

# The Reflector

Newsletter of the Peterborough Astronomical Association

## The Closest New Stars To Earth



Image credit: NASA and ESA Hubble Space Telescope. Acknowledgements: Kevin Luhman (Pennsylvania State University), and Judy Schmidt, of the Chamaeleon cloud and a newly-forming star within it — HH 909A — emitting narrow streams of gas from its poles.

ETHAN SEIGEL

**W**HEN YOU THINK, about the new stars forming in the Milky Way, you probably think of the giant star-forming regions like the Orion Nebula, containing thousands of new stars with light so bright it's visible to the naked eye. At over 400 parsecs (1,300 light years) distant, it's one of the most spectacular sights in the night sky, and the vast majority of the light from galaxies originates from nebulae like this one. But its great luminosity and relative proximity makes it easy to overlook the fact that there are a slew of much closer star-forming regions than the Orion Nebula; they're just much, much fainter.

If you get a collapsing molecular cloud many hundreds of thousands (or more) times the mass of our sun, you'll get a nebula like Orion. But if your cloud is only a few thousand times the Sun's mass, it's going to be much fainter. In most instances, the clumps of matter within will grow slowly, the neutral matter will block more light than it reflects or emits, and only a tiny fraction of the stars that form — the most massive, brightest ones — will be visible at all. Between just 400 and 500 light years away are the closest such regions to Earth: the molecular clouds in the constellations of Chamaeleon and Corona Australis. Along with the Lupus molecular clouds (about

600 light years distant), these dark, light-blocking patches are virtually unknown to most sky watchers in the northern hemisphere, as they're all southern hemisphere objects.

In visible light, these clouds appear predominantly as dark patches, obscuring and reddening the light of background stars. In the infrared, though, the gas glows brilliantly as it forms new stars inside. Combined near-infrared and visible light observations, such as those taken by the Hubble Space Telescope, can reveal the structure of the clouds as well as the young stars inside. In the Chamaeleon cloud, for example,

*See "Chamaeleon" on page 16*

## President's Message

# Invite Your Friends!

**A**s I am writing this letter, I am thinking in our first PAA public event for the year of 2016, Earth Hour, on March 19, at Armour Hill. I remember a few years ago my first encounter with PAA members at the same public event. It was spectacular for me, my wife and my kids to see the planets, nebulae, the Moon, and other wonders of the deep sky. It was a cold night, but filled with excitement. The last time I saw the Moon through a telescope, before this event, was when I was twelve years old, with a Tasco telescope. To be honest, when I saw the telescopes that PAA members brought to the public event and the knowledge they displayed during the event, I felt intimidated, but this feeling quickly vanished after I realized how friendly the PAA are and their willingness

to educate the public. I remember asking a bunch of question that night, and I received friendly and amazing responses. I can only imagine how my kids felt that night.

Years later, luckily, I was able to contact the PAA and join this group of amazing individuals, and soon realized that despite the different level of knowledge about astronomy, all of us like to talk about astronomy and share the knowledge with a person like me, a "newbie".

Well, if the weather allows us, Armour Hill will be our stage and you, PAA members will be the host. So, spread the word, let the people know about this event, post it in social media, send a tweet, invite your friends. See you there!

**Jaime Morales**  
**PAA President**

## Letter from the Editor

# Spring is Around the Corner

**A**nd none too soon. Even though *El Niño* has blessed us with a mild winter (no it's not Global Warming, but it felt like a harbinger), it's always a treat to await the oncoming of the vernal equinox.

We have a pretty awesome line-up for the March issue. John Crossen starts off with a report from February's meeting, articles about the Clipper Mission to Europa, an argument for heading to the Moon as a preparatory school for any Mars mission, an explanation of Jupiter's delights and some fun facts about the closest star to us: our Sun.

Ken Sunderland reviews the documentary, *The Search for Life: The Drake Equation*, which you might want to pause your binge-watching of *Breaking Bad* to check out on Netflix. I plan on doing that.

Finally, Rick Stankiewicz braved the early morning frost to record the planetary

alignment before dawn this winter so you wouldn't have to. Thanks, Rick. Our LPA director also reminds us about importance of Earth Hour.

So, till next we reconvene, enjoy this month's newsletter.

**Phillip Chee**  
**Editor, The Reflector**



## The Reflector

The Reflector is a publication of the Peterborough Astronomical Association (P.A.A.) Founded in 1970, the P.A.A. is your local group for astronomy in Peterborough and the Kawarthas.

[www.peterboroughastronomy.com](http://www.peterboroughastronomy.com) • [jaime.a.mbl0@gmail.com](mailto:jaime.a.mbl0@gmail.com)

Phone: 705.748.2038

Club Mailing Address

Jaime Morales, President

Peterborough Astronomical Association

1587 Redwood Drive

Peterborough, ON K9K 1N9

# Johnson Space Centre Was The Centre of Our Attention



JOHN CROSSEN

**P**RESIDENT JAIME MORALES welcomed us to the February 5 meeting and Sean Dunne introduced our four guest visitors who came to sample a PAA meeting. Then it was off to the Moon.

Rick Stankiewicz took us on a dream tour of NASA's Johnson Space Centre at our February meeting. Located near Houston, Texas, the Centre is NASA's museum of the history of American spaceflight.

The huge establishment takes more than a day to absorb all the displays. The string of buildings house actual rockets, spacesuits, space shuttles, moon rocks and full-size reproductions of lunar landers as well as the moon-mobiles astronauts drove across our celestial dance partner. And did I mention the International Space Station as well as the new Orion space shuttle? Yup, there's plenty to see!

The pinnacle of the tour was Rick's walk alongside an unused Saturn V rocket from the days of the Apollo Moon missions. The

little tusker is nearly as long as a football field and had to be broken down into its three launch segments for display.

It was a remarkable tour and we thank Rick for taking the many hours needed to organizing all his photographs and put words to the tour for us. Great job, Rick!

Coffee Break didn't quite live up to its name because there was no coffee. But that didn't stop members from mingling and talking "astro-stuff", especially the broadcast astronomy contingent.

Mike McCarthy brought along some of the PAA's substantial library of DVDs and books for members to borrow and Dean Shewring distributed his "sky this month" data sheets to the members.

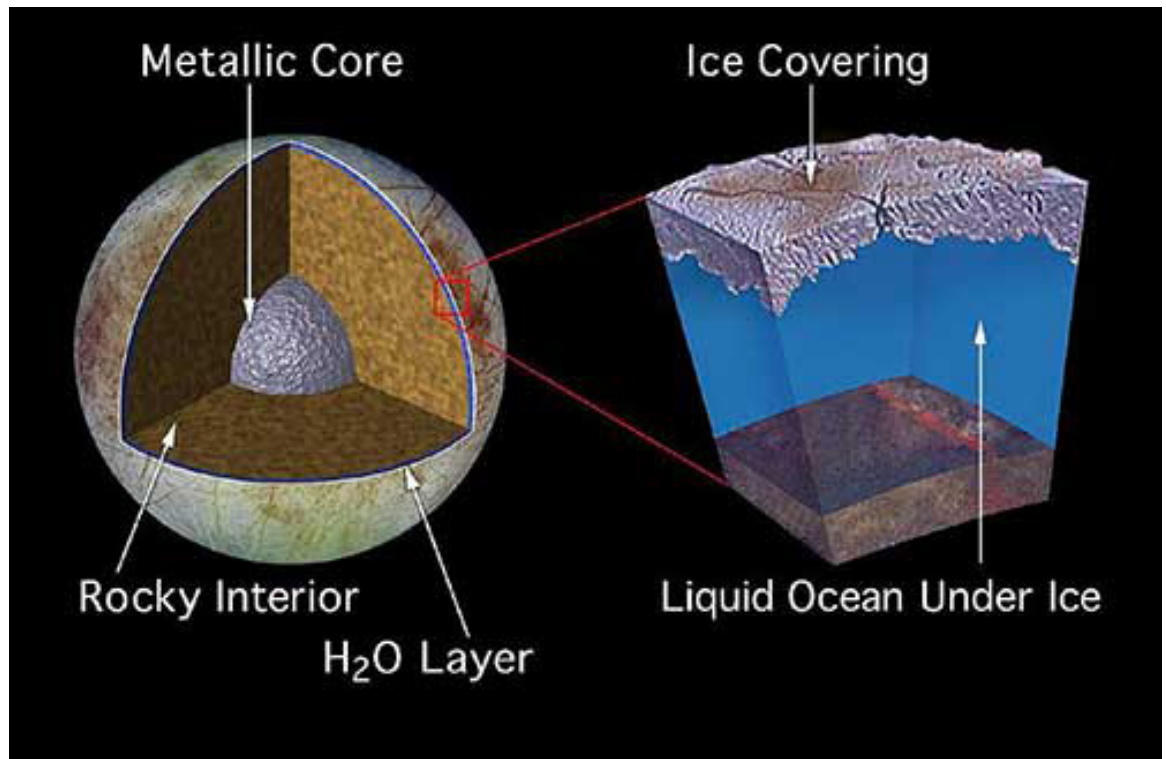
Paul Ward capped things off with a visual presentation of February's observing treats. Paul tried a new technique involving screen captures from Stellarium and writing the verbal portion of the show himself. It worked perfectly.

During the second portion of our meeting John Crossen teased members with a

**See "PAA Meeting" on page 15**



# NASA's Clipper Mission Sets Sail for Alien Life



**EUROPA CUT-AWAY.** Europa's icy crust lurks a water world that could be teeming with life.

JOHN CROSSEN

**T**HE NAME "CLIPPER MISSION" is appropriate since water is a prime ingredient for life. The search for extraterrestrial life forms is a driving force behind the National Space and Aeronautical Administration (NASA). Even if all we find is life at its microbial stage it will be proof that life forms can take root on planets other than Earth.

Considering the fact that most stars have planets orbiting them, there are probably more planets in our universe than there are stars. That makes the chance of other life forms existing at more advanced stages absolutely staggering.

Closer to home, it's a well-established fact that Mars not only had oceans of water in its past, but has under-ground aquifers and seasonal water-ice melts today.

Moving past Mars, astronomers know that Jupiter's moon Europa has a crust of

ice covering an ocean. In fact Europa has about 2.5 times the water as planet Earth.

Beyond Europa is Saturn's moon Enceladus. Its geysers guarantee water on that fascinating little ice ball. Plus the Cassini Mission to Saturn has analyzed the water from Enceladus using spectroscopy and it is also rife with nutrients essential to life. Recent data from Pluto shows that it also has water, at least in the form of ice.

NASA's next mission will be a closer examination of Europa. Because Jupiter has extremely powerful radiation fields, the mission will send a radiation-tolerant spacecraft into a long, looping orbit around Jupiter to perform repeated close flybys of Europa.

Expected to launch in the mid-2020s, the mission's payload will include cameras and spectrometers to produce high-resolution

**See "Europa" on page 15**

# The Rites of Spring Correct the Wrongs of Winter



**JUPITER'S GREAT RED SPOT.** The Great Red Spot on Jupiter may be growing smaller and dimmer, but it doesn't so in this photo taken by the New Horizon's Mission as it orbited the planet for a gravitational assist on its way to Pluto. Also referred to as the GRS, it is currently large enough to swallow 2.5 Earths.

JOHN CROSSEN

**M**ARCH BRINGS WITH IT three things that I like. The weather is slightly warmer. The switch to daylight savings time (Mar 13) means no more dinner after dark or breakfast before sunrise. And spring mixes the last of winter's major celestial attractions setting in the west with an exciting new cast of characters rising in the east.

So as we wave goodbye to Orion and the Seven Sisters, we welcome Leo, Cancer and Virgo to the night sky. In addition to the spring characters already mentioned, constellation cadets can also connect the dots for Corvus, the crow and Crater the Goblet. They ride the night sky just above Hydra the Water Snake. If you can't find the Big Dipper look high up overhead. That's where it resides in the springtime.

Jupiter rules the celestial roost this March. It will be at opposition (directly opposite the Sun and Earth) on March 8. So Jupiter will rise at sunset and set at sunrise the following day. As a result you'll have all night to ogle the solar systems' gas giant.

Jupiter's brightness makes it an easy naked eye target and those with a small telescope can watch its four largest moons change positions from night to night. Also visible telescopically are the dark bands and white zones that wrap around the planet's deep cloud cover. Even a pair of 10×50 hand-held binoculars will show the bands and pin-point moons.

Jupiter's famed Giant Red Spot has been growing smaller during the recent decade. As a result you'll need a steady, transparent

*See "Great Red Spot" on page 15*



# A Challenging Planetary Alignment



**RICK STANKIEWICZ**

**T**HIS PAST FEBRUARY around mid-month, I saw all six naked-eye planets lined up across the early morning sky. I am including Earth in this mix because all these planets stretched our horizon from southeast to west. This type of alignment is not rare, but is unique in that all these planets are nicely strung out across the sky, which perfectly traces the imaginary path they travel in the sky, called the ecliptic. So often the planets are divided between morning and evening skies.

The challenges seeing last month's alignment was multi-faceted. First were the cloud conditions we faced for most of the month. There were only a handful of clear mornings to work with because you needed to be cloud free, right to the horizon. As the month wore on, the planets spread further apart in the sky.

Second, there was a very small window in which to witness or record this event. Ideally, you had to be looking south with a clear horizon from about 1 to 1 ½ hours before sunrise. At this time of year it meant getting up and organized by 5:30 a.m.

Third, particularly to record the event, meant that you had even a smaller window of opportunity to capture the planets because even though Jupiter, Mars and Saturn were readily visible in the southern sky most of the night, Venus and Mercury did not clear the horizon until the twilight had begun. This meant that there was a loss of contrast for dimmer Mercury to register in the same exposure as all the other much brighter planets. This is mostly due to our northern latitude and lower ecliptic this time of year.

Fourth, were the frigid conditions under which we got the few clear mornings we did to work with. It was always colder than -20°C and a wind chill that would make your finger tips go numb in a matter of minutes.

To face the above challenges, I got up early every chance I got (3x's), dressed warm as possible (still froze my finger tips operating camera controls), used an 8.5mm lens to try and squeeze enough of the sky, but still

**See "Planets" on page 9**

# Mars Can Wait Let's Go Back to The Moon First



**LUNAR DOME.** Using available materials, this Moon-dome is covered by a thick layer of lunar soil as protection from UV rays as well as small meteorites. Using locally-available materials saves time and transportation costs. Image made by the European Space Agency.

JOHN CROSSEN

**I** WAS DOING A PRESENTATION on Pluto the other night and one of my points was that the New Horizons Atlas V rocket whisked past the Moon's orbit in just 9 hours. The Apollo astronauts took 3 days to cover the same distance!

New Horizon's speed was 58,000 km/h. That's over 16 kilometres per second, which puts the Moon within commuting distance of Earth. And that, girls and boys is what started me thinking about colonizing the Moon first, then Mars.

A 9-hour trip means less time for something to go wrong verses our current estimate for arrival on Mars of one year. The short Moon-trip also makes it easier and faster to deliver the building materials and supplies necessary to get things rolling. If there's an emergency, help is only hours away instead of a year. Plus, we've been to the Moon six times already. Even though

that was 40 years ago using technology that is ancient compared to today, we did it and we learned how to do it better with each successive mission.

That doesn't mean my "lunar commute" would be a no-risk piece of cake. We'd still need billions of dollars plus a train-load of rocket scientists and engineers to pull it all together. But this could be more than a practice lap for the Mars mission.

Because the Moon's gravity is about one third that of Earth's, building things wouldn't be as difficult. We might be able to make a telescope mirror that's far bigger with a much greater light grasp than is possible on Earth. It could show us the Big Bang.

Living on the Moon could also help us learn to use local materials for construction. Compacted regolith (Moon soil) could

**See "Lunar Trip" on page 13**

## PHOTO GALLERY

# The No-Snow Full Moon



The Full Moon of February is usually referred to as the Snow Full Moon because this time of year is when we see the deepest snow accumulations as a typical winter progresses. I say typical because not all years are created equal and 2016 was a good example of a not so typical year. On February 22 when the Moon was full we had virtually spring-like conditions with virtually no snow left on the ground. In the early morning hours of the 23rd I captured the rare No-Snow Full Moon heading for the western horizon. Things are not always what they appear to be.

Keep looking up,

Rick Stankiewicz



*continued from page 6*

### Planets

as all the other planets because the twilight glow was too overpowering. The best I could do was image Venus to Jupiter in one shot and then zoom in to get Mercury and Venus in a separate shot. The fruits of my labour are attached. I found Mercury was a challenge without a pair of binoculars, as it played hide-and-seek before sunrise.

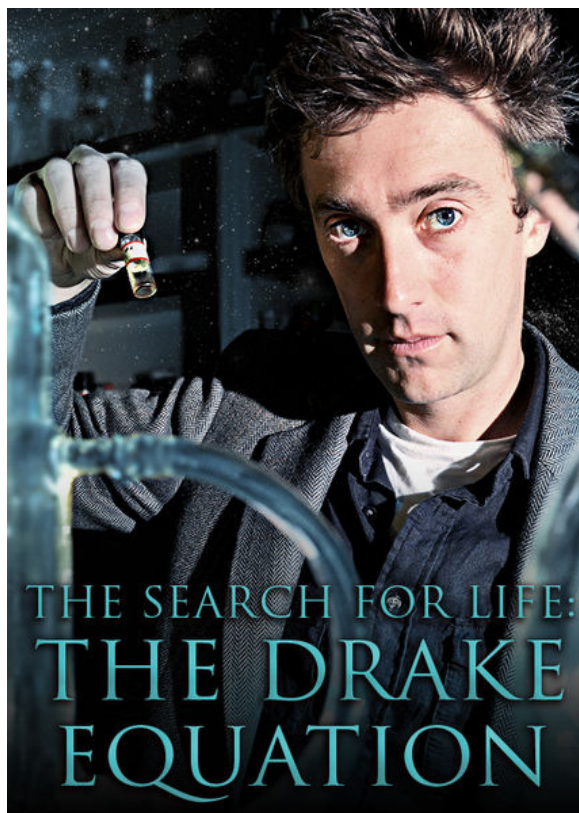
Had weather conditions been more favourable around the end of January the planets would have been gathered closer together with Mercury and Venus further from the Sun.

There will always be next time, if I live that long.



## FILM REVIEW

### The Search for Life: The Drake Equation (2010), 59 Minutes



**T**his British made documentary examines the Drake Equation with the help of none other than Frank Drake himself. The Drake Equation (1961) contains seven factors that, when multiplied together, give an estimate for the number ( $N$ ) of advanced communicating civilizations in our galaxy. Original values plugged into the equation gave  $N=50,000$ , which is a significant number. Radio signals in the “Water Hole” frequencies were determined to be the most likely information carriers and the search was on. Drake and followers were voices crying in the wilderness in the early years. Little time and effort was given to the search. Over the years, the equation (and the search) has gained supporters, morphing into the SETI project in recent years.

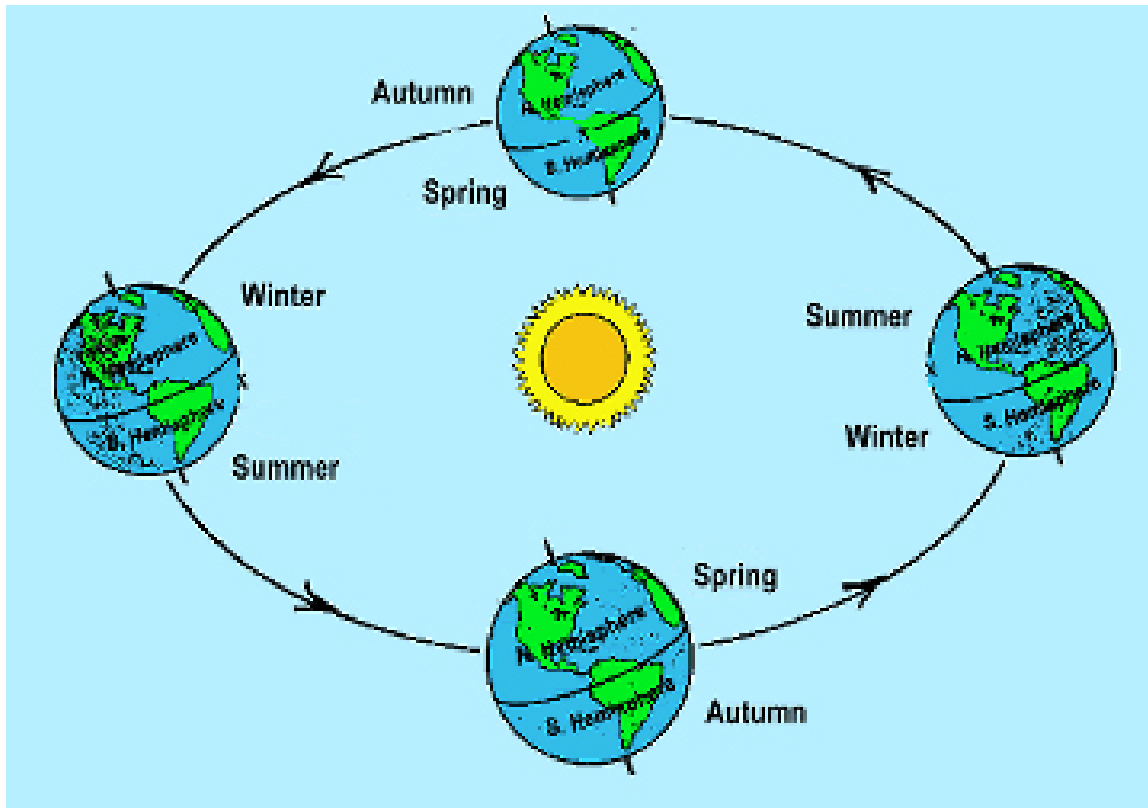
So far, we face an eerie silence despite the thousands of civilizations predicted by the equation. Enrico Fermi famously asked “Where is everybody?” — the so called Fermi Paradox. The narrator more closely exam-

ines factors in the Drake Equation for clues to the failure. A storyline leading to intelligent life is framed in terms of evolutionary hurdles to be overcome. In particular, the factors surrounding the probability of life arising, and then intelligence, are explored. Experts present findings from cutting edge research in various fields, along with fascinating speculation. Finding another kind of life outside our own genetic Tree of Life would fundamentally change the debate. While life may be inevitable across the universe, intelligent life that becomes technologically advanced and lasts thousands of years may be very, very, rare.

Whatever the future outcome of all our searching, for now, be sure to enjoy this entertaining program. Recommended. (Recently added to Netflix)

**Ken Sunderland**

# Make Yourself a Little Brighter About the Sun



**EARTH TILT AND SEASONS.** The Earth's 23-degree tilt is what causes the seasonal changes as we orbit the Sun. In the Northern Hemisphere's summer we are tilted towards the Sun and absorb more of its warmth. The opposite is true for our winter.

## JOHN CROSSEN

**U**NLESS YOU'VE SPENT YOUR entire lifetime watching *Duck Dynasty*, you probably know that the Sun isn't unique. It's a star just like the gazillion others that inhabit our universe.

It lives at the centre of our solar system and for us Earthlings it is our source of heat as well as the reason we have food on our tables. To do this the Sun pumps out a lot of energy as well as some remarkable statistics.

Despite the fact that the Sun is just over 1 million times the size of the Earth, it is listed as a Yellow Dwarf. That means there are hundreds upon hundreds of distant "Suns" which are bigger than our solar furnace by up to 100 thousand times. If the Sun were hollowed out, you could place the Earth

and our Moon inside and the Moon would continue to orbit Earth without touching the inner walls of the Sun. Now that's big, at least in terms you and I can come to grips with.

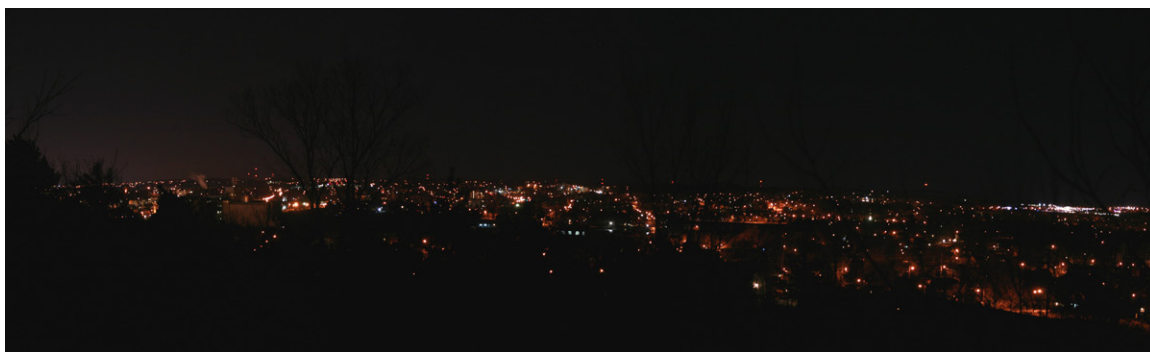
In terms of mass, the Sun's mass is 330,000 times that of the Earth. Overall, the Sun comprises just over 99% of the mass in our solar system. Put another way, you could place our whole solar system inside the Sun and still have room for your wife's shoes.

Speaking of being our solar furnace, the Sun has a surface temperature of nearly 5,500 degrees Celsius. And in its outer atmosphere, called the corona, 1 million degrees C is the norm. Happily we're in the

*See "Seasons" on page 13*



# Earth Hour 2016



**A**RE YOU READY FOR Earth Hour 2016? I hope you will be ready, willing and able to join the other members of the PAA on top of Armour Hill on the evening of March 19th before 8:30 p.m. This will be the 8th annual celebration of Earth Hour on the Hill overlooking Peterborough. It is a great place to be during the hour (longer I hope) we can be thinking about and celebrating our planet and the environment we all need to protect. Rather than just burning candles at home, why not join club members and the multitude of public that will likely come to check out the sights across the city and into the heavens. It is so much more than turning lights out for an hour. It is an awareness and a commitment to make

a change. This is what makes our annual gathering on Armour Hill so unique because it focuses people's attention skyward to one of the most precious gifts we have, the night sky. We put ourselves in the best position, between heaven and earth, to have a dialogue about the affects we are having on our planet and the environment around us. Bring your equipment or just yourself, but at the very least, spread the word about where we are and what we are doing for Earth Hour. See you there?

Check out the attached short YouTube clip:

<https://www.youtube.com/watch?v=WTuotGlZj60>

Change Climate Change,

Rick Stankiewicz

LPA Director



Image Credit: EarthHour.org

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### Lunar Trip

become bricks. Water from ice-filled lunar craters is available for consumption, making fuel and oxygen or a number of things. Keep in mind that any things you don't have to transport are big money and time savers. So learning to live off the land is imperative.

Given that we are a global community, the cost of a Moon colony could also be shared by a number of participating nations. As an international undertaking, nobody has to shoulder the entire financial or manpower load. Plus we can learn from our

lunar mistakes — mistakes that would be far more costly on a year-long Mars venture.

Thanks for reading and don't forget to help save our dark Kawartha skies by keeping your outdoor lamps shielded and dimmed down.

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### Seasons

Goldilocks Zone, not too close or too far from the Sun. So temperatures are "just right" — at least for most of us.

The Sun does have its cool spots. They're called sunspots and the temperature in one of these areas is a balmy 4,500 degrees C. If you've ever seen a photograph of the Sun, they're the little dark spots. But if you dive down into the Sun's core you'll find that a temperature of 15 million degrees Celsius awaits you.

During a single second the Sun puts out enough energy to power North America for nearly 9,000 years. The source of all that power is hydrogen. The Sun is 98% hydro-

gen so there's fuel to spare. Here's how the process goes.

At the Sun's core the pressure on the hydrogen atoms is so great that they fuse together to become helium atoms. This fusion process gives off a little bit of energy. It's like a hydrogen bomb, but with a warm friendly side. Once that energy is generated it can take up to 1 million years to climb up from the Sun's core to its surface. Add in the 8 minutes it takes Sunlight to reach Earth and the glow on your face is one million years and eight minutes old. Now if you'll excuse me I have to get back to *Duck Dynasty*.



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UK  
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The Market Plaza, Peterborough  
91 George St      705-745-0085



natalie.graham@live.ca  
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## The Sky this Month

**Mercury** is well placed in the morning sky from the 1st to the 14th. Superior conjunction with the Sun on the 23rd.

**Venus** is shining brilliantly all month. At aphelion on the 20th.

**Mars** moves from Libra into Scorpius on the 13th. Rises after midnight.

**Jupiter** rises just before sunset. At opposition in Leo on the 8th. In close conjunction with the Moon on the 22nd.

**Saturn** in Ophiuchus and rises before midnight. Begins retrograde motion on the 25th.

**Zodiacal Light** visible in northern latitude in west after evening twilight for 2 weeks starting on the 25th.

**Daylight Savings Time** begins on the 13th.

**Equinox** arrives at 12:30 am on the 20th.

## Moon Phases

Last Quarter	6:11 PM	March 1
New Moon	8:54 PM	March 8
First Quarter	12:03 PM	March 15
Full Moon	7:01 AM	March 23
Last Quarter	11:17 AM	March 31



*continued from page 3***PAA Meeting**

presentation of what might become yet another PAA observing site/public outreach event – or maybe more.

Known as the Ganaraska Forest Centre (GFC), the 11,000-acre property is just an hour's drive from Peterborough. It has plenty of tree-shielded open spaces as well as meeting rooms, dormitories and dining rooms. The GFC is open all year with plenty of family activities highlighted. Maybe they want to add astronomy to their list of activities.

An in-person visit is planned soon and all members are invited. With any luck we'll know our visit date well in advance so car pools can be arranged.



**KW** *Telescope*  
P E R C E P T O R

*continued from page 5***Great Red Spot**

sky to see it. Most astronomy publications give you a chart showing when it will come around to the side of Jupiter facing Earth.

Mars won't rise until after midnight and will be a bit of a disappointment for those scanning for surface detail. You'll have to wait until later in the year to spot anything of interest on the ornery orange orb.

I'll just say ditto for Saturn. This spring it will be a target for the insomniac set.

Uranus will be out of sight behind the Sun and Venus will be dropping lower and lower in the eastern dawn sky as it glides behind the Sun to emerge as an evening target.

Deep sky observers will have the trio of galaxies in Leo, star cluster M44 in Cancer as well as the Sombrero Galaxy in Corvus to look forward to. And that's just the tip of the March night sky iceberg.

*continued from page 4***Europa**

images of Europa's surface and determine its composition. Also onboard will be ice-penetrating radar. It will determine the thickness of the Europa's icy shell and search for subsurface lakes similar to those beneath Antarctica's ice sheet. The mission will also carry a magnetometer to measure the strength and direction of the moon's magnetic field, which will allow scientists to determine the depth and salinity of its ocean.

Will we finally find a life form beneath the icy surface of Europa? Let's put it this way, we have discovered critters living inside the ice of Antarctica as well as in the lakes beneath its surface. So as wild as it seems, we might just come up lucky.

*continued from page 1*

### Chamaeleon

there are between 200 and 300 new stars, including over 100 X-ray sources (between the Chamaeleon I and II clouds), approximately 50 T-Tauri stars and just a couple of massive, B-class stars. There's a third dark, molecular cloud (Chamaeleon III) that has not yet formed any stars at all.

While the majority of new stars form in large molecular clouds, the closest new stars form in much smaller, more abundant ones. As we reach out to the most distant quasars and galaxies in the universe, remember that there are still star-forming mysteries to be solved right here in our own backyard.

This article is provided by NASA Space Place.

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Peterborough Local 590

## Articles

Submissions for *The Reflector* must be received by the date listed below. E-mail submissions are preferred (Microsoft Word, OpenDoc, ASCII and most common graphic formats are acceptable). If your article contains photos or graphics, please provide a separate file for each. Typed or hand-written submissions are acceptable provided they are legible (and not too long.) Copyrighted materials will not be published without written permission from the copyright holder. Submissions may be edited for grammar, brevity, or clarity. Submissions will be published at the editor's sole discretion. Depending on the volume of submissions, some articles may be published at a later date. Please submit any articles, thoughts, or ideas to:

[phillip.chee@gmail.com](mailto:phillip.chee@gmail.com)

**Next submission deadline:**  
**March 27, 2016**



### Meetings

The Peterborough Astronomical Association meets every first Friday of each month, except July and August, at the **Peterborough Zoo Guest Services and Rotary Education Centre** (inside the main entrance at the north end of the Zoo) at 7 p.m. P.A.A. general announcements will begin each meeting with the guest speaker starting at 7:30 p.m.