Peterborough Astronomical Association

The Reflector

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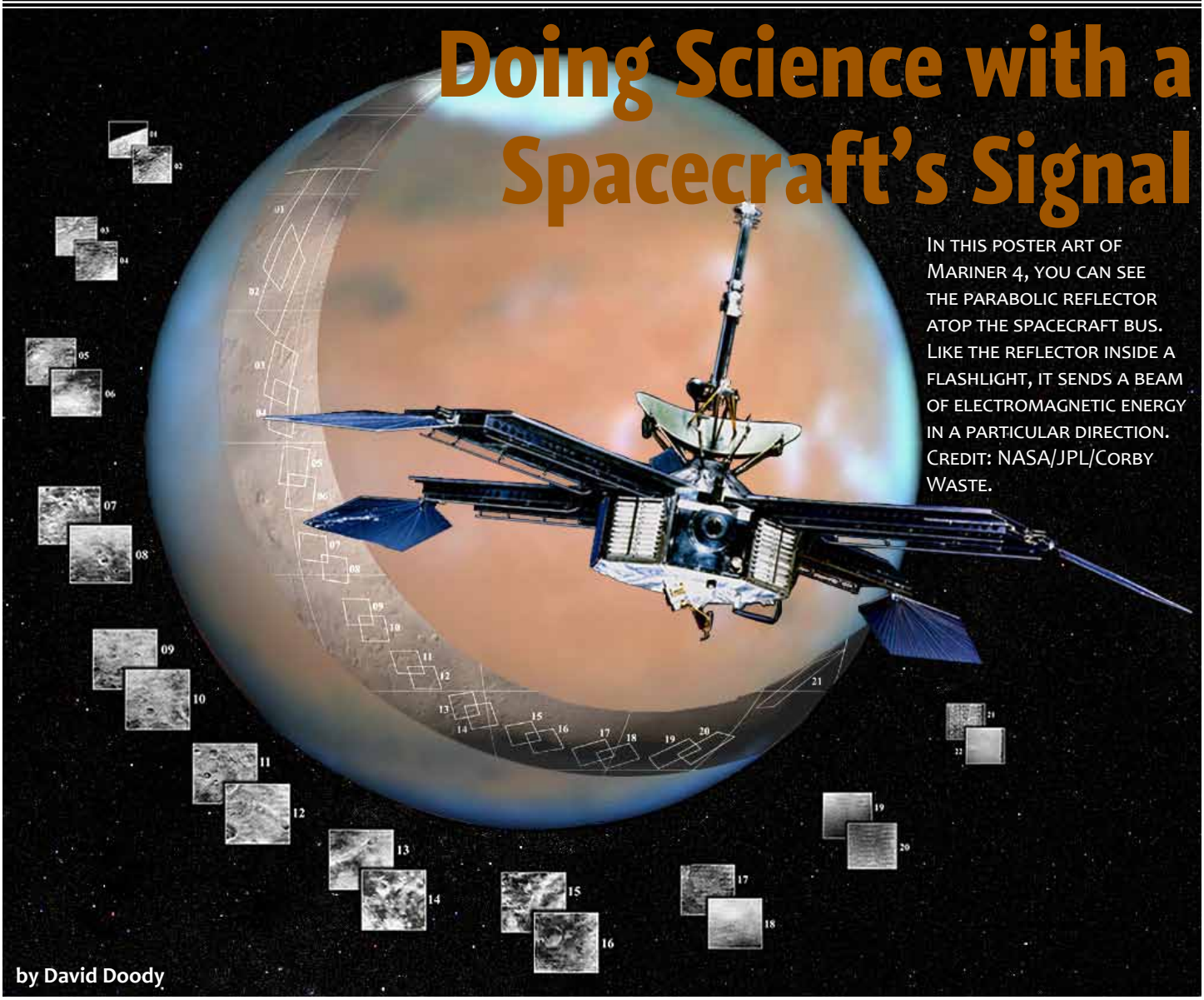
Doing Science with a Spacecraft's Signal



In this poster art of Mariner 4, you can see the parabolic reflector atop the spacecraft bus. Like the reflector inside a flashlight, it sends a beam of electromagnetic energy in a particular direction. Credit: NASA/JPL/Corby Waste.

by David Doody

Mariner 2 to Venus, the first interplanetary flight, was launched August 27 fifty years ago. This was a time when scientists were first learning that Venus might not harbour jungles under its thick atmosphere after all. A Russian scientist had discovered that atmosphere during the rare Venus transit of 1761, because of the effects of sunlight from behind.

Mariner 2 proved interplanetary flight was possible, and our ability to take close-up images of other planets would be richly rewarding in scientific return. But it also meant we could use the spacecraft itself as a "light" source, planting it behind an object of our choosing and making direct measurements.

Mariner 4 did the first occultation experiment of this sort when it passed behind Mars as seen from Earth in July 1965. But, instead of visible light from the Sun, this occultation experiment used the spacecraft's approximately 2-GHz radio signal.

The Mariner 4 experiment revealed Mars's thin atmosphere. Since then, successful radio science occultation experiments have been

see "Mariner " on page 16

President's Message

Fall Skies Arguably the Best

As the days get shorter and the nights get longer we usually enjoy clearer skies and better observing. Still not so cold that you shiver at the eyepiece but you do have to dress accordingly. The fall skies in my mind rival the spring for clarity. Let's hope for a number of good nights before the cold of winter sets in.

Saturday September the 22nd a number of us enjoyed a bus trip to the David Dunlap Observatory (DDO). This has to rank as one of the highlights for 2012. Dean Shewring originally suggested the idea and followed through with organizing this with Paul Mortfield — Chair DDO Committee (RASC Toronto Centre). Paul was our tour guide and showed a tremendous amount of enthusiasm and knowledge. The DDO is Canada's largest optical telescope with a primary mirror 74 inches in diameter, an awesome sight. More on this in this issue with some photos.

One area we need some help with is to provide more local focus to the stories in *The Reflector*. If you have a fond memory of an astronomy related event, perhaps with photos, write it up and send to out editor Phil Chee. I'm sure he would welcome any submission and it would give you an opportunity to contribute to our great organization.

Rodger Forsyth
PAA President

Letter from the Editor

Waiting For the Next Thing

I don't know about you, but I'm feeling a bit jaded about visual astronomy these days. Not that I don't appreciate staring longingly at the night sky, yet there are times I wish there was more. Perhaps witnessing the last transit of Venus until the next century makes the heart sink a little.

We always seem to miss total solar eclipses in this neigbourhood. There hasn't been a really spectacular meteor shower in decades. Bright comets always seem to grace the southern hemisphere.

Which is why I was excited by the news that the recently discovered comet C/2012S1 might be the brightest comet in ages. If all goes according to plan it may brighten to magnitude -11 to -16, 1000 times brighter than Venus. But we will have to wait till November 2013 when the comet makes its closet approach to the Sun from above 1.1 million kilometres. Now, being that close to the sun means it may melt like a snowball in June. If it survives like the December 2011 comet Lovejoy, it may just be the most spectacular sight for a long time.

Impatiently waiting,

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.
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Things Only a Lunatic Would Know — or Want To

The classic Harvest Moon of September allowed farmers to work into the night. Remember, they didn't have tractors with electric lights back then. Image Credit: Dan Bush of Missouri Skies.

John Crossen

Let's start with dear old Luna's name. Moon is its official name. That's why it is capitalized. If you were talking about Jupiter's moon Io the word "moon" isn't a name but a category like a planet or an asteroid. Only when writing about our Moon is it a proper name. Actually we shouldn't call it "the Moon." That's like saying "the Kevin" or "the Bob." But bad habits won't go away — sort of like the Toronto Maple Leafs.

While we're on the topic of names, there are many lunar land marks that bear new names thanks to the Apollo astronauts. Bob's Bend, Apollo Ridge, Marilyn's Mountain and even the infamous Boot Hill are all nicknames our space rangers dubbed familiar Lunar landmarks during their geography lessons for Moon landings.

In a flip-flop of logic, what we often call "the dark side of the Moon" is actually lighter in colour than the near side which faces us. The fact that we can't see the Moon's far side has led us to give it the name "dark side."

The Russians were the first to photograph the "dark side" of the Moon via an orbiting satellite in 1959. They simply waited until the Moon passed between Earth and the Sun and used old Sol as a gigantic flashbulb. Smile, poof, gotcha! The Apollo 10 astronauts were the first humans to lay eyes on the Moon's back side.

The term "Blue Moon" has nothing to do with the Moon's colour. It has simply crept into our jargon via the phrase "once in a Blue Moon" which means a rare event. Today it also is used for the second Full Moon in a single month. The next Blue Moon won't happen until 2015, so it is indeed a rare event. *[Most recently August 2012. Ed.]*

Every Full Moon of the year has a specific name, usually attached to some activity. The Harvest Moon happens in September when farmers would have welcomed the extra light for their harvest activities. October brings with it the Hunter's Moon. In November we have the Beaver Moon and in December the Full Moon is aptly called the Cold Moon.

See "Lunatic" on page 15

P.A.A. Excursion
David Dunlap Observatory

Rodger Forsyth

The bus trip to the David Dunlap Observatory (DDO) has to be one of the big highlights for 2012. We ended up with 39 people on the 40 seat bus, a fantastic turnout. The bus was ready for us to board at 5:15 p.m. and we were on our way at 5:30. The weather wasn't encouraging; however the "Clear Sky Clock" promised a break in the clouds for the period of time we would be at the observatory. Suffice to say, it's been wrong before.

As we sped down the highway we felt it was time to break out the sandwiches.

As I went forward up the aisle of the bus handing out small plates my assistant "flight attendant" followed me handing out the food. Here we notice the V for victory sign from trip organizer Dean Shewring. The bus ride was uneventful and gave the attendees lots of opportunity to chat. Sleeping would have been difficult.

When we arrived at the DDO parking lot a number of members of R.A.S.C Toronto Centre were on hand to greet us, "stamp our hands" and escort us to the observatory itself. A room had been set up in the administration building where we were able to leave the second tray of sandwiches, drinks and cookies baked by our resident chef Dean.

Here we see the observatory itself with shutters open and members of Toronto RASC set up with telescopes. The shutter were closed shortly after we got there on account of a chance of rain.

Paul Mortfield — chair DDO Committee (RASC Toronto Centre) was our tour guide and led us first to the "belly" of the observatory. He stated that this was special for us — the public don't get to go there. Here he showed us the massive weights and pulley system that are part of the system to rotate the dome. A rope wraps entirely around the dome and friction alone provides the rotation. In another part downstairs we saw the vacuum chamber where the mirror is recoated. This chamber resembled a large vat so naturally I asked if that was where they brewed the beer. The mirror weighing in at two tons is brought down to this area in a manually operated elevator.

This part of the tour (created for us) ended and we went back to the ad-

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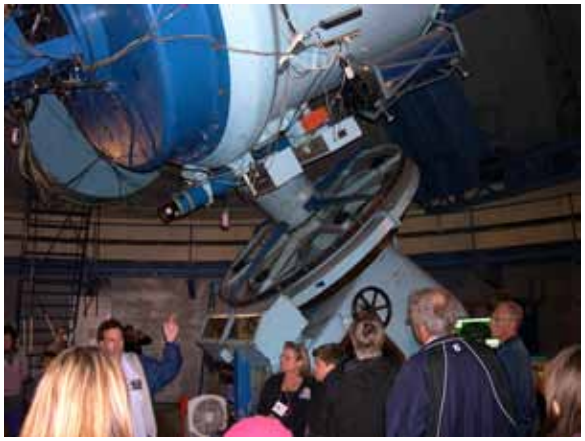
ministrative building for a lecture on Red Dwarfs or M-Stars by Dr. Michael De Robertis, Professor of Physics and Astronomy at York University. The title of the lecture: "M Dwarf Stars. Small but very interesting" A synopsis: "M dwarf stars are smaller than our sun. We can't see any of them without a telescope, yet 75% of the stars in our galaxy are M dwarfs. There's renewed interest in these stars because they might be home to habitable Earth-sized planets." The thinking here is that they are candidates because of their shear numbers and their long life.

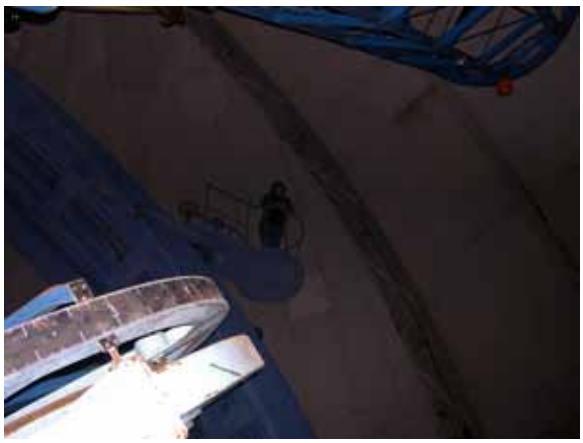
OK, let's go back up the hill to the observatory. Now we get to see this monster telescope.

The telescope as mentioned has a two ton mirror and its total weight is 23 tons. The building is 61 feet in diameter and weighs 80 tons.

I wasn't able to get back far enough to capture the scope in one shot.



Paul Mortfield points out the mechanism of the telescope. The telescope is so precisely balanced that it can be turned in right ascension using the hand wheel visible in the photo. Impressive for 23 tons. The telescope main observing eyepiece is a whopping 100mm and is located at the Cassegrain focus. There is a Newtonian focus located way up and you have to be on the platform shown to get to it. This gal is brave; you wouldn't



catch me up there. A fascinating part of the history of this facility is that the telescope and building were built in England in the 1930's, dismantled, shipped to Canada and re-assembled here.

As stated at the outset, this trip will go down as a highlight for 2012. Dean Shewring did a fantastic job organizing it and Paul Mortfield was an excellent tour guide full of enthusiasm and very knowledgeable. One possible lesson learned here? Let's do more of this type of activity.

Invasion of the Star Creatures

Nearly 20 Star Creatures beamed down to see a star named after one of their departed friends. It was a wonderful gesture and they all knew that it wasn't an officially named star. Only the International Astronomical Union can do that, and they're not for sale.

John Crossen

I won't soon forget the night of September 15, 2012. Overhead the sky was a pitch black shroud punctuated by hundreds of softly flickering stars. There was scarcely a breeze. All was silent save for the sound of my feet shuffling through the grass. Then I heard a rumbling. It grew closer until a bright light suddenly swept across the lawn. It was quickly followed by another and yet another until a half dozen craft rested on the ground. This was the night I had waited for. It was the night of the Star Creatures.

My Star Creatures turned out to be a lot like Earthlings. They were pleasant, kind spirited and even spoke English. They were in fact a group of about 20 humans who had come to view just one star. It was a star they had had named after one of their friends.

Before prattling on I should make it clear that there is only one official organization that can name celestial objects. It is the International Astronomical Union. There are groups called star registries that will name a star after a loved one. But it isn't official. No professional astronomer anywhere else in the world is going to get an email telling them that Zeta Orionis has been renamed Bob Smith.

What the registry does is to keep a catalogue of stars it has named in honour of a girlfriend or departed loved one. Some are global operations so that whatever country

see "Big Numbers" on page 15

InOMN

Saturday, September 22, 2012 marked the 3rd annual International Observe the Moon Night (InOMN), when people all over the world were to gather to observe the Moon. During this years event many members of the PAA were at the David Dunlap Observatory (DDO) in Richmond Hill. It was a cloudy night and unfortunately for many members of the Toronto Centre of the RASC that had their telescopes set-up at the DDO for the public to do some observing of the night sky, not even the Moon was visible.

However, if you had been looking later in the evening there was a brief opportunity around Peterborough, just before the Moon set on this day of the Fall Equinox. As I drove home (11:45 p.m.) from Peterborough, after our trip to the DDO, there was a coloured first quarter Moon between the western horizon and the band of clouds that had kept the Moon hidden all evening. The attached image was taken from my deck and shows the beauty of partaking in such events as InOMN. All too often humanity takes the natural world for granted and it is events like InOMN that helps us focus and share the wonders of the night.

(Cropped image from DSLR & 200mm lense @ ISO 200; f/5.6; 1/25 second exposure)

Local Lunatic.

Rick Stankiewicz

PHOTO GALLERY

September P.A.A. Meeting

Sent along from Dean Shewring:

Phillip,
I've attached three photos I took at our Sept. 7 meeting during the talks on the varieties of telescopes. The first is Rodger with the infamous "nope scope"; the second is of a couple of different scopes; and the third is of Brett Hardy with his 6" Refractor. If you can use these in *The Reflector*, please feel free to do so.
Clearish skies,
Dean Shewring, V-P, PAA

David Dunlap Observatory

Rick Stankiewicz sent along a couple of photos from the Peterborough Astronomical Association road trip to the David Dunlap Observatory. We thought it was such a cool event that we could not not showcase the dome and telescope.

Venus Greets the Moon

Rick Stankiewicz

The morning of September 12th was a sight to behold in the early hours before dawn.

This is just the latest in a long line of conjunctions this year that have involved Venus and the Moon. It is always striking though and in this case, worth getting up for. I was up at 3:30 a.m. until dawn to get these images. There is just something about the brightest planet next to an Earthshine Moon that leaves you spellbound. Hopefully you saw it for yourself, but if you missed it, here is what you missed.

(Tripod mounted DSLR and 18 to 200mm lens @ 170 & 34mm; ISO 400; f/5.6 & 4.0; 3.2 & 4 sec.)

Here's What's Up in November

John Crossen

An hour after sunset, most of winter's constellations are up and at 'em. Auriga with star clusters M37, M38 and M36 is well above the treetops. All three of its star clusters are binocular targets, so no expensive equipment is required. Just a star chart, a clear night, binoculars and some warm coffee.

Taurus the Bull is also breaking free of the branches and should be a good target. The bright star Aldebaran marks the bull's eye and above it to the right is the misty patch known as the Seven Sisters or the Pleiades.

Jupiter. Jupiter, the solar system's largest planet shines brightly in Taurus.

This year Jupiter does a little bull riding or should I say plays the matador. Just look for the brightest object, the Moon excepted, near Taurus. Jupiter will be in front of the bull's horns for the duration of winter.

As the night progresses mighty Orion will take to the sky. Your key target in Orion will be the Orion Nebula. Also known as Messier Object 42 or M42, it lays just below the three stars the represent Orion's belt. You can see it with the naked eye as a blurry star-like glow. In binoculars it begins to show more shape and a small telescope will reveal M42 as a surprisingly bright and expansive object, even at low power.

The jewel in November's crown of events is the Leonid Meteor Shower. Observing it will take some strong coffee, a hand-full of No-Doze tablets and a lot of determination. The shower doesn't occur until the wee hours of the morning when Leo the Lion is rising. The meteors will appear to radiate from the direction of Leo, which is how it got its name, the Leonids.

There is no guarantee how impressive the shower will be, but in 1999 my wife and a friend sat with me as we counted 1,200 streakers in just an hour. That's impressive! But again meteor shows are as predictable as cats, so you never know what to expect. I'll talk a bit more about the shower and how to observe it in an upcoming article.

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Orionids

Orionids. Peak time this year is the morning of Sunday, October 21 between 1 a.m. and dawn. The first quarter Moon will have set before the peak so if it's clear it should be good viewing.

Phillip Chee

Fall is a great time for astronomy nuts. The Milky Way galaxy appears high overhead from horizon to horizon. It's prime time to look for the Andromeda Galaxy. If you are in a dark location you should be able to make out with the naked eye a fuzzy patch in the constellation of Andromeda. Use averted vision to locate it.

October offers a chance to witness the Orionid meteor shower. This meteor shower is the result of the Earth passing through the debris path of Halley's Comet. The peak weekend will be Friday, October 19 to Sunday, October 21. The best time to see it will be after 1 a.m. when the radiant of the shower rises above the horizon. This radiant is located to the north of Orion near the region of his arm. (see image above). On average this shower produces around 20 meteors per hour. The first quarter Moon will have set before the action starts so the possibility of favourable viewing is high.

If you are into astrophotography you will have a nice challenge at this time of year. The zodiacal light will be visible for two weeks from October 13 during the morning hours before the beginning of astronomical twilight. Zodiacal light is a faint glow that is observable twice a year. In the fall it is seen before dawn in the east and in the spring after twilight in the west. This phenomenon

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is the combined reflected sunlight from millions of small dust particles in the orbital plane of the inner solar system. It appears as a faint pyramidal cone of light that lies along the Ecliptic, the path that the planets, the Sun, the Moon, and the Zodiac constellations travel along from our vantage point. It is best observed from dark sky locations but digital cameras should be able to image it from reasonably dark skies.

So bundle up, grab a chair and some coffee and enjoy the wonders of a pre-dawn autumn fall.

Zodiacal Light. Perhaps you'll glimpse the Zodiacal light while you observe a meteor shower before dawn. Photo by Phillip Chee.

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November

Moon-atics will have a nearly Full Moon to contend with on November 1. The bright Moon means stargazing will be as difficult in the rural Kawarthas as it is in light-polluted Peterpuddle. However, by November 7 the Moon will be at Last Quarter phase and won't rise until after midnight, so stargazing can replace TV.

New Moon comes on November 13. That's the night to stay up stargazing. Granted, you'll arrive at work yawning and sleepy, but an all-nighter under the stars is worth it. Your boss will understand ... trust me.

As far as the planets go, they're pretty much gone with the exception of Jupiter. Mars is lost in the glow of the setting Sun just 10 degrees above the horizon. Neptune will be in the Aquarius directly south. At magnitude 7.9 it is well below the limit of the naked eye and just visible in binoculars. Next door in Pisces the Fish lurks Uranus. It will be an easier binocular target at magnitude 5.8. Happy stargazing and don't forget to set your clocks back 1 hour when you go to bed on Saturday, November 3.

Be Careful What You Say

There once was an astronomer who was giving a sky tour to a very intelligent and enthusiastic six year-old and his parents. The astronomer brought the Andromeda Galaxy into the eyepiece of the large telescope and exclaimed, "This galaxy was larger than our home galaxy of the Milky Way and is 2.2 million light-years away, and as we speak it is moving toward us and the two galaxies will crash into each other in about 3 to 4 billion years." He went on to show the group a number of other celestial wonders like nebula, star clusters and the Moon. Everyone was suitably impressed and enjoyed the evening out under the stars.

On the way home the young boy expressed his concern about the Andromeda Galaxy smashing into the Milky Way. His parents tried to comfort him with the fact that nothing terrible was going to happen for a very, very longtime. The youngster was still not totally convinced and said that everyone should be quiet. After a short while his parents started talking and the young lad continued to insist that no one talk. The parents were perplexed at this request and asked the boy why no one should talk. To this the boy said, "The astronomer said that ... AS WE SPEAK the Andromeda Galaxy is moving toward us." The parents were at a loss for words to argue with that logic. We all know that astronomer can be taken at their word and that is what he said!

This is a true story. However, the moral to this story is, be aware of your audience and be careful what you say, you might be taken literally.

Rick Stankiewicz
(The Astronomer)

The Sky this Month

Mercury low in west-south-west during evening twilight. On the 8th 1.8° north of Spica and is near the Moon on the 17th.

Venus in eastern morning sky. On the 3rd is 0.1° south of Regulus and 6° south of the cresent Moon on the 12th.

Mars low in western evening sky and sets mid-evening. Moving rapidly from Libra to Scorpius and into Ophiuchus. Passes north of Antares between 18th and 22nd.

Jupiter rises north of east in late evening in Taurus. Begins retrograde motion on the 4th. On the 5th is occulted by the Moon.

Saturn not visible. In conjunction with the sun on the 25th.

Zodiacal Light visible in east before morning twilight for two weeks from the 13th.

Orionids meteors peak at midnight on the 21st.

Moon Phases

Last Quarter	**3:33 AM**	**October 8**
New Moon	**8:02 PM**	**October 14**
First Quater	**11:32 PM**	**October 21**
Full Moon	**3:49 PM**	**October 29**

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Lunatic

Other Full Moons are January's Wolf Moon, February's Snow Moon, March's Sugar Moon, April's Planter's Moon, the May Flower Moon, June's Strawberry Moon, July's Blood Moon, and August's Moon of the Green Corn.

Size-wise the Moon is about one quarter the size of Earth and its mass is even less because it is composed of lighter minerals. Thus you would weight about one sixth your Earth weight on dear old Luna. Likewise your athletic prowess would increase. Jumping one foot on Earth would become a six-foot rocket liftoff on the Moon.

Aside from being a fascinating object to observe, the Moon also serves a very useful purpose. It counteracts Earth's tendency to wobble as it spins. This stabilizing force means that our planet doesn't flip-flop back and forth causing swift and deadly climate changes. It takes stability for life to evolve and over the last three and a half billion years the Moon has given us that, too. It makes me glad to be a lunatic.

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Star Creatures

you are in, you can go to the registry and look up the person's name and star.

Happily the people who were visiting knew this in advance, so no hearts were broken. It was simply a kind gesture of remembrance and they wanted to see the star. Luckily it was next door to Polaris, the North Star. So I punched in the coordinates and as the telescope tracked along, each member of the group had a look at "James's Star."

Depending on the darkness of the sky at your location and the season, approximately 2,500 stars are visible to the naked eye under ideal conditions. Most of the brighter stars already have names that originated in Arabic, Babylonian, Greek, Roman, or Phoenician cultures. But those are the brightest stars. The average human eye can't see stars dimmer than sixth magnitude, so these faint stars become the domain of the star registries. In most cases these stars are numbered and are only found on the star charts professional and advanced amateurs use to scout their way around the heavens. As a result, they are the ones which the star registry will name.

So before you have a star named after someone you care about, make sure that it can at least be seen in binoculars or a small telescope. Also make certain that the star is visible from your location. I had one fellow who asked me to look up a star he had named after his granddaughter. To his dismay he would have to travel to Florida to find it.

Make a wish on any star you see. But remember, if you can see the star it probably already has a name.

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Mariner 4

conducted at every planet and many large moons. And another one is on schedule to investigate Pluto and its companion Charon, when the New Horizons spacecraft flies by in July 2015. Also, during that flyby, a different kind of radio science experiment will investigate the gravitational field.

The most recent radio science occultation experiment took place September 2, 2012, when the Cassini spacecraft carried its three transmitters behind Saturn. These three different frequencies are all kept precisely "in tune" with one another, based on a reference frequency sent from Earth. Compared to observations of the free space for calibration just before ingress to occultation, the experiment makes it possible to tease out a wide variety of components in Saturn's ionosphere and atmosphere.

Occultation experiments comprise only one of many categories of radio science experiments. Others include tests of General Relativity, studying the solar corona, mapping gravity fields, determining mass, and more. They all rely on NASA's Deep Space Network to capture the signals, which are then archived and studied.

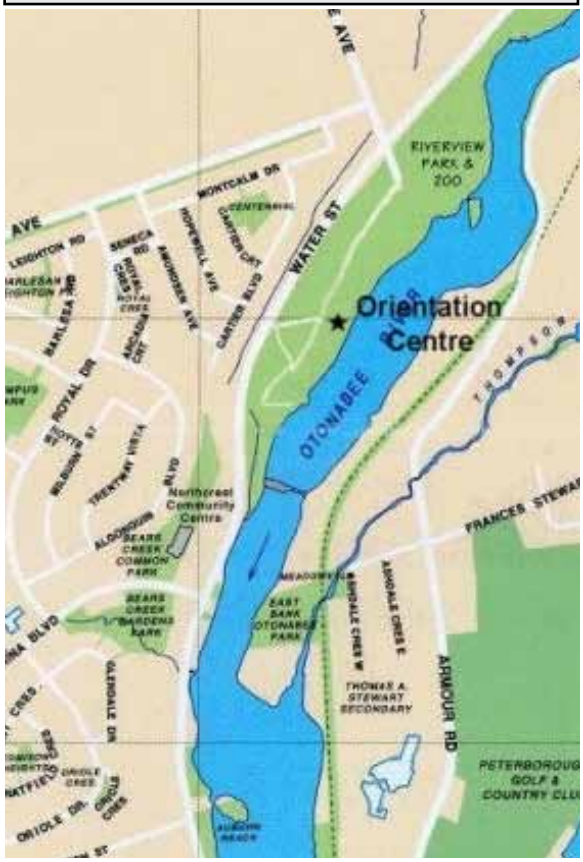
Find out more about spacecraft science experiments in "Basics of Space Flight," a website and book by this author, http://www2.jpl.nasa.gov/basics. Kids can learn all about NASA's Deep Space Network by playing the "Uplink-Downlink" game at http://spaceplace.nasa.gov/dsn-game.

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 handwritten 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 26, 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.