Peterborough Astronomical Association

The Reflector

Volume 11, Issue 1 ISSN 1712-4425 January 2012

Dawn Takes a Closer Look

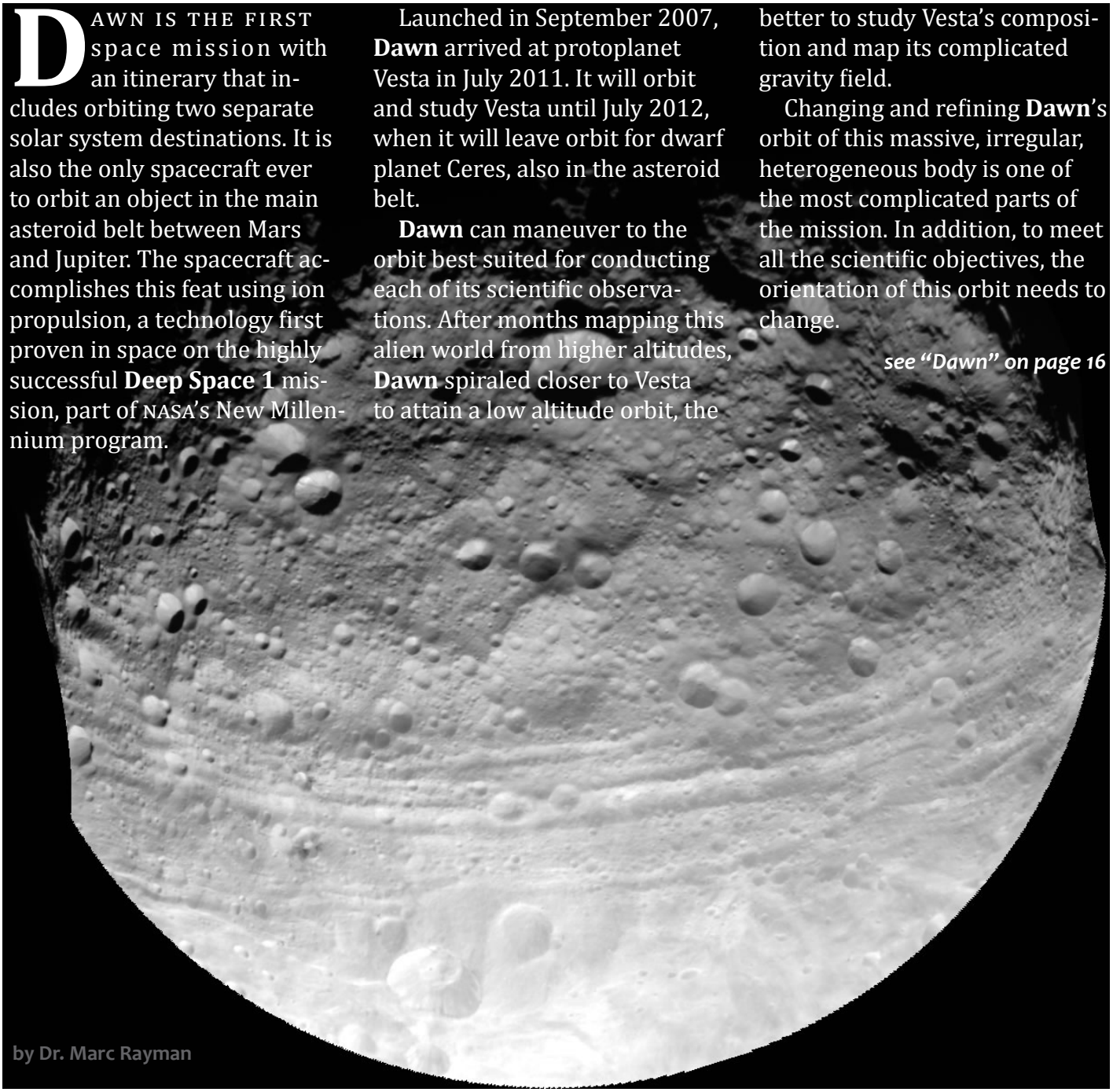
Dawn is the first space mission with an itinerary that includes orbiting two separate solar system destinations. It is also the only spacecraft ever to orbit an object in the main asteroid belt between Mars and Jupiter. The spacecraft accomplishes this feat using ion propulsion, a technology first proven in space on the highly successful **Deep Space 1** mission, part of NASA's New Millennium program.

Launched in September 2007, **Dawn** arrived at protoplanet Vesta in July 2011. It will orbit and study Vesta until July 2012, when it will leave orbit for dwarf planet Ceres, also in the asteroid belt.

Dawn can maneuver to the orbit best suited for conducting each of its scientific observations. After months mapping this alien world from higher altitudes, **Dawn** spiraled closer to Vesta to attain a low altitude orbit, the better to study Vesta's composition and map its complicated gravity field.

Changing and refining **Dawn**'s orbit of this massive, irregular, heterogeneous body is one of the most complicated parts of the mission. In addition, to meet all the scientific objectives, the orientation of this orbit needs to change.

see "Dawn" on page 16



by Dr. Marc Rayman

President's Message

Happy New Year

Another year has zipped by and as I reflect on the past year, the P.A.A. had its good moments and bad moments. For the first time since I became a member the "Astronomy on the Hill" event was literally a washout. Mother Nature unleashed her fury causing us to cancel the Saturday night observing on the hill and forced us into a portable for the Sunday session. The planned observing sessions were a mixture of the good, the bad and the ugly with many of them cancelled. As the new year begins we can only hope for better weather this year.

The new year brings change to the P.A.A. At the Annual General Meeting (A.G.M.) some executive positions changed either by acclamation, election, nomination or simply someone put their hand up. I am taking on the role as President, Dean Shewring is staying on for 1 year as Vice-President and John Cameron is staying for 1 year as Secretary. Thank you Dean and John for this. Rick Stankiewicz is taking over the role I had as Publicity Director and as Light Pollution Abatement Director. Thank you Rick for a job well done for the last 5 years or so as president and I know we can count on you to do the club proud in your new roles. Phillip Chee and Boyd Wood have agreed to stay on as Editor of *The Reflector* and Webmaster for the club, respectively. Phil and Boyd have been outstanding in their respective roles. The only new face on the executive is Mike McCarthy as Librarian. I thank Phil, Boyd and Mike for their support. A great big thanks to Valerie Mathias for the job she did as librarian. Pat Crebar, Margaret Scorthorne-Brons and John Crossen have 1 year left of their mandate as Treasurer, Membership Director and Observing Director respectively.

As a result of a suggestion by Boyd Wood a new committee has been formed under the heading "Light Pollution Abatement" with Rick as director. The members are Rick, Mark, Boyd and Ben. If you'd like to be a part of this please contact Rick or myself.

This is my first message in *The Reflector* as President and I apologize for its length but I thought the "adjustments" to the executive should be mentioned here for the benefit of the members that weren't at the A.G.M. I'm sure there will be some bumpy moments as I get my feet wet but I hope I can measure up to your expectations. I'm hoping that we can spend more time on education at the meetings and less time on business.

Rodger Forsyth

Letter from the Editor

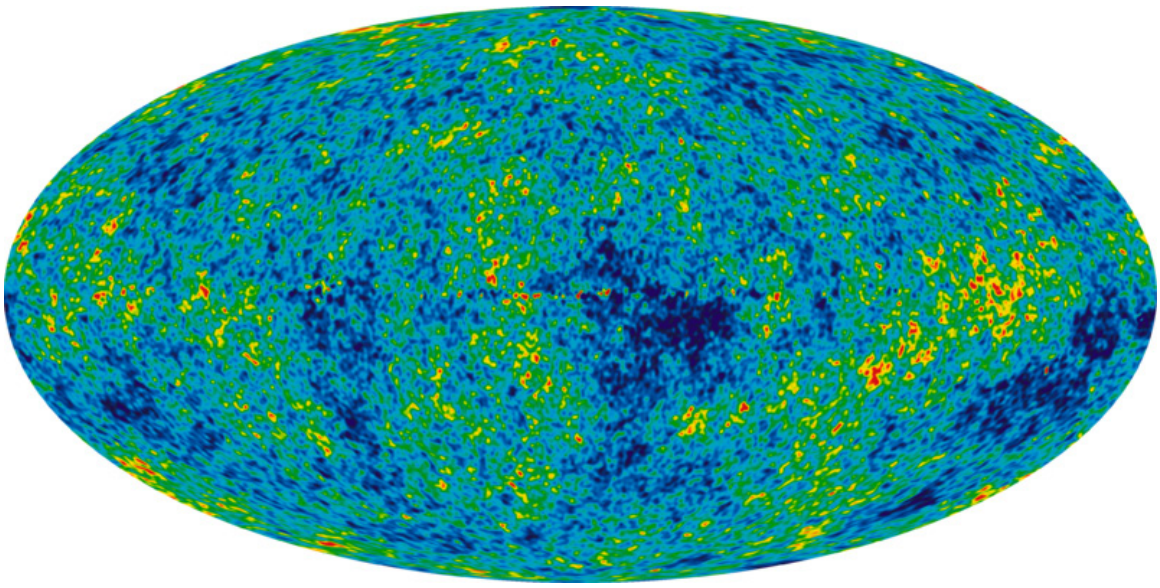
Welcome to the eleventh edition of *The Reflector*, the newsletter of the Peterborough Astronomical Association. Yours truly has signed up for another two-year term as editor. I hope to continue bringing you the finest publication of astronomy and related news in the Kawarthas.

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 • rforsyth@nexicom.net
Phone: 705.292.0729
Club Mailing Address
Rodger Forsyth, President
Peterborough Astronomical Association
536 Robinson Road
Ennismore, ON K0L 1T0

Amazing Space



Cosmic Microwave Background. This is the oldest object ever imaged. It's the Cosmic Microwave Background, a radio image of the energy remaining after the big bang 13.7 billion years ago.

John Crossen

For me the march of time often morphs into a parade of fascinating facts. So here I go with a litany of little-known tidbits that probably should have remained so.

Uranus is the only planet that rolls on its side. Astronomers think this is the result of a collision during the time our solar system was forming about 4 billion years ago. As the larger planets grew from the clumps and chunks that were coalescing there were as many as 100 of them vying for supremacy. Only eight made the final cut. Sorry Pluto.

While we're planet bashing, Earth's Moon is also the result of a smack up early in the history of dear old terra firma. Three billion years ago a planet the size of Mars slammed into Earth blasting a large chunk of the two bodies out into space. The remaining portion of the impactor merged with the Earth. The blob that was blown into space never escaped Earth's gravitational tug and eventually became our Moon. The Moon is round because gravity pulls evenly from all sides.

Not to belabour the point, but the planet Venus is also an orbital oddity. It rotates backwards from all the other planets. Again a planet-to-planet clobbering during the formative years of our solar system is the suspect.

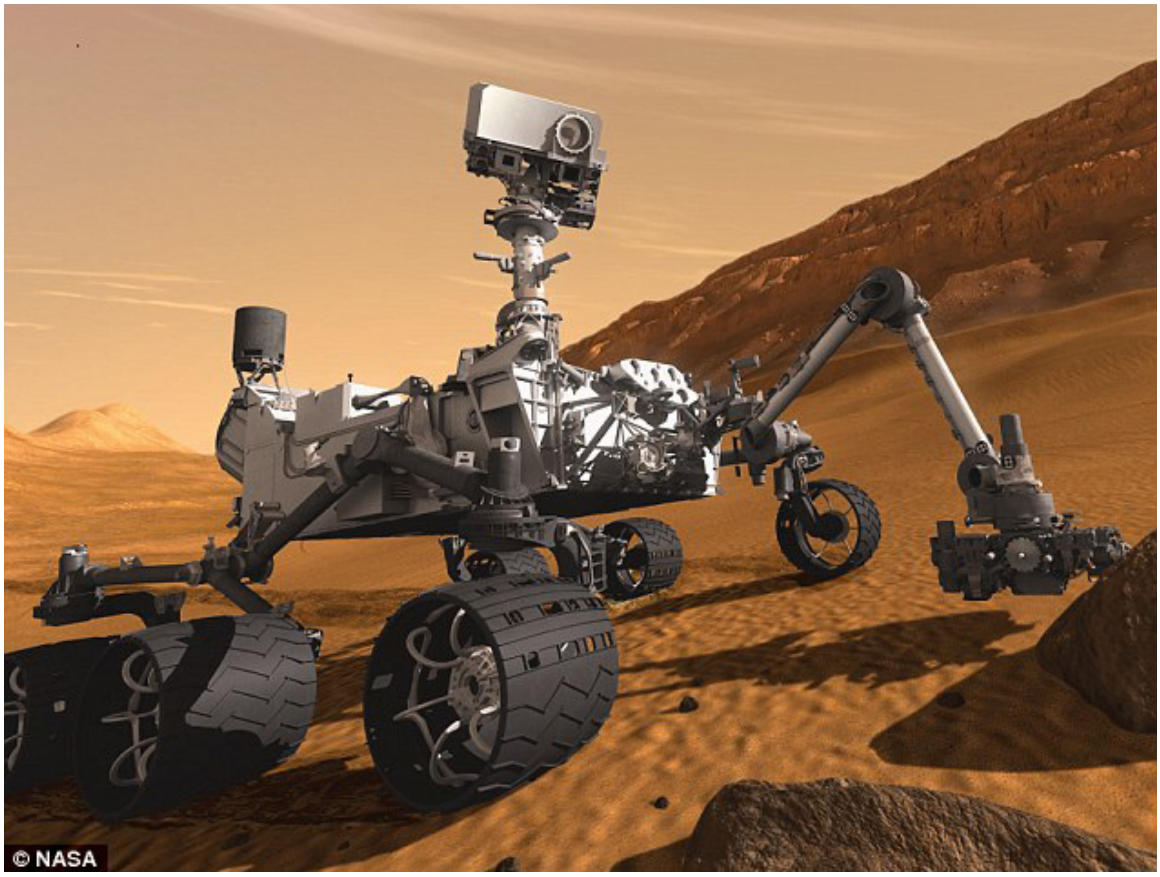
Looking for a celestial heavyweight? Just one teaspoonful of a neutron star would weigh 900 times more than the Great Pyramid of Giza. There are 2,000 neutron stars in the Milky Way Galaxy and its companion galaxy the Large Magellanic Cloud. Depending on the size of the parent star they range from 12 to 20 kilometres in diameter.

The planet Mars is just half the diameter of planet Earth. But Mars has almost the same land area. How can this be? Mars has no oceans or large bodies of water. Earth, on the other hand, is 72% swimming pool and 28% beach. Sorry, trick question.

If you're impressed by hot and cold places, the Boomerang Nebula would be the coolest place for you. For some reason

See "Hot and Cold" on page 14

Here Comes Mars and There Goes Jupiter



The Curiosity Rover is on its way to Mars and will land this coming August 6th. It is much larger and more sophisticated than the previous rovers. Curiosity can also travel farther and faster. If there's life on Mars this laboratory on wheels should be able to tell us.

John Crossen

Mars greets the eastern evening sky about 10:00 pm in early January. By midnight it has risen above the horizon-hugging haze and is in good viewing position for those with telescopes. As the month progresses Mars will draw closer to Earth and appear to grow in size from 9 to almost 14 arc seconds. At this point some surface detail should be visible on nights of steady seeing.

Midway across the southern sky is giant Jupiter. With its dancing moons and striking weather bands, Jupiter makes an excellent target to explore while you're waiting for Mars to climb higher up. You'll need a small telescope or binoculars mounted on a tripod to steady them to view Jupiter's weather bands and the moon dance should be easily visible. But don't count Jupiter out yet. It will be with us into the spring, though it will be growing dimmer.

Look towards the west on the same evening and be prepared to be dazzled. That's where bright Venus puts on its show as the "Evening Star" this winter. If you have binoculars or a small telescope, see if you can watch Venus go through its phases — somewhat like the Moon.

See "Mars" on page 15

Venus is Rising — Everybody Run!

John Crossen

If there were an award for weird planets, Venus would scoop the trophy faster than a 13-year old can run to a Justin Bieber concert. And if there was an award for being mean and nasty, Venus would be a front runner for the Medusa award. Here's the skinny.

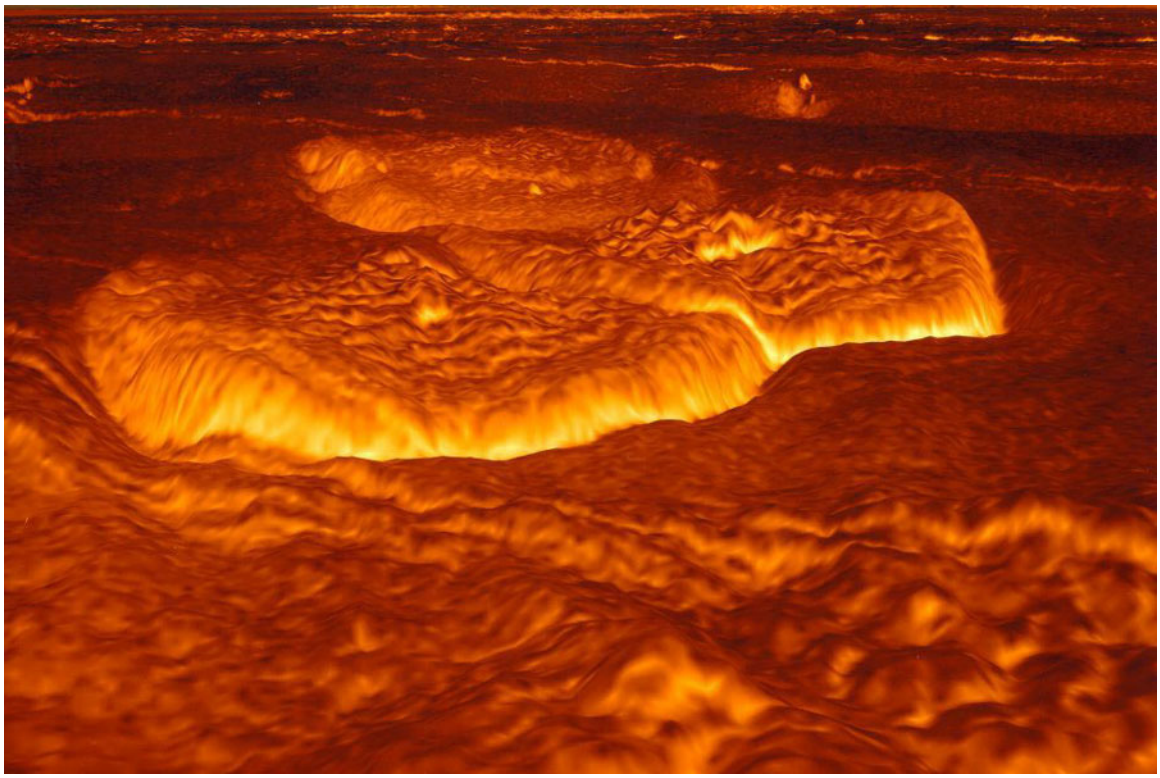
The atmosphere on Venus is hot, heavy and mostly carbon dioxide. Surface temperatures on our so called beauty queen are well above 450°C. The atmospheric pressure is 90 times that on Earth. So you'd be melted and squished before your foot touched Venetian soil, rock or possibly lava.

Then there's the carbon dioxide atmosphere to contend with. One whiff and you're dead. Move further up where clouds of concentrated sulphuric acid drift and your skin falls off. In addition to being the solar system's "Little Shop of Horrors" Venus is also a one-planet freak show.

If you took a stroll at Venus' equator, you'd be moving faster than the planet is rotating. And to make things even weirder, Venus rotates in the opposite direction to the other planets with the exception of Uranus, which rolls on its side.

Here on Earth we rotate from west to east. So when you look up the Sun, planets and stars, they appear to be moving from the east to the west. It's like being on a train but instead of telephone poles and cows it's the stars that are whistling

See "Venus" on page 15



The real Venus hides beneath a 100 kilometre-thick cloud layer. Shown here is a computer-generated drawing of the planet's surface based on the Magellan radar images.

Orions's Belt & Sword

At the last club observing session on December 17, at Cedar Knoll Observatory, I took the opportunity to image something that most all of you have seen in the past, the "belt and sword" of Orion. The "belt" is the three bright (2.2 to 1.8 magnitude) stars that run on a diagonal at Orion the Hunter's "waist" (R to L—Mintaka, Alnilam and Alnitak). From these stars hangs the

See "Orion" on page 13

Life On a Pulsar Isn't For the Faint of Heart

John Crossen

Imagine a demure little 100-pound figure skater here on Earth. On a pulsar she'd tip the scales at 10 billion tons. But wow could she spin. On the pulsar at the centre of the Crab Nebula, she'd drill into the ice at 1,800 RPM. Where do these bizarre critters come from?

Pulsars are born during the dying seconds of stars that have grown from four to eight times the size of the Sun. In a single cataclysmic crunch of gravity these big, old stars collapse into one of the most powerful explosions possible — a supernova.

During any star's lifetime it produces energy by fusing hydrogen into helium. In the fusion process a bit of energy is given off. That's what powers the star, makes it shine and give off heat. The energy released also pushes out on the star, trying to blow it apart. Fortunately the gravity created by the star's immense mass counteracts the push outward and the star remains balanced.

This "push/pull" battle continues throughout the star's existence. When it runs out of hydrogen to fuse into helium, it begins fusing heavier elements into even heavier ones. This can go on for millions of year. Then the star hits the iron barrier. Iron doesn't fuse into another element and produce energy. And that spells the collapse of the giant star.

Within seconds the star collapses from a behemoth that would straddle our solar system down to a pulsar which is about 12 kilometres across. Now that's what I call shrinkage! But it's not weight loss. That little orb still has a lot of the original star's mass.

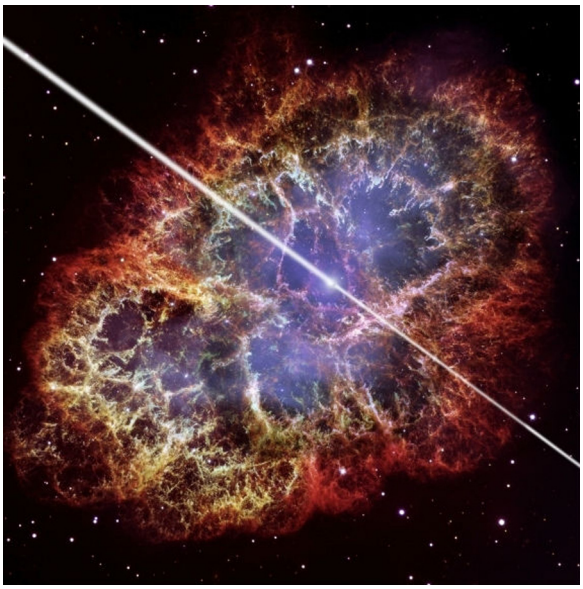
Inside the pulsar, gravity has literally crushed the atom. If you could squish Mount Everest down to a lump about 1 inch around you'd have just a tiny chunk of a pulsar. Drop it and that chunk would fall through the Earth like a rock in water. Needless to say, the gravity generated by a neutron star's mass is incredible.

Here on Earth jumping off a metre-high ledge is no big thing. Jump off that same ledge on a pulsar and you'd be travelling at nearly 7.2 million km/h when you landed. The only person smiling after that would be your chiropractor.

Why does a pulsar spin? It's called conservation of angular momentum. All that really describes is how a figure skater spins faster as he or she pulls their arms in.

As the material from the giant star collapses in on the central star, it is not only crushed, it also begins to spin. That spin generates gamma rays causing the star to radiate a beam like a lighthouse. What we detect are pulses of energy. That's how the

See "Pulsars" on page 14



When the pulsar at the centre of the Crab Nebula was detected the Gamma Rays were listed as messages from LGM — Little Green Men.

PHOTO GALLERY

The Beacon Venus

This winter we see Venus like a beacon in the evening sky. It is eye catching and unmistakable after the Sun sets. Look high in the southeast and the brightest object will be the second planet from the Sun. At magnitude –4.0 it outshines everything in the night sky but the Moon.

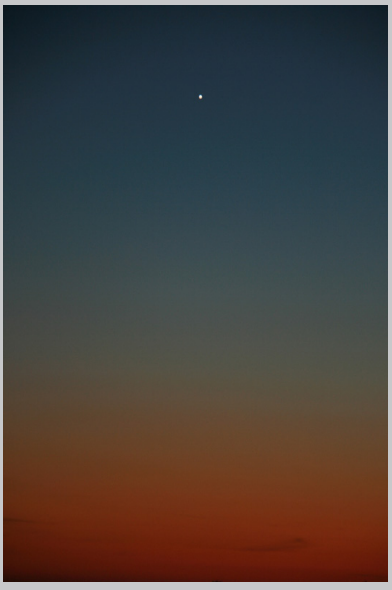
The beauty of a beautiful coloured twilight sky keeps drawing me back to image it again and again. On December 10th and 12th last year I did just that. On the 10th Venus was shining brightly over my neighbourhood south of Peterborough (top left image.) I used a tripod mounted Canon 400D and Sigma 70mm lens setting with ISO 400, f/4.0 & 0.5 second exposure.

On the 12th a similar opportunity presented itself, so I found myself in my backyard capturing the beautifully bright planet high above the orangey-red twilight glow. The striking contrast is so captivating to me (bottom left image.) I used a Canon 400D and lens at 100mm with ISO 200, f/5.6 & 0.5 second exposure.

Then I rushed down to the nearby Otonabee River because the night was so calm and I caught the following reflection of Venus (bottom right image.) This was taken using a similar camera setup, with a 24mm lens setting at f/4.0 and 0.8 seconds. How can you not be all but drawn in to the setting, with this brightest of planets to guide you?

Spellbound by Venus,

Rick Stankiewicz



Spot the Sunspot

There is no question there is a lot more activity on the surface of the Sun these days. Just about any day now you can see sunspots, but you still have to have the right conditions and equipment. Larger spots are more easily seen and this is what I saw the day before Christmas. On December 24th, around noon, the Sun was covered by a very heavy cloud-bank, but not so heavy that it still could not shine through. The following image is cropped to 50 percent of what I recorded with my camera using a 300mm lens at ISO 100, f/11.0 and 1/1,000 second.

The clouds do not allow for a sharp image, but Sunspot #1384 was so big it still showed up quite obviously. Larger than the diameter of Earth, it is no wonder that I was able to see it. There were also a number of smaller spots too, but they were not visible through the clouds. Keep an eye open for more activity in the future, but don't rely on the clouds to filter your view, this rarely works and your images are never as sharp as using a proper solar filter in clear skies.

Rick Stankiewicz

A New Astronomy DVD and An Astronomically Good Video Store

John Crossen

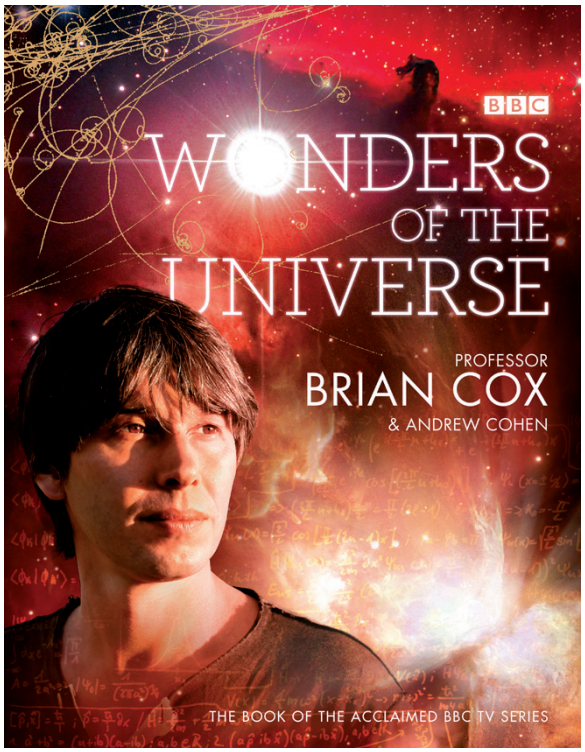
Professor Cox's "Wonders of the Solar System" was the finest astronomy/physics DVD I have ever had the pleasure of viewing. Beautifully photographed and intelligently presented it informed and entertained. Canada's leading astronomy author, Terence Dickinson, ranks Brian Cox as today's greatest astronomy presenter—perhaps the best since Carl Sagan. That's saying a lot since Mr. Dickinson is one of the finest astronomy popularisers in North America.

So when I heard that "Wonders of the Universe" had just come out on DVD I fired the afterburners and launched myself to Lakefield's **The Movie People** to scoop up a copy. I wasn't disappointed. It was everything the previous DVD had been. In fact it was so good that I bought a copy for my collection.

Again Brian Cox takes us on a sky tour. But instead of the solar system he shifts to a wider field of view—the entire universe. The thread that runs through the entire presentation is gravity. Whether he's talking about star formation, star death, the birth of the universe or planets coalescing around their host stars, the importance of gravity always comes to the forefront. It's not only what holds the universe together, but this remarkable documentary as well.

But there's another story here. It's the video store called **The Movie People**. Lakefield is rich in cultural attractions, and this video store has the best section of documentary DVDs I have ever seen. More than once I have gone to the "Something Different" and "TV Documentaries" sections to rent DVDs that most stores wouldn't devote shelf space to. Not so at **The Movie People**.

If you're looking for a DVD about the International Space Station, our Destiny in Space, the Hubble Space Telescope, or the BBC Life Series, it's there. If it's a PBS, or NOVA series on ecology or any of a dozen other nature-and-science-related subjects, you'll find it on the shelves at **The Movie People**. Something else you'll find are people who know movies and can talk intelligently about them. Sure beats the variety store!



***Wonders of the Universe* is entertaining, incredibly well photographed and if you like learning things—it's flat out exciting. Professor Brian Cox's casual presentation style along with breathtaking film footage moves science out of the musty lab and gives it real-life relevance.**

But why stop there? Store owner Kevyn O'Callaghan is also a music and theatre buff so you'll find some jazz, blues and music anthologies on the shelves along with classic flicks and, yes, even foreign films.

I first rented "Wonders of the Universe" from **The Movie People**. It was one of their 7-day rental titles. One viewing and I bought it—which is something else you can do at the store.

The First "Rocket Man"

As promised in the April 2011 issue of The Reflector (Vol.10, No.4), I said I would share with you any of the Russian issued 50th anniversary stamps of Yuri Gagarin. The copy included here I received at the end of 2011. It is the mini-souvenir sheet (#096053) of a 50P. stamp issued on April 12, 2011, that depicts a smiling Gagarin in his space suit helmet. The side panel shows the Vostok I space-craft atop an R-7A Rocket as it lifts off the launch pad from the Baikonur Cosmodrome.

Many countries have released stamps during 2011 to celebrate the 50th anniversary of either Gagarin's historic achievement of being the first human in space or just humankind reaching space. It seems like Canada was one of the only countries not celebrating the event. If any of you out there run across any stamps that depict this anniversary be sure to pick them up and let me know about it and I would be most interested in acquiring them from you. Keep your eyes open!

Your Astronomical Philatelist,
Rick Stankiewicz

Correction

In the November (Vol. 10, No. 9) *The Reflector* the price in the ad for a telescope for sale was unfortunately omitted. The price should have been listed as $500.

Certificates of Merit

Left to right: Rick Stankiewicz (outgoing President), Rene Bowe (past Treasurer), Robert Fisher (past Vice-President), Valerie Mathias (past Librarian), and Mark Coady (past Light Pollution Abatement Director).

On the night of our Annual General Meeting (AGM), December 2nd, 2011, I had the pleasure of performing one of my last official duties as President of the P.A.A., I awarded "Certificates of Merit" to four members in attendance. This was the first ever presentation of these new certificates that are intended to recognize members of the P.A.A. who have served the P.A.A. and it's goals and objectives. I chose to recognize members of the executive who have completed their term of office as a member of the executive and that helped and served with me during my term as President, from March of 2007 until now. These members have "stepped up to the plate" and did more than most. Doing a term on the P.A.A. executive makes a real difference to the leadership of this club. No one knows this more than the President (Right, John?)

John Crossen (Past President).

Trish McCloskey (Past Treasurer).

Pictured here from left to right is Rene Bowe (past Treasurer), Robert Fisher (past Vice-President), Valerie Mathias (past Librarian) and Mark Coady (past Light Pollution Abatement Director).

continued on next page

continued from previous page

Harold Briggs (Past Membership Director).

Then I had to track down a few other members who were unable to attend the AGM. The inserted images show the following members with their certificates. They include, John Crossen (Past President), Harold Briggs (past Membership Director) and Trish McCloskey (past Treasurer). Everyone looks pleased with their new awards and so they should, they deserved them. They have been a help to me over the years and this means they have helped you too. Not that there aren't other deserving members out there, but this group met my criteria. We are only as good as those that help. Without those who are willing to get involved, there is no P.A.A. Thank you all!

Rick Stankiewicz
former PAA President

continued from page 6

Orion

"sword" made up of several stars, the last and brightest being 2.8 magnitude and includes the famous Great Orion Nebula (M42) and the smaller reflection nebula above it (M43). This star-forming region is located about 1,500 light-years from Earth. Luckily, Orion is prominently placed all winter in the southern sky after dark, so take the opportunity to investigate this amazingly diverse constellation and all it has to offer whether you use binoculars or a telescope of any size, you will not be disappointed.

I unfortunately waited just a little too long this night before imaging, as a thin layer of cloud drifted in and started to obscure my view. The attached image was a single exposure taken with a modified Canon EOS 50D camera and Canon 200mm lens at ISO 400; f/2.8; for 30 seconds.

It is too bad that we can't see such colours with our naked eye, but the bright cloudy appearance of the nebula is distinct in binoculars, which is similar to the view captured here.

Rick Stankiewicz

continued from page 3

Hot and Cold

it is even colder than deep space — just 1 degree Kelvin. That's -272.15 degrees Celsius. For you hotties the Sun makes a good stopping spot. On the surface of old Sol the temperature hits about 5,500 degrees Celsius. Dig down to the Sun's core and the thermometer pegs 15 million degrees Celsius.

It wouldn't be fair to leave the Sun without mentioning that it takes almost 1 million years for the energy generated at the Sun's core to reach its surface. So today's sunlight was created inside the Sun 1 million years ago. Oh, and don't forget to add in the 8 minutes it takes the sunlight to travel from the solar surface to Earth.

The speed a rocket needs to travel to escape Earth's gravitational pull at its surface is 11.2 km/s (kilometres per second) this "escape velocity" decreases as the rocket gains altitude. To break free of the Sun's surface a rocket needs to hit 617.5 km/s. To escape from a black hole you'd need to exceed the speed of light, which is impossible.

continued from page 7

Pulsars

pulsar name came to be. A neutron star is just a pulsar that is old and has stopped spinning.

But let's go back just before the star went supernova. At this point it has long since stopped converting hydrogen into helium. As those fuel sources ran out, it began fusing heavier and heavier elements in the struggle to stave off its collapse. During that time it creates about 26 of the 92 basic elements in the periodic table. The other 66 are created by the titanic heat and pressure when the star goes supernova.

So the gold in your wedding band, the carbon in your body and the calcium in your teeth are all the result of supernovas that happened billions of years ago.

The Sky this Month

Mercury in the southeastern dawn sky for the first 3 weeks of the month but moving toward the sun. At aphelion on the 18th.

Venus in western evening twilight. Moon passes 7° N on the 26th.

Mars rises in late evening at the Leo-Virgo border. Continues to brighten as it approaches a March 3rd opposition. Begins retrograde motion on the 25th.

Jupiter in the evening sky near Aries-Pisces border, slowly beginning direct eastward motion after its late 2011 retrograde loop. Sets after midnight.

Saturn in the morning sky in Virgo northeast of Spica. Northen side of its rings visible at about a 14° tilt until October but opening up to 19° year's end.

Quarantid Meteors peak at 2:00 AM on the 4th.

Moon Phases

First Quarter	1:14 AM	January 1
Full Moon	2:30 AM	January 9
Last Quarter	4:00 AM	January 16
New Moon	2:39 AM	January 23
First Quarter	11:10 PM	January 30

continued from page 4

Mars

Beyond all doubt, Venus will be the brightest object in the night sky. Even the Moon, though it is closer and appears larger, won't match Venus for sheer magnitude — minus 4 to be precise.

Insomniacs will welcome beautiful Saturn in the pre-dawn sky. This year Saturn's rings will be facing us more completely. As a result the planet will appear a bit brighter and when viewed through a telescope, the rings should be spectacular.

The Moon, our celestial dance partner begins the month at its most desirable phase. As a waxing First Quarter Moon the shadows cast by the crater rims and mountains stand out sharply. Binoculars will give you a hint of the many impacts that have taken place on the Moon. A small telescope can deliver a jaw-dropping experience.

But January doesn't just belong to the bino-and-scope set. The constellations are shifting and Leo the Lion is climbing up the eastern horizon. Overhead Auriga, Gemini and Taurus are in splendid view. And we can't overlook magnificent Orion to the south.

I always find it amusing that the fierce hunter is just above Lepus the Hare. Imagine that, Orion the Great Hunter and he can't catch a little rabbit. Maybe by Easter he'll track the widdle wascal down.

If you like tracking down deep sky objects, January has plenty to offer. For the naked-eye observer M45, the Double Cluster, the Hyades and the Pleiades are rewarding targets. With the exception of the Hyades, they appear as misty patches in the night sky. Hoist up a pair of binoculars and they burst into life.

So bundle up and look up. January may be chilly, but there's plenty to see on a clear crisp night.

continued from page 5

Venus

past. On backwards-rotating Venus the Sun, stars and planets would appear to rise in the west and set in the east. That's if you could see through Venus's thick atmosphere.

But the weirdness doesn't end here. It takes Venus longer to rotate once about its axis than it does to orbit the Sun. Venus takes 243 Earth days to make one complete rotation. That means that a Venetian day is longer than a Venetian year — the 225 days it takes Venus to orbit the Sun. Figure that one out Mr. Hallmark Cards.

The surface of Venus is thought to be relatively new thanks to recent volcanic activity and Venus's hefty atmosphere. Small meteors would melt trying to penetrate that wall of carbon dioxide. So if you were looking for craters, you'd better pack a lunch, because you have a fair bit of trekking to do. Astronomers estimate that there are only 1,000 craters strewn across the entire planet's surface. So compared to our Moon, Venus is a relatively zit-free zone.

This winter Venus will be our so-called "Evening Star." It will shine brighter than any of the planets — even Jupiter. During the months of January and February you will see it in the western sky. Each night it will appear higher and higher up. On January 25th and on February 25th Venus will be near the waxing Crescent Moon. Those evenings will be guaranteed photo-ops for the astro imagers.

Shining at magnitude -4 (our Sun shines at magnitude -27) Venus will once again be a thing of beauty. Just don't get too close because this beauty is a bitch.

continued from page 1

Dawn

These differing orientations are a crucial element of the strategy for gathering the most scientifically valuable data on Vesta. It generally requires a great deal of maneuvering to change the plane of a spacecraft's orbit. The ion propulsion system allows the probe to fly from one orbit to another without the penalty of carrying a massive supply of propellant. Indeed, one of the reasons that traveling from Earth to Vesta (and later Ceres) requires ion propulsion is the challenge of tilting the orbit around the sun.

Although the ion propulsion system accomplishes the majority of the orbit change, **Dawn's** navigators are enlisting Vesta itself. Some of the ion thrusting was designed in part to put the spacecraft in certain locations from which Vesta would twist its orbit toward the target angle for the low-altitude orbit. As **Dawn** rotates and the world underneath it revolves, the spacecraft feels a changing pull. There is always a tug downward, but because of Vesta's heterogeneous interior structure, sometimes there is also a slight force to one side or another. With their knowledge of the gravity field, the mission team plotted a course that took advantage of these variations to get a free ride.

The flight plan is a complex affair of carefully timed thrusting and coasting. Very far from home, the spacecraft is making excellent progress in its expedition at a fascinating world that, until a few months ago, had never seen a probe from Earth.

Keep up with **Dawn's** progress by following the Chief Engineer's (yours truly's) journal at http://dawn.jpl.nasa.gov/mission/journal.asp. And check out the illustrated story in verse of "Professor Starr's Dream Trip: Or, how a little technology goes a long way," at http://space-place.nasa.gov/story-prof-starr.

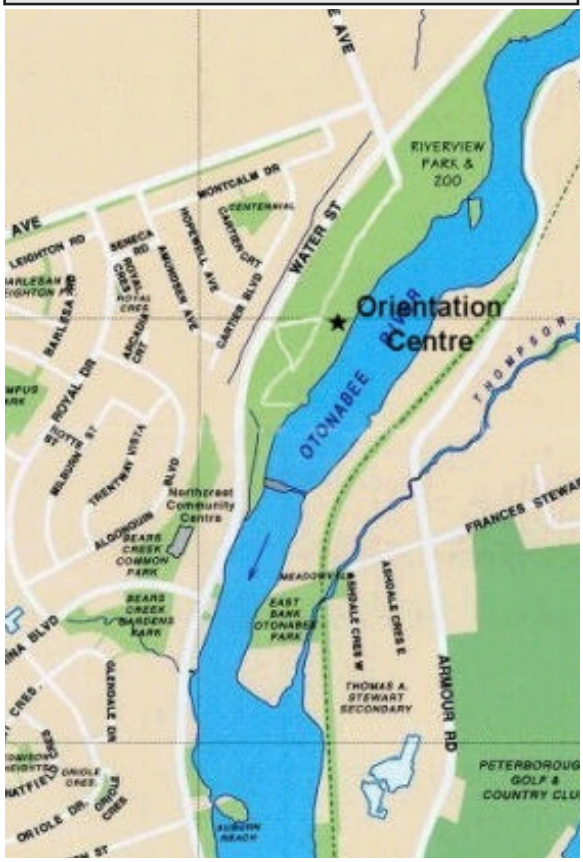
This article was provided courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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:
JANUARY 27, 2012



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.