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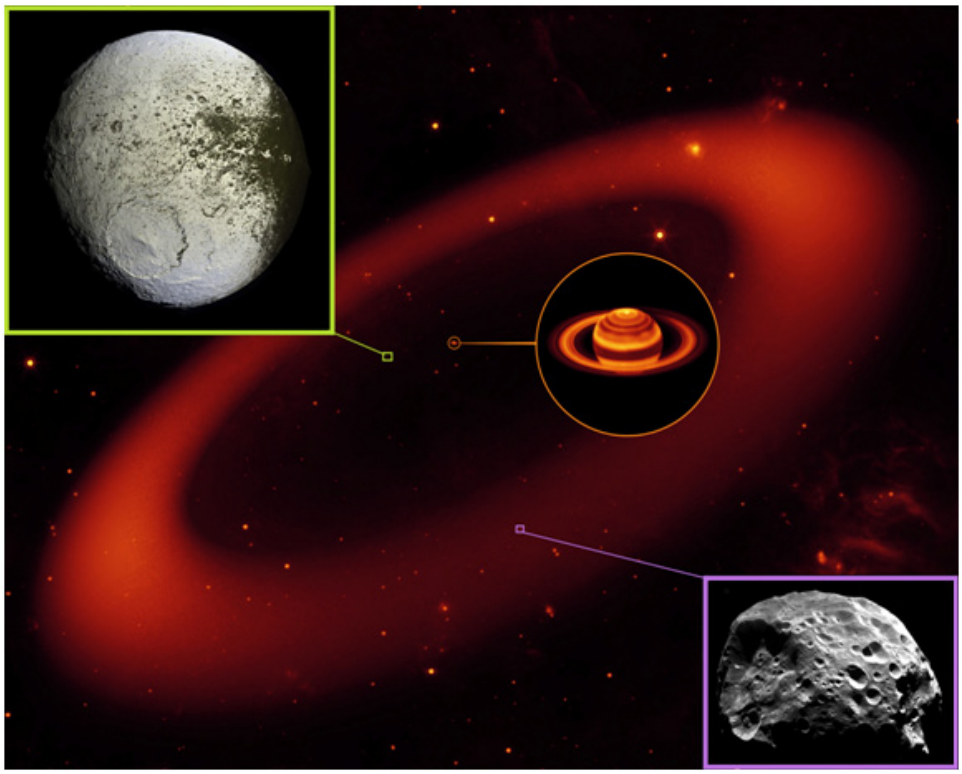
The Reflector

Newsletter of the Peterborough Astronomical Association

A Two-toned Wonder for the Saturnian Outskirts

Dr. Ethan Siegel



Images credit: Saturn & the Phoebe Ring (middle) - NASA / JPL-Caltech / Keck; Iapetus (top left) - NASA / JPL / Space Science Institute / Cassini Imaging Team; Phoebe (bottom right) - NASA / ESA / JPL / Space Science Institute / Cassini Imaging Team.

Although Saturn has been known as long as humans have been watching the night sky, it's only since the invention of the telescope that we've learned about the rings and moons of this giant, gaseous world. You might know that the largest of Saturn's moons is Titan, the second largest moon in the entire Solar System, discovered by Christiaan Huygens in 1655. It was just 16 years later, in 1671, that Giovanni Cassini (for whom the famed division in Saturn's rings — and the NASA mission now in orbit there — is named) discovered the second of Saturn's moons: Iapetus. Unlike Titan, Iapetus could only be seen when it was on the west side of Saturn, leading Cassini to correctly conclude that not only was Iapetus tidally locked to Saturn, but that its trailing hemisphere was intrinsically brighter than its darker, leading hemisphere. This has very much been confirmed in modern times!

In fact, the darkness of the leading side is comparable to coal, while the rest of Iapetus is as white as thick sea ice. Iapetus is the most distant of all of Saturn's large moons, with an average orbital distance of 3.5 million km, but the culprit of the mysterious dark side is four times as distant: Saturn's remote, captured moon, the dark, heavily cratered Phoebe!

Orbiting Saturn in retrograde, or the opposite direction to Saturn's rotation and most of its other Moons, Phoebe most probably originated in the Kuiper Belt, migrating inwards and eventually succumbing to gravitational capture. Due to its orbit, Phoebe is constantly bombarded by micrometeoroid-sized (and larger) objects, responsible for not only its dented and cavity-riddled surface, but also for a huge, diffuse ring of dust grains spanning quadrillions of cubic kilometers! The presence of the "Phoebe Ring" was only discovered in 2009, by NASA's infrared-sensitive Spitzer Space Telescope. As the Phoebe Ring's dust grains absorb and re-emit solar radiation, they spiral inwards towards Saturn, where they smash into Iapetus — orbiting in the opposite direction — like bugs on a

see "Iapetus" on page 18

President's Message

Earth Hour Approaches

Every year when March rolls around, we are presented with our first scheduled public outreach event and this year is no different. We will meet on March 29th to celebrate Earth Hour, an annual event. The PAA has its permit and we "own the hill" from 6:30 p.m. until midnight. Let's hope for clear skies, something that has been quite rare so far this year. Please join us "on the hill." If you don't own a telescope this is a great opportunity to view the night sky through some impressive equipment owned by members.

I have provided a catalogue listing, complete with photos, of the viewing equipment currently owned or on loan to the PAA for this issue of *The Reflector*. I hope this helps you decide on which instrument you would like to borrow for a two month period. The catalogue provides a description of each telescope along with comments about its size and weight, important considerations regarding portability.

Once again a reminder that it is membership renewal time. The deadline is April 1st.

Rodger Forsyth
PAA President

Letter from the Editor

Baby, It's Cold Outside!

March is supposd to herald spring but I wouldn't be surprised if winter keeps a firm grip on us. I read today that the City of Peterborough works department is predicting that some of their snow piles won't melt until July.

Meanwhile there's always this month's *The Reflector* to keep you occupied. John Crossen reports on the successful format change of our club meetings as of February. He also penned the interesting article on China's Jade Rabbit moon rover.

Ken Sunderland continues with his Moon series. This month he looks at the Moon's depiction in classic cinema.

In our photo gallery I'm just clearing out the backlog of wonderful images from Brian McGaffney and John Chumak. You must admit these are gorgeous examples from two masters of the astrophotography genre.

As Rodger Forsyth writes above this month ends with Earth Hour on March 29. With any luck we'll have clear skies and moderate temperatures. Surely winter will be over by then.

Phillip Chee
Editor, The Reflector

PETERBOROUGH ASTRONOMICAL ASSOCIATION

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.

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February PAA Meeting Well-Attended

Rodger and Ken admire the new telescope donated to the club from the George Bryant Estate. Photo by John Crossen.

John Crossen

And that's a good thing, because it was a really good one. The new format worked really well. In fact we finished early with plenty of spare time for astro-chats and more coffee.

Rodger opened with a brief rundown of upcoming events after which Ken Sunderland presented Ken Seale with his long-awaited name tag. He then proceeded to introduce four new guests and one new member to us along with astro-imager Brian Colville, who will be our guest speaker in the near future.

Dean Shewring reminded everyone about the upcoming PAA display at the Peterborough Library and the need for aurora images that club members have taken. He also would appreciate any aurora materials—posters, books, whatever that you might be able to lend him.

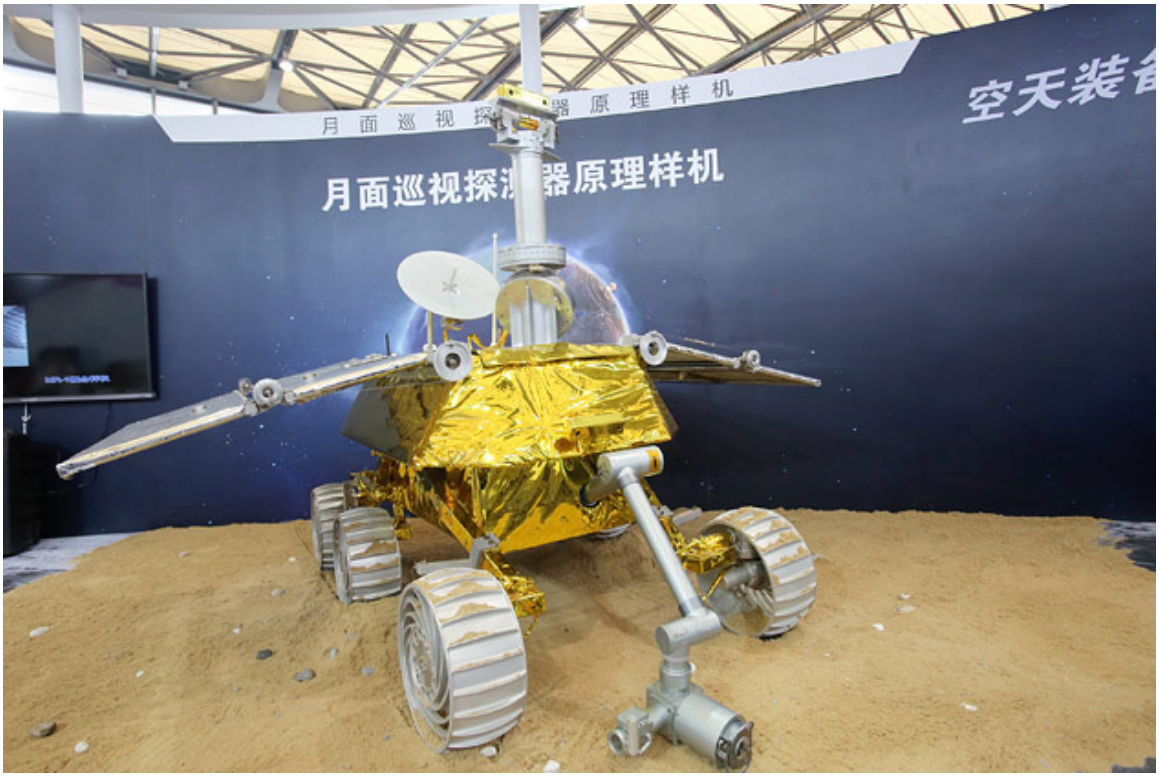
We arrived at Rick Stankiewicz's talk ahead of schedule, which is good because we had to swap the club's laptop with Rick's because of technical difficulties. Then we were off on a tour of Lowell Observatory on the mountain overlooking Flagstaff, Arizona.

Rick showed us the telescope through which Percival Lowell sketched his images of the canals on Mars—at least what he thought to be canals at the time. We even took a look inside his sketch book.

The telescope itself is an amazing 24-inch Clark refractor which dwarfed Rick in the photograph. The mount for such a scope

See "February Club Meeting" on page 15

Latest Moon Lander Made in China



Jade Rabbit on the Moon. The Jade Rabbit Moon Rover takes its name from a Chinese legend of a rabbit that lived on the Moon. The rover's scientific mission includes collecting samples of lunar "soil" and taking ultraviolet readings of stars. Jade Rabbit is also a popular public diplomacy tool to highlight China's rapidly growing scientific prowess and future ambitions. An increasing number of emerging nations such as India, Brazil, and Turkey now have space agencies and are involved in their own space races. Photo courtesy of Imagechina.

John Crossen

What's up as 2014 gets off to a start? Big news is the fact that China is now on the Moon. The Lunar Rover—named Jade Rabbit—touched down December 14, 2013 and is taking photographs, analysing materials and exploring the Luna Firma.

China's future missions include establishing a community on the Moon as well as their own space station. The U.S. nixed China's participation in the International Space Station on the grounds that they would steal technology. As it is, they seem to be doing quite well on their own.

If you were a baby in your mother's arms when humans last walked on the Moon, you are now in your mid-40s. Perhaps the success of Jade Rabbit will spark a new space race and mankind will once again explore new worlds—in person.

Black hole buffs will be delighted to know that NASA's Wide-field Infrared Survey Explorer—WISE—has discovered a dance duo of super-massive black holes spinning around each other. Observations with the Australian Telescope Compact Array and the Gemini South Telescope in Chile confirmed the twin black holes. The most likely cause of such a rare find would be a galactic merger billions of years ago that is just winding down.

Ever since the asteroid incident in Russia that injured nearly 1,500 people,

See "Jade Rabbit" on page 12

Spring Constellations in Bloom Even if Spring Isn't

John Crossen

Turn your eyes skyward and its spring. Leo the Lion is marching regally across the sky to the south southeast. You can identify his front half by the Sickle-shaped arc of stars sprouting up from the bright star Regulus or Lions Heart.

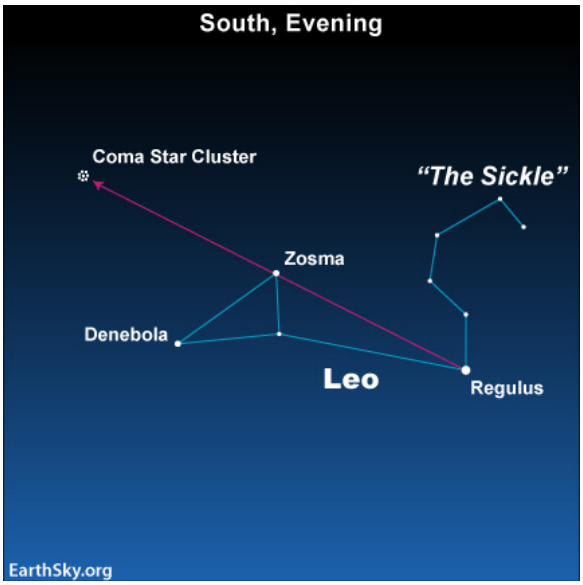
Leo has the honour of being one of the few constellations that actually resembles its namesake — no mind altering substances required, just a star chart and a clear night.

In front of Leo's nose is Cancer the Crab. In this dim, K-shaped critter you'll find two open star clusters. One is Messier object 44 or M44.

Also known as Praesepe (Pray-Sepp-Ee) M44 is a dim patch of light that was once thought to be a thin spot in heaven's floor. The souls of the departed were said to enter Heaven through it. From a dark observing site it is a naked eye target and a real treat in binoculars. The second star cluster is known as M67 and requires a telescope.

Leo is a lionly treasure chest of galaxies. To his front are M95, M96 and M105. To the rear in his haunches are M65 and M66. A telescope with a wide field of view will also draw NGC 3628 into the same field of view. Bingo, you've got the famous Leo Trio in your eyepiece! But we're not done with his majesty yet.

Lion's have a tail and in Leo's case it's a large tuft of stars known as Coma Berenices. Coma Berenices is now one of the 88 constellations and is visible with the naked eye from a dark rural site. It is a lovely swim of stars in binoculars.



Leo the Lion. It looks like a lion and it prowls like a lion. It must be Leo, a sure sign of spring, even if you're still knee-deep in snow.

This large open cluster represents the beautiful tresses of Queen Berenices, Queen of Egypt, who pledged to cut them off and leave them at a temple if her husband returned safely from war. He did. She did. And now they look down from the night sky.

Also in the spring sky is Virgo the Virgin. Known as the goddess of Fertility, she is an appropriate choice for this time of planting and celebrating winter's end. But she doesn't travel alone. Accompanying her is the Angry Red Planet, Mars.

In mythology Mars is the god of War which goes with the planet's blood-red colour. Actually the planet's red glow comes from iron oxide on its surface. And what is iron oxide? Rust is what they call it at the auto-body shop.

Mars will rise about 10:00 p.m., so you don't need to lose any sleep waiting to spot the little red ball. On April 8 it will be at opposition — directly opposite

See "Spring" on page 12

The Moon (Layer 5 – Classic Films)

Kenneth Sunderland

"For me, the cinema is not a slice of life but a piece of cake." — Alfred Hitchcock

In the spirit of Hitch's famous remark let's consider three "pieces of cake" that take us to the Moon. To complete the amusement, these films suggest observing several craters to exercise the imagination.

Georges Méliès's 1902 silent film *Le Voyage dans la Lune* is an important achievement in the history of cinema. It was the blockbuster of its day. Méliès said the film was inspired by Jules Verne's novels *From Earth to the Moon* and *Around the Moon*. Although none were presumed to exist, in 1993 a hand-coloured print surfaced, which was restored and shown at the 2011 Cannes Film Festival. This version (Ref. 1.) has a soundtrack by the electronica band AIR which enhances the action. Purists will no doubt prefer the silent black and white version.

The film begins at the Astronomy Club meeting (Figure 1) where the Merlin-type members decide to go to the Moon.

Figure 1. Astronomy club meeting.
Credit: Google images

Gosh ... is this what PAA meetings look like to outsiders? A bullet-shaped capsule, fired from a super-gun, takes them to the Moon. (Robert Goddard's rockets are still many years in the future.) The spaceship hits the Man in the Moon squarely in the eye (Figure 2) producing one of cinema's most enduring images.

Figure 2. Spaceship hits the Man in the Moon.
Credit: Google images

From the Moon, the Earthlings marvel at the rising Earth and then sleep while theatrical scenes unfold above them (Figure 3). In the protection of a cave, they find strange vegetation, and encounter Selenites. A fight ensues, the Earthlings are captured and, but wait ... they escape! The spaceship falls off a lunar cliff and back to Earth where it splashes down in the ocean. The final scenes celebrate a successful mission.

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FIGURE 3. Theatrical scene above sleeping Earthlings- Credit: NASA/John Young.

It is clear that when this film was made there was no concept of how to get to the Moon. Then the following year the Wright Brothers made history and Apollo 11 landed 66 years later. Science fiction realized! Although a fantasy, certain scenes do resonate, such as, marvelling at Earth as seen from the Moon, an ocean splash-down to end the mission, and the key role of caves. A cave would shelter a lunar base from radiation and micro-meteorites, in addition to regulating extreme temperature swings. Recent evidence suggests that there may be a suitable cave on the floor of Copernicus (Ref. 2). Will future PAA members regularly view the perimeter lights marking Copernicus Base?

Forward to the year 1950 and the film *Destination Moon* (Ref. 3) produced by George Pal. The script contends that only American private industry, not government, has the resources to make a Moon shot possible, and in winning the Moon, America will win the Cold War. More or less true, as it turned out.

The elegantly streamlined, single-stage, spaceship Luna (Figure 4) is powered by an atomic engine. Such were the hopes and dreams for the use of atomic energy in those days — not today's nightmare. The Apollo design involved multiple stage rockets, orbital rendezvous, docking manoeuvres, a separate lander, etc. This stands in contrast to the film's idea of one great ship to do it all. In reality, energy requirements would demand a Luna of impossible mass and size.

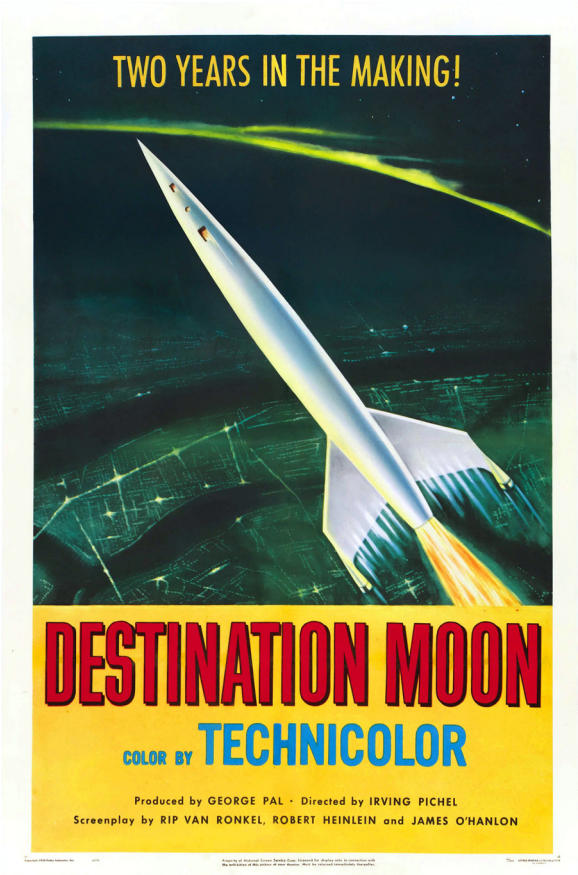


FIGURE 4. Movie poster featuring graceful Luna. Credit: Google Images.

Apart from the spaceship itself, this film gets credit for trying to be scientific. The famous sci-fi writer Robert Heinlein was involved in the project. A film within the film starring Woody Woodpecker is used to explain the mechanics of a Moon shot to a group of industrialists — very entertaining! On the way up to the Moon the astronauts are portrayed in a weightless environment, they take a spacewalk to fix an antenna, and use a bottle of compressed gas as a thruster.

The great ship lands and the astronauts descent the ladder just like Armstrong and Aldrin. Since they used too much fuel during the landing, the plot tension revolves around reducing mass to get off the lunar surface. Of course, wasn't that the Big Question about LM Eagle? Will she get off the surface?

See "Space Odyssey" on page 13

PHOTO GALLERY

Orion's Belt

Hi all, does anyone know this area? Imaged on December 10, 2013. Noise levels are up due to a 60% moon, but compensated for later. Acquisition time 90 minutes, just for fun.
Brian McGaffney

M33 Triangulum Galaxy

M33 The Triangulum Spiral Galaxy, at a distance of 2.6 million light-years away and is the second closest spiral galaxy to us. It is a sister to the Milky Way Galaxy, along with Andromeda, and a handful of nearby dwarfs galaxies, they all make up the Local Group of Galaxies.

Due to its very low surface brightness it can be a challenge to see from or nearby cities, but from a dark location on a perfectly clear night and assuming you have 20/20 vision, it is the furthest object the human eye could see into deep space without optical aid.

The thing that amazes me about M33 other than it being our neighbor and a beautiful spiral, is that M33 is loaded with 292 pink nebulae (HII star formation regions), the largest pink HII region being NGC 604, which is actually visible in a 6" diameter telescope ... to be able to see nebula visually in other galaxies now that is really cool!

NGC 604 HII region is extremely bright and one of the Large Known Ionized HII regions ... it's like the Great Orion Nebula in our Own Milky Way Galaxy, except that NGC 604 is much larger, about 40 times larger, and NGC-604 is about 1500 light years across. NGC 604 is the largest red/pink object near the bottom of this image.

At the heart of NGC 604 are over 200 hot stars, much more massive than our Sun ranging from 15 to 60 solar masses, Lots of spectral type O and WR Stars! These stars are ionizing the walls of hydrogen gas making them fluoresce (red/pink) seen in this image. So just how hot is that HII gas, well it is a whopping 17,000 degrees F!

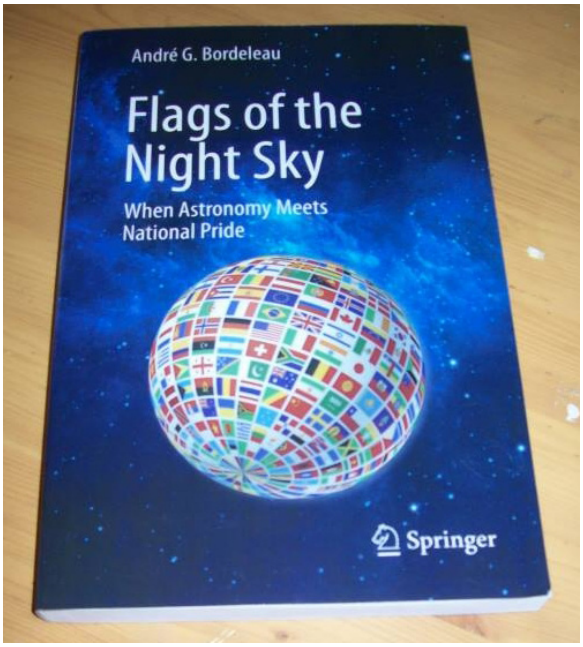
You can see a lot of nebulae and star clusters and even a few globular clusters can be seen in this image. There are so many more nebulae and clusters I could talk about here ... sorry, but no time right now.

John Chumack www.galacticimages.com

BOOK REVIEW

Flags of the Night Sky

John Crossen



André Bordeleau

Springer, 2014

341 pages; ISBN 978-1-4614-0929-8, $29, Softcover

We've all seen national flags with images of the Sun, Moon and stars. Some represent astronomical objects such as constellations. Others are just designs. The flag of the United States sports 50 stars. But all they represent is the number of states.

At the opposite end of the spectrum is Brazil's national flag. It is almost a star chart. It depicts stars such as Canopus and Spica and complete constellations.

The national flags of Australia and New Zealand are less of a brain twist to decipher because both show the stars that form the Southern Cross. But what about flags that feature what looks to be the Crescent Moon? Or could it really be an eclipse of the Sun that hasn't reached totality?

André Bordeleau's new book *Flags of the Night Sky: When astronomy meets national pride* digs into the astronomical origins of nearly 40 different national flags. It is written with the authority of a man who has done his homework very thoroughly. But of equal importance, it immerses the reader in a seemingly endless river of fascinating facts and intriguing details.

Country by country, Bordeleau takes us on a 220-page guided tour through time to show how national flags evolve as history and countries change. Sometimes the modifications reflect significant political events, the addition of new provinces and changes in geographic boundaries.

Some flags come to life as new nations are born. And at other times changes are made simply to assure that the flag could not be mistaken for that of another country. As an example of this, with the exception of being green and yellow the Brazilian flag once wore stars and strips in almost the same design as the American flag.

The seeds of *Flags of the Night Sky* were planted in 2008, in the form of a four-page article that André had written for *The Planetarian Magazine*. But André wanted to take the idea farther—a lot farther.

A friend and professor at the University of Chicago suggested that André talk with the editor at Springer Publishing whom he though might be interested in such a book. André emailed him the

See "Constellation Flags" on page 15

Take a Look on the Sunny Side of Astronomy

FIGURE 1. The Sun makes enough energy to power 317 trillion, billion homes every second. Or you can multiply the world's nuclear stockpile by 7 million and detonate it. Photo by Brian McGaffney of Nutwood Observatory.

JOHN CROSSEN

WE TAKE THE SUN for granted. It rises every day and sets every night—end of story. Hang on, there's a lot more to know about Earth's outer-space heater. Let's start with some simple facts that a lot of people don't know.

For starters, the Sun is a star. You'd be surprised how many guests at my observatory are amazed to learn that the only difference between the Sun and one of the 100 billion stars in our galaxy is distance. While the other "twinkling suns" are light years away, our Sun is just 143 million kilometres from Earth. By cosmic standards, we're neighbours. Still, it takes sunlight about 8 minutes to traverse that distance. So the sunlight that warms your face is already 8 minutes old. And light isn't slow.

Through empty space light zips along at about 300 thousand kilometres per second. That's right, per second! In the snap of a finger light will travel around the Earth 7.5 times. But let's get back to the Sun, it's full of surprises.

The Sun is 1 million times larger than Earth and nearly 110 times Earth's diameter across. To buy a pair of pants that would fit around the Sun, you'd have to specify a 4,730,005 kilometre waist band!

Astronomers have calculated that the Sun accounts for 99.86% of our solar system's total mass. So if you squeezed all 8 planets, the 3 dwarf planets, their moons and the asteroid belt into one big clump, the Sun would have just about the same mass. In fact they'd all fit inside the Sun.

Big though the Sun seems in comparison to puny Earth, it is still classified as a yellow dwarf star. That's a bit of a misnomer

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Sol

because the light the Sun gives off is white and astronomers really classify old Sol as a G2V series star. This denotes a star with about a 6,000 degree Celsius surface temperature.

So how hot is the dwarf next door? True to its G2V classification, the surface temperature of the Sun pumps the thermometer up to about 6,000 degrees Celsius. But the core of the Sun is where the real heat is — 15 million degrees Celsius of it. That's unimaginably hot. So what's up?

The Sun's energy output is the result of nuclear fusion. It's a process in which hydrogen atoms are heated and compressed to the point that 99% of the hydrogen mass fuses into helium and 1% escapes as pure energy. It's the same process as the hydrogen bomb. In just one second the Sun produces enough energy to power the entire United States for 9 million years — and we're still polluting our planet with fossil fuels!

The Sun is a middle-aged star with a life expectancy of about 10 billion years. As it ages it will expand from a yellow dwarf into a red giant and engulf all the rocky inner planets. So our source of light and life will eventually be our end. But cheer up and look on the sunny side. That's 2 billion years away.

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Spring

Earth and the Sun. So we will see it rise as the Sun sets.

Saturn is in the constellation Libra, the Scales of Justice. Rise time during March is about midnight, so you'd best catch a nap if the ringed thing is one of your targets.

This year Saturn is favourably inclined from Earth's point of view, so the rings should show beautifully in a telescope. Binocular observers will see the planet as an oblong football shaped object thanks to its rings.

That's your spring tonic of constellations. Anyone with a real interest in observing should pick up a copy of Terence Dickinson's *NightWatch*. It has great star charts that are easy to read and plenty of text to give you background information.

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Jade Rabbit

professional and amateur observing programs have begun to scour the sky in search of these renegade rocks.

As a part of the sky scans, NASA has reactivated a program/space mission with the unpronounceable moniker of NEOWISE. Designed primarily to catalogue near-Earth Objects — NEOs — the mission will give us a better understanding who our closest neighbours are and help in planning future space missions to capture an asteroid for study with an eye towards mining it.

The space mission, which has been in hibernation since 2011, emerged from its sleep in excellent shape. In addition to the orbiting eye, ground-based data collection and number crunching will be helping out in the mapping proceedure.

Despite Edward Snowden's warnings of government window-peaking, I'm glad this big brother is watching.

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Space Odyssey

FIGURE 5. Astronauts at Harpolus crater. Credit: Google Images

Luna puts down in Harpalus crater (52.6° N, 43.4° W) which is an easy observing target. While looking at it through the eyepiece, imagine what it would look like standing there, and doing a 360° turn. In the film (Figure 5.), Dr. Cargraves observes that the scene is "one of utter barrenness and desolation and then the silence ... the sky is black, velvet black, and pierced by the most intensely brilliant stars anyone ever dreamed of. Hanging over the mountains in the distance I can see our own planet Earth many times larger than the Harvest Moon. I can see most of the Western Hemisphere and I can also see it's about sunrise in San Francisco. It's afternoon here and will be for a couple of more days." Think about it.

For any modern viewer, the corny dialogue, primitive special effects (it won an Academy Award for special effects!) and eerie space music make it a hoot to watch. That's the charm.

The final film, Stanley Kubrick's *2001: A Space Odyssey* is widely considered a masterpiece of cinema. I can still recall seeing this 1968 film with the pressing awareness that people would actually go there ... and soon. The film continues to age well and arguably the "look-feel" influenced many, if not all, subsequent space films. Remarks here will be confined to that part of the film and book (Ref. 4) containing the lunar action. Clavius crater (58.4° S, 14.4° W), in the heart of the Southern Highlands, is the location of Clavius Base (Figure 6.) contructed in 1994 by the U.S. Astronautical Engineering Corps. Essentially a man-made cave, we are told that Clavius Base can be entirely self-supporting. Next time you're examining Clavius, imagine people going about their daily business beneath the crater floor at Clavius Base.

In the routine Moonbus ride from Clavius over to Tycho crater (43.3° S, 11.4° W)

FIGURE 6. Clavius Base in the distance. Credit: Google Images

the book describes Earthshine illuminating the terrain with "a cold, blue-green phosphorescence" and how the stars look in the pre-dawn. The film captures this in addition to a hovering Earth in the background. The book also points out that the Sun's corona is always visible at lunar dawn and the strangely close horizon is due to the Moon's tight curvature compared to Earth's. The Moonbus slides down the inner terraces of Tycho arriving finally at Tycho Magnetic Anomaly-One (TMA-1) a.k.a. the black monolith (Figure 7). What a mind-blowing scene to visualize while actually observing Tycho. The book describes Tycho crater itself "as if someone had hurled a bag of flour at the face of the Moon, and it had spattered out in all directions." With Tycho shouting "look here", it does seems the obvious place for passing aliens to plant their warning beacon.

Charged with an artistic lift from these films, you may now see Harpalus, Clavius

See "Tycho Crater" on page 15

The Sky this Month

Mercury is a dawn twilight apparation. It reaches greatest elongation west (28°) on the 14th. The waning crescent Moon passes near it on the 29th.

Venus is low in the south east dawn sky and reaches greatest elongation west (47°) on the 22nd. The waning crescent Moon passes north 4° on the 27th.

Mars is in the morning sky in Virgo a few degrees NE of Spica and rises mid-evening. Begins retrograde motion on the 1st.

Jupiter is well placed in the mid-evening sky in Gemini. Ends retrograde motion on the 6th.

Saturn begins retrograde motion on the 3rd in Libra. Rises near midnight.

Zodiacal Light visible in northern latitude in the west after evening twilight for next two weeks from the 18th.

Daylight Savings Time begins on March 9.

Spring Equinox arrives 12:57 pm on March 20th.

Moon Phases

New Moon	3:00 AM	March 1
First Quarter	10:27 AM	March 8
Full Moon	12:08 PM	March 16
Last Quarter	8:46 PM	March 23

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February Club Meeting

was equally humongous. Not your backyard model to be sure. We also got to see what was the equivalent of a 60-foot slide rule and some of the other instruments used during the early half of the 1900s — including a display of beautiful brass telescopes.

Highlight of the talk for me was the shot of the blink comparator that Clyde Tombaugh had used when comparing images that led to his discovery of the planet Pluto. There was also a scrapbook announcing the discovery including a photo of the young lady from England who gave Pluto its name. Amazing how the first two letters in Pluto also stand for Percival Lowell.

No tour would be complete without seeing Percival Lowell's mausoleum. It is only fitting that he be buried there. He built the original facility from his own personal fortune. Then he made it famous during the "Mars Sensation Years" that inspired the likes of Carl Sagan, Neil deGrasse Tyson, Isaac Asimov and many others to take up an interest in astronomy.

We look forward to Rick's return from Australia in a few months, and another great tour talk. Thanks Rick for a great job.

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Tycho Crater

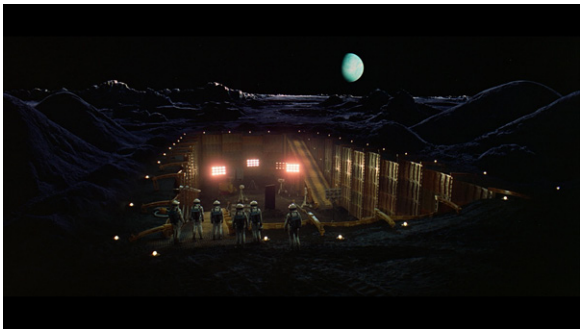

FIGURE 7. TMA-1 excavation at Tycho crater. Credit: Google Images

and Tycho as much with your imagination, as with your eyes. Hitch would advise you to enjoy the "pieces of cake", but don't forget about the "slices of life" at the eyepiece.

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Constellation Flags

same four-page article to read on the plane while traveling. As the fates would have it, the publisher was traveling to Brazil the following day to look into opening an office there. Fortunately for all of us the publisher found the article fascinating and André's four-page article has morphed into a nicely illustrated book.

Flags of the Night Sky is available on Kindle and as a paperback via Springer Publishing. If you have $29 left after the Christmas buying binge, the paperback is available at Amazon. Kindle readers will only have to find $20 to enjoy the same read.

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References & Links

1. *Le Voyage dans la Lune* (Full length colour version) http://www.youtube.com/watch?v=o3GMDBA7WZg
2. Zimmerman, R., (2013, April), "Exploring Caves on Other Worlds," *Sky & Telescope*, 18-24 (This article discusses caves on Mars and the Moon. Cave types are described as are possible candidates for development.)
3. *Destination Moon* (Full length) http://www.youtube.com/watch?v=DsisGSBlQqo&list=TL_CY48_RfA3E
4. Clarke, A., (1968), *2001: A Space Odyssey*, New American Library.

PAA Scope Catalogue

Hello you telescope bargain hunters. Doesn't this look like an ad for your favourite telescope store? Well no matter what store is your favourite, nobody can beat our prices. These telescopes are all FREE. You read that correctly, they are all free, for a two month loan period, as long as you're a member of the PAA. This is one of the many rewards of being a PAA member. The rules for borrowing one of these fine instruments are on our website. The selection allows you to try different designs, capabilities, transportability etc. and may help you decide on the best type of telescope to buy to suit your needs.

Let's examine the offering from the smallest easy to transport to the big guys offering astounding views of the night sky.

The smallest most portable is actually two telescopes coupled together more commonly called binoculars. Here we have 15 × 70 binoculars complete with tripod. Fifteen power with 70 mm aperture yield excellent views of the moon and nebulae such as the Great Orion Nebula M42. We often recommend starting out with binoculars before buying a telescope.

Now we move up a bit to a refractor. This is a very portable telescope. It's a NewStar once brought out by the folks at Efston Science. The telescope is 70 mm with a focal length of 900 mm yielding f/13. The mount is a Vixen Porta Mount on loan from John Crossen at B.H.O. Quick and easy setup, lightweight makes this a good "grab and go" telescope.

Our next offering includes either a Bushnell or Meade 114 mm reflector. These are both 700 mm focal length, f/6 telescopes on "Dobsonian" style mounts. Easily transportable in a small car and quick to set up make these a good choice. The Bushnell is also on loan from the B.H.O. Our cat Rambo is checking these out and is not part of the loan agreement.

We begin to get a little more serious with this fine SkyWatcher telescope on an equatorial mount. This is not part of the club's current inventory but is available on loan from me. A generous 130 mm with a focal length of 650 mm yielding f/5 makes this a great portable telescope. The mount being equatorial means that the user should be prepared to do polar alignment to get the most benefit. It features flexible slow motion controls and counterweight. Demonstration and instruction is available.

Increasing the size once again we get to the 6" SkyWatcher reflector on "Dobsonian" style mount. This is a 150 mm with a focal length of 1200 mm f/8 telescope. It is easy to set up and quite portable in a mid-sized car. The mount is large therefore you must consider this depending on your vehicle.

We arrive at the two largest telescopes in the inventory. Firs, the Orion SkyQuest. A great telescope with a generous aperture on a "Dobsonian" style mount. It's a 203 mm, 1200 mm focal length, f/6 telescope. As with the 6" transportability is to be considered when choosing this one.

Finally and certainly not least is our premium offering. The Meade LX90 donated by former member the late George Bryant. A great computerized "goto" telescope with AutoStar hand controller and Telrad finder this will be a joy for the user. At 203 mm, 2000 mm focal length this 8" f/10 offers superb views of the night sky. A word of caution, the O.T.A. in the fork arms without the tripod checks in at about 35lbs. The telescope is however quite portable. The benefit of the S.C.T. is apparent here as the whopping 2000 mm focal length is achieved in a package less that 17" in length. The manual has been downloaded and printed and will be made available with the telescope. User training will be required however before borrowing this instrument.

As you can see the PAA has a great selection of telescopes in the inventory. We also have a wide range of eyepieces available. Don't forget to remind me to give you eyepieces when you pick up a telescope. That little detail is easily missed and renders the telescope useless without the eyepiece. All of the above are available for a two month loan for PAA members. Pickup and drop off is at the Robinson Road Observatory. Delivery service is not included however telescopes under 6" can be made available at a meeting with an advance request.

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Iapetus

highway windshield. Was the dark, leading edge of Iapetus due to it being plastered with material from Phoebe? Did those impacts erode the bright surface layer away, revealing a darker substrate?

In reality, the dark particles picked up by Iapetus aren't enough to explain the incredible brightness differences alone, but they absorb and retain just enough extra heat from the Sun during Iapetus' day to sublimate the ice around it, which resolidifies preferentially on the trailing side, lightening it even further. So it's not just a thin, dark layer from an alien moon that turns Iapetus dark; it's the fact that surface ice sublimates and can no longer reform atop the leading side that darkens it so severely over time. And that story—only confirmed by observations in the last few years—is the reason for the one-of-a-kind appearance of Saturn's incredible two-toned moon, Iapetus!

Learn more about Iapetus here: http://saturn.jpl.nasa.gov/science/moons/iapetus.

Kids can learn more about Saturn's rings at NASA's Space Place: http://spaceplace.nasa.gov/saturn-rings.

to next article

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 photso 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

Next submission deadline:
March 24, 2014

Meetings

The Peterborough Astronomical Association meets every first Friday of each month, except July and August, at the **Peterborough Zoo Orientation Centre** (Next to the PUC Water Treatment Plant) at 7 p.m. P.A.A. general annoucements will begin each meeting with the guest speaker starting at 7:30 p.m.