

Event Horizon



**Volume 24, Number 1
November 2016**



From The Editor

With the start of a new membership year, the HAA council has had a few portfolio changes.

Enclosed are Steve Germann's final Treasurer's Report and annual Financial Statements before handing off Treasurer's duties to past E.H. Editor Ann Tekatch. Steve also presents the first The Sky This Month of his term as Observing Director.

Happy Reading!

Bob Christmas, Editor



Chair's Report by Bernie Venasse

Welcome to Autumn...

Our semi-annual Scope Clinic is set for Saturday, November 19th, 2016 and will be open to the public from 1:00 to 4:00 PM. Admission is FREE but donations to the FOOD BANK are always welcome and appreciated.

Please make a point to remember to renew your membership. Your fees go to supporting the club and the many things that we do.

Calendars will be available at the November 11th meeting. They are being offered at the same prices as last year.... \$15 each or 2 for \$25.

Special thanks go out to.... Steve Germann who has done a great job as our Treasurer. He has moved to the position of Observing Director and will be making his first presentation in that position at our November meeting.

Thanks also go out to Ann Tekatch for her services as Recording Secretary. Ann somehow has managed to make sense of our *(Continued on [page 2](#))*

IN THIS ISSUE:

- The 2017 HAA Celestial Events Calendar
- The Sky This Month
- In the Shadow of the Moon; an occultation story
- Wanted --- Dead and Alive Part II

- Cartoon Corner
- NASA's Space Place
- 2015-2016 Financial Statements
- Treasurer's Report
- Upcoming McCallion Planetarium Shows
- Upcoming Events
- Contact Information

Chair's Report (continued)

discussions and to present the minutes in such an accurate and timely manner. Ann now moves to the position of Treasurer.

And a final thanks going out to Matthew Mannering who has been our Observing Director and entertaining, challenging and educating all of us with his monthly contributions to the club. Matt now takes on the position of Recording Secretary.

Our October meeting was a great success, enjoyed by all in attendance. A special thanks to our guest speaker, Roberto Abraham.

The scheduled guest speaker for our November meeting is Brian Dernes. Brian is the proprietor of KW Telescope-Perceptor.

Councillors-at-Large will be appointed at our next council meeting. If you have any interest in joining our council this is a gentle way to wade in and get your feet wet. Interested??? Speak with me or any councillor and we can give you more detail.

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 will be collecting 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: *Scene from a past H.A.A. Telescope Clinic, by John Gauvreau.*

Don't miss the H.A.A.'s fall-2016 Telescope Clinic, Saturday, November 19, 2016, from 1 pm to 4 pm at the Hamilton Spectator Auditorium. Admission is free. Food bank donation optional but greatly welcome.

Hamilton Amateur Astronomers 2017 Celestial Events Calendar

The HAA once again offers its wall calendar available for sale starting in November. 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.





The Sky This Month for November 2016 & Beyond by Steve Germann

There are 3 possible purposes for this article, combined of course with my talk at our general meeting.

The first is to let you know what's coming up, to allow you to advocate for astronomy in casual conversation with people who ask what's happening in the sky. I can help by providing the most interesting thing that is happening near the end of the month, so you can use it all month :).

For the month of November, the thing you will likely need to talk about most is what's that bright light in the western sky after sunset. It's Venus. Try pointing your scope at it after sunset, and see how the partial phases of Venus change.

The second purpose is to let you know about astronomical events that happen soon, but rarely, which I hope you will want to make the effort to see it, to help you stay connected, astronomically speaking.

It might be a case where you could interest a friend to see it too. My first contact with the HAA was to see Saturn at opposition, when the rings were best displayed for the next 30 years. I hope i can get you, already members of the club, to take advantages of less rare but still spectacular events.

The third purpose of this article is to kindle a spark of interest in you, to become an active regular observer of your personal set of chosen sky phenomena, by presenting various opportunities and categories in an inviting and accessible way. That has the potential to literally brighten your life for years to come.

So, with nothing less than those thoughts and goals in mind, I have volunteered to be your observing director for the coming year.

Rest assured I have cooked up an far-reaching plan for your observing challenges, dinner conversation, and advocacy/recruitment abilities.

Anyone in our club can still get an Observer's Handbook for \$20, which will contain some of the information I present, and EVERYTHING else, arranged in such a way that you might not spot the good stuff.

However, there's one thing you won't fail to spot. That's the **solar eclipse of 2017**, which will be the most-watched eclipse of in history, and it's happening near enough to us to justify a bit of an expedition.

I have the honour and privilege of being the Observing Director during this extremely famous event, which is probably only going to be outclassed by the eclipse of 2024 which will go right over Hamilton... but even then we would be advised to double our totality time by travelling 50 miles closer to the center-line near Welland or Niagara.

<http://eclipse.gsfc.nasa.gov/SEgoogle/SEgoogle2001/SE2024Apr08Tgoogle.html>

It's already pushing up the price of homes in Burlington south of the QEW; alas, unfortunate Mississauga is outside the path of totality. Millions of people are going to pass us that day to get to Hamilton.

Don't wait for 2024. Plan to come and see what the fuss is all about.

At least 8 of your club members have already made plans to get into the path of totality. Will we see a dark cloudy sky? Will we see the diamond ring and totality? Stars and the corona in the middle of the day? Perhaps a comet near the sun?

(Continued on [page 5](#))

The Sky This Month (continued)

It depends on many things. But make no mistake. The difference between seeing a total eclipse on TV compared to being there in person, is like the difference between watching the world series on TV, and being a player on the winning team. The interviews alone are worth the drive to Missouri. Ask me about the fully booked bed & breakfast with a backyard where I plan to camp right on the eclipse path. Some people plan and save for years to make a trip to see an eclipse. They might still get clouded out, or worse. This expedition won't even cost you \$250 for gasoline and meals, if you plan accordingly.

So, now that you know what I am up to, let's get started.

I will begin with something that every member of the club can participate in, as no equipment is required except perhaps a building or shrubbery to shade your eyes from a nearby source of light pollution, and a view of the zenith at least 45 degrees wide. You will need warm clothing and a comfy reclining chair.

What is there in November that can get you out of the house and under the stars? Well, you won't want to miss the **Leonid Meteor Shower**. The shower peaks on the 17th, after midnight, but has a rate above 50 percent of maximum for just 1 day, so you will need to be there to see it. Your best view will be to rise early on the morning of the 17th, and the moon will be setting, and the peak is at 5 am our time. Give yourself an hour to see some amazing meteors.

The **Leonids** are comparatively large, and very fast. You will have no trouble seeing them at that time if the sky is clear. There are 6 such meteor showers in the next year. Imagine the achievement to have seen some meteors from each of them? 4 or more will merit a certificate for you. Bonus Showers can be found on Page 254 of the 2017 observer's handbook.

Don't worry, I will be sure to remind you of each of them as their time approaches.

The Leonids are actually moving almost parallel, towards the earth, but from our vantage point they seem to fan outwards from a point in the constellation Leo.

The ideal way to record meteor tracks is on a planisphere, set for the time and direction you are looking. Use a crayon or grease pencil. I use a white 'tire marker' from Canadian Tire. You can photocopy it and erase the tracks later.

You can pick up a planisphere (or a replacement if you are fortunate enough to mark up your planisphere beyond further use) at our next club meeting. We have a good supply.

Write the times on the chart, beside the track, and we can compare from various places, who saw the same meteor. I will be delighted to present you with a certificate of achievement at the November 2017 Meeting if you can collect meteors from 4 or more of the top 6 showers. For your future plans, the others are **Geminids** Dec 14, peaking in early evening but visible all night, and despite a full moon, they are the most numerous meteor shower of the year, the **Quadrantids**, also very numerous, with an excellent moon aspect, Jan 3 in the morning, the **Eta Aquarids**, parts of Halley's comet, a multi day shower centered on May 5-6, the **Perseids**, August 12 in the evening, and the **Orionids**, on October 21 morning or evening.

Now that you have 6 reasons to get outside if it's clear that night, and perhaps the night before just in case, let me try to interest you in using binoculars at other times. I have always said that binoculars are a great way to enter the hobby of astronomy. But you will need one of those gadgets to hold them steady on a tripod, and don't even think of looking toward the zenith with them... *(Continued on [page 6](#))*

The Sky This Month (continued)

November is absolutely the best time to use your binoculars for viewing the comparatively easy minor planet **1 Ceres**. It was at opposition on October 21, at magnitude 7.4 and will be brighter than magnitude 8 until November 27th.

To see down to magnitude 8, almost any pair of binoculars will do, but you need to know where to look, and you will need to support the binoculars on a tripod.

There are 22 minor planets that can be seen without the aid of photography, and except for Pluto, they all reach magnitude 10 at some point in the year.... so here's your chance to embark on a year long journey to see them all. Why not start with number 1?

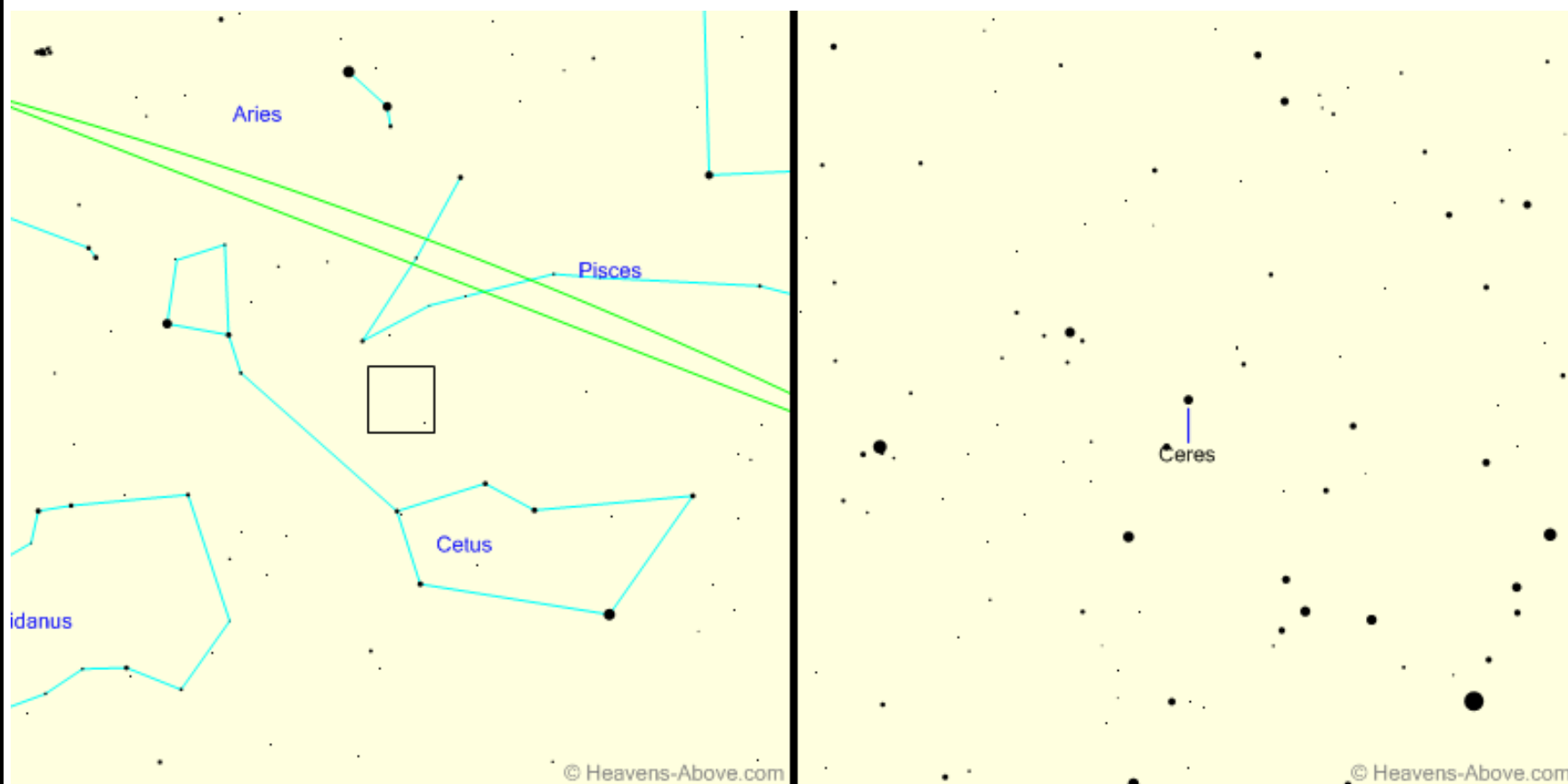
If you miss one, it comes into opposition once a year. However, the roundness of its orbit determines which are the best oppositions to spot it.

You can read a few details about Ceres here:

<https://solarsystem.nasa.gov/planets/ceres/indepth>

The finder chart for minor planets can be computed with an free website called 'Heavens Above'. (HA) It's best done taking into account the probable limiting magnitude of your optics, date and time, and to a certain extent, your location, but for minor planets you don't even need a login to specify your location. HA generally makes charts to magnitude 10.

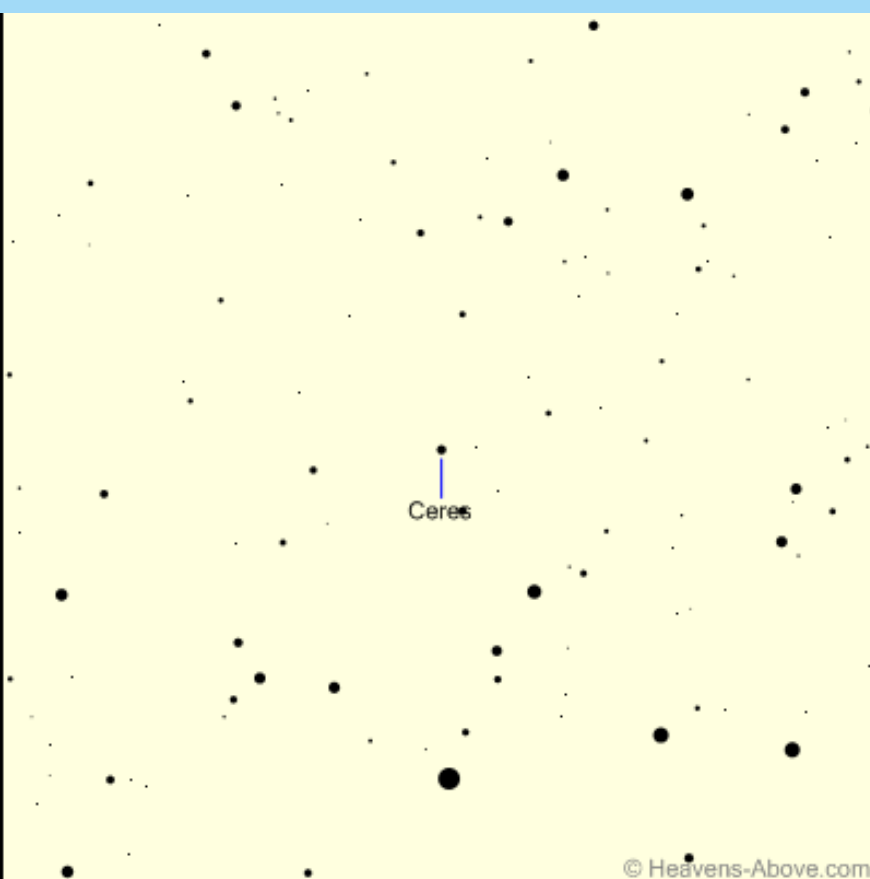
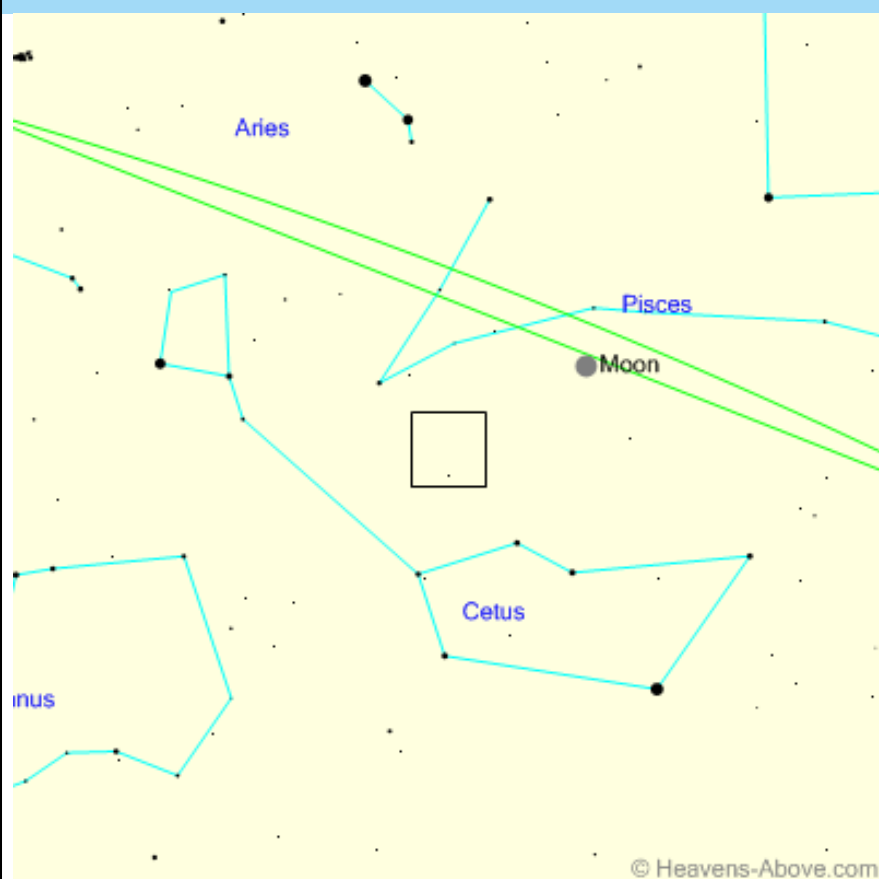
There's no time for you to get up to speed on all this software and still spot it on November 3, so I am including the charts for Ceres here in the Event Horizon. We will go over how to generate your choice of chart, at my talk in November.



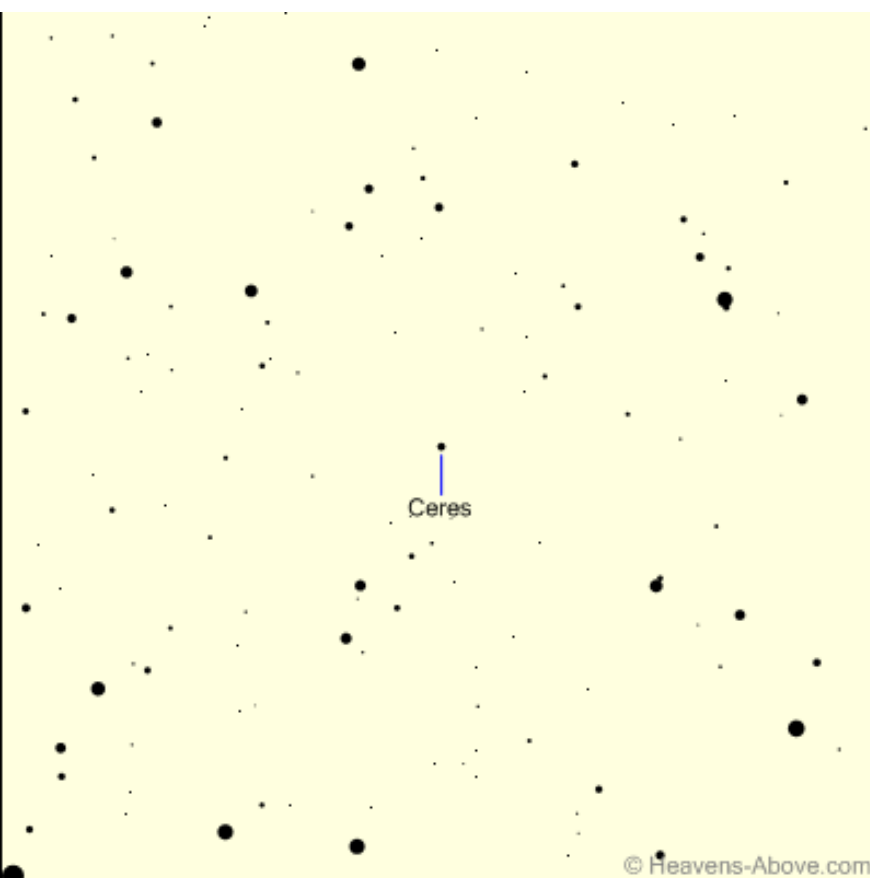
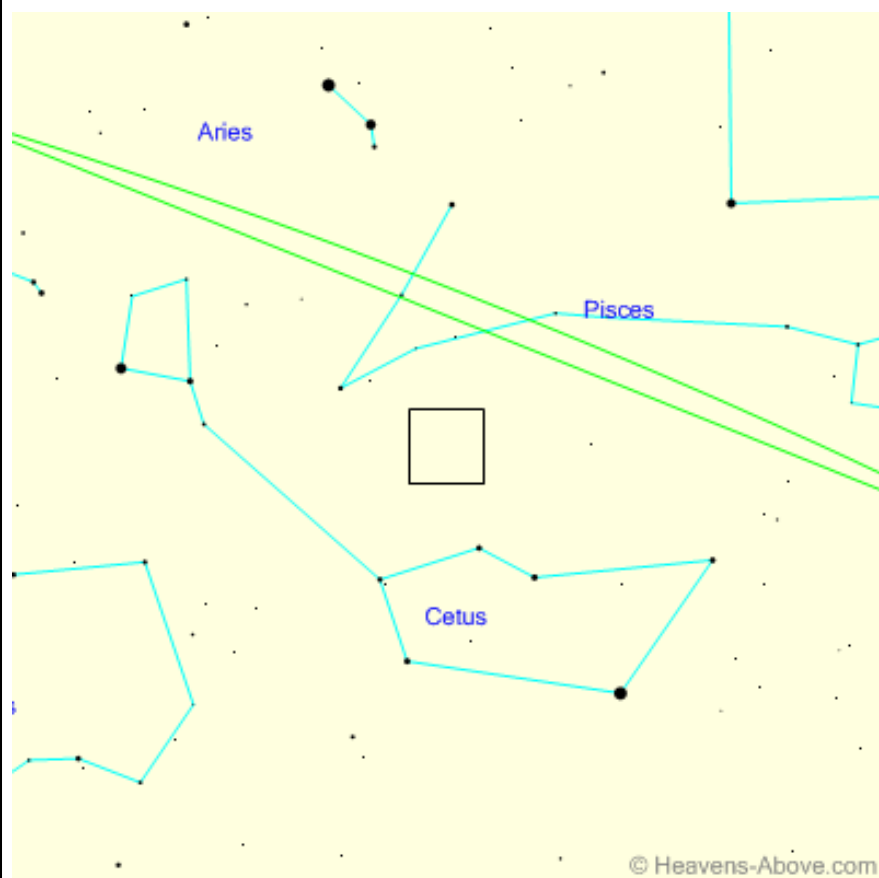
Asteroid 1 Ceres --- November 3, 2016

(Continued on [page 7](#))

The Sky This Month (continued)



Asteroid 1 Ceres --- November 12, 2016



Asteroid 1 Ceres --- November 30, 2016

*For all 3 chart pairs, coarse finder chart field of view=60°, limiting magnitude=5;
fine finder chart field of view=5°, limiting magnitude=10.*

You can see from the above charts that Ceres moves pretty far in a few days. From the 3 pairs of charts included, Ceres moves approximately the width of the chart, starts that were at the lower right edge, being at lower left at the end of the month, while of course the chart view remains centered on Ceres.

(Continued on [page 8](#))

The Sky This Month (continued)

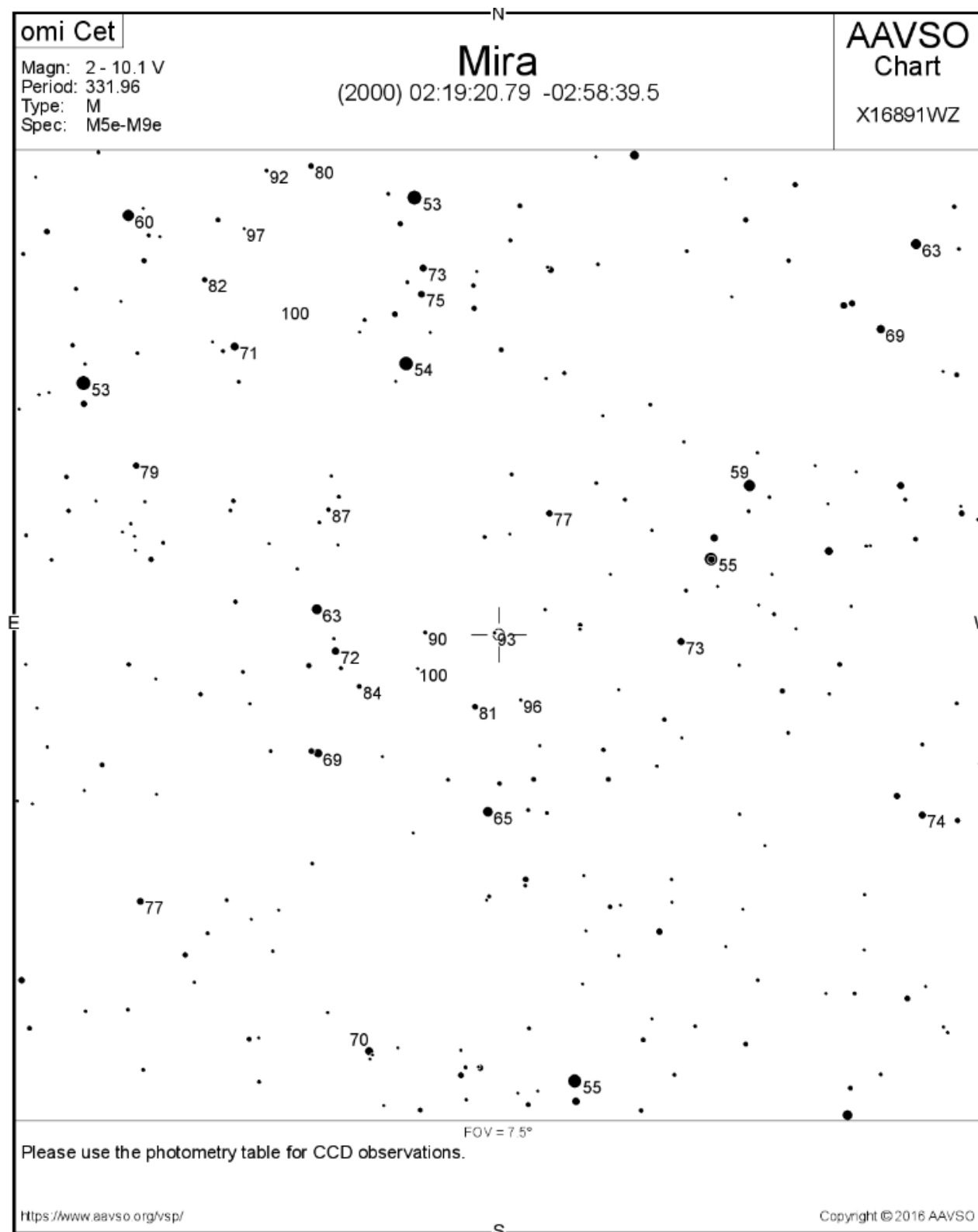
If you are looking for a slightly more challenging object, you can find **4-Vesta** with this link. It's also a binocular object between Leo and Gemini making it a morning object.

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

Make your own charts with this link, which allows you to enter the time of your observing and it will be super-accurate.

<http://heavens-above.com/MinorPlanet.aspx?desig=1&>

If you have a telescope or, as we all do, as members of this club, you know somebody with a telescope, then I would like to tell you about an interesting thing which can be found in the November sky between 8 pm and midnight.



The long period variable, **Mira**, will be very well placed for a peek in November. Conveniently, it's not far from Ceres, and can be seen on the same finder chart just below the head of Cetus. However, you won't see it in the sky without binoculars, and here's the chart that shows exactly where to find it. At magnitude 6, it will be brighter than the 9.3 magnitude star beside it.

It's actually pretty hard to star hop to Mira. The best way I could imagine doing it is to locate mag 3.8 Alpha Piceses and mag 4 Delta Ceti, which is the star on the main Ceres finder chart just below the head of Cetus. Mira is south of the line joining those 2 stars, almost on the perpendicular bisector of it, but more like 60 percent of the way towards Delta Ceti and about the same distance below the line as Delta is from the east end of that line.

(Continued on [page 9](#))

The Sky This Month (continued)

The stars on the AAVSO chart labelled 54 55 and 59 form a tall thin triangle easily visible in binoculars, that can be recognized and used to zero in on Mira which will be pretty bright by now and slightly below the triangle.

Once you know how to find Mira, I suggest you check up on it every few weeks until it nears its peak brightness, at the end of January, and see how the ancients would have wondered about it. If you have a goto scope, you will be able to enter 'Mira' and it will do all the work for you.

Mira is a variable star with a large magnitude range, and it is in a double star system. It gets dimmer and redder, then brighter and less red, over 332 days. It's best to start observing it when it's slowly increasing in brightness. It will reach its peak on January 31. By then it should be visible without binoculars, between second and third magnitude, actually brighter than the 2 stars I suggested you use to help find it.... but right now it's a challenge object at more like 6th magnitude. Not invisible even in binoculars now, but still you need to know where to look.

Mira is 420 light years away, and on average, very bright as stars go. 15000 times brighter than our sun and 500 times its diameter.

The safe distance for a planet to orbit Mira now would be twice the size of Pluto's orbit, but Mira will not stay this way for long.

Within a million years it will have turned into a fading white dwarf, but it is in a double star system and its companion star will shine on. The companion is currently capturing dust from Mira into orbit around it, and will accumulate about 3 Jupiter masses eventually, into a disk and will possibly form its own rocky planets someday.

We are fortunate that the Moon is so varied and interesting, and that it moves in its stately orbit always facing us with the same side, so that we can study the same features under a continuum of solar angles. The moon also provides a handy pointer to other objects that would be harder to find without its help. This month, you can sometimes 'use' the moon to find planets in the daytime, especially when it passes near Venus.

But for your best dinner conversation item, the Full Moon this month is the largest full moon for 2016. On the evening of November 13th, it will be as large as you will see it this year. It will reach its peak size at 8.52 AM on November 14th, 90 minutes before it sets. This time of the year, the full Moon is actually up more than 12 hours.

Here's a handy link for that sort of thing:

<http://www.timeanddate.com/moon/canada/hamilton>

The full Moon is also the best time to peer around the corners at the far side. Whichever libration we happen to have, will be illuminated. This month, check out the northern edge of the Moon on November 17th. You will be seeing 6.5 degrees of the 'far side' on the 17th, still well lit up by the sun.

I hope I have given you much more than a glimpse of the wonders in the sky, and that it will motivate you to get you under the stars this month for some sights which will help sustain what is for many of the members, and can also be for you, a lifelong hobby: astronomical observing for the appreciation of beauty, wonder, and learning.



In the Shadow of the Moon; an occultation story by John Gauvreau

On the night of October 18th, or really the morning of October 19th, the Moon occulted the bright star Aldebaran. An occultation is simply when one celestial object passes in front of and obscures a second, more distant, celestial object. Every time you're trying to watch an important TV show and somebody stands in front of the TV and blocks it, they are occulting the TV. At this time of year with Halloween just past, we think of a different kind of occult, but the word has the same root. To 'occult' is to hide or obscure something, whether it is a star or a meaning or the truth. We can see that if the Moon occults the Sun, we experience a solar eclipse. So why do we call them eclipses instead of occultations? Well, an eclipse is when an object passes between the sun and another object, this casting a shadow. The moon might cast a shadow on the Earth during a solar eclipse, or the Earth might cast a shadow on the Moon during a lunar eclipse. An occultation is any celestial object obscuring another, so all eclipses are occultations, but not all occultations are eclipses.

If you have observed the Moon through your telescope frequently at all, you have probably noticed the occasional star in the field of view with the Moon. As the Moon travels in its orbit around the Earth, you can actually notice it change position over the course of a single observing session. It might even creep closer to one of those stars or even pass in front of it. Ta-da! An occultation! These happen quite often and aren't hard to catch, even by chance. On the night of the 18/19 of October I wanted to see one of these, but a specific one. Aldebaran is not only the brightest star in the constellation Taurus, but one of the brightest stars in the sky. This should be a spectacular occultation!

Aldebaran isn't the only bright star that gets occulted by the moon. The Moon's orbital path as seen from Earth carries it in front of Antares in Scorpius, Regulus in Leo and Spica in Virgo. But not all bright stars can be occulted from our view; Rigel, Betelgeuse, Vega, Deneb and many others are all in parts of the sky that the Moon never travels too. So although there is no point in waiting to see the Moon pass through Orion or the Summer Triangle, the ones that do get occulted, like Aldebaran, do so quite frequently.

Aldebaran occultations occur in groups that last many years. The current cycle will last until September of 2018, so you have more opportunities to see this sight. The next one will occur just a couple of minutes after 11pm on the night of December 12th. The Moon will be nearly full and Aldebaran will disappear behind the barely distinguishable dark side. An hour and a quarter later, at 17 minutes past midnight, Aldebaran will reappear on the opposite side of the Moon. A telescope is wonderful for these events, but not at all necessary. Binoculars will show the event quite well and even a view with the unaided eye can be fun. How close can the Moon and the star get and still be visible as separate objects in the sky?

The night of October 18 was our club's council meeting, and after I got home from the meeting I went outside to observe the occultation of Aldebaran. It was an exceptionally clear and steady sky, and if it weren't for the gibbous moon it would have been wonderful for some deep sky. However, I kept the scope on the moon (well, mostly) as it crept up on Aldebaran. I was using my 130mm refractor on a simple alt-azimuth mount. No fancy tracking or go-to necessary to find and follow the Moon! The star showed a very clear and bright colour, especially as the nearly monochromatic limb of the moon got close. Just before ingress the star appeared sharp and bright and seemed to hover just on the lunar limb, and as I was thinking that it was so close it must be touching, it suddenly blinked out! The moment of occultation was sharply defined. Quite a sight! I also found it interesting how bright the star appeared when close the lunar limb. The Moon is large in the sky and has is very bright overall, but the star clearly has a brighter surface brightness. There was no problem picking it out even when right next to the dazzlingly bright lunar surface. I thought the proximity of the moon might obscure the nearby star, and to the naked eye it nearly did, but through the scope the star remained bright and colourful right to the very end.

(Continued on [page 11](#))

In the Shadow of the Moon; an occultation story (continued)

I chose to observe the occultation rather than photograph it. Let's face it, photographically a point of light next to the moon is less than spectacular, but the event itself in real time through the scope was wonderful. Nevertheless, here is an image of the moon taken through the 130mm refractor that I took when there was still plenty of time leading up to the occultation. After I took this photo, I put the camera away and just observed. In the picture you can see Aldebaran sitting to the upper left.

During the course of the night I spent some time at high magnification on the moon (around 400x) but the best views seemed to be around 250x. After Aldebaran disappeared (no, I did not stay up to see it reappear!) I took in the Orion Nebula, but between the city lights and the large moon it was not the best view I've had of it. Not bad at all, but not the best. No problem picking out the E and F stars in the Trapezium though, so that was nice.

All in all a very lovely night under the stars, or at least all those that were left after Aldebaran disappeared. Don't miss the next one!



Image credit: John Gauvreau --- The Moon and Aldebaran on October 18-19, 2016.



Schrödinger's Cat - Wanted: Dead and Alive The Double Slit Experiment and the Multiverse (Part II or III)

Recap and Introduction

As a quick reminder, Part I of this article discussed the various sophistication levels of the double slit experiment where wave interference patterns are observed but not when we attempt to detect which slit they travel through. The Copenhagen Interpretation that tells us that observation causes the wave-function collapse resulting in a transition to a particle. Here in Part II, we will discuss the Big Bang, Inflation, Eternal Inflation as well as the Level I and Level II Multiverses. The significance of the double slit experiment will become clear in Part III when we touch on Quantum Field Theory and give reality a shake up with the Level 3 Multiverse and the “Many Worlds” interpretation.

Big Bang - Inflation

After Einstein's 1915 paper on General Relativity he realized that a “static” universe would not obey his equations and so in what he called his greatest blunder he added a constant. In 1922 Russian physicist Alexander Friedmann realized that the normal state of a Universe is not static but either contracting or expanding and thus the Big Bang concept was born (but ignored). In 1927 Belgian priest and astrophysicist George Lemaître independently rediscovered and published Friedmann's Big Bang solution also to be ignored until Edwin Hubble established the existence of galaxies and their movement away from us.

Evidence for the Big Bang includes: Hubble's discovery of galaxies moving away from us, Big Bang nucleosynthesis (prediction of initial concentration of hydrogen, helium and lithium) and the discovery of the cosmic microwave background (CMB). It was discovered that the temperature the CMB was close to absolute zero and very homogenous. To account for this homogeneity (the Horizon Problem) in 1981 Alan Guth proposed his famous inflation theory.

Although our Universe may be infinite in size (in which case it was always infinite), in what we call the beginning of time, at least our observable Universe was scaled down to a very small bit of space. All the stuff that would eventually make up our observable Universe, as we know it, was compressed into this tiny volume of space. But, in about 10-35 seconds it stretched (inflated) in size 10²⁶ times to about the size of an orange but weighing 10⁸¹ times more. It then continued to expand with a decelerating expansion rate until about 5 billion years ago when dark energy began to dominate over the force of gravity and the expansion rate began to accelerate.

(Hot off the press! The discovery of the accelerated expansion of our Universe using analysis of Type 1A supernovae led to Nobel Prize in 2011. But, a new study by Sakar et al published in Nature Oct 21, 2016 was based on a larger dataset and a more sophisticated statistical analysis. The Sakar team discovered only marginal evidence of an accelerated expansion rate. It appears the expansion rate may be constant and this makes it feasible that dark energy does not exist. A 10 to 15 year study is planned when the European Extremely Large Telescope makes observations with an ultrasensitive ‘laser comb’ to determine whether the expansion rate is accelerating or not.)

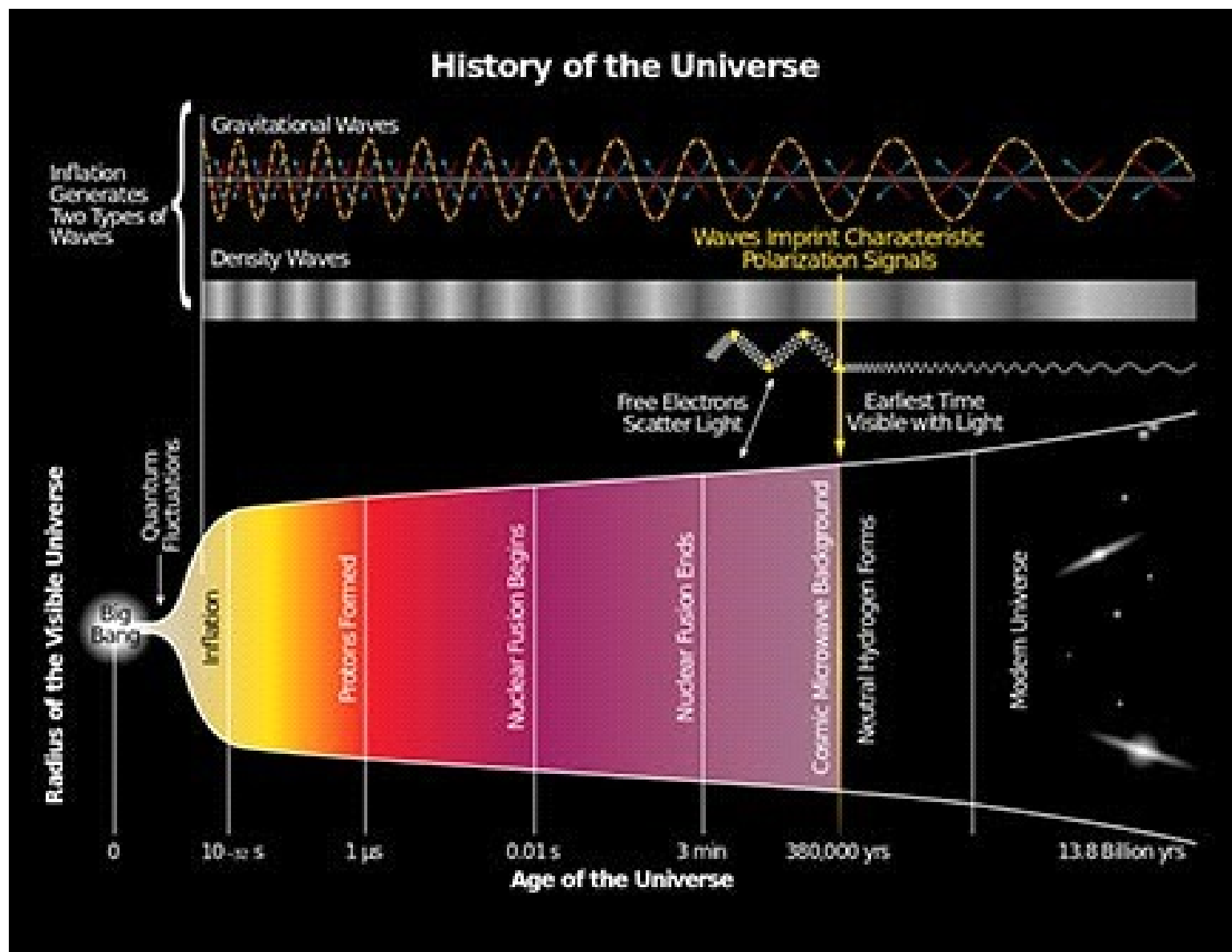
One of the many amazing wonders of our Universe is that the formation of stars, planets and galaxies was caused by very slight fluctuations of energy in the quantum fields at the time of the Big Bang. In empty space, the energy level of the quantum fields hovers around zero. The very slight energy fluctuations blew up during the inflation process and as our Universe continued to expand. The very slight temperature variances in the temperature of the CMB (as measured by WMAP and more recently the Planck

(Continued on [page 13](#))

Wanted --- Dead and Alive Part II (continued)

probe) are a direct result of these original energy fluctuations. The CMB temperature variances map nearly perfectly to the current structure of our current observable Universe.

The warmer higher energy areas had slightly more gravitational force and acted as seed areas for the accumulation of baryonic matter. As the matter accumulated, the effect of gravity became more pronounced until nuclear fusion occurred and stars were born. Stars exploding in supernovae collapsed into black holes, which became major gravitational attractors for the formation of galaxies. (Though, some giant primordial black holes may have formed without star formation). The higher-level elements forged in the nuclear fusion process and during supernovae explosion provided the building material for asteroids, planets and people.



Eternal Inflation

In his book: *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality*, Max Tegmark discusses that it is not correct to claim that inflation happened “after” the Big Bang and that it marks the beginning of time. We really do not know if time has a beginning and “the early stages of inflation were neither strikingly hot nor big nor much of a bang”. Tegmark mentioned that Andrei Linde (early significant contributor to inflation models) coined the term eternal inflation when he discovered that his simplest inflation model inflated eternally. A large class of inflation models has been analyzed and almost all lead to eternal inflation. According to Tegmark “our Big Bang wasn’t the ultimate beginning, but rather the end—of inflation in our part of space”. Of course, this would lead one to think that inflation

(Continued on [page 14](#))

Wanted --- Dead and Alive Part II (continued)

would end in other parts of space as well. More details to follow when we discuss the Level II multiverse, but first Level I.

Level I Multiverse

There are many different descriptions or classifications of possible types of universes. I will use the levels described Max Tegmark book. I like the simple logic behind his classifications. Tegmark defines Physical Reality as “everything that exists” and our Universe as “the part of physical reality we can in principle observe”. This would be the region of space within our particle horizon (~93 billion light years across) that “contains about 1011 galaxies, 1023 stars, 1080 protons and 1089 photons”.

(Hot off the Press! A new deep sky analysis using the Hubble Telescope and other observatories discovered that there are at least 10X more galaxies in the observable universe than previously thought. Most of these are small and faint, similar to the size of the satellite galaxies surrounding the Milky Way - NASA.)

What is beyond our Universe? Likely more universes, but its light or other information has not been able to reach us. Beyond that universe, another and another and if inflation made our space infinite then there are infinitely many Level I multiverses. Tegmark speculates that since these universes share our history, they are similar (same physical laws) but vary slightly due to randomness of the quantum fluctuations that seed the structure of universes. If truly infinite, eventually the initial conditions for our Universe would repeat and this repetition would occur an infinite number of times and thus there is an infinite number of planet “Earths”.

Level II Multiverse



If eternal inflation stops in one particular area and fills a volume of space, there is no reason why it can't do this again and again. Between these volumes of space where inflation has stopped, inflation is still occurring. The inflation effectively keeps creating intervening space between the volumes of non-inflating space, thus the degree of separation between the Level II multiverses is much greater than that for Level I. Tegmark speculates that fundamental physical laws remain the same but there are “effective” laws that vary locally in the separated Level II universes that correspond to different constants. This facilitates explanation for “fine tuning” often cited in discussions relating to the anthropic principle (we

(Continued on [page 15](#))

Wanted --- Dead and Alive Part II (continued)

find ourselves in a universe supporting life because we live and we can observe it).

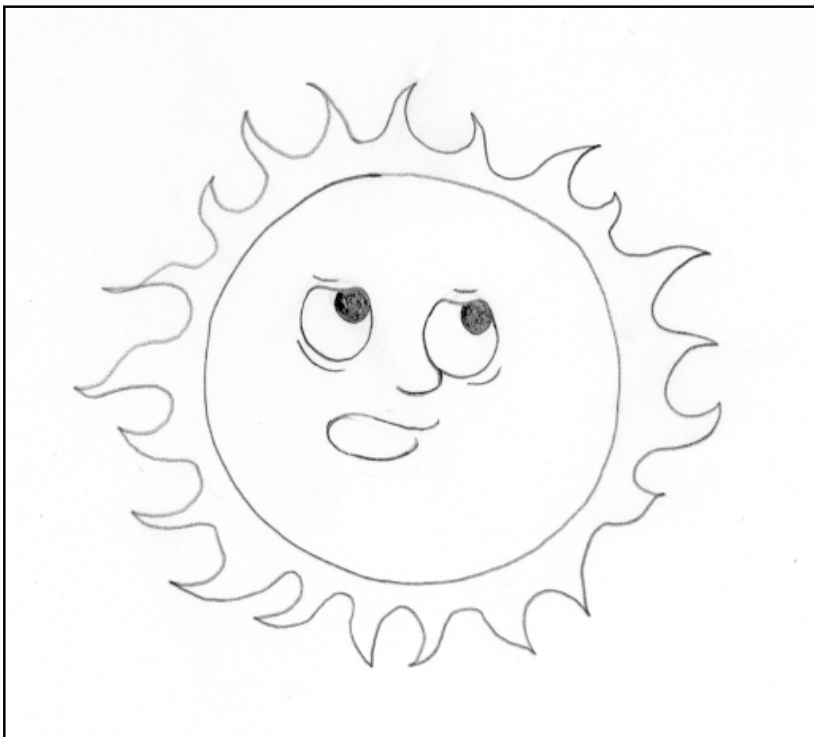
It seems counterintuitive with Level I & II Multiverses that there can exist many infinite volumes of space but General Relativity allows this. Tegmark's explanation was somewhat obscure. I found a slightly better explanation from a like-minded blogger that was based on Brian Green's book "The Hidden Reality". It is not straight forward, and since I have not yet read Green's explanation I am still quite fuzzy on it. So, I will skip it except to indicate that the bubble universes grow into inflationary space, and mathematically it is related to relativity of both time and simultaneity (whether two events happen at the same time or not depends on observer's frame of reference).

Tegmark points out that there has been a dramatic shift in the scientific community where previously the concept of multiverses was assigned "lunatic-fringe status". Now they are openly discussed in conferences and in peer-reviewed papers. The existence of multiverses is no longer an imagined concept but is an inevitable prediction of credible theories.

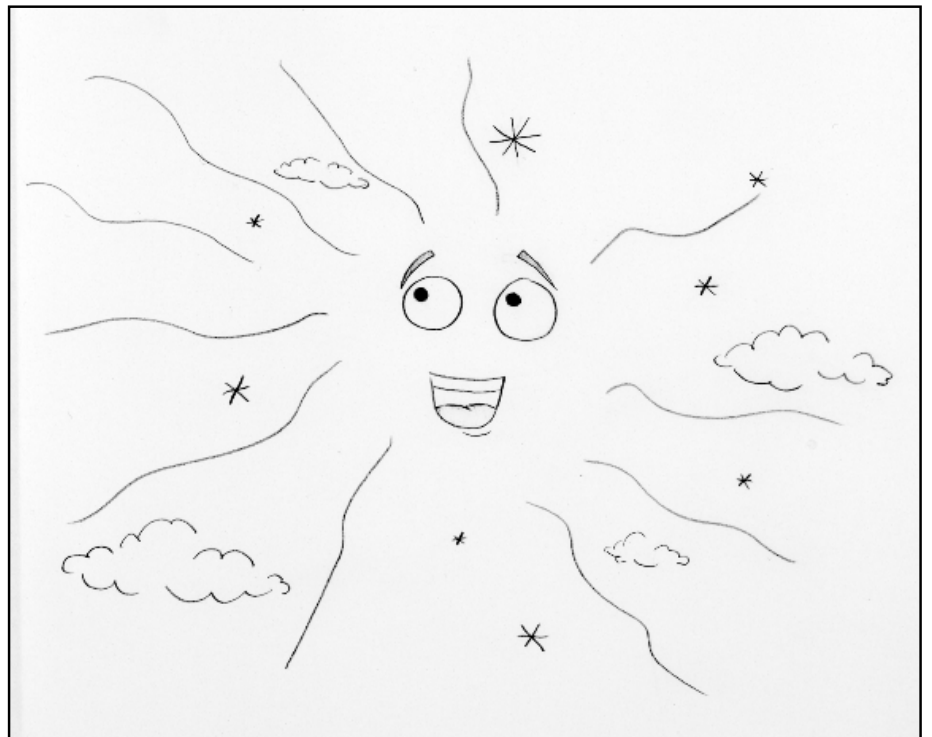
To be continued.....



Cartoon Corner by Alexandra Tekatch



**"I had an OK November.
How about you?"**



"I had a SUPER NOVA-mber!"



Is Proxima Centauri's 'Earth-like' planet actually like Earth at all?

by Ethan Siegel

Just 25 years ago, scientists didn't know if any stars—other than our own sun, of course—had planets orbiting around them. Yet they knew with certainty that gravity from massive planets caused the sun to move around our solar system's center of mass. Therefore, they reasoned that other stars would have periodic changes to their motions if they, too, had planets.

This change in motion first led to the detection of planets around pulsars in 1991, thanks to the change in pulsar timing it caused. Then, finally, in 1995 the first exoplanet around a normal star, 51 Pegasi b, was discovered via the “stellar wobble” of its parent star. Since that time, over 3000 exoplanets have been confirmed, most of which were first discovered by NASA's Kepler mission using the transit method. These transits only work if a solar system is fortuitously aligned to our perspective; nevertheless, we now know that planets—even rocky planets at the right distance for liquid water on their surface—are quite common in the Milky Way.

On August 24, 2016, scientists announced that the stellar wobble of Proxima Centauri, the closest star to our sun, indicated the existence of an exoplanet. At just 4.24 light years away, this planet orbits its red dwarf star in just 11 days, with a lower limit to its mass of just 1.3 Earths. If verified, this would bring the number of Earth-like planets found in their star's habitable zones up to 22, with 'Proxima b' being the closest one. Just based on what we've seen so far, if this planet is real and has 130 percent the mass of Earth, we can already infer the following:

- It receives 70 percent of the sunlight incident on Earth, giving it the right temperature for liquid water on its surface, assuming an Earth-like atmosphere.
- It should have a radius approximately 10 percent larger than our own planet's, assuming it is made of similar elements.
- It is plausible that the planet would be tidally locked to its star, implying a permanent 'light side' and a permanent 'dark side'.
- And if so, then seasons on this world are determined by the orbit's ellipticity, not by axial tilt.

Yet the unknowns are tremendous. Proxima Centauri emits considerably less ultraviolet light than a star like the sun; can life begin without that? Solar flares and winds are much greater around this world; have they stripped away the atmosphere entirely? Is the far side permanently frozen, or do winds allow possible life there? Is the near side baked and barren, leaving only the 'ring' at the edge potentially habitable?

(Continued on [page 17](#))

NASA's Space Place (continued)

Proxima b is a vastly different world from Earth, and could range anywhere from actually inhabited to completely unsuitable for any form of life. As 30m-class telescopes and the next generation of space observatories come online, we just may find out!

Looking to teach kids about exoplanet discovery? NASA Space Place explains stellar wobble and how this phenomenon can help scientists find exoplanets:

<http://spaceplace.nasa.gov/barycenter/en/>



An artist's conception of the exoplanet Kepler-452b (R), a possible candidate for Earth 2.0, as compared with Earth (L). Image credit: NASA/Ames/JPL-Caltech/T. Pyle.

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!





2015-2016 Financial Statements by Steve Germann

CASH FLOW

Income	31-Oct 2016	31-Oct 2015
Memberships	\$3,131.00	\$2,775.00
HAA Calendars	\$3,275.00	\$2,875.00
RASC Handbooks	\$0.00	\$0.00
Clothing Sales	\$0.00	\$0.00
50/50	\$503.00	\$594.00
Coffee Fund	\$0.00	\$0.00
Advertising Revenue	\$100.00	\$0.00
Cash Donations	\$50.00	\$45.00
Messier Marathon	\$0.00	\$0.00
Banquet Revenue	\$0.00	\$0.00
Miscellaneous	\$0.00	\$0.00
Prepaid Postage	\$0.00	\$0.00
Total Income	\$7,059.00	\$6,289.00
 Expenses	 31-Oct 2016	 31-Oct 2015
Insurance	\$854.28	\$829.44
EH Newsletter	\$0.00	\$0.00
Brochures/Promotion	\$1,045.29	\$712.44
HAA Calendars	\$2,182.59	\$2,118.75
RASC Handbooks	\$0.00	\$0.00
Clothing Sales	\$0.00	\$0.00
Donations Outgoing	\$918.00	\$918.00
Depreciation Expense	\$596.32	\$632.34
PO Box Rental	\$176.28	\$169.50
Speakers Allowance	\$267.25	\$126.27
Office Supplies	\$28.52	\$0.00
Postage	\$0.00	\$20.00
Banquet Costs	\$0.00	\$0.00
Kids Outreach Kit	\$0.00	\$0.00
Hall Rental	\$1,130.00	\$1,130.00
Prepaid Hall Rental	\$1,130.00	\$1,130.00
Miscellaneous	\$206.82	\$168.00
Equipment Repairs	\$0.00	\$6.21
Total Expenses	\$7,405.35	\$6,830.95
 Surplus/Deficit	 -\$346.35	 -\$541.95

*

* **not counted in total expenses for the year**

(Continued on [page 19](#))

2015-2016 Financial Statements (continued)

HAMILTON AMATEUR ASTRONOMERS ACCOUNTS

Assets	31-Oct 2016	31-Oct 2015
Bank	\$5,879.62	\$5,743.81
Cash	\$0.00	\$0.00
Inventory	\$0.00	\$0.00
Prepaid PO Box Rental	\$176.28	\$176.28
Prepaid Mailing Expense	\$0.00	\$0.00
Prepaid Liability Insurance	\$0.00	\$0.00
Prepaid Hall Rental	\$1,130.00	\$1,130.00
Accounts Receivable	\$0.00	\$0.00
Prepaid Banquet Expenses	\$0.00	\$0.00
Prepaid Calendars	\$2,251.25	\$2,182.59
Total Current Assets	\$9,437.15	\$9,232.68
Fixed Assets		
Equipment	\$2,630.04	\$2,736.87
Total Fixed Assets	\$2,630.04	\$2,736.87
Total Assets	\$12,067.19	\$11,969.55
Liabilities	31-Oct 2016	31-Oct 2015
Deferred Membership Revenue	\$1,460.00	\$1,336.00
Banquet Tickets sold	\$0.00	\$0.00
Accounts Payable	\$0.00	\$0.00
Total Liabilities	\$1,460.00	\$1,336.00
Equity		
Opening Balance	\$10,633.54	\$10,780.49
Adjustments	\$0.00	-\$5.00
Donated Equipment (Book Value)	\$320.00	\$400.00
Current Year	-\$346.35	-\$541.95
Closing Balance	\$10,607.19	\$10,633.54
Total Liabilities and Equity	\$12,067.19	\$11,969.54

(Continued on [page 20](#))

2015-2016 Financial Statements (continued)

REVENUE & DEPRECIATION TABLE

HAA 2016 Revenue (Net)	31-Oct 2016	31-Oct 2015
Membership	\$2,875.00	\$2,775.00
Calendars	\$1,156.25	\$756.25
Cash Donations	\$50.00	\$45.00
50/50 Draw	\$503.00	\$594.00
Planetarium Trip	\$0.00	\$0.00
Donations in Kind	\$320.00	\$400.00
Intangible Donations	\$0.00	\$0.00
Banquet	\$0.00	\$0.00
Net Revenue	\$4,904.25	\$4,570.25
Food Bank Estimate	\$2,000.00	\$2,000.00
Depreciation Table	31-Oct 2016	31-Oct 2015
Opening Balance	\$2,736.87	\$2,954.21
Depreciation Full Year	\$547.37	\$590.84
Donated Equipment	\$320.00	\$400.00
Additions	\$169.50	\$35.00
Sales	\$0.00	\$20.00
Net	\$489.50	\$415.00
Depreciation Part Year	\$48.95	\$41.50
Total Depreciation	\$596.32	\$632.34
Closing Balance	\$2,630.04	\$2,736.87



October 2016 Treasurer's Report by Steve Germann

Treasurer's report for October 2016 (Unaudited)

Opening balance:	\$8,968.02
Revenue:	\$536.00
Expenses:	\$3,714.64
Closing Balance:	\$5,879.38

Revenue included Memberships \$550; 50/50 \$26; and cash donations \$50.
We also received a donation-in-kind of a telescope, valued at \$320.

Expenses were Prepaid Calendars \$2,251.25; Prepaid Hall Rental \$1,130; the club's SkyStopper, \$169.50; and web hosting for 2016 until now, \$209.15.



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:
 - **Nov 2: Introductory Astronomy for Kids (1st Wed of every month)**
 - **Nov 9: Cosmic Corpses: Nebulae, Neutron Stars and Black Holes**
 - **Nov 16: Rust and Stardust: the lives of the stars and the origin of the elements**
 - **Nov 23: The Celestial Bear: The Six Nations' Night Sky**
 - **Nov 30: The Great Debate: Galaxies and Their Place in the Universe**
- For more details, visit
www.physics.mcmaster.ca/planetarium

UPCOMING EVENTS

November 11, 2016 - 7:30 pm — *HAA Meeting* at the Hamilton Spectator Auditorium. Our main speaker will be **Brian Dernes** of K.W. Telescope-Perceptor.

November 19, 2016 - 1:00 pm - 4:00 pm — *Fall Telescope Clinic* at the Hamilton Spectator Auditorium.

Many types of telescopes will be on display, and experts will be on hand to answer questions. You can also bring your own telescope and get tips and pointers about its use. Whether you have a telescope, are thinking of getting one, looking for advice on a unique Christmas gift, or just want to learn more about exploring our amazing universe.

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	To be confirmed by the new council

Check out the Hamilton Amateur Astronomers
Website

www.amateurastronomy.org

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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 outdoor 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

