil Kotayer. Congratulations, Sunil.

What are YOUR goals for 2017? Perhaps you will want to complete your Messier list or the Caldwells. Maybe you are resolving to become more active in the club. We would certainly welcome your participation. Perhaps your goal is to attend at least one observing event at Binbrook. Whatever your goal, I wish you luck.

(Continued on page 2)

IN THIS ISSUE:

Chair's Report (continued)

Elsewhere in this issue, you will find the 2017 Calendar of Events. Keep in mind that there are other viewing dates that are not listed. Binbrook Park dates and Guerilla Astronomy dates are by necessity last-minute announcements so watch for a blast message from the club for information and invitations.

Speaking of eMails… please ensure that we have your current contact information.

The 2017 calendar is almost sold out but we will have a limited quantity available at the January meeting. Be sure to see Jim or Ann when you come in.

Hamilton Amateur Astronomers 2017 Celestial Events Calendar

There are still some HAA 2017 Celestial Events Calendars for sale. If you don't have yours yet, better hurry before they sell out! This beautiful calendar features images exclusively by your fellow HAA members. They make wonderful gifts and look great when displayed at home or office.

The price is $15 each or two for $25.

Any revenue generated from sales goes back into the club to help support club activities.

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.

Masthead Photo: *The Dumbbell Nebula (M27), by Bernd Mueller.*

Taken Summer 2016 with an 8 inch RC and a QHY8Pro camera on an EQ6 equatorial mount.
Exposures: 3 X 10 minutes; 30 minutes total.

The December 2016 general meeting of the HAA by Matthew Mannering

This month our guest speaker was *Gord Williams*. He is a long time member of the Mississauga RASC and he does a lot of public outreach. His talk was about the observatory he built at his cottage in the Kawartha Lakes region.

The 8'x10' base is tied into the granite with 43 bolts. The top floor of the building is at 42' and has a total height of 50'. It took two years to enclose the tower with siding. Seven flights of stairs go up the inside wall of the tower and the centre portion contains an elevator made from a water tank to raise and lower telescope equipment. A concrete telescope pier containing over 80 pieces of rebar also runs up the centre of the building.

Before he can begin observing, the roof must be lowered in four sections down against the outside of the building. The roof sides are lowered and the main beam is taken down. This all takes about 20 minutes. The tower is stabilized with wires using 500' of 22 strand wire which he wound himself. Lightning rods protect the structure during storms.

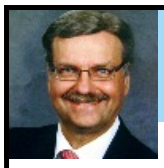
Gord's talk was very entertaining. We were all impressed with his ingenuity, scrounging abilities and persistence.

During the break we had a free draw for a new Celestron 114mm telescope. The winner was Sunil Koteyar. We hope he enjoys using it.

Steve Germann then presented his first "The sky this month" talk.

- Mentioned that his aim is to encourage observing so;
  - Talked again about the variable star Mira which is currently getting brighter. Encourages us to start following the changes in brightness through the peak and back down.
  - Steve talked about a few observing tools.
    - The Photographers Ephemeris – can be used to arrange photo opportunities. Tells you where you need to be to see an event over a specific land mark.
    - Heavens Above – used to find Iridium flares, the ISS and Asteroids.
    - LROC (Lunar Reconnaissance Orbiter) – gives you access to high resolution photographs taken by the orbiter.
  - The April 8th (3:17:42pm to 3:20:23pm at Binbrook) 2024 eclipse will be visible from Hamilton although the center line passes over Buffalo. Binbrook conservation area will get 2mins 41secs of totality.
  - Check out the Jan 3rd Quadrantids meteor shower after the Moon sets.

Bernie then closed the meeting at 9:40pm.



The Sky This Month for January 2017 by Steve Germann

Right now

The year 2017 is upon us now. The first few of this month's astro-events come hot on the heels of the new year.

First thing... you need to look at the below map, and check your calendar, and if it's January 2 evening, or even better, the morning of January 3 just before dawn, when the first quarter Moon has long set.

Then put this paper down and watch for the *Quadrantids* meteor shower.

The radiant is visible all night, between the big dipper and Hercules, and the rate of meteors will increase all night, to levels that exceed the summertime Perseid Meteor Shower.

Yes, January 3 might be a work day, but it's still worth getting up early for this.

The peak of the Quadrantids is comparatively narrow, lasting only about 8 hours.

This year, those 8 hours are when it's night on our side of the earth, so let's take this opportunity.

Planets to watch

On your way home from New Year's celebrations, if you can find *Mars*, you also have *Neptune*, just 0.02 degrees away, but 400 times dimmer. You will need big binoculars or a 3 inch telescope to spot Neptune but at least you will have an easy time to find it.

You can also be guided to Neptune on the 25th this time by *Venus*. Venus and Neptune will be close together on the 25th of January. The difference in brightness will be 100,000 times. I suggest you try positioning Venus outside the eyepiece then look for Neptune.

Venus/Neptune is the widest variation between 2 major planets possible in our Solar System.

This is also a good month to watch for *Mercury* in the sky in the early morning, preceding the sun. It is at its greatest western elongation on Jan 19 and will be 24 degrees ahead of the sun, with Mercury rising about 1 hour before sunrise.

(Continued on page 5)

The Sky This Month (continued)

Asteroids

Vesta peaks on January 18th at magnitude 6.2, and it will be an easy binocular object.
As in my previous articles, Heavens-Above is your friend, easily giving you a definite finder chart for any date and time. Use this link and adjust the date and time:

http://heavens-above.com/MinorPlanet.aspx?desig=4&lat=0&lng=0&loc=Unspecified&alt=0&tz=UCT

It's prominent near Gemini and up almost all night this month.

The month of January is usually a pretty cold time of the year for us, and so I want to feature things that are easy to see from your own backyard or driveway, without having to travel and set up and tear down equipment.

For us, that pretty much means stars and planets, which defy light pollution better than any other deep sky objects can.

It's full of stars

First of all, this is the time of the very bright winter constellations. *Orion* is prominent in the sky, and it's recognizable shape including the 3 equally spaced belt stars, directs with its belt towards *Aldebaran* on the right and towards *Sirius* on the left.

At one time we can see *Aldebaran* (13th brightest star; magnitude 0.8), *Betelgeuse* (10th 0.6), *Rigel* (7th 0.1), *Sirius* (1st -1.4), *Procyon* (8th 0.3), *Castor* (23rd 1.57), *Pollux* (16th 1.1), and *Capella* (6th 0.08), which rank in the top 26 brightest stars of the night sky. I have seen these bright stars even with my reading glasses on, as large blurs obvious in the night sky when the rest of the stars are washed out by being spread by my nearsightedness.

All of those stars are intrinsically brighter than our Sun, so they merit a few words. All are massive, and will eventually go supernova. Some may have already exploded, their light and neutrinos still approaching us. Betelgeuse is one such star, currently a variable red giant. It only takes a year to burn Oxygen to Silicon in the core, and a day to burn Silicon to Iron in the core, so once it runs out of Helium, we are in for a big show.

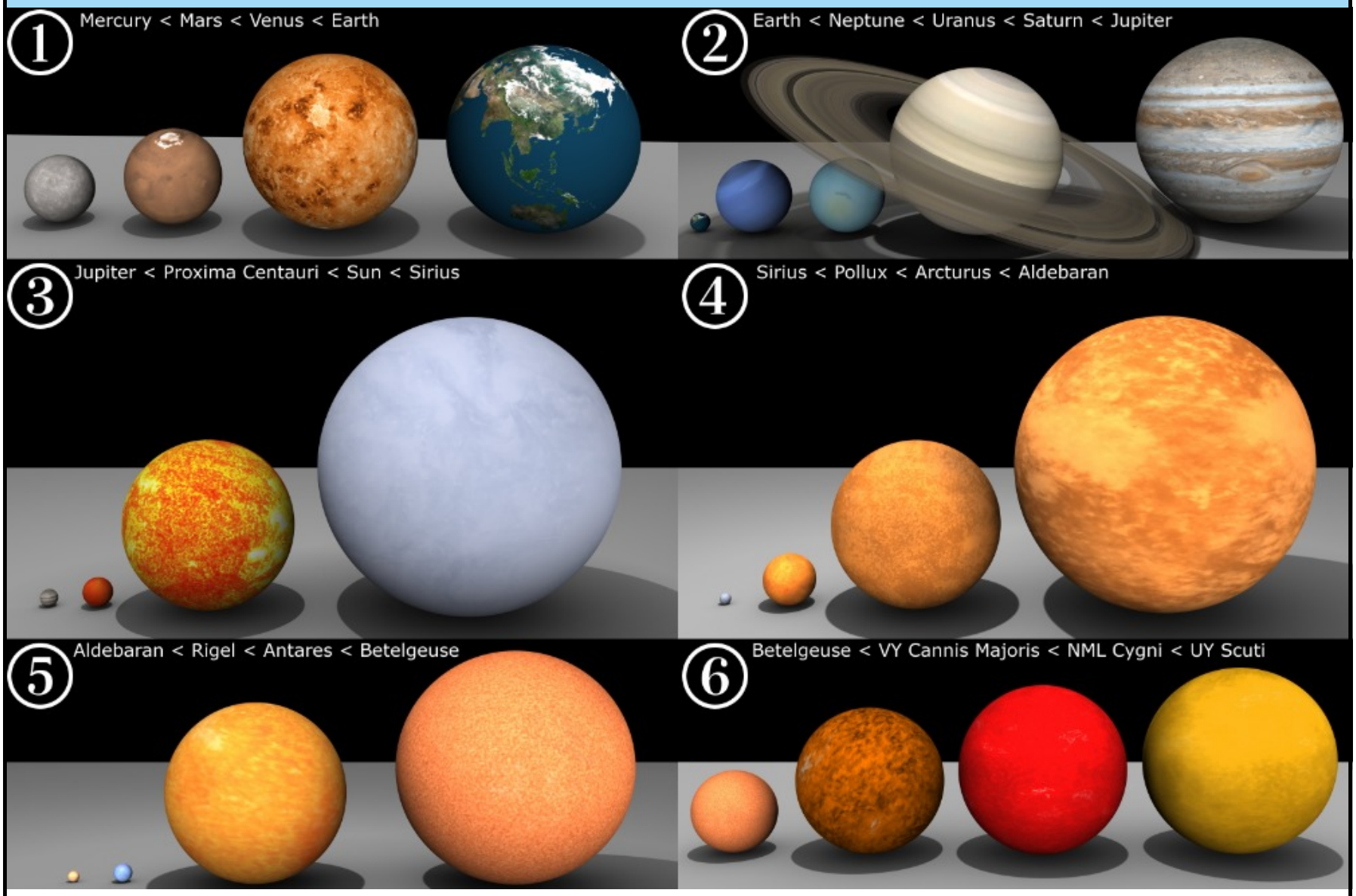
This got me thinking about the most likely supernovas in our galaxy among the prominent visible stars. (The actual next supernova in our galaxy probably won't be on this list; it will be an obscure white dwarf picking up mass from a companion somewhere... but I continue).

I refer shamelessly to Wikipedia for this kind of stuff...

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

Browsing that list, of stars at least 10 Solar Masses at late stages of their evolution I see Betelgeuse and Rigel as winter stars worth a look... Unfortunately, their clocks are still about a million years before supernova (according to current theories which lack all of the needed data)... so I am not so sure about that estimate.

(Continued on page 6)



Back of the envelope Astrophysics

And I found this excellent graphic showing relative sizes of objects in the night sky, which I legally attribute to:

By Jcpag2012 - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=39771065

A little physics for us number hungry people...

In this graphic you can see how much difference temperature makes to the brightness of a star. Comparatively small Rigel outshines Betelgeuse even though they are roughly the same distance from us. Rigel's surface temperature is 12300 K which makes it about 20 times as bright for a given surface area than our sun which is only at about 5800 K; the heat output scales with the 4th power of the temperature. Betelgeuse is at about 3590 K and Rigel is 128 times brighter per unit area.

Some math about our Sun's brightness:

Our sun emits about 63 megawatts per square meter.

Following all that power back to the center of the sun, the volume of material is 230 million cubic meters, for a power output of just over a quarter watt per cubic meter. However, if you only consider the core of the sun (which is about the size of the Earth) as generating all the power, then that square meter cones down to just a square centimeter at the edge of the core, and the volume behind it is

(Continued on page 7)

The Sky This Month (continued)

about 230 cubic meters. The sun's core puts out about .25 megawatt per cubic meter, with each cubic meter of the Sun's core containing about 160 tons of Hydrogen and Helium. Pretty compact, I would say.

Current hopes are that fusion reactors will achieve about 10 times the power density, at a much lower temperature and density, by fusing Deuterium and Tritium instead of plain-old Hydrogen.

I don't know how big the core of Sirius would be, so I cannot do the same math for it, but by the time the energy gets to the surface of Sirius, it's flowing out at 1.26 gigawatts per square meter, the power output of a couple of nuclear power reactors, or roughly the amount of solar energy hitting a square kilometer of space, at the distance of Earth's orbit (1AU).

But seriously, (no pun intended) this is the time to just appreciate the splendor of all those bright stars brought together in the winter constellations. When I look at those stars I feel a connection to people thousands of years ago who saw the same constellations and wondered about them, untroubled by light pollution, seeing stars down to 6th magnitude in those constellations, from where they lived.

They also saw the stars twinkle.

If you have a high power telescope on a comparatively cheap mount, try this technique to see detail in twinkling: Sirius is always comparatively low in the sky when it's visible. It's so bright, it has photons to spare, so we can spread them around. While observing Sirius, tap the telescope lightly... maybe tap the tripod or somewhere you can conveniently reach. The telescope will vibrate for a few seconds, and then (hopefully) settle down again. While it's vibrating, the dot that is Sirius will change to an oval, and you will see, spread out on that oval path, colour variation and twinkling due to the Earth's atmosphere.

Astro-gossip

Venus is bright in the evening sky still setting near 9 PM.

Librations

On the 9th of January, just before Full Moon, the moon's north Limb is favourably exposed. You have a chance to see some of the 6 percent of the 'far side of the moon' then.

The next rising of the Full Moon will be on Thursday January 12th, the day before our monthly meeting.

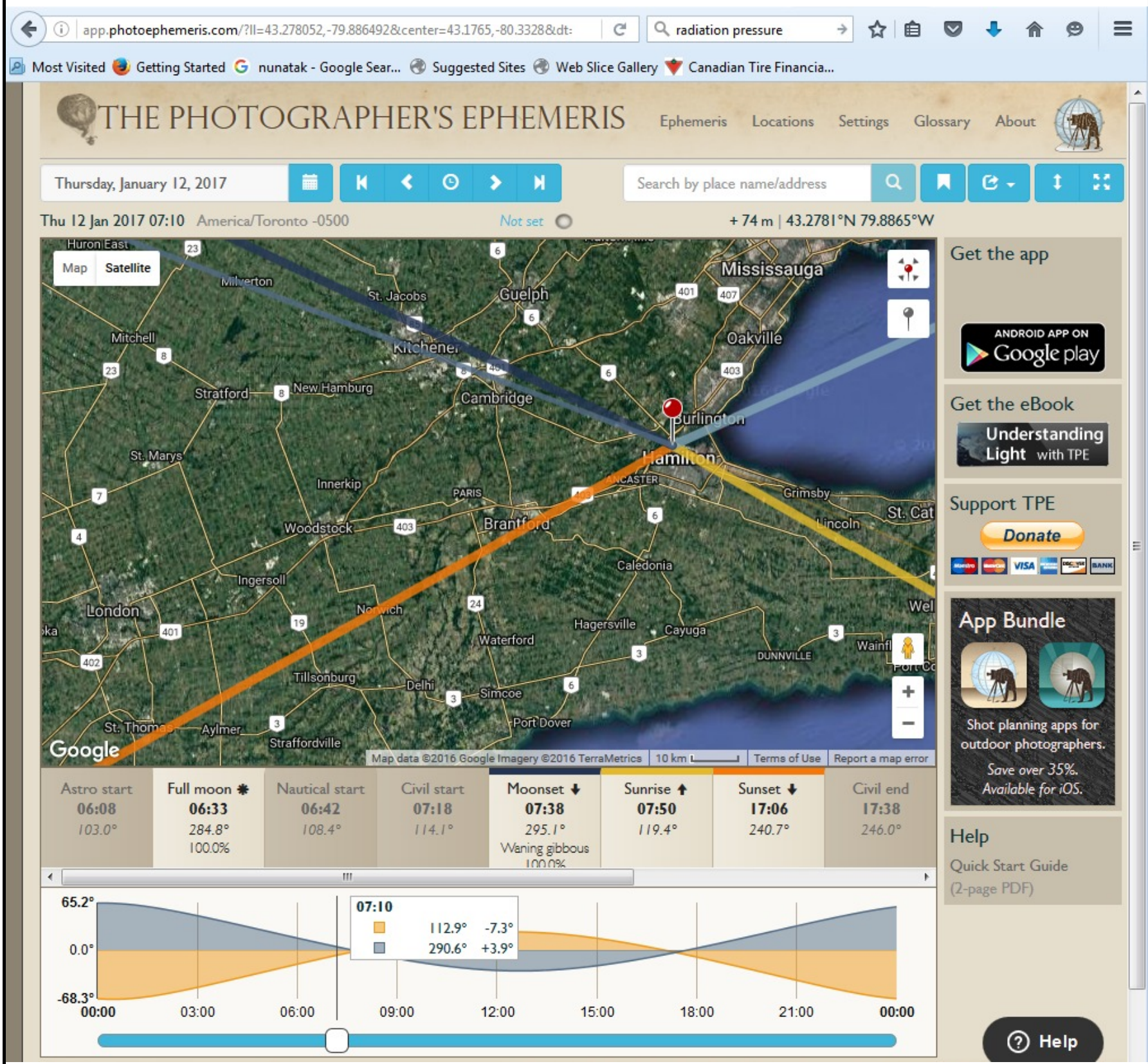
A group of intrepid Moon-photographers usually gets together to capture some Moon-rise shots in the evening. This month, on the 12th, Moon-rise is at 5:43 PM at an azimuth of 65.8 degrees.

See the screen shot of The Photographer’s Ephemeris on the next page for a map with viewing directions for the the January 12 moonrise.

Contact me (observing ‘at’ amateurastronomy.org) if you want to be in on the planning for it.

(Continued on page 8)

The Sky This Month (continued)



Screen shot of Photographer's Ephemeris Website, with Sunrise, Sunset, Moonrise and Moonset Directions for Hamilton, Ontario, January 12, 2017.

H.A.A. is a Gift by Dave Gaylor

A member's personal story and perspective:

I have been a member of Hamilton Amateur Astronomers since moving to Dundas in 2005. Astronomy has always been an interest in my life – who isn't fascinated by our night sky? - but I never had the time to spend to learn more. My life was very busy as a chemical/environmental engineer and later consulting as an occupational hygienist looking at the evaluation and control of workplace health hazards.

We moved to Dundas for many reasons one of which was to have access to services for a brain injury I had sustained in December of 2000. My wife, Nancy and I, were in a bad motor vehicle accident when someone came through a stop sign and T-boned us early in the morning on a snowy day. Having two parents hospitalized for a significant time was also very traumatic for our four children aged 9-18 at the time of the accident. Brain injury ultimately has had the most impact on me with memory and concentration issues that have only partially resolved.

Finding HAA was a bonus in our move here. I had more time now being forcibly retired… Unfortunately, it has not been that simple with the memory and concentration problems making new learning and remembering old learning problematic. Not as much of a problem if you can devote the necessary time but much of my good recovery is owed to the volunteer work I do at the Hamilton Brain Injury Association and Hamilton Health Sciences and that is about as much as I can handle at this point. The recovery is also due to a very supportive family which still occupies a good deal of my time as well. As a result, the extra time I thought I had gained has not really ever materialized.

I went out and bought a decent small refractor telescope at an appropriate store i.e. not a department store as per HAA advice, was disappointed in what I could see and couldn't spend long enough at night when I was disproportionally more tired to learn more… I bought a more expensive 8 inch Schmidt Cassegrain and soon found myself in the same position with learning, concentration and tiredness… When I still have trouble remembering the constellations and where they all are, this was clearly the wrong thing to do. Fortunately, I had a wonderful organization to donate the instrument to that would put it to good use… apparently, it still is - right Jim Wamsley?

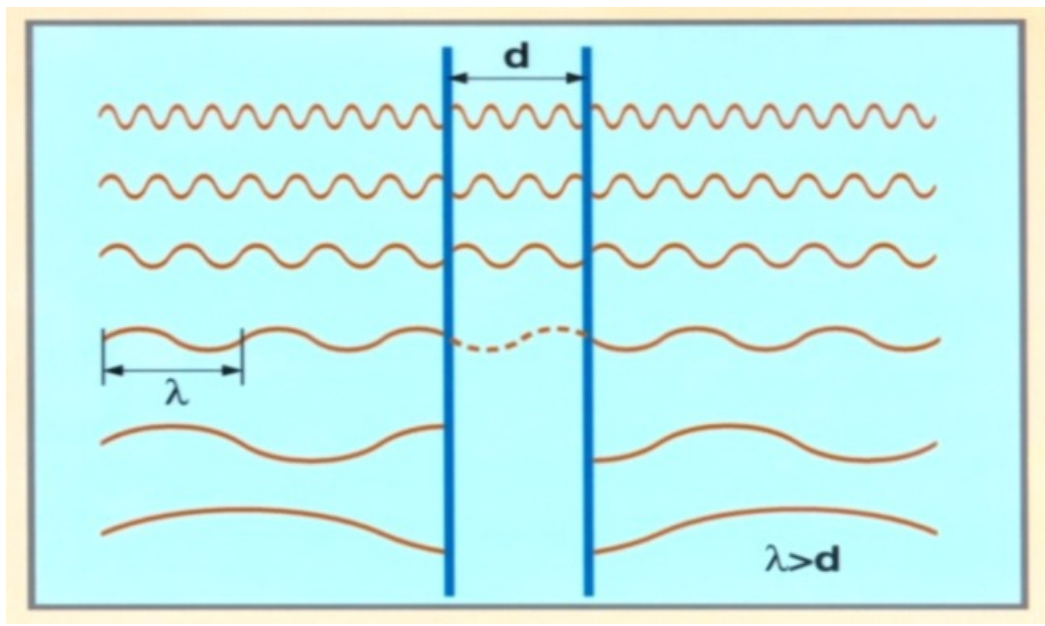
So you have not seen me very often at star parties or observation nights and less so at regular meetings. This is not at all because I am not interested but because I am respecting the limits that now apply to my life. In the meantime, I enjoy every meeting I get to and particularly all the people I meet there. Intelligence and caring for the deeper meaning of life that the love of astronomy ultimately leads one to, is rampant in this organization. It is truly a gift to be part of it and I hope to remain so for many years to come.

The Casimir Effect and Black Holes by Bruce Pawlett

The Heisenberg Uncertainty Principle says one cannot accurately measure both the position and momentum of a particle at the same time. But, it also can be stated that both the time and energy of a particle cannot be simultaneously measured accurately. For instance, you may measure exactly when a photon arrives but you will not be able to determine its energy (and vice versa). The uncertainty principle applies even to zero energy photons. If a photon has zero energy, fundamentally it is not there, but due to the uncertainty the non-existing photon could acquire energy and briefly pop into existence.

Energy can be borrowed as long as it is quickly put back "before anyone notices". This applies to all types of particles but the more energy borrowed, the less time it may be borrowed for. Therefore, the more massive "virtual particles" exist for shorter times. In empty space, the quantum fields (except the Higgs field) hover around zero energy but quantum energy fluctuations are always occurring. These fluctuations allow the creation of the virtual particles. There is a rule that the virtual particles are created in pairs, a particle and an anti-particle that usually annihilate one another (e.g. electron and positron). Although empty space is thought of as empty, it is actually teeming with virtual particles coming in and out of existence.

In 1948 Dutch physicist *Hendrick Casimir* proposed an experiment to detect the presence of such virtual particles. Two non-charged conducting parallel, mirrored plates are placed very close together (within a micron) in a vacuum chamber. Due to the limited distance between the plates, the wavelength and the number of virtual photons between the plates is constrained in comparison to those that come into existence and bounce around the outside of the mirrored plates. This results in a lower pressure between the mirrors compared to the pressure outside around the mirrors. This pressure difference causes the mirrors to move closer together with a measurable force.



The Casimir effect was experimentally first confirmed in 1997 by Steve Lamoreaux (then at the University of Washington). Experimental measurements agreed with theoretical prediction to an accuracy of 5%. Subsequent experiments were able to measure the Casimir force to within 1% of the predicted value. "Two mirrors with an area of 1 square cm separated by 1 micron will have an attractive Casimir force of 10 to the power of -7 Newtons – roughly the weight of a ½ mm diameter water droplet". With a 10-nanometer separation the Casimir effect produces about an equivalent of 1 atmosphere of pressure.

The effect is real and presents theoretical physicists with a dilemma. When the mass of the virtual particles is taken into account, a universe with infinite mass density is predicted. Obviously, the effect is not so grand and to compensate, a complex mathematical renormalization process must be applied to

(Continued on page 11)

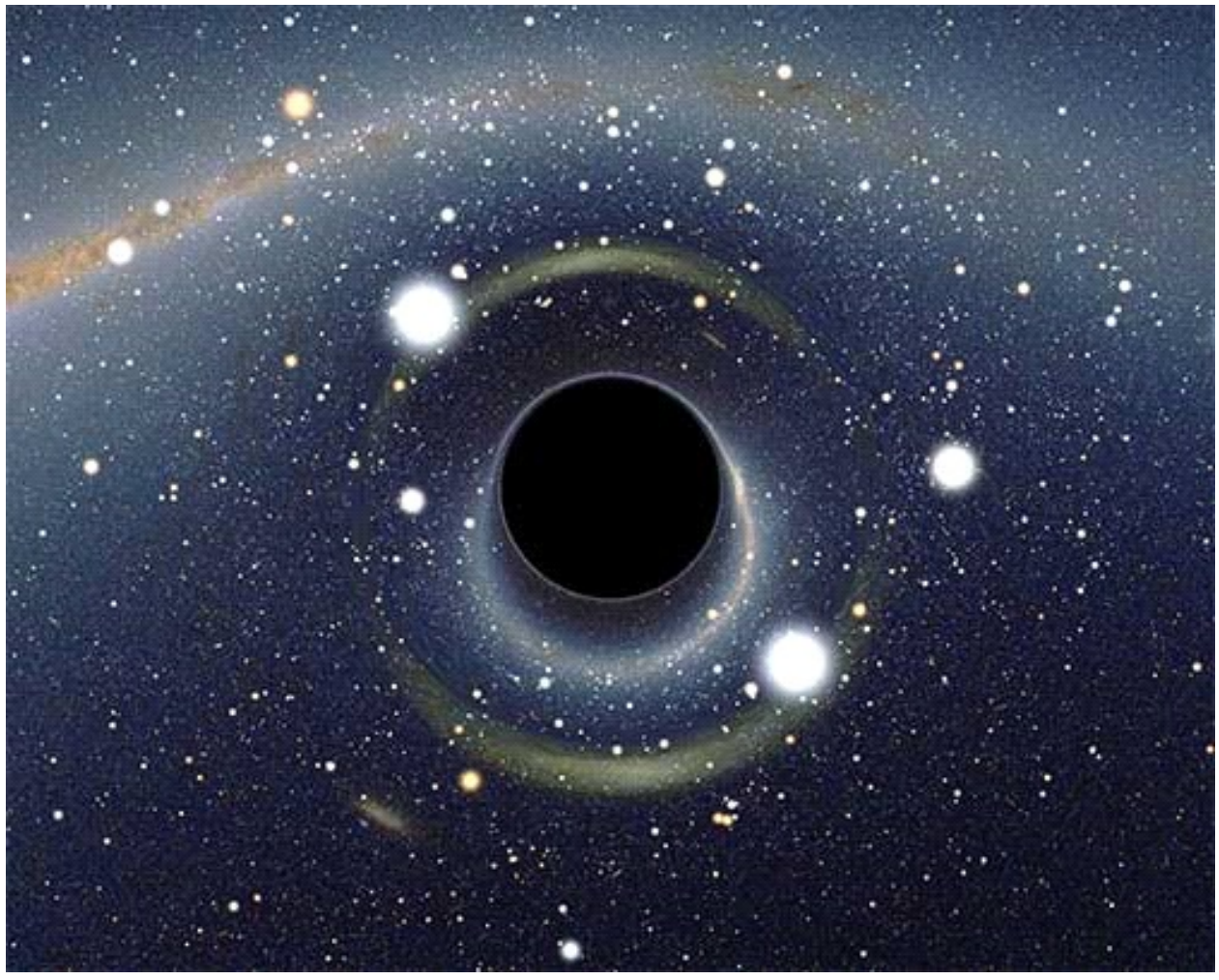
The Casimir Effect and Black Holes (continued)

allow the infinities that are created in the equations to be ignored. (Another area of limited understanding).

The dynamical Casimir effect occurs when one of the mirrors is moved back and forth at a relativistic speed. At slow speeds the virtual particles adapt to the movement of the mirror and continue to pop into existence in pairs that quickly annihilate one another. If the mirror is moved at a relativistic speed (approaching the speed of the photon) some of the paired photons become permanently separated and thus do not annihilate one another. If enough photon pairs become separated the mirrors begin to produce light. The energy to allow this to happen comes from the energy put into the system to move the mirror.

It is not feasible to conduct an experiment involving moving a mirror at relativistic speeds. However, in 2011 Wilson et al released a paper "Observation of the Dynamical Casimir Effect in a Superconducting Circuit" that describes their successful experiment that used a superconducting circuit to demonstrate the effect. They used a transmission line with an electrical length that could be changed at the rate of ~5% of light speed using a superconducting quantum interference device (SQUID). The change of the electrical length of the transmission line is equivalent to moving the mirror. They successfully produced microwave photons using this method.

The dynamical Casimir effect occurs at the event horizon of black holes. Einstein's Equivalence Principle tells us that acceleration is indistinguishable from gravity. If you are in an enclosed rising elevator you really can't tell if you feel heavier because the elevator is moving upward or gravity is increasing.



Black holes do not have moving mirrors but they do have gravity, it is the same physics that is at work. When the virtual pairs of particles are created some will fall into the black hole and become separated from their partner, thus creating real photons. The energy for creating the photon has to come from somewhere, the black hole. Essentially, the photons that fall into the black hole reduce the black hole's mass (energy). This is the Hawking radiation that will eventually result in the evaporation of all the black holes in our Universe.

References:

Casimir Effect & Black Holes – Sixty Symbols (University of Nottingham)
Nothing but Net – One Universe at a Time – Brian Koberlein
The Casimir effect: a force from nothing – Astrid Lambrecht – Physics World (2002)

This article is provided by NASA Space Place.

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.

Visit spaceplace.nasa.gov to explore space and Earth science!

Big Science in Small Packages

By Marcus Woo

About 250 miles overhead, a satellite the size of a loaf of bread flies in orbit. It's one of hundreds of so-called CubeSats—spacecraft that come in relatively inexpensive and compact packages—that have launched over the years. So far, most CubeSats have been commercial satellites, student projects, or technology demonstrations. But this one, dubbed MinXSS ("minks") is NASA's first CubeSat with a bona fide science mission.

Launched in December 2015, MinXSS has been observing the sun in X-rays with unprecedented detail. Its goal is to better understand the physics behind phenomena like solar flares – eruptions on the sun that produce dramatic bursts of energy and radiation.

Much of the newly-released radiation from solar flares is concentrated in X-rays, and, in particular, the lower energy range called soft X-rays. But other spacecraft don't have the capability to measure this part of the sun's spectrum at high resolution—which is where MinXSS, short for Miniature Solar X-ray Spectrometer, comes in.

Using MinXSS to monitor how the soft X-ray spectrum changes over time, scientists can track changes in the composition in the sun's corona, the hot outermost layer of the sun. While the sun's visible surface, the photosphere, is about 6000 Kelvin (10,000 degrees Fahrenheit), areas of the corona reach tens of millions of degrees during a solar flare. But even without a flare, the corona smolders at a million degrees—and no one knows why.

One possibility is that many small nanoflares constantly heat the corona. Or, the heat may come from certain kinds of waves that

(Continued on page 13)

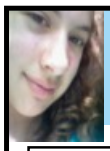
propagate through the solar plasma. By looking at how the corona's composition changes, researchers can determine which mechanism is more important, says Tom Woods, a solar scientist at the University of Colorado at Boulder and principal investigator of MinXSS: "It's helping address this very long-term problem that's been around for 50 years: how is the corona heated to be so hot."

The $1 million original mission has been gathering observations since June.

The satellite will likely burn up in Earth's atmosphere in March. But the researchers have built a second one slated for launch in 2017. MinXSS-2 will watch long-term solar activity—related to the sun's 11-year sunspot cycle—and how variability in the soft X-ray spectrum affects space weather, which can be a hazard for satellites. So the little-mission-that-could will continue—this time, flying at a higher, polar orbit for about five years.

If you'd like to teach kids about where the sun's energy comes from, please visit the NASA Space Place: http://spaceplace.nasa.gov/sun-heat/.

Astronaut Tim Peake on board the International Space Station captured this image of a CubeSat deployment on May 16, 2016. The bottom-most CubeSat is the NASA-funded MinXSS CubeSat, which observes soft X-rays from the sun—such X-rays can disturb the ionosphere and thereby hamper radio and GPS signals. (The second CubeSat is CADRE — short for CubeSat investigating Atmospheric Density Response to Extreme driving - built by the University of Michigan and funded by the National Science Foundation.) Credit: ESA/NASA



Cartoon Corner by Alexandra Tekatch

Another successful race around the Sun. Happy New Year!!

Treasurer's Report by Ann Tekatch

December 2016 Treasurer's Report (Unaudited)

Opening balance:	$6,941.61
Revenue:	
50/50 Draw:	$27.50
Calendar Sales:	$420.00
Memberships:	$245.00
Expenses:	
Attila Danko Clear Sky Chart Donation	$50.00
Niagara Peninsula Conservation Authority (Binbrook) Donation	$100.00
Christmas Meeting treats	$44.95
Poster Printing	$9.89
Closing Balance:	$7,429.27

2017 Calendar of Events

March 4 — Outreach at Grimsby Welcome Centre

March 10 — Regular meeting at the Spectator Building

March 25 — Messier / Caldwell event at Binbrook Park

April 7 — Regular meeting at the Spectator Building. Note that this is the FIRST Friday of the month

April 22 — Scope Clinic/ Open House at the Spectator Building

April 29 — Outreach at Bayfront Park… Astronomy Day

May 12 — Regular meeting at the Spectator Building

May 27 — Outreach at McQuesten Park

June 9 — Regular meeting at the Spectator Building

June 24 — Outreach at Lakeland Park … mostly Solar observing

July 29 — Outreach at McQuesten Park … mostly Solar observing

August 12 — Club Picnic and public Perseid Event at BinbrookPark

August 21 — Outreach at McQuesten park for Solar Eclipse… for those not going south for the event.

September 8 — Regular meeting at the Spectator Building

September 30 — Outreach at Bayfront Park… Astronomy Day

October 13 — Annual General Meeting at the Spectator Building

October 21 — Outreach at Grimsby Welcome Centre

November 10 — Regular meeting at the Spectator Building

November 18 — Scope Clinic/ Open House at the Spectator Building

December 8 — Regular meeting at the Spectator Building

Photo Credit:

Jim Wamsley (both)

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:**
  - **Jan 11: Introductory Astronomy for Kids — Solar System**
  - **Jan 18: Life in the Universe**
  - **Jan 25: The Celestial Bear: The Six Nations' Night Sky**
- **For more details, visit**
  www.physics.mcmaster.ca/planetarium

UPCOMING EVENTS

January 13, 2017 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium. H.A.A. Chair **Bernie Venasse** will talk about 'cleaning your optics', and H.A.A. member **Kevin Salwach** will talk about 'his favourite astronauts'.

February 10, 2017 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium.

2016-2017 Council

Chair	Bernie Venasse
Second Chair	Mike Jefferson
Treasurer	Ann Tekatch
Webmaster	David Tym
Membership Director	Leslie Webb
Observing Director	Steve Germann
Education Director	John Gauvreau
Event Horizon Editor	Bob Christmas
Recorder	Matthew Mannering
Secretary	Jim Wamsley
Publicity Director	Mario Carr
Councillors at Large	Denise White Brenda Frederick Kevin Salwach

Check out the H.A.A. **Website**

www.amateurastronomy.org

Contact Us
Hamilton Amateur Astronomers
PO Box 65578
Dundas, ON
L9H 6Y6

www.amateurastronomy.org

General Inquiries:
secretary@amateurastronomy.org

Membership:
membership@amateurastronomy.org

Meeting Inquiries:
chair@amateurastronomy.org

Public Events:
publicity@amateurastronomy.org

Observing Inquiries:
observing@amateurastronomy.org

Education:
education@amateurastronomy.org

Newsletter:
editor@amateurastronomy.org

Webmaster:
webmaster@amateurastronomy.org

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/
905-692-3228

HAMILTON AMATEUR ASTRONOMERS