

# Orbit



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# Issue Number 1, November, 2018

## Roger Hill, Editor

This time next year, I'm hoping that there will be another name on the masthead of Orbit, a new design perhaps, and a new focus. I've decided that this coming year will be my last as Orbit Editor.

Why? Well, for the most part, Orbit is something I enjoy doing, but the last three issues, or so, have been really tough sledding, with just a sense of relief at having finished it. And when I realized a couple of days ago (last week, as you're reading this) that I'd be putting another one together in the coming few days, and it felt more like a chore, then I realized that the time has come for someone else to sit in front of a dozen blank pages and put their stamp on the Centre.

I also had a look at the things I've committed to doing for the Centre, and I think that a number of them are things I'd rather be doing.

Orbit takes a number of hours to put together. Sometimes, the words just flow from my fingers, and I'm essentially finished in a single evening, but not always, and not recently. I look after the Forum, too, and I put together the Heavy METUL nights. The latter means that I'm the de facto Observing Director. I'm also on the Board, and I'd like to do some actual astronomy...my telescope has forgotten what it's like to gather starlight for my eyeball!

I'll also be giving a talk on the wonders and pitfalls of astrophotography to the Grimsby Photography club at the end of November. It's a one hour talk about how difficult it is to take images of things in the night sky, and while I have a good idea of what I want to talk about, it's not written yet.

Anyway, something has to give, and that something is Orbit.

So, if there's anyone out there who'd like to take over for Volume 52, they should let the Board know. I've committed myself to do Orbit for this year, and I will.

We had our first Board meeting in October, and I must admit, I really enjoyed it. What was great was that it was NOT composed of the same old, grey-haired men. There is a wonderful diversity about this year's Board, and it's not just the presence of two women. It is also that this year's Board is, on average, younger than it has been for a while.

Add in that Mark Smith and Gavin Hill, two regular members, made it out to the meeting, also gave the meeting a wonderful breath of fresh air.

Perhaps it was that invigorating freshness that prompted me to think that since I am the de facto Observing Director, I may as well take the title and start organizing that extra monthly meeting you'll hear about further inside Orbit.

I should also thank Gavin for organizing the Fall Observatory clean-up. I haven't had a chance to visit the site since the work was done, but I hear that the place looks great!

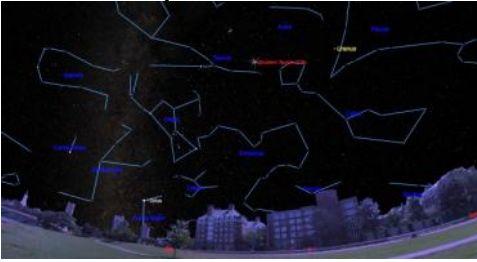
What was also great was the group of people that Gavin was able to muster...again, a number of people whose names were unfamiliar to me. And that bodes well for the future of the Centre.

That's enough for this month, I think.

See you in the dark,

Roger

# What's up in the November Sky from Troy McCoy



**Monday, November 5 midnight to dawn - Southern Taurids Meteor Shower Peaks** This shower offers up to 5 meteors per hour, often produces colourful fireballs. An old crescent Moon should leave the sky dark enough for meteor watching with the best viewing at 1 a.m. local time, when the shower's radiant in western Taurus, is high in the southern sky.

**Tuesday, November 6 pre-dawn - Old Moon meets Venus** Visible low in the east-southeastern sky before dawn on Tuesday, November 6, the old crescent moon will appear 8.5 degrees (or a generous palm's width) to the left of the very bright planet Venus. Viewed in a telescope, Venus will exhibit the same illuminated phase as the moon.

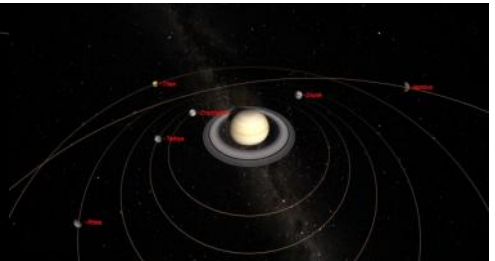
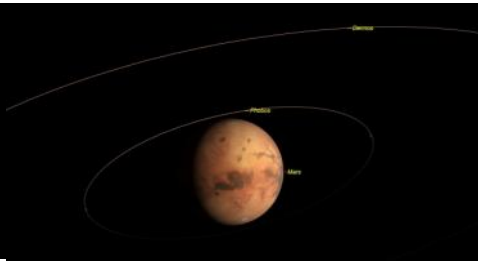
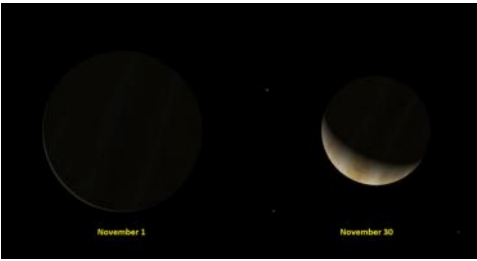
**Tuesday, November 6 after sunset - Mercury at Greatest Eastern Elongation** Mercury will be 23 degrees from the Sun, its widest separation from the Sun for this evening appearance. Telescopically, the planet will be a waning disk, 63% illuminated. The elusive planet will set less than hour after sunset. The best time to look will be between 5:15 and 5:45 p.m.



**Friday, November 9 after sunset - Mercury and Young Moon over Antares** A young crescent moon will appear 6.5 degrees (about a palm's width) above Mercury, which will shine with a visual magnitude of -0.22. Mercury, in turn, will be situated less than two degrees above Antares. Mercury will set shortly before 8 p.m. local time.

**Monday, November 12 midnight to dawn - Northern Taurids Meteor Shower Peaks** This weak shower offers only 5 meteors per hour at peak, is derived from debris dropped by the passage of Comet 2P/Encke. With a young moon setting in early evening, the sky will be ideal for meteors. With the best viewing time around 1 a.m. local time.

**Monday, November 12 early evening - Moon near Pluto and Vesta** In the southwestern sky the waxing crescent moon will be near Vesta and Pluto. Vesta, visible in binoculars, will be less than 3 degrees to the lower left of the moon. The moon will pass in front of Pluto at about 19:00 UT, but will not be visible in Hamilton because the Sun not have set.



**Venus**, which passed solar conjunction in late October, will re-appear in the eastern pre-dawn sky among the stars of Virgo during November. The planet will spend the month swinging farther from the sun while waxing in illuminated phase and shrinking in apparent disk size. Meanwhile, its visual magnitude will brighten from -4.2 to -4.9. Visible low in the east-southeastern sky before dawn on November 6, the old crescent moon will appear 8.5 degrees to the left of Venus. On November 13, Venus will stop traveling westward through the stars of Virgo and commence eastward motion. On the same date, the planet will appear only about 1 degree to the lower left of Virgo's brightest star, Spica.

**Mars** will be better positioned for viewing during November because the autumn evening ecliptic has lifted it higher. On November 11, the red planet's eastward orbital motion will take it out of Capricorn and into Aquarius. During the month, as Earth pulls away from the Red Planet, Mars will remain a bright reddish naked-eye object, but its visual brightness will diminish from magnitude -0.6 to 0.0. Meanwhile, the planet's apparent disk diameter will decrease from 11.8 arc-seconds to 9.3 arc-seconds. On November 15, the waxing, slightly gibbous moon will land 3 degrees to the lower right of Mars.

**Saturn** will be easily observable in the pre-dawn sky during April, appearing as a yellowish, visual magnitude 0.5 object located above the Teapot asterism of Sagittarius and within 4 degrees of the Messier objects 22, 25, and 28. During the first week of the month, Mars will remain within a handful of degrees of Saturn, but the red planet's eastward orbital motion will steadily draw them apart. On April 7, the last quarter moon will form a linear grouping with Mars and Saturn. All three objects will appear within a binocular field of view. During April, Saturn will rise steadily earlier, becoming an evening object in May.

**Jupiter** will begin November in the western evening twilight, observable with difficulty at about 6:45 p.m. local time. By mid-month the planet will still be above the west-southwestern horizon at 5 p.m. local time, but very hard to see. Afterwards, Jupiter will disappear into the sun's glare, reaching conjunction on November 26.

**Uranus** (magnitude 5.7) will be very well positioned for observing with binoculars and backyard telescopes all night during November. The planet will move slowly retrograde westward among the stars of western Aries. On November 1, Uranus will sit less than 2.5 degrees to the left of the naked-eye star Omicron (o) Piscium, and close to within 1.5 degrees of that star at month end.

**Neptune** will be visible for most of the night, setting in the west in the hours after midnight. The distant planet will spend the month moving retrograde westward through the stars of central Aquarius - shifting slowly toward naked-eye Hydor (Lambda (λ) Aquarii). Hydor will be about 2 degrees to the west of Neptune all month.

Monthly Sky watching information is provided by Chris Vaughn of Starry Night Education. Chris is a member of the Toronto Centre of the RASC. Follow Starry Night on Twitter @starrynightedu and Chris at @astrogoegy

## November's Dance of the Planets By Jane Houston Jones and David Prosper



November's crisp autumn skies bring great views of our planetary neighbors. The Moon pairs up with Saturn and Mars in the evenings, and mornings feature eye-catching arrangements with dazzling Venus. Stargazers wanting a challenge can observe a notable opposition by asteroid 3 Juno on the 17<sup>th</sup> and watch for a few bright Leonid meteors.

Red **Mars** gleams high in the southern sky after sunset. **Saturn** sits westward in the constellation Sagittarius. A young crescent Moon passes near Saturn on the 10<sup>th</sup> and 11<sup>th</sup>. On the 15<sup>th</sup> a first quarter Moon skims by Mars, coming within 1 degree of the planet. The red planet receives a new visitor on November 26<sup>th</sup>, when NASA's InSight mission lands and begins its investigation of the planet's interior. News briefings and commentary will be streamed live at: [bit.ly/landsafe](http://bit.ly/landsafe)

Two bright planets hang low over the western horizon after sunset as November begins: **Jupiter** and **Mercury**. They may be hard to see, but binoculars and an unobstructed western horizon will help determined observers spot them right after sunset. Both disappear into the Sun's glare by mid-month.

Early risers are treated to brilliant **Venus** sparkling in the eastern sky before dawn, easily outshining everything except the Sun and Moon. On November 6<sup>th</sup>, find a location with clear view of the eastern horizon to spot Venus next to a thin crescent Moon, making a triangle with the bright star Spica. The following mornings watch Venus move up towards Spica, coming within two degrees of the star by the second full week of November. Venus will be up three hours before sunrise by month's end – a huge change in just weeks! Telescopic observers are treated to a large, 61" wide, yet razor-thin crescent at November's beginning, shrinking to 41" across by the end of the month as its crescent waxes.

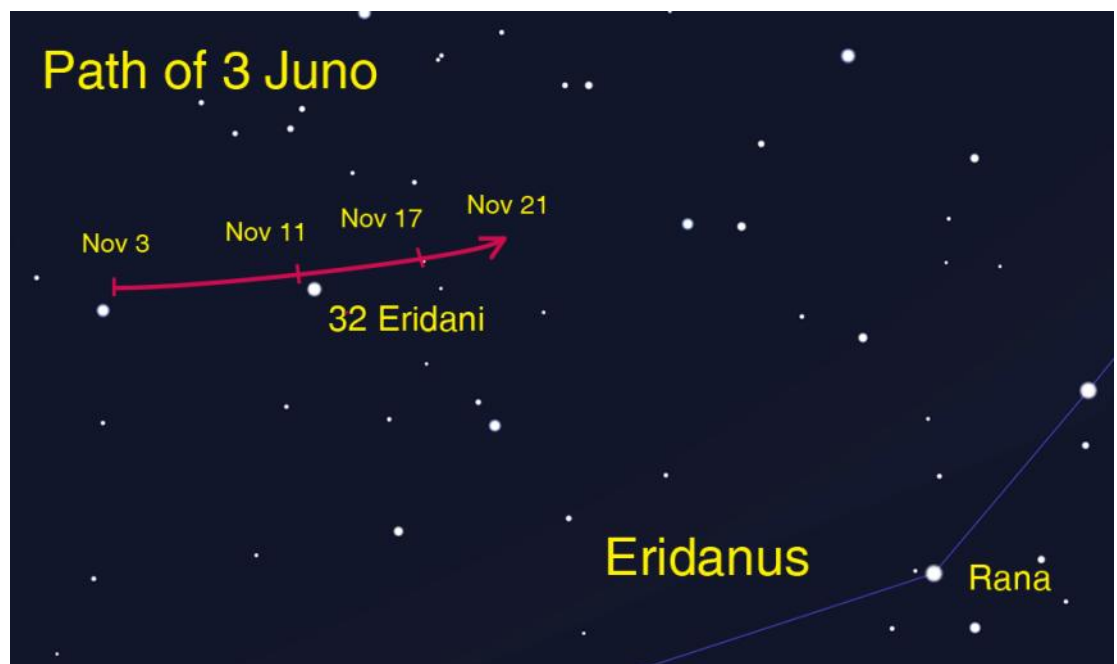
Observers looking for a challenge can hunt asteroid **3 Juno**, so named because it was the third asteroid discovered. Juno travels through the constellation Eridanus and rises in the east after sunset. On November 17<sup>th</sup>, Juno is at opposition and shines at magnitude 7.4, its brightest showing since 1983! Look for Juno near the 4.7 magnitude double star 32 Eridani in the nights leading up to opposition. It is bright enough to spot through binoculars, but still appears as a star-like point of light. If you aren't sure if you have identified Juno, try sketching or photographing its star field, then return to the same area over the next several days to spot its movement.

The **Leonids** are expected to peak on the night of the 17<sup>th</sup> through the morning of the 18<sup>th</sup>. This meteor shower has brought "meteor storms" as recently as 2002, but a storm is not expected this year. All but the brightest meteors will be drowned out by a waxing gibbous Moon.

Stay warm and enjoy this month's dance of the planets!

You can catch up on all of NASA's current and future missions at [nasa.gov](http://nasa.gov)

With articles, activities and games **NASA Space Place** encourages everyone to get excited about science and technology. Visit [space-place.nasa.gov](http://space-place.nasa.gov) to explore space and Earth science!



*Caption: This finder chart shows the path of the asteroid 3 Juno as it glides past 32 Eridani in November 2018. The asteroid's position is highlighted for selected dates, including its opposition on the 17th. Image created in Stellarium for NASA Night Sky Network.*

# Grinning-Skull Asteroid Set to Whiz by Earth

Better late to the Halloween party than never: An asteroid shaped like a grinning skull is set to pass by Earth on Nov. 11.

Asteroid 2015 TB145 was first discovered in 2015, when it zipped within 301,986 miles (486,000 kilometers) of Earth right on Halloween. According to NASA's Jet Propulsion Laboratory small-body object database, the asteroid's next flyby will not be nearly so close; it will pass about 24 million miles (38 million km) from our planet. That's about a quarter of the distance from the Earth to the sun.

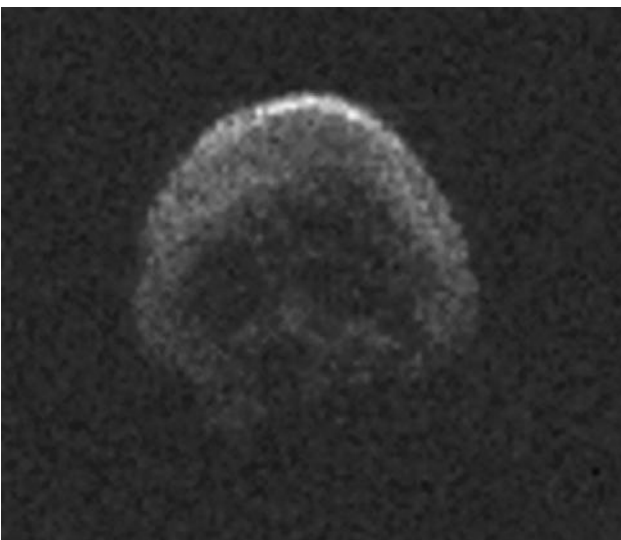
The next time 2015 TB 145 approaches Earth won't be until 2082, when it will pass at about a third of the distance between the Earth and the sun. Its orbit will take it closer to Venus and Mercury in 2024, 2028 and 2037.

Scientists had the opportunity to snap some spooky images of 2015 TB 145 when it first passed the planet, in 2015. The pictures showed a mostly spherical rock with indentations that resembled gaping eye sockets and a nose hole, at least from some angles

The asteroid is about 2,047 feet (625 meters) wide, according to a 2017 study, making it a relative pip-squeak, astronomically speaking. (By comparison, the asteroid thought to have wiped out the dinosaurs was about 6 miles, or 10 km, across.)

The skeletal rock didn't affect Earth on its 2015 flyby, and the asteroid won't have any effect on the planet during its more-distant November pass-by. However, researchers have found that the asteroid is not just spooky, but also special. According to NASA researchers, the asteroid's oblong orbit and its velocity suggest that it might be a dead comet, stripped of its icy debris tail by too many trips around the sun. Comet tails are tails of dust and gas that stream behind a comet due to solar radiation.

While the Halloween asteroid won't be coming very close to Earth on its flyby, there will be a few close shaves with other space rocks in the near future. According to Max-Planck-Institut für extraterrestrische Physik scientist Thomas G. Müller, an asteroid dubbed 1999 AN10 will pass 185,911 miles (299,196 km) from Earth on Aug. 7, 2027. On April 13, 2029, an asteroid named 99942 Apophis, after the Egyptian god of evil, will whiz by Earth at a distance of only 23,239



This radar image of 2015 TB145, a dead comet, was generated using radar data from the Arecibo Observatory in Puerto Rico. Credit: NAIC-Arecibo/NSF



The "Halloween Asteroid" 2015 TB145, shown here in an artist's illustration, is expected to whiz by Earth a little later than usual, swinging by on Nov. 11, 2018. Credit: JOSÉ ANTONIO PEÑAS/SINC

miles

(37,400 km), about a tenth of the distance from the Earth to the moon.

## Fall 2018 Observatory Clean Up - Gavin Hill

Our annual fall clean up day was held Saturday October 20th. Brisk temperatures and the occasional drizzle didn't deter our amazing group of volunteers from completing what at first looked like a daunting task. Members and non-members worked together to clean and organize the warm room and observatory, while other volunteers manned the lawnmower and trimmers to tame the overgrown vegetation.

At the end of the day we were able to catch up with old friends and meet new ones, while enjoying the fruits of our labour and a warm lunch. Hope to see everyone out again this spring.

Thank you very much to club members:

Ed Mizzi  
Michael Pell  
Sam Ierullo  
Abigail Hughes  
Gavin, Max & Winnie Hill  
Bob Prociuk

And non members:

Valerie Hodson  
EC Sullivan  
Ryan Akitt



## Astronomy Outreach at Milton Public Library—Abigail Hughes

On September 22 I ventured to Milton Public Library for an Afternoon of Astronomy. Approximately 15 people attended with the majority being under the age of 12. With some math, some history, and a whole lot of astronomy I rambled on for about an hour and a half.

The presentation started by covering some basic history of astronomy and the fundamental changes made over the past 4000 years. With use of a simple demonstration, a tennis ball attached to a string, I was able to demonstrate Kepler's second law of planetary motions as well as how gravity affects the different planets. After, we explored our own solar system and all the classifications of objects to be found inside ranging from our home planet, to the Sun, out to Oort cloud and most everything between. With the participation of the younger audience members, I demonstrated the properly proportioned distance between the Earth and the Moon using a basketball and a tennis ball. I finished the presentation by discussing different types of galaxies in the Universe, the number of galaxies, and finally the scale of the universe itself.

Overall, I hope that the entire audience was able to leave the presentation having learned something new about astronomy.



## NOVA evolves!

A few years ago, I realized that there were a number of people in the Hamilton Centre who had incredible knowledge of technology, kept up with the latest news from the astronomical world, but who had some fairly large holes in their basic knowledge of astronomy.

I should not have been surprised, since we all tend to know a lot about what we like, and this was no different.

Why care about the various features on the Moon if you actively try to avoid it? Do you need to know the length of a day on Mars when you look at it once or twice every couple of years?

The thrill of astronomy, for some, lay not in finding a faint, fuzzy Messier object, but rather teasing out the finest possible details of an object captured on a camera, getting plate solving or auto-focus working, or any of the other techniques needed to master that most difficult art: Astrophotography.

And there is absolutely nothing wrong with this...I like people who are passionate about something...they tend to be much more interesting people. For instance, in 2007, Les Nagy and I went to the Texas Star Party. Les likes to get me out of my comfort zone (and we've remained friends!), and so we'd sit with someone different at every meal. One guy we sat with was about the most anti-social person I'd ever met. Monosyllable answers to questions were the norm, when he bothered to reply at all. And then someone dropped by our table and told us to ask him about observing Earth satellites. We did, and the floodgates opened. We had a fascinating time, as it turned out that he was as knowledgeable as anyone I've ever met, but if it wasn't launched from Earth, he wasn't interested. His particular love was tracking down military satellites, the ones that governments don't really want anyone to know about.

Anyway, I knew we had a number of people who were members of the Centre who could, perhaps, benefit from a wider understanding of the night sky.

There was also a need to ensure that people new to the hobby had a good grasp of what I would call "The Basics". Terms like Right Ascension and Declination, the magnitude scale of stellar brightness, the evolution of stars, how to tell the age of a star cluster, the distance scale of the universe, the phases of the Moon, and so on.

I had done a series of workshops around 2008-2010 for the City of Burlington. Although they were aimed more towards adults, they were not the people who attended. The majority seemed to be children between 8 and 12 who were fascinated by the night sky, and they dragged a parent along.

Shortly after I'd done the last one in 2010, I came across a program that the Sunshine Coast Centre of the RASC had put together. It consisted of 8 nights of lectures and workshops, and they had produced hand-outs, and other material.

They set up the course so that the first year of membership included the cost of the course (I seem to remember it was an extra \$40. The next year is cheaper and every new member had a reasonable grounding in the hobby. Finally, they offered up their course materials and curricula to every other Centre.

A number of other Centres did indeed take the course and run it. Most Centres, it turns out, have one person do a section so that they need 8 people. This reduces (considerably) the work load.

But I'd realized, many years ago, that there is nothing like the Hamilton Centre Board anywhere on the planet that is better at creating work for other people to do. I have tried (and sometimes failed) to keep to the dictum of only offering up new programs, ideas, or things to do unless I was also willing to follow through with my own proposal. NOVA was no different.

SO I found myself taking the my Burlington sessions apart, moving the material around and adding in a lot more to produce the 8 nights of NOVA. I also tried to set it up so that attendees would complete the Explore the Universe certificate by the end, but no-one actually finished it.

NOVA ran for four years, but the material in the textbook we used (The Beginners Observers Guide by Kingston Centre luminary Leo Enright) was getting dated, and for the final year, we couldn't get enough copies. One member of the course bought one of these copies, took the binding off with a bandsaw and patiently pushed each page through a sheet-feed scanner.

In 2104, the RASC announced that they were going to re-vamp the NOVA course, and the textbook they were going to use was a new booklet that was a guide to the Explore The Universe certificate. The book was produced, and while I've seen a "beta" version of the new NOVA course, that was over two years ago.

So, I decided to bide my time and should NOVA ever start again, I'll happily present it, although I may have to conscript a few people to help out.

In the meantime, the need for a "beginners" night remained. There was also the fact that the Observatory was relatively under-utilized. This was how the first Heavy M.E.T.U.L. night came about. The aim was to offer guidance in helping people to get through the "easier" of the RASC Observing Certificates (Explore the Universe, Explore the Moon, and the Messier). The acronym was Messier, Explore The Universe and Luna.

They were quite successful and I arranged the nights so that sometime the Lunar people had something to observe, and sometimes the Messier (they prefer the absence of the Moon). However, most nights also were social nights, and there was a massive sense of déjà vu amongst the old-timers.

At the Board meeting in October, there was the thought that the third Friday of each month should be reserved for an Observatory Night, and we just observe whatever is visible. This was when I became the de facto Observing Director, as this sounded like a more rigidly schedule M.E.T.U.L. night. It sounded like a good idea, and so we decided to go with it. Then, when was adding these dates to the Calendar on the Forum, I realized that many nights would be subject to a Full Moon, or nearly so. For the coming year, though, it might be better to have the Observatory Nights be 8 days after the general meeting, or "A Week Tomorrow" if talked about at the meeting.

It was further decided that if the night was cloudy, then I'd do one of the NOVA sessions. I also said that if I was not available, then I'd provide some objects to Observe and someone else would lead a "Discussion" group if it was cloudy. In other words, there would ALWAYS be something going on at the Observatory on Observatory Nights.

The calendar says that the next one will be on November 16th, and we'll start at 8pm. There'll be a waxing 60% moon that night, the following will be nicely placed to observe:

Plato:	A dark-floored crater on the margin of Mare Imbrium south of Mare Frigoris
Teneriffe Mountains:	A small mountain range in the N part of Mare Imbrium
Spitzbergen Mountains:	A small range in the E quadrant of Mare Imbrium
Archimedes:	A sharp crater with terraced walls to the E of Mare Imbrium to the west and Palus Putredinis
Timocharis:	A prominent crater located near the middle of Mare Imbrium
Eratosthenes:	A large crater at the S tip of Montes Apenninus
Sinus Aestuum:	The Seething Bay, on the South of Mare Imbrium
Mare Nubium:	The Sea of Clouds, the southernmost sea directly west of Alphonsus
Rupes Recta:	The Straight Wall is a cliff on the east side of Mare Nubium
Tycho:	A recent crater best seen at the Full Moon when its rays can be traced over much of the lunar surface
Maginus:	A large old and eroded crater above Clavius.
Clavius:	A large crater at the southern end of the Moon

## Over The Moon Book Review

This month's book review comes from Abigail Hughes, which she titled: A Love Note to the Moon.

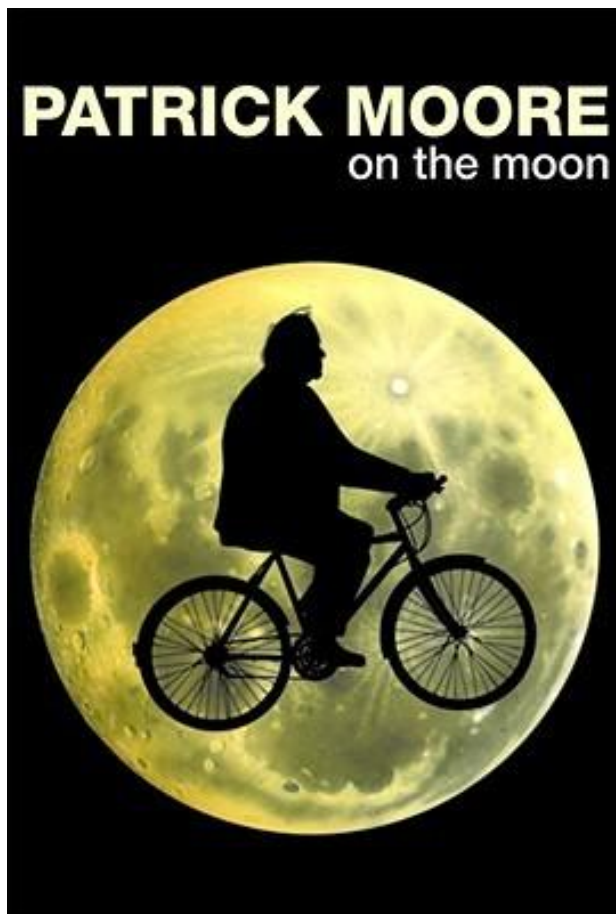
*Patrick Moore on the Moon*. Pages 239. Appendix and Photo Collection. London, Cassell & Co., 2001. ISBN 0304354694. Available at observatory.

Being the Earth's closest neighbor, the Moon has provoked curiosity and wonderment throughout all of human history. In his book, Sir Patrick Moore explores the myth, the facts, the material, and the possible future of the Moon. Moore was a passionate amateur astronomer with no formal education. He wrote his first scientific paper at the age of 13 and continued to contribute to the study of the Moon until his death in 2012.

He starts the book with a fascinating yet brief history of the Moon and the mythologies surrounding its purpose and creation according to different cultures around the world. For those less interested in the mythic and more interested in the scientific, the rest of the book has got you covered. The first half of the book is spent on the observational elements of the moon starting from its location in the solar system, relative to the Sun and the Earth, to its famous craters near and far. The latter half of the book explores the composition of the Moon and the missions sent to gather said information. Fortunately, the book is excellent for those who desire to sit and read about the Moon as well as those who would rather have reference material that is easily accessible. Nearly 35% of the book is reserved to appendixes which, with the exception of 1, are brilliant reference material (the one exception being a list of eclipses of the Moon which expired in 2008). Additionally, the chapter titled "Features of the Moon" works as a standalone chapter for amateur astronomers who wish to start lunar observation.

The precision and detail of the book frequently left me forgetting that Moore wrote the book nearly 20 years ago. Only occasionally am I drawn out the time trance when small details such as Pluto's status or, relative to the book, the most recent eclipses that have taken place are mentioned. Alongside all the factual information, Moore provides a personal insight to the events and his position in relation to them. Moore writes in a language understandable to any audience with some level of education. The love Moore has for the Moon shines through with his anecdotal writing style and attention to details neglected by other astronomy books. Moore's optimism and hope toward future Lunar exploration leaves the reader with the dream of more funding being spent toward our celestial partner.

My favourite part of the book, or more accurately Moore's opinion, is his adamant belief that the Moon and Earth should be a binary planet. Once the reader overcomes the jarring nature of Moore's stance, it is easy to understand his arguments and not disregard it as nonsense. Don't believe me? Read the book for yourself.



## RIP Kepler: NASA's Legendary Planet Hunting Space Telescope is Dead

NASA's legendary Kepler space telescope, which is responsible for the discovery of thousands of bizarre and intriguing exoplanets, has officially run out of fuel. With the telescope's retirement comes the end of the most prolific period of planetary discovery in the entire history of astronomy — at least so far.

“As NASA's first planet-hunting mission, Kepler has wildly exceeded all our expectations and paved the way for our exploration and search for life in the solar system and beyond,” said Thomas Zurbuchen, associate administrator of NASA's Science Mission Directorate, in a statement. “Not only did it show us how many planets could be out there, it sparked an entirely new and robust field of research that has taken the science community by storm. Its discoveries have shed a new light on our place in the universe, and illuminated the tantalizing mysteries and possibilities among the stars.”

Launched in 2009, the Kepler space telescope was a pioneering spacecraft that shattered most scientists' expectations. Within just its first few weeks of observations, researchers found a handful of previously unknown exoplanets, and over time, the numbers rapidly grew. At present, there are just shy of 4,000 known worlds around other stars, and Kepler is responsible for discovering more than half of them.

### Exoplanet Transits

Though Kepler was certainly technologically advanced for its time, it hunted planets in a surprisingly straightforward manner. By fixating on a specific area of the sky in the constellation Cygnus, Kepler was able to continuously monitor the varying brightnesses of roughly 150,000 stars. Researchers used these observations to then search for periodic dimming events around each star, which indicates an exoplanet has passed in front of the star. By closely analyzing how much the host star's brightness dropped and for how long, researchers can tease out characteristics of the planet such as size and orbital distance.

“When we started conceiving this mission 35 years ago we didn't know of a single planet outside our solar system,” said William Borucki, retired Kepler principal investigator. “Now that we know planets are everywhere, Kepler has set us on a new course that's full of promise for future generations to explore our galaxy.”

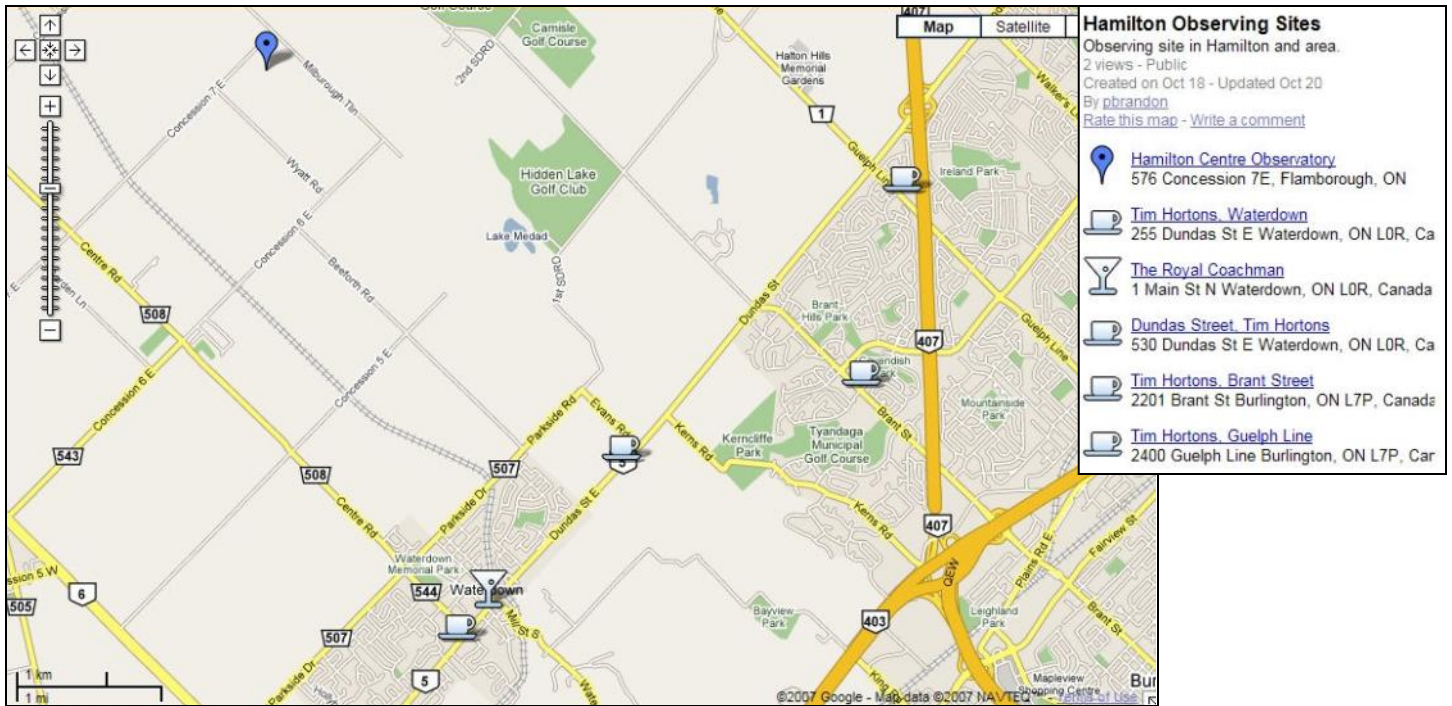
### Kepler's Legacy

Based on the planets discovered by Kepler, researchers now think about 20 to 50 percent of stars in the Milky Way harbor rocky, roughly Earth-sized planets that may be able to support liquid water on their surfaces. However, although these planets tend to be the most enticing, according to Kepler, they are not the most common type of planet out there. In fact, Kepler found that the most common type of planet doesn't have an analog in our solar system at all. These are worlds that are larger than Earth, but smaller than Neptune, and we still know very little about them.

Fortunately, although Kepler is now retired, its successor, the Transiting Exoplanet Survey Satellite (TESS) is just getting started. Launched in April, TESS will build on Kepler's planet-hunting legacy by searching for exoplanets around nearly 200,000 of the brightest and nearest stars to Earth. With a combined catalog of exoplanets discovered by both Kepler and TESS, in the early 2020s, NASA's James Webb Space Telescope will then be able to follow-up on the most tantalizing finds. And who knows, Kepler may have already discovered a planet that is harboring life, we just need a more detailed view to spot it.



Artist's concept of the Kepler Space Telescope, which led the search for exoplanets over the past decade. (Credit: NASA/JPL-Caltech)



576 Concession 7 East, Flamborough ON  
 N43° 23' 27" W79° 55' 20"  
**RASC Hamilton, P.O. Box 969,  
 Waterdown, Ontario L0R 2H0**

Email: [hamiltonrasc@hamiltonrasc.ca](mailto:hamiltonrasc@hamiltonrasc.ca)  
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Treasurer	Bill Leggit	Councillor	Bob Speck

Here's another image from Jeff Booth.  
 It's an hour's worth of exposures ( 60 X  
 60s ) on the Elephant's Trunk Nebula, in  
 Cepheus.

This data was collected 13 months ago, in  
 late September 2017, but he got around to  
 it at the end of October

The image is in Hydrogen Alpha only, as  
 he does not have enough time on other  
 filters to get colour (*not yet, anyway...JB*).

He took the images from his home in  
 beautiful Bronte.

He used a SkyWatcher ED 600mm with a  
 ZWO cooled mono camera.

Jeff notes that this is a very interesting  
 Deep Sky Object, and you you'd like to  
 know more, check out the Wikipedia en-  
 try for it at : [https://en.wikipedia.org/  
 wiki/Elephant%27s\\_Trunk\\_Nebula](https://en.wikipedia.org/wiki/Elephant%27s_Trunk_Nebula)

