Peterborough Astronomical Association
The Reflector
Volume 10, Issue 8 ISSN 1712-4425 October 2011

Dark Clues to the Universe

This Hubble Space Telescope image of Galaxy NGC 4414 was used to help calculate the expansion rate of the universe. The galaxy is about 60 million light-years away. Credit: NASA and The Hubble Heritage Team (STScI/AURA)

by Dr. Marc Rayman

Urban astronomers are always wishing for darker skies. But that complaint is due to light from Earth. What about the light coming from the night sky itself? When you think about it, why is the sky dark at all?

Of course, space appears dark at night because that is when our side of Earth faces away from the Sun. But what about all those other suns? Our own Milky Way galaxy contains over 200 billion stars, and the entire universe probably contains over 100 billion galaxies. You might suppose that that many stars would light up the night like daytime!

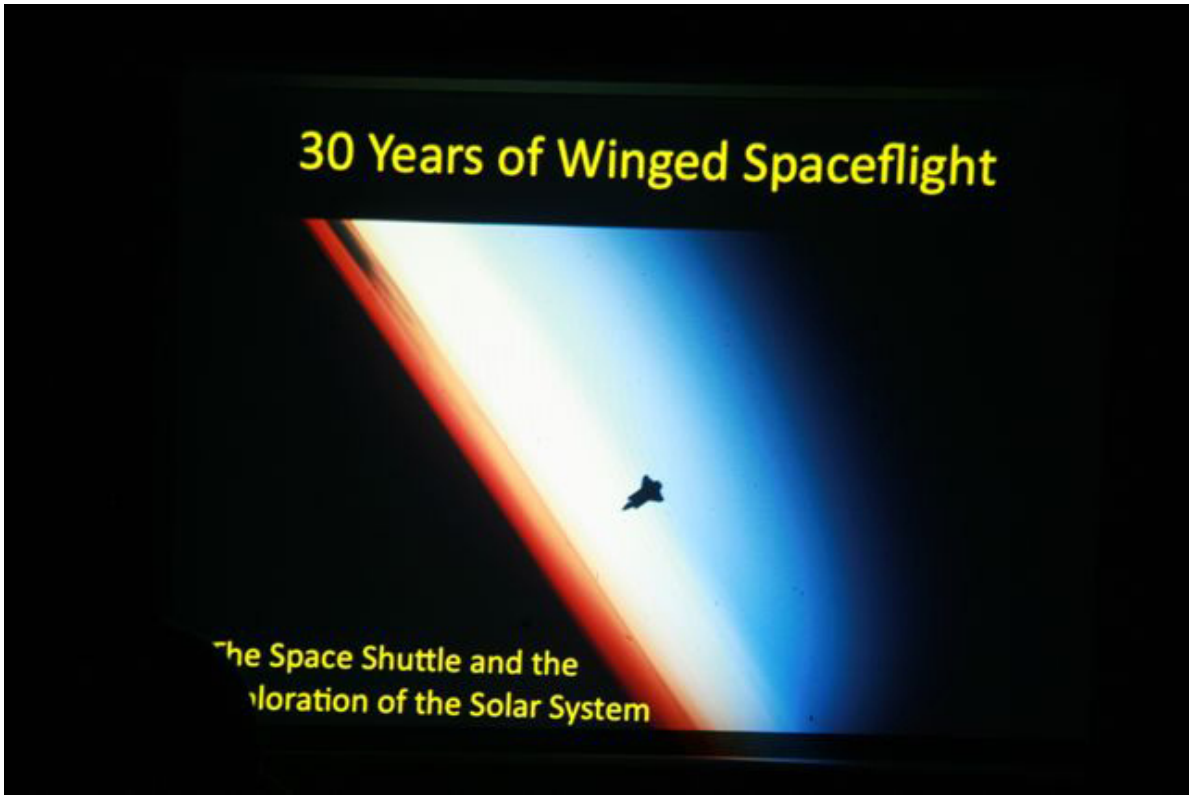
Until the 20th century, astronomers didn't think it was even possible to count all the stars in the universe. They thought the universe was infinite and unchanging.

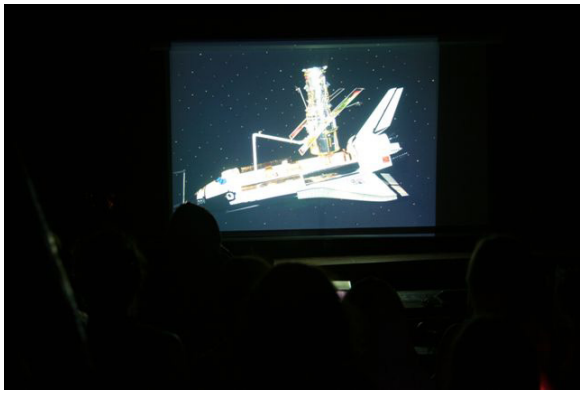
Besides being very hard to imagine, the trouble with an infinite universe is that no matter where you look in the night sky, you should see a star. Stars should overlap each other in the sky like tree trunks in the middle of a very thick forest. But, if this were the case, the sky would be blazing with light. This problem greatly troubled astronomers and became known as "Olbers' Paradox" after the 19th century astronomer Heinrich

see "Olbers Paradox" on page 16

President's Photos

Welcome Back!





Letter from the Editor

In lieu of a president's message (our esteemed Chair of the Club is away) he sends some photographs from last month's PAA meeting held at Emily Provinicial Park, northeast of Omemee. Guest presenter, Randy Attwood, from the Mississauga RASC, lectured about the history of NASA's Space Shuttle missions with the title: *"The Space Shuttle — 30 Years of Winged Spaceflight"*.

An impromptu trip to Toronto dragged me away from this meeting and I am sorry I missed it. But, we have another meeting this month with PAA member Brian McGaffney, of Nutwood Observatory near Apsley, as our guest. Brian is a first-rate deep sky object astrophotographer and we've published a number of his work in this newsletter. Not to be missed.

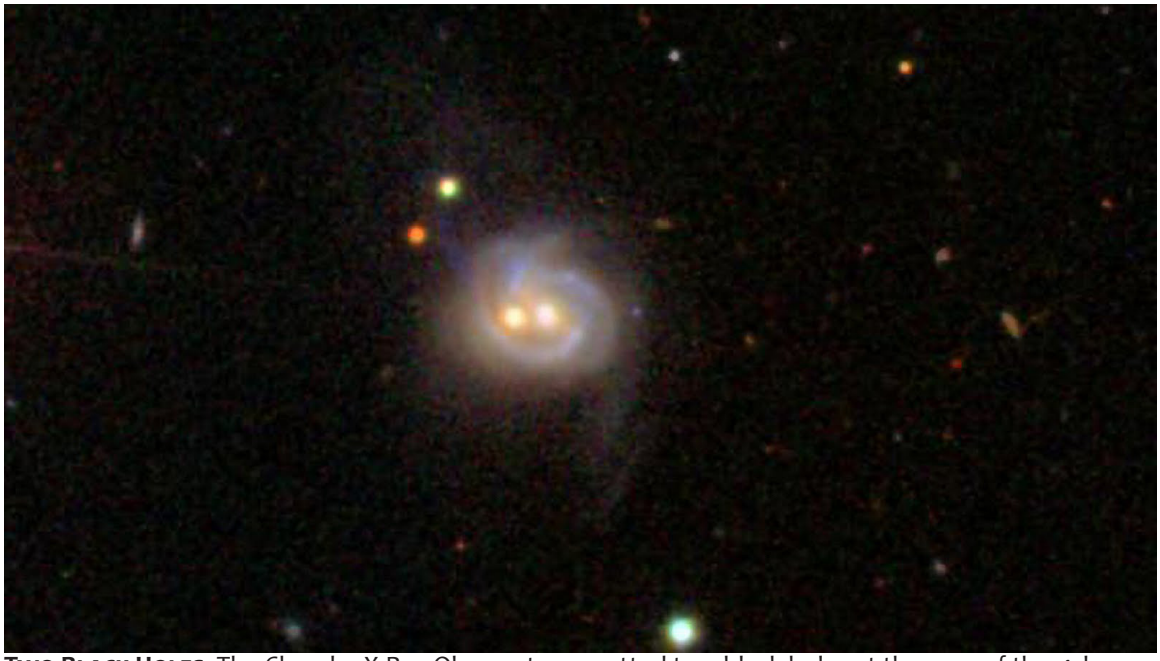
Phillip Chee
Editor, The Reflector

Peterborough Astronomical Association

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 • stankiewiczr@nexicom.net
Phone: 705.295.6158
Club Mailing Address
Rick Stankiewicz, President
Peterborough Astronomical Association
10 Hazel Crescent, RR #8
Peterborough, ON K9J 6X9

Latest News From the Solar System and Beyond

John Crossen



Two Black Holes. The Chandra X-Ray Observatory spotted two black holes at the core of the galaxy Markarian 739. They are 11 light years apart. Both are active.

A number of space missions are beginning to pay dividends in data recently harvested. From the Messenger Spacecraft orbiting Mercury comes photographs of previously unseen terrain as well as information about the planet's thin atmosphere and magnetic field. Surprises include the fact that the planet has a much different mineral content than expected. The innermost planet has lower amounts of iron and titanium as well as high amounts of sulphur. That's the reverse of what scientists expected for a planet that formed so close to the Sun. It seems that the more we learn, the less we know for certain.

Travelling beyond our solar system the European Space Agency's CoRoT Space Telescope has discovered another ten confirmed exoplanets. Seven of the exoplanets are classified as "Hot Jupiters" because they are giant planets that orbit closer to their star than Mercury is to the Sun. Plus, one of the seven Hot Jupiters orbits a star that is already twice as old as our Sun. That's about 10 billion years old. It's an odd lot, but scientists think studying them will help understand how solar systems form.

Fans of mysterious black holes will be delighted to know that astronomers have discovered a galaxy with not one, but two of the demonic star-feeders at its core. Known as Markarian 739 the galaxy lies at a distance of 420 million light years. If you want the distance in kilometres, just multiply 420 million by 10 trillion. The existence of the two black holes is attributed to a galactic merger in our universe's distant past.

See "Space Telescope" on page 15

You Go Underground to Look Up at the Planets

John Crossen

The Johnson Geo Centre in St. John's, Newfoundland is the place to go if you want to learn how the Earth formed over the last 4.5 billion years. Newfoundland (a.k.a. the Rock) is made of some of the most ancient rock discovered on Earth. Some of the rocks in northern Labrador have celebrated 4 billion birthdays. If you've never seen a rock celebrate its birthday, it's a very still occasion — exceedingly quiet, too.

The Geo Centre is built into the side of Signal Hill where the rocks are still quite young. They date back 550 million years. Youthful as that might be, compared to the rocks in Labrador, the Signal Hill rocks are still senior citizens geologically speaking. They predate the first trilobite fossils by 50 million years. They're older than the first fish or land plants. Even the earliest insects and reptiles are about half their age. The rocks on Signal Hill predate the Rocky Mountains by nearly 400 million years. To these old timers the dinosaurs of the Triassic period are relative new comers. The human race is a mere baby, still wet behind the ears, at about 3 million years old.

Nifty as that all is, the surprise for me came when I looked up to see a humongous scale model of the solar system in the 3-story-high underground Reception Hall. Jupiter was about 15 feet wide and Saturn with its rings was breathtaking. The other planets — minus Pluto — were all there in proportion to each other.

You might wonder what all this has to do with ancient rocks, but in studying the formation of the Earth scientists can learn how some of the other rocky inner planets formed. Of course, the reverse is true for studying the planets. And why not, we're all part of the same solar system.

Planets in the Reception Hall. At the Johnson Geo Centre you learn about geology from outer space to the Earth's inner core. With the exception of the restaurant and gift shop, the rest of 37,000 square foot facility is — where else — underground.

Coming back down to Earth, there is a fascinating indoor walk that takes you across the exposed face of the rocks in Signal Hill. Along the way you also have numerous interactive geo exhibits to wander through. Toss in the Geo Theatre, the Earth and Space Auditorium, one mini-theatre and the Exxon-Mobil Oil & Gas Gallery, and you've got a lot of rockin' to do.

To top it all off, history buffs can also have their curiosity quenched at the Geo Centre's Titanic Tour. It gives you the inside story on the most tragic non-war disaster of its time. The Titanic went down off the coast of Newfoundland and many of the lucky survivors found refuge in St. John's harbour.

That's how I spent my summer vacation. It was only a week, but I enjoyed my fill of geology and space as well as great food and a few mugs of Quidi Vidi beer. The Johnson Geo Centre can be visited online at: www.geocentre.ca. It really is "the wonder underground".

The Search For a Scope

Mark Coady

Many of you who do not own a telescope, yet, often wonder how can you get a good used starter scope at a reasonable price without falling into the trap of buying a trash scope? Believe me, it's far easier to buy a piece of crap than it is to land a half-decent scope. I should know having dealt with stuff from Ebay, garage sales, and the like. A lot of patience and due diligence is required.

Just like with buying new equipment, start with the professionals by checking out astronomical retailers like Efston Science, Astromechanics, and Perceptor. They often have used telescopes that they have checked out and offer to the public at a discount much like buying a used vehicle from a reputable new car dealer. Often they list used equipment on their websites complete with photos so you can get an idea of the condition it's in.

Mark's "New to him" scope.

A good internet resource is www.astrobuysell.com. This is a Canadian website used by amateur astronomers country-wide to sell their surplus gear. It is financially supported by astronomical retailers who have links to their stores at the top of each page. Most amateurs will post pictures of the stuff they are selling. As with buying a used car, privately, *caveat emptor* — the buyer beware — is the rule, however, sales are generally on the up and up with this website as a deal gone wrong could ruin someone's reputation in the hobby. Some of the astronomical dealers will also post ads for web-only specials.

Then there are local sources like newspaper ads and Kijiji on the net. With these you have to be careful as many of these are trash scopes and the asking price is way more than what it is actually worth. If the deal looks good don't hesitate to ask the opinion of your fellow members, especially people like John Crossen who have seen more trash scopes than he'd like to have.

If the source of the scope is a garage sale the following rule of thumb applies: If it's a 60mm refractor — no more than $20 as there will be eyepieces and other accessories to buy to make it worthwhile; if it's a cheap reflector (names like Orbitor come to mind) — no more than $30 for the same reasons as above. If you are unsure, either don't buy it or call a fellow knowledgeable member first.

Sometimes patience rewards you and you just fall into a good deal. One day, Susan mentioned an ad she saw on Peterborough Kijiji that had a telescope that I might like. When I viewed it I immediately recognized it as possibly one of Stargazer Steve's models. Whether it was or

See "Scope" on page 15

Sunspots Are Coming

2011 is proving to be a banner year for solar activity [sunspots, solar flares and coronal mass ejections (CME's)] after the years it languished in long periods of few to no sunspots for example. That has all changed now and it looks like we are finally getting into the solar maximum rhythm. Assuming you have the proper safety filter to do so, start watching the Sun for those dark spots that blemish our stars normally smooth yellow face. Did you know that it would take about 108 Earths side-by-side to span the disk of the Sun? This gives you an idea of how big the Sun is, but also helps to gauge the size of sunspots, with some being larger than several Earths.

The attached image from August 1st, 2011, shows just how busy the face of the Sun is getting these days. This nice string of sunspots graced the Sun and is typical of the activity that has been occurring on a regular basis lately. From upper left to lower right are sunspots #1265, 1260, 1261 and 1263 respectively. The statistics speak for themselves too.

Sun "Spotless" Days, as reported by NASA's — SpaceWeather.com :

- 2011 total: 2 days (<1%)
- 2010 total: 51 days (14%)
- 2009 total: 260 days (71%)
- Since 2004: 821 days

All the images I took this particular

See "Sunspots" on page 14

All Rise For Jupiter

John Crossen

Jupiter has never done anything small. It is the biggest planet in our solar system and 1,300 times larger than Earth. Despite grand girth, Jupiter is quite a speed demon making one complete revolution in just 10 hours. It takes tiny Earth 24 hours to accomplish the same feat.Jupiter is classified as a Gas Giant because it is primarily made up of the two lightest gasses known — hydrogen and helium. That fact, combined with Jupiter's rapid rotational rate account for the planet looking somewhat oblate when viewed at high power in a telescope.

When it comes to storms, there's nothing puny about Jupiter either. The famous Giant Red Spot (GRS) has been visible since 1830. At its edge there are winds that whip around at 360 km/h and the GRS could swallow two Earths side-by-side.

Jupiters massive gravitational pull has attracted a total of 63 moons — the most that any planet can boast.

The planet has also attracted a lot of attention from spacecraft. Pioneers 10 and 11 gave the big guy a fly-by in 1973. Voyagers 1 and 2 buzzed Mr. Big in 1979 and the Galileo mission made 34 orbits around Jupiter in 2003. Next up will be the Juno Mission — a sophisticated multi-experiment satellite with a diameter of 20 metres when its solar panels are extended. I'll have more about this mission as the story unfolds.

For those of us who must remain Earth-bound, Jupiter rises about 10 p.m. in September. With the exception of the Moon it owns the sky with a magnitude of –2.5. So it should be easy pickings for even a

See "Jupiter" on page 15

Juno Mission and Jupiter. This NASA artist's concept of the Juno Mission satellite that will orbit Jupiter at close range taking measurements, photographs and eventually launching a probe into the planets thick cloud layers.

PHOTO GALLERY

Comet Garradd

PAA member, Michael McCarthy sent along the following image of Comet Garradd. He writes, “This is a 32 sec integration with my C14 at F1.8 with Starizona’s hyperstar using a Mallincam Extreme video camera. It was broadcast on NSN (Nightskies Network), my channel is Fairview Observatory.”

ISS "A" to "V"

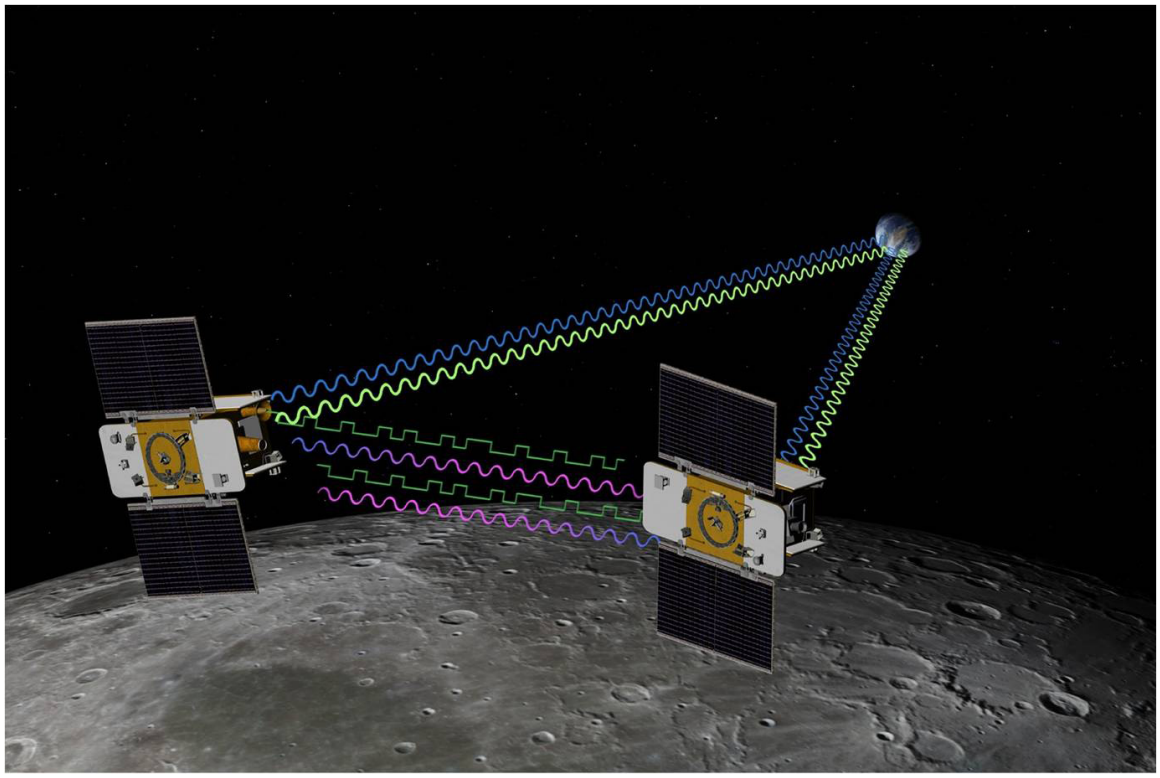
On February 10, 2011, at 5:51 a.m., the International Space Station (ISS) arched across the sky, starting as an object of –3.6 magnitude, 53 degrees up in the western sky. Meanwhile, the planet Venus (-4.0 mag.) shone brightly near the southeastern horizon. The interesting thing about this particular transit of the ISS was that it appeared to pass right in front of Arcturus, the –0.04 magnitude alpha star of the constellation Bootes and headed right for the planet Venus. This "occultation" of Arcturus was interesting enough, but you will note another passing in front of a bright star about half way along the ISS flight path at this particular morning. This was the 3.7 mag. alpha star in the constellation Serpens Caput.

The attached image captured a 92 second portion of the whole three-minute show. The ISS is moving from upper right to lower left in this image and like a very long meteor, goes from brightest to dimmest, as it gets closer to the horizon. It may seem odd that when the ISS passes overhead it appears to be moving so fast (which it is at 26,000 kph), but as it approaches the horizon it seems to "slow down" (which it is not), but it is all a matter of perspective. Like a racecar on a racetrack, in the distance it appears to be moving slower as it heads toward you, but as it passes in front of you it just flies by!

On this particular morning, the same thing happened, because even though the first portion of this exposure the ISS appeared to move quickly through the sky, after this exposure was taken the ISS continued it's slower decent to about 10 degrees about the horizon (very near where Venus was located in the lower left) and dimmed further until it disappeared.

Now days some people are becoming less excited about the passing of the ISS, but I still find it exciting when a chance alignment makes it just that more interesting, as in this case. The challenge when photographing it too is to have clear skies, at the right time, and be in the proper location to capture it. In this case I was in my back yard south of Peterborough (near Keene) with a tripod mounted Canon 400D camera and Sigma 10 to 20mm lense set at 10mm, using ISO 800; at f/4.0.

GRAIL Will Explore the Moon From Crust to Core



GRAIL Mission. This artist's concept shows the two GRAIL satellites orbiting the Moon and relaying the information back to Earth. Image from NASA files.

John Crossen

For all the missions NASA, ESA, the Japanese, the Russians and India have sent to the Moon you'd think we know a lot about our next-door neighbour. But we've only scratched the lunar surface. Aside from a few shallow samples and a couple hundred pounds of rocks the Apollo missions brought back, we know little of what lies beneath the Moon's surface.

Does the Moon have a molten core? Or does it have a solid iron core? If so, how big is it? Why is the Moon's crust on the near side thinner than on the far side? How come some lunar impact basins have higher concentrations of mass — called mascons — than others? Do mascons produce gravitational perturbations that cause satellites orbiting the Moon to speed up and slow down as they orbit the big rock? GRAIL — Gravity Recovery And Interior Laboratory — is designed to help answer those questions and more.

On September 10 a Delta II rocket launched two satellites that will orbit our celestial side-kick for a year. The project is solar powered and will take nearly a year to reach the Moon. Using gravity it will peek beneath the lunar crust to measure what lies below. Here is how it works.

When the two satellites arrive at the Moon they will be deployed so that they are a set distance apart. Slow-downs and speed-ups between the two satellites caused by differences in gravitational pull

See "GRAIL" on page 13

Clash of the Titans in the Ultimate Outdoor Stage

John Crossen

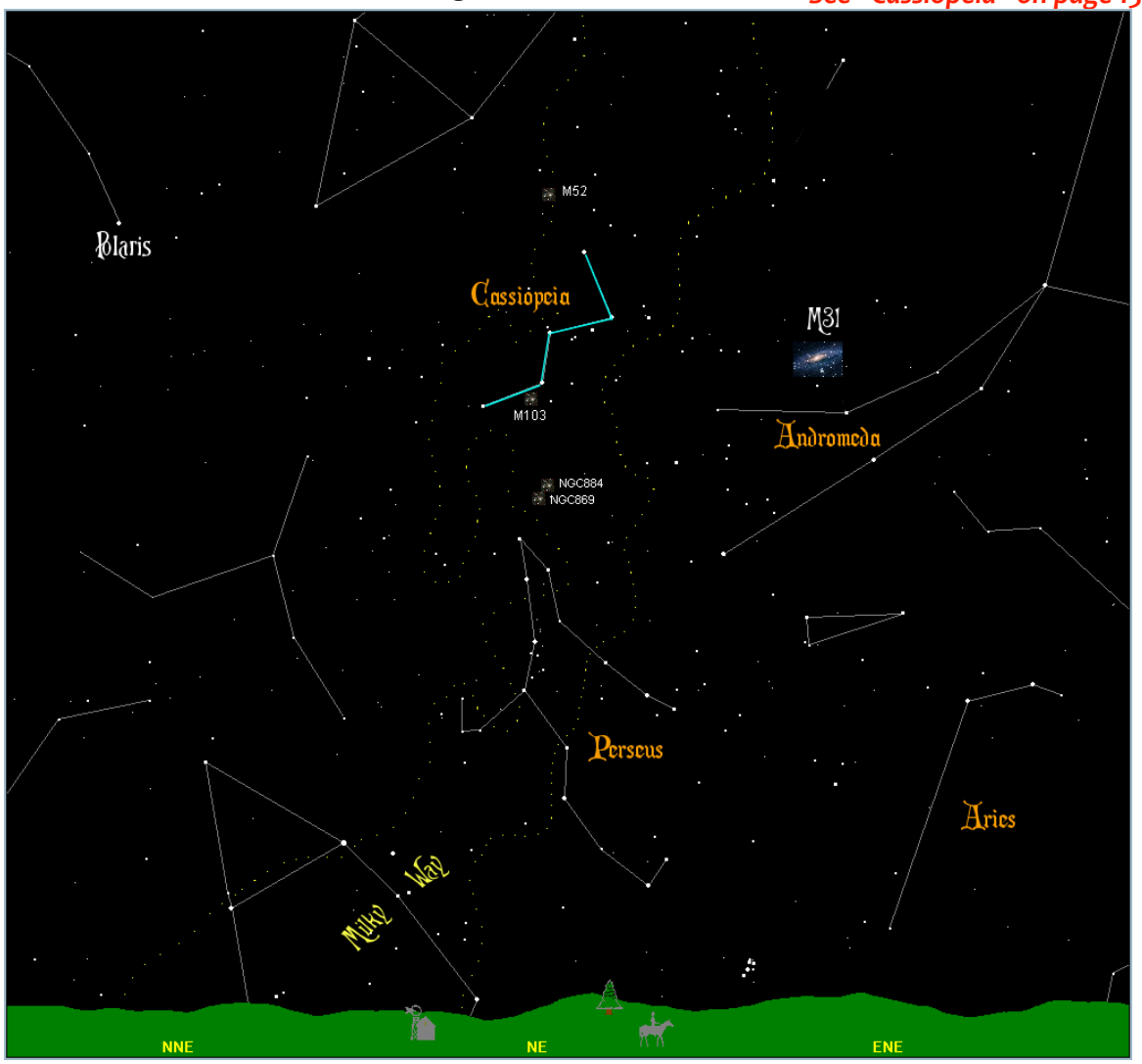
Its screen dwarfs that of any IMAX theatre in the world. Admission is free. And to see it all you have to do is go outside and look up. It's the night sky, and now showing on its celestial screen is the epic blockbuster *Clash of the Titans*.

The classic tale originated in the days of ancient Greece and has been told and retold again for centuries. Its characters are timeless. Vain Queen Cassiopeia, weak-kneed King Cepheus, the beautiful Princess Andromeda and courageous Perseus riding the winged horse Pegasus with the head of Medusa dangling from his clenched fist.

In October the entire cast of characters perform on any clear, moonless night. While the tale is ancient in origin it has been made into a film twice recently—first in 1981 and again in 2010. Plus there's a video game, too.

To connect the dots that make up the cast, get your hands on a copy of *SkyNews Magazine* and check the star chart. All the characters are in the same section of sky.

See "Cassiopeia" on page 13



What Is In a Word

Many of you have likely been following the exciting space drama involving a roving space probe, Deep Impact. The drama started to unfold back on January 12, 2005 when it was launched to send an impact mission to Comet Tempel 1 (9P/Tempel). The "impactor" successfully hit its target on July 4, 2005. The spacecraft kept right on ticking though.

The Deep Impact mission was finished with the visit to Comet Tempel 1. But the spacecraft still had plenty of maneuvering fuel left, so NASA approved a second mission, called EPOXI, that included a visit to a second comet. Three years ago, the mission had to shift course when the comet it was aiming for, Comet Boethin, could not be found. The backup target was Hartley 2 (103P/Hartley). On November 4, 2010 it met it's target and sent back amazing images in case you missed them: http://en.wikipedia.org/wiki/103P/Hartley.

The extended mission is called EPOXI, which is a "hybid acronym" for Extrasolar Planet Observation and Deep Impact Extended Investigation. EPOXI combines two objectives: the Deep Impact Extended Investigation (DIXI), and the Extrasolar Planet Observation and Characterization (EPOCh). Deep Impact will conduct both missions, the EPOCh during the cruise phase to 103P/Hartley, and the DIXI at the flyby.

http://en.wikipedia.org/wiki/Deep_Impact_(space_mission)

Comet Watcher,
Rick Stankiewicz, PAA

Learning Spectral Stars — A Rhyme in Time

Have you ever wanted to memorize the order of the spectral temperatures of stars the way they are classified from hottest to coolest? You mean I am the only one? This information can be handy when you read more about stars and their evolution and age because this is often reflected in their surface temperature. Generally speaking, younger stars tend to be hotter and brighter and older stars will dim as they cool. Our closet star (the Sun) is a middle aged, medium sized, whitish-yellow star (G class — 5,000 to 6,000 degrees Kelvin), so this gives you an idea of which way we are headed in a few billion years, as the Sun uses up its fuel and burns out.

Humour me and I will show you how easy it can be if you use a simple mnemonic rhyme.

If we just focus on the seven main sequence of stars from hottest (blue < 25,000 Kelvin) to white, yellow and orange (cooler > 3,500 K), with the shades in between, these are the classifications of O, B, A, F, G, K, M.

1. **O**h, **B**e **A** **F**ine **G**irl (or **G**uy), **K**iss **M**e
2. **O**nly **B**old **A**stronomers **F**orge **G**reat **K**nowledgeable **M**inds
3. **O**nly **B**ored **A**stronomers **F**ind **G**ratification **K**nowing **M**nemonics

Who knew how easy it could be?

Rick Stankiewicz

continued from page 11

Cassiopeia

Most obvious is Queen Cassiopeia. She's the big "W" shaped constellation rising up the north east sky. Imagine her in profile seated on her thrown. Just below her is Perseus and to his right are Andromeda and Pegasus. King Cepheus is just above Cassiopeia and looks a bit like a child's drawing of a house. By the way, Pegasus is flying upside down, so his front legs are pointing up. I guess he was fully acrobatic.

Boiled down to a few paragraphs the story goes like this. Vain Queen Cassiopeia bragged to the sea nymphs that she was more beautiful than they were. In fact she was even more beautiful than the gods.

Finding Cassiopeia's boastful statement rather demeaning, the jealous nymphs snitched to Zeus the king of the gods. The thought that any mortal could think herself more beautiful than a god enraged Zeus. His punishment was swift.

Zeus set a sea monster loose on the Kingdom of Cepheus and Cassiopeia. There was a way to end the carnage. Zeus would return the monster to the sea if Andromeda were sacrificed to it. Cepheus was a good king, but a bad dad. He agreed in a flash.

Happily Perseus was flying past the sacrificial scene when he looked down and spotted the beautiful Andromeda about to become sea monster mush. Having just slain Medusa he swooped down and showed her hideous face to the sea monster. One look and the sea monster turned to stone, at which point he sank to the bottom of the sea.

Of course Perseus and Andromeda were married, Cepheus learned a lesson in bravery and Cassiopeia got a quick course in public relations.

If that's not enough excitement for an October night Jupiter, the king of planets, will rise about 10:00 p.m. It makes a marvellous target in small telescopes which will reveal Jupiter's dancing moons at just 20 power. They change position from night to night, so sometimes you'll see all four and other nights just a couple will be visible. Of course there's more to see and we'll talk about that as October unfolds.

continued from page 10

GRAIL

will help identify mascons. That difference can be as high as one percent.

A similar mission called GRACE — Gravitational Recovery And Climate Experiment — successfully mapped the gravitational field of the Earth recently. Maintaining a precise distance between the two orbiting satellites — called Tom and Jerry was complicated by Earth's atmosphere. On the nearly atmosphere-free Moon that is not a problem.

So what will GRAIL do? Job one will be to study the nature and structure of the huge impact basins on the Moon. They were formed by massive asteroid impacts during the Early Heavy Bombardment. They are now full of basaltic lava and overlay denser-than-average regions in the Moon's upper mantle. GRAIL should give us more details on their structure and on the formation of the mascons.

GRAIL will also tell us why there are differences in the Moon's crustal thickness. The crust on the near side of the Moon is 12 km thinner than the crust on the far side. As well it will answer questions on how some of the Moon's rocks became magnetized.

Yet another key question is that of the lunar core. Until recently astronomers weren't sure whether the Moon had an iron core. GRAIL will help estimate the size of that core. Put it all together and GRAIL may even give us the story of the Moon's origin.

continued from page 6

Sunspots

evening were with a variety of "point and shoot" digital cameras handheld at the eyepiece of my Meade ETX telescope equipped with a Thousand Oaks solar filter. These images are cropped to focus on the sunspot details. Note the black looking centre of sunspot #1263 is called the umbral area of the sunspot and the grayish halo area is referred to as the penumbral area. Did you know that the dark areas of sunspots are actually 2,000 degrees (Kelvin) cooler than the surrounding area of the Sun? Keep looking up because every day is a different story and you just never know what you might see as new sunspots appear and old ones disappear.

Solar Observer,
Rick Stankiewicz

The Sky this Month

Mercury in evening twilight sky in last half of the month. Near crescent moon on the 27th. Lies 2° from Venus at end of the month.

Venus is low in the southwestern evening twilight sky. Moon passes 2° south on the 28th.

Mars in eastern morning sky moving from Cancer to Leo.

Jupiter rises early evening and visible all night. At opposition on the 29th.

Saturn in conjunction with the sun on the 13th and reappears in the dawn twilight late in the month.

Orionid Meteors peak at 7:22 PM on the 21st.

Zodiacal Light visible in the eastern sky before morning twilight for next two weeks from the 24th.

Moon Phases

First Quarter	11:15 PM	October 3
Full Moon	10:06 PM	October 11
Last Quarter	11:30 PM	October 19
New Moon	3:56 PM	October 26

continued from page 3

Space Telescope

Canadian astronomer Ian Shelton and his assistant discovered a supernova in the large Magellenic Cloud 23 years ago. At the time Shelton was the resident astronomer for the University of Toronto at its Southern Telescope in Las Campanas, Chile. His discovery was the first naked-eye supernova visible in over 383 years. Now it has begun to brighten again. This marks its beginning as a supernova remnant.

Amid the never-ending hokum about the faked Moon missions and the release of a new film called Apollo 18 — why we never went back — at least somebody thinks we went there — NASA has launched a new mission to take a closer look at our nearest neighbour. Called Grail — Gravity Recovery and Interior Laboratory — the mission involves two lunar orbiters which were launched on September 10 from Cape Canaveral. They will study the Moon's geology "from crust to core" to see if our celestial dance partner still has a molten core and to help solve the mystery of why the "dark side" of the Moon has such a different geographic topography from the side we usually see.

The August launch of the Juno spacecraft to Jupiter rounds out the space news. It is due to arrive in 2016. Named in honour of Jupiter's wife who was able to see through clouds, that's just one of the things the spacecraft will do during it's mission to the gas giant planet. The spacecraft will orbit Jupiter 33 times, skimming to within 3,100 miles (5,000 kilometres) above the planet's cloud tops every 11 days, for one year.

continued from page 5

Scope

wasn't, it was a Dob and it was going for $60. SOLD! It did, indeed, turn out to be a Stargazer Steve creation — a 4-¼" f/10 planetary reflector on a light weight Dobsonian mount which went for over $300 in the late 90s. As these scopes, which are no longer made, only came with inexpensive rifle cross-hairs for finders, I added a 6×30 right angle finderscope that I found on EBay for $20. I will probably paint the tube at some time but for now, since it is so easy to carry around, I have an $80 grab and go scope.

continued from page 7

Jupiter

novice to spot. This year the jovial giant will occupy a spot just below the constellation Aries. Just check your star chart and Jupiter will be the brightest object in that part of the sky.

While finding Jupiter with the naked eye can be a treat, a pair of 10×50 binoculars will boost the excitement. Mounted on a tripod to eliminate vibration, they will show you the planet and its four Galilean moons — Io, Ganymede, Europa and Callisto. Move up to a small telescope you'll take in the moons plus some of the weather bands. A larger scope will bring out the GRS as well as the weather bands and festoons in the upper layer of Jupiter's atmosphere.

Jupiter's speedy spin means that the GRS can be viewed through a large scope over the course of the night. Another pastime for "scopers" is watching the four Galilean moons dance around the planet. If you're really lucky, you can see a moon transit the big planet, usually by spotting its shadow. The moons tend blend in with the planet's surface.

Until we meet again, keep your cottage lights aimed down and dimmed down. You'll save money, energy and the dark Kawartha night sky.

continued from page front page

Olbers Paradox

Olbers who wrote about it, although he was not the first to raise this astronomical mystery.

To try to explain the paradox, some 19th century scientists thought that dust clouds between the stars must be absorbing a lot of the starlight so it wouldn't shine through to us. But later scientists realized that the dust itself would absorb so much energy from the starlight that eventually it would glow as hot and bright as the stars themselves.

Astronomers now realize that the universe is not infinite. A finite universe—that is, a universe of limited size—even one with trillions of stars, just wouldn't have enough stars to light up all of space.

Although the idea of a finite universe explains why Earth's sky is dark at night, other factors work to make it even darker.

The universe is expanding. As a result, the light that leaves a distant galaxy today will have much farther to travel to our eyes than the light that left it a million years ago or even one year ago. That means the amount of light energy reaching us from distant stars dwindles all the time. And the farther away the star, the less bright it will look to us.

Also, because space is expanding, the wavelengths of the light passing through it are expanding. Thus, the farther the light has traveled, the more red-shifted (and lower in energy) it becomes, perhaps red-shifting right out of the visible range. So, even darker skies prevail.

The universe, both finite in size and finite in age, is full of wonderful sights. See some bright, beautiful images of faraway galaxies against the blackness of space at the Space Place image galleries. Visit http://spaceplace.nasa.gov/search/?q=gallery.

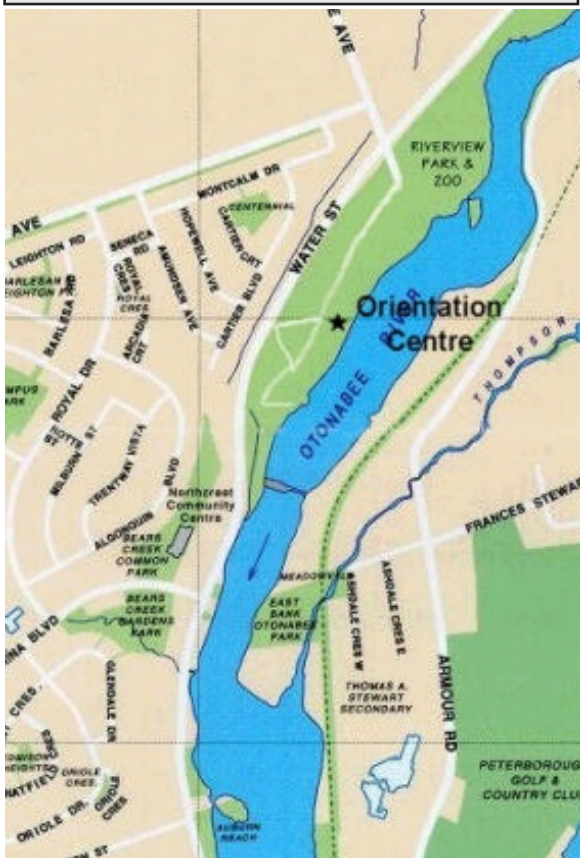
This article was provided courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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:
OCTOBER 24, 2011



Meetings

The Peterborough Astronomical Association meets every first Friday of most months at the **Peterborough Zoo Orientation Centre** (Next to the PUC Water Treatment Plant) at 8 p.m. P.A.A. executive business will be conducted starting at 7:30 P.M. Members and the public are welcome to attend the earlier time.