Peterborough Astronomical Association

The Reflector

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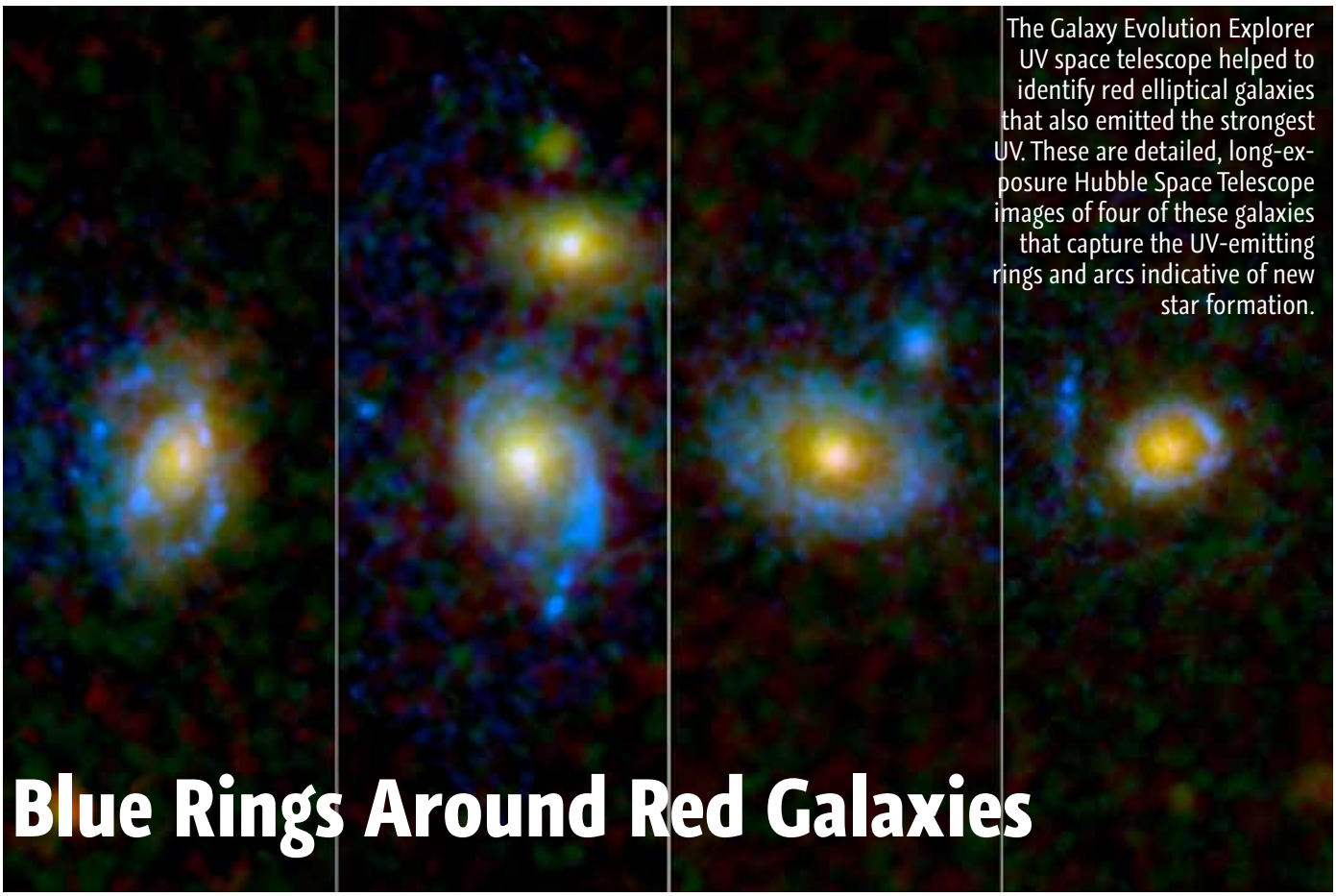

The Galaxy Evolution Explorer UV space telescope helped to identify red elliptical galaxies that also emitted the strongest UV. These are detailed, long-exposure Hubble Space Telescope images of four of these galaxies that capture the UV-emitting rings and arcs indicative of new star formation.

Blue Rings Around Red Galaxies

Beautiful flat rings around the planet Saturn are one thing—but flat rings around entire galaxies? TRUDY E. BELL AND DR. TONY PHILLIPS

That is the astonishing astonishing discovery that two astronomers, Samir Salim of Indiana University at Bloomington and R. Michael Rich of UCLA described in the May 10, 2010, issue of *The Astrophysical Journal Letters*.

"For most of the twentieth century, astronomers observing at visible wavelengths saw that galaxies looked either 'red and dead' or 'blue and new,'" explained Salim. Reddish galaxies were featureless, shaped mostly like balls or lentils; bluish ones were magnificent spirals or irregular galaxies.

Elliptical galaxies looked red, astronomers reasoned, because they had mostly old red giant stars near the end of their life cycles, and little gas from which new stars could form. Spiral and irregular galaxies looked blue, however, because they were rich in gas and dust that were active nurseries birthing hot, massive, bluish stars.

At least, that's how galaxies appear in visible light.

As early as the 1970s, though, the first space-borne telescopes sensitive to ultraviolet radiation (UV) revealed something mysterious: a few red elliptical galaxies emitted "a surprising ultraviolet excess," said Rich. The observations suggested that some old red galaxies might not be as "dead" as previously supposed.

see *page* 16

President's Message

Season's Greeting

As you read this issue of *The Reflector* we will be wrapping up yet another year of astronomical achievements for our club. We have much to "reflect" upon and to be proud of over the past year. We have successfully entered the world of Skyping and this has opened a whole new dimension to our club speaker agenda (warp speed). The world has been opened up to us through this latest media method. We had a full suite of speakers and presentations at our monthly meetings this past year, there were great public events too (Earth Hour, Library Displays, Astronomy Weekend/Raffle, Parks Day, Perseid Shower, to name a few). It is nice to see some of these becoming annual for us to look forward to.

With our Annual General Meeting (AGM) just around the corner, I would like to acknowledge the dedicated service that our executive has given to this club.You should be thankful for their efforts, for with out them and our other member volunteers, we would not have the club we have today and we have an astronomy club to be proud of. In particular, I would like to thank Trish McCloskey for her term as our Treasurer and Mark Coady for his long run as our Light Pollution Abatement Director. This position exists solely due to his tireless efforts over the years. We sincerely thank you both for your service to the PAA and we trust that you will continue to support us as you are able, in the years to come.

Merry Christmas and Happy New Year! (If I don't get to see you before then.)

Rick Stankiewicz
President

Letter from the Editor

A Little Thing

PHILLIP CHEE, EDITOR

Today, the National Aeronautics and Space Administration (NASA) had us waiting with bated breath for a significant astrobiology announcement today. Many people were wondering if NASA planned to announce that E.T. had contacted us. No, it was more prosaic, but neverthless, potentially revolutionary.

Dr. Felisa Wolfe-Simon, a geomicrobiologist, had discovered a new bacterium that thrived on arsenic in Mono Lake, California. What's so earth-shattering about that you ask? Well, GFAJ-1, our arsenic-loving microbe, has just re-written our biology textbooks. It is widely-held as scientific doctrine that all life on this planet needs six fundamental atoms: carbon, oxygen, hydrogen, nitrogen, phosphorus, and sulfur. Well, you can now substitute arsenic for phosphorus as this little guy can incorporate it into its DNA, replacing phosphorus (in short supply in an arsenic environment) and continue growing and multiplying as if this was common-place.

NASA believes that's compelling evidence to expand our search criteria for extra-terrestrial life knowing that it may indeed be based on a wholly different chemistry than our own. You can read more about this discovery here: `http://www.astrobio.net/exclusive/3698/thriving-on-arsenic`

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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Northminster Cubs Get Their Badges

I received an e-mail from John Crossen asking if Trish and I would be interested in doing our **Homestar** show-and-tell with the Northminster cubs. We decided to do this and were there on November 10th. TRISH MCCLOSKEY AND RODGER FORSYTH

We have a small program where we hand out write-ups of constellations to small groups. For this event we covered Ursa Major, Ursa Minor, Cassiopeia and Orion.

The kids study the write-up with a leader and one from each group is chosen to read the folklore for their constellation. The write-up includes questions with answers for each subject. Another cub then asks the entire group questions. If no one in the group can answer, then that cub provides the answer.

This can be rather amusing at times as one youngster was anxious to respond to every question. For example "What's another name for Ursa Major?" The answer given was "The Queen." This answer was given for every question much to the amusement of the group and finally when we got to Cassiopeia everybody cheered.

Another question was "How are Cassiopeia and Ursa Major similar or what do they have in common?" The response from one youngster was "Stars." While not the answer we were looking for we have to give credit for being technically correct.

A photo of the group of Cubs, a few Beavers, a couple of Scouts and leaders is presented here.

This was another successful session and Trish and I will continue this process to help children get their Astronomy badge. There are a lot of cub packs out there so we could be busy.

December Brings the First Day of Winter and Lots More

All of the winter constellations are up by the time the Sun dunks beneath the western horizon in December. JOHN CROSSEN

As a result constellation buffs will have some new celestial playmates. Plus they have more time to play because the long nights of winter are officially upon us with the arrival of Winter Solstice on December 21.

Orion (The Hunter) reigns as king of the winter sky. He is accompanied by his hunting dogs, Canis Major and Canis Minor. Gemini (The Twins) is well clear of the eastern horizon as is Auriga, The Charioteer. Accompanying them is Lepus the rabbit who scampers in plain sight of the hunter and Eridanus, the long snaky river.

The planet count goes up in December, but it helps if you're on the dawn patrol. Both Mercury and Venus will be available in the dawn sky and beautiful Saturn is a pre-dawn target in the constellation Virgo.

The night watch will still have giant Jupiter to view with its nightly moon dance of Callisto, Io, Europa and Ganymede. And nearly next to the jovial giant will be Uranus. Both the dancing moons and Uranus are visible through 10x50 binoculars.

Top bill for celestial events will be the total lunar eclipse of the morning of December 21. For those of us in Ontario the eclipse officially begins at 12:32 a.m. on December 21. But that's just the penumbral (Earth's foreshadow) portion of the eclipse. The dark centre of Earth's shadow (the umbra) starts to nibble into the Moon's disc at 1:32 a.m. here in the Kawarthas. That's the part you want to see.

Orion is the king of the winter sky. The three stars that mark his belt make him easy to spot rising in the east/southeast.

see "December" on page 14

Make an Astronomer Merry This Christmas

JOHN CROSSEN

Gifting the astronomy enthusiast depends on a number of variables. If your giftee is an absolute beginner, you have a huge list of possibilities. Everything from astronomy books, star charts, software, astro magazines and planispheres to warm mittens, coffee mugs and toques are up for grabs.

If your choice is an astronomy book, they don't come any better than *Night-Watch* by Terrence Dickinson. It may well be the only astronomy book your fledgling astronomer ever needs. And it's an easy read for anyone from age 10 on up.

SkyNews Magazine is a great Canadian astronomy magazine with content for almost all ages and an excellent star chart in each issue. For the more mature or advanced reader, *Astronomy Magazine* along with *Sky & Telescope Magazine* are good choices.

To get an idea of what's available visit `www.skynewsmagazine.com`, `www.skyandtelescope.com` or `www.astronomy.com`. All have online shopping with books, charts, astronomy calendars, red astronomy flashlights, gadgets and more.

Another excellent choice is a membership in the **Royal Astronomical Society of Canada**. Along with regular memberships and junior memberships the RASC also has an online gift shop that's worth a visit.

Locally they have chapters in Bellville and Kingston which have monthly meetings. Even closer to home, the Peterborough Astronomical Association offer student, family and individual memberships. In addition to monthly meetings, they also have observing sessions and do a lot of public outreach work.

The most useful tool a beginning astronomer can have is binoculars. Small, portable and relatively inexpensive, binoculars open up a whole new world of star clusters, galaxies and nebula. Look for 7x50 or 10x50 models. With 7 or 10 power the images remain steady when hand held. And the 50mm aperture lets in plenty of light.

They take the beginner deeper into the night sky than the naked eye ever can. Yet they aren't beset by the problems of telescopes that can be hefty to lug around, time consuming to set up, expensive if you purchase one worth having, and impossible to operate if you buy a cheap wobbly one.

I have seen a lot of people put off astronomy by trash scopes from big box stores. So please, please, please don't buy the beginner a telescope. Aside from the Moon, he or she will have no idea were to point it until they learn the night sky.

If you're shopping in Toronto EfstonScience and Khan Scope Centre are well worth a visit. Just north of Toronto, Schomberg is home to Perceptor Telescopes. Further north is Astro Mechanics in Barrie and to the east try Focus Scientific in Ottawa.

For the novice astronomer your choices are many —ranging from books to binoculars, mittens to star maps, software and more. The intermediate and advanced astro nuts will already know what they want, so just ask.

Total Lunar Eclipse an Early Christmas Present

The early morning of December 21, 2010 will mark the first total lunar eclipse we have had since 2008. JOHN CROSSEN

That's a long haul without the Moon dipping into Earth's shadow. The usual timing between lunar total eclipses is approximately 18 months though the interval can go as high as three years.

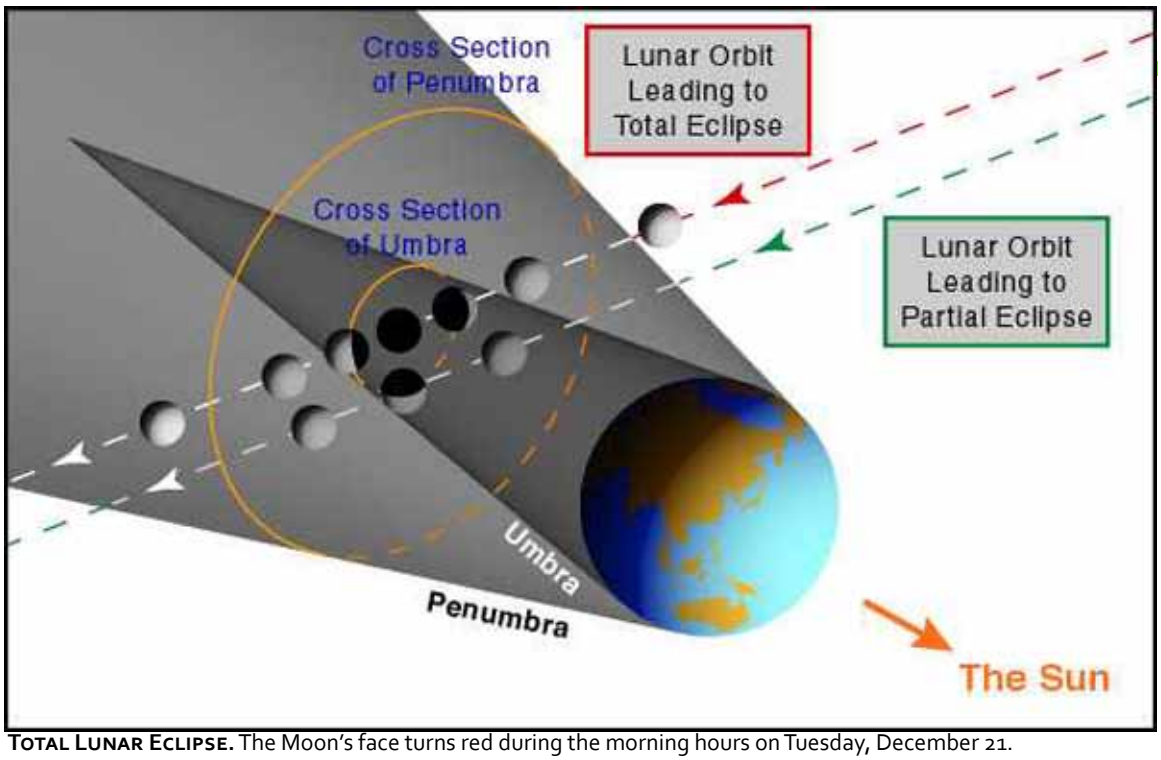
A total lunar eclipse happens when the Moon, Earth and Sun are lined up so that the Sun causes the Earth to cast a long shadow into space. As the Moon orbits the Earth, it passes into Earth's shadow and we are spectators to a lunar eclipse. You might think that this would happen every time we have a Full Moon, but the Moon's orbit around Earth is canted about 5 degrees. So on most of the Moon's Earthly orbits it passes above or below Earth's shadow.

Occasionally we are treated to as many as five lunar eclipses in a single year, though not all of them will be total. If you have the patience and the longevity, the next year of five lunar eclipses (both partial and total) will be 2132.

The number of total eclipses possible in a single year peaks at three. If you were around in 1982 you had the opportunity to witness the last rare three-peat year. If not, you'll have to hang tight until 2485 for the next trio of totality.

All of North America will be able to enjoy this eclipse. But those of us in the Eastern Time Zone will have to be night-owls to take it all in. For us the Moon enters the Earth's penumbra (dim outer

see "Eclipse" on page 15



Total Lunar Eclipse. The Moon's face turns red during the morning hours on Tuesday, December 21.

Buckhorn Observatory Marks a Decade Under the Stars

Group around the telescope. Is the next Carl Sagan or Jill Tarter in this group of astro-buffs? Perhaps, but even if it's just another person with a newly-acquired appreciation of the night sky, we're happy to have made it so.

JOHN CROSSEN

As 2010 winds down Buckhorn Observatory celebrates its tenth birthday. Just ten years ago there was just a telescope and a chubby little astronomer set up in our driveway. In those days Deb and I were new to country living and I kept having visions of newspaper headlines that read: **Local Astronomer Eaten by Bear.** Happily that never happened. But a lot of has since then.

From having the neighbours over to view the partial solar eclipse in 1999, we have gone on to host guests and groups from China, England, Japan, Australia, France, Germany, the U.S. Mexico and South America. At least twice a year our property is home to a temporary tent city of astronomers from Peterborough and the surrounding area. And we have enjoyed a steady parade of scouts, pioneers, senior groups and naturalist clubs as visitors.

Today we have two observatories, the big roll off roof observatory that we use during the spring through autumn months and the new little POD that is our winter telescope haven.

Since I almost zapped a visitor with my laser pointer doing a constellation tour we have built the John Kidner Star Deck. Now visitors are safely seated away from my laser pointer as it shoots a visible shaft of light 5,000 feet into the night sky.

Over the years we have shocked and surprised hundreds of guests by showing them how they can see the Andromeda Galaxy with their naked eyes. The galaxy is 2.5 million light years away and one light year is equal to 10 billion kilometres, so that's quite a stretch for the old peepers!

The observatory has also been involved in astronomy education with its portable planetarium and digital slide shows for schools and scout troops. The results earned us a spotlight on the NASA Solar Website.

Over the years BHO became partners with the Peterborough Astronomical Association and Trent University. Thanks to my friends at Trent I had the opportunity to be a judge in the 2010 Canada-Wide Science Fair in Peterborough. And with the help of the PAA we were successful in having light pollution by-laws adopted by the CGH Municipal counsel.

It's only been ten years, but considering the fact that this was just a hobby, it certainly has grown into something more like a job. Given good health—and not being eaten by any bears—we hope to see another decade of growth in our future.

PHOTO GALLERY

The Orion Nebula

Orion Nebula, also called Messier 42 and M42, is one of the most photographed objects in the night sky. The brightest part of the nebula is possible to spot even with the naked eye, although you might not see the suttle differences that a telescope can bring out. This CCD camera image shows a trememdous amount of detail.

This image was taken from the Nutwood Observatory on Nov 11th 2010. Specific details: LL-RGB image totaling 5 hrs exposures. Using a 300 mm Astrograph, Astrodon filters, Apogee U16M CCD camera on an ME mount. Subframes at 30 minutes.

Photo by Brian McGaffeny

High on Iridescence

This shimmering altocumulus cloud appeared high in the sky above my house south of Peterborough, Ontario, late in the day (4:00 p.m.) on December 23rd, 2009. The roof of my house is blocking the Sun and its glare. What is this beautiful cloud colour and what causes it? It is a phenomenon called *iridescence* and nearly always occurs in mid-level thin altostratus or altocumulus clouds (between 5,000 ft and 15,000 ft or 1,524–4,572 m in altitude) when the conditions are right. Such clouds are made up of tiny water droplets, which, because of their tiny size, "deflect" sunlight rather than "refract" or "reflect" it. When a wave of light encounters an obstacle such as small droplets of water it's bent and spread out in such a way to produce overlapping colors—the process of diffraction. The brightest and purest colors result when the droplets are of the same size throughout the cloud. You do not end up with a rainbow effect because that would be light and water droplets combining to refract (like a prism) and breaking out the colours of the spectrum by order of wavelength and this is not what is happening here. You can get a similar effect when clouds are near the Moon too. In these cases, the light from the Sun is "reflected" off the Moon and then "deflected" by the clouds. Usually, the Moon is near a full phase for this effect to be detected because it needs to be relatively bright. The second photo was taken November 23rd from my driveway as clouds drifted in front of a waning gibbous Moon at 9:30 p.m., just two days past full phase. (Tripod mounted Canon 400D at f/4.5; ISO 200; 1 sec. exp. and 17-70mm Sigma lens at 70mm.

The best way to view the "iridescent cloud effect" is with "polarization", like sunglasses or camera filters. The subtle colours are mostly lost to the naked eye otherwise, through the normal glare of the Sun. Always be careful to avoid looking directly at the Sun when viewing this atmospheric effect. It is best to cover or obscure the disk of the Sun. It is also possible to see this phenomenon at anytime of year because the trick is in the clouds and their moisture content and not as much the time of day or angle of the Sun or Moon. The other thing to look for is a fairly thin layer of clouds to capture the effect. The rays of light have to be able to penetrate the clouds and reach your eye.

Photos by Rick Stankiewicz

Misadventures of an Aspiring Imager

Adventure #10—Periodic Error Correction.

JOHN GALLE

At this point, if you recall, I have setup and balanced my telescope, and been able to actually focus my camera, despite the vagaries of "seeing" and miscellaneous other challenges. I have also learnt to auto guide while taking long exposure images, without any uncontrolled backlash. The next task that I tackled was "periodic error correction" (PEC). Periodic error refers to the predictable variations in tracking caused by the RA drive train, such as the motor, gear reduction drive, bearings, or worm gear being out of round. PEC is software that will compensate for the imperfections by sending tracking corrections to the RA drive motor.

Periodic error is typically directly proportional to the dollars you spend on purchasing your mount. In my innocence I once asked a Takahashi owner how he adjusted his PEC only for him to respond that Tak owners don't do PEC!!! I'm less fortunate, being the owner of a lowly Losmandy mount. An exceptional mount can track with an accuracy of 2-3 arcseconds; the average low-cost mount tracks to within 15-20 arcseconds; the Losmandy, when tuned, is in-between, at about 5-6 arcseconds.

Periodic error issues are also directly proportional to the scope focal length. With very long focal lengths it may be impossible to get the PEC down to an acceptable level except by upgrading the mount.

Periodic Error Graph

To determine the extent of the mount's periodic error is fairly straightforward. The first step is to determine the periodic error with the mount unguided and without any PEC software operating. I do this using PemPro from CCDWare. This is a very easy package to use, and provides features for analyzing the periodic error. If you run the program for a number of full cycles you'll be able to spot the frequency of repeatable errors. Then from the specifications for your mount you should be able to calculate the frequencies for the various drive components i.e., the rpm for the motor, gear reducer, worm, etc (PemPro does this automatically). With this information you should be able to identify the major causes for any cyclical errors.

Some of the actions that can be taken to improve this error include:

- making sure the drive train is absolutely clean, with no grit, etc.
- lubricating gears with high quality grease.

continued on next page

continued from previous page

- making sure the drive train is aligned properly—this is a very common cause of fluctuations.
- making sure the worms, gears, etc have no burs.
- possibly upgrading the worm drive.
- overhaul or replace the gearbox, if indicated.

In my case, as my Losmandy is quite old and well used, I was not surprised that the above analysis resulted in an upgraded worm and a new gearbox.

Once everything feasible is done to make the drive train as smooth as possible the next step is to use the mounts PEC software (if available) to set up a correction model that is used to speed up or slow down the RA drive motor. This can take a bit of effort, and may have to be done a number of times, in an additive way, in order to derive an model that reduces errors to the lowest arcsecond variation possible.

Also note that the PEC corrections sent to the RA motor need to vary depending on the declination of the imaging target. This is automated with the Losmandy, but not with all GoTo software packages; with some packages PEC must be done for each target—which could be onerous, to say the least. This is an important point when selecting a mount—but I've never seen it mentioned in the equipment selection literature.

One question that often arises is whether PEC is required if you are autoguiding. My own observation is that if your periodic error is just a gentle cycling without sudden peaks (like the graph above) then PEC is not required as the guider can readily compensate for this. On the other hand, if there are rapid changes, especially steep peaks, then the autoguider will not be able to react fast enough, and using PEC will improve the autoguiding nicely. In my own situation I find that PEC controls the mounts variability very well, and the autoguiding is mainly helpful in adjusting variances caused by seeing, winds, or random fluctuations.

Note that it is possible that the autoguider and PEC will work in conflict with each—this will be very evident as the guiding will go berserk—thus an advance timing adjustment for the PEC corrections can be setup in the GoTo software (with the Losmandy, anyway).

At this point I have mastered (?) pretty well all the "mechanical" aspects of imaging. From here on it's more and more into the "artistic" aspects—an area in which I am not at all comfortable—especially as I'm quite colour blind!

So with the next issue I'll continue with some of my "artistic" misadventures, including:

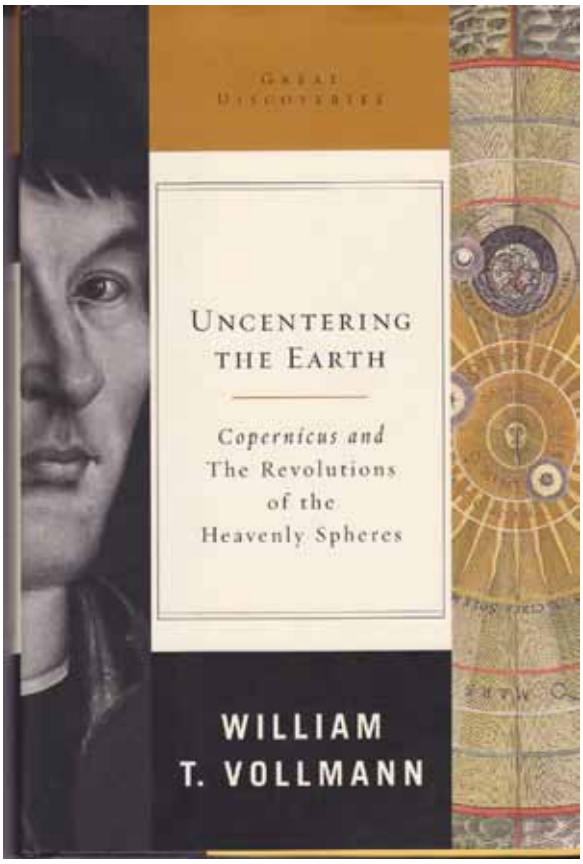
- why I am becoming a computer geek
- being colour blind doesn't help
- digital developments
- and I thought curves was all about beautiful women and fast cars
- keeping things in balance and sharp
- presenting the snaps to the world
- and what makes it all worthwhile

Stay tuned.

BOOK REVIEW

Uncentering The Earth:
Copernicus and The Revolutions of the Heavenly Spheres

William T. Vollmann (2006). W. W. Norton
ISBN-13: 978-0393059694



RICK STANKIEWICZ

When I picked up this book at Chapter's I figured that William T. Vollmann was going to write a very different book than he did. I was expecting a pretty light read too, at only 294 pages in small format, but instead I found a rather heavy read and not at all what I expected. This author spends most of his book down-playing the famous works of Nicholas Copernicus of 1543, *The Revolutions of the Heavenly Spheres*. Given he was trashing my "astronomic hero", I was lucky to even finish this tome.

With almost 40 pages of source references, it was not that this book was a work of fiction and no one ever said that all that Copernicus did was original or the first to ever consider a heliocentric universe or solar system, as the case may be, but there is equally no denying that *Revolutions* was a ground-breaking work of its day and was a turning point for all that followed. It is no surprise that refinement and corrections occurred after the release of *Revolutions* too, but given the instruments of the period and the mindset of the Church and where Copernicus found himself as a cleric, he accomplished much for his time.

Just to give you a sample of Vollmann's writing style, consider this excerpt from a discussion around the observations and calculations of the orbital "circles" of Saturn, Jupiter and Mars to determine their angles of apparent latitude:

> "The modern inclination values obviously correspond fairly well to Copernicus's maximum inclination values.
> "As for deviation, given that that is now nothing but the decomposed cadaver of an erroneous concept, I will content myself by regaling you with the following eternal maxim:"

Not my idea of a "good read" or a style that impressed me, but this is only this reviewer's opinion. I would think twice about spending $32 CDN for this book, even if you are a lover of all things Copernican. I doubt I will be reading anything else by this author anytime soon (and he has written at least 14 other books).

Empty toilet paper rolls stretch to the Moon and back

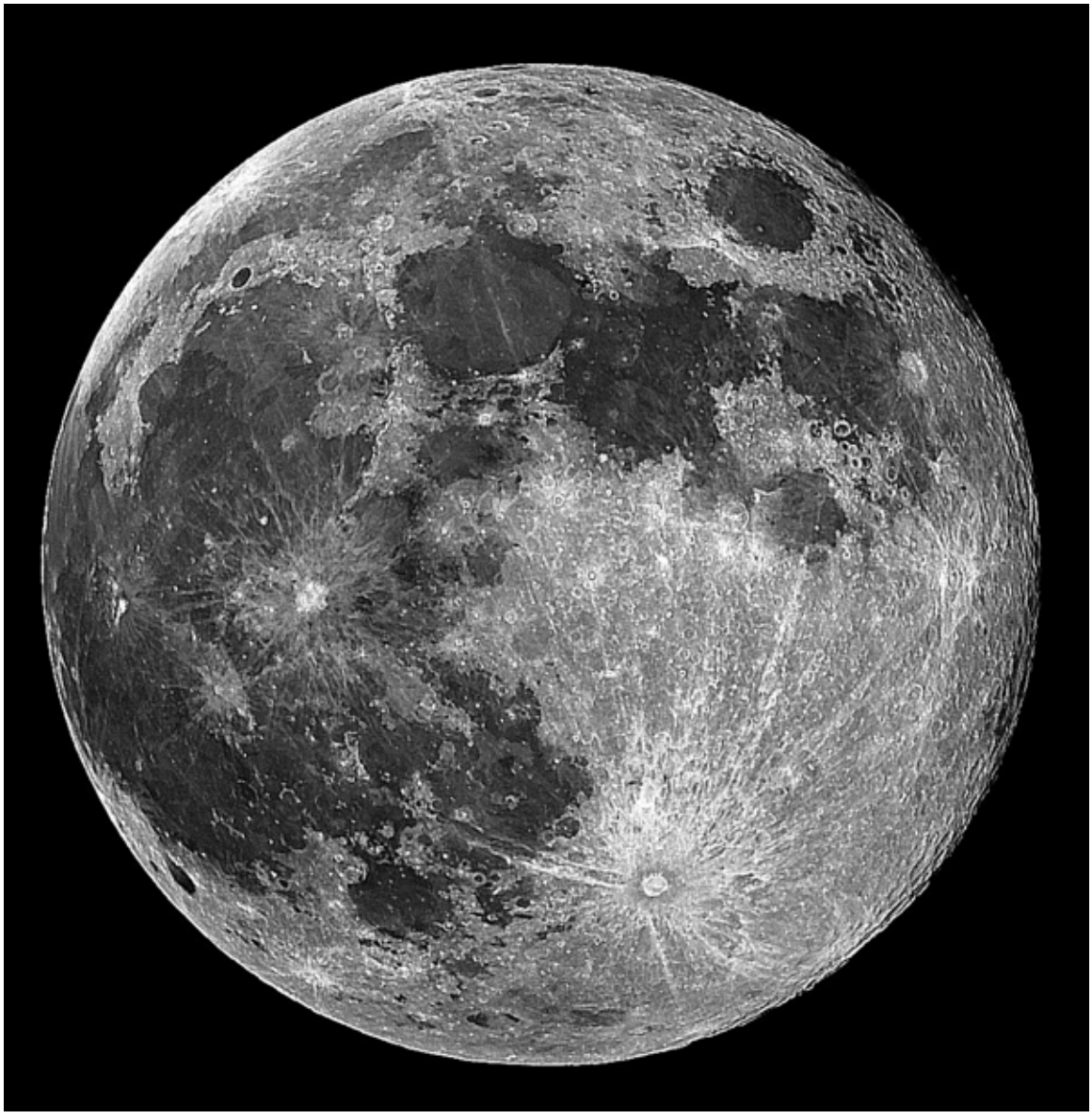
It's time for some wacky space facts, so here are a few from the land of "Strange but True." JOHN CROSSEN

It is estimated that if you took the world's annual supply of used toilet paper rolls and stacked them end-to-end they would reach to the Moon and back. That's an 800,000-kilometre round trip, give or take a couple of sheets. But the world of the weird and the wonderful doesn't end there.

If you feel the need for speed, slip behind the wheel of the Milky Way Galaxy. It's rotating at about 530 kilometres per second and our solar system is moving right along with it. So every minute—about the time it takes you to read four paragraphs—you are 19,000 kilometres away from where you were sixty seconds ago.

Short people like me should spend more time in outer space. That's because

See "Moon" on page 15



The Moon moves 3.8 cm away from Earth every year. It's a process called tidal acceleration, the aggregate of competing gravitational forces between the Earth and the Moon. As a result, the Earth's rotation slows down at about .002 seconds per century and the Moon stretches its gravitational leash.

continued from page 4

December

Falling star fans should put on their catcher's mitts on the night of December 13-14. That's when the Geminid Meteor Shower takes place. The peak of the shower will be about 6 a.m. in the morning and is expected to produce a few spectacular fireballs. So keep your eyes on the skies.

With winter's arrival, a few tips on cold-weather observing are in order. Layers of clothing work the best. The layers trap body warmth and should you become too warm, you can peel off a layer.

I'm not a fan of hats, but when the temperature dips below zot, I'm not afraid to be seen in my dopy hat. It's one of those Russian-style jobs with the fur ear flaps that snap under your chin. Ugly, but warm, it's the best astronomy investment I've ever made.

Getting down to feet level, fur-lined boots with thick soles are your first line of defence for not getting cold feet. Somehow once the feet are gone, so is the astronomer. So do the double sock thing when the weather calls for it.

Tight-fitting jeans aren't making fashion headlines in Nunavut. A thin layer of denim retains no body heat. Better to put on a pair of track pants with some long-johns for a night under the winter stars. My rule of thumb—winter isn't a fashion show it's survival. And speaking of thumbs, don't forget the mittens and/or gloves.

Here's to some long, clear winter nights with big bright stars. If you see some guy dressed like Bib the Michelin Man staring through a telescope, that'll be me.

The Sky this Month

Mercury is in the western evening sky first half of the month. Inferior conjunction on the 20th and reappears in the morning sky late in the month. Reaches greatest elongation east on the 1st.

Venus appears in eastern morning sky and is brightest on the 4th. Waning crescent Moon passes 6° south on the 2nd.

Mars vanishes into evening twilight.

Jupiter visible during the evening and sets near midnight.

Saturn is well placed in the morning sky.

Moon has a widely visible total lunar eclipse on the 21st.

Winter Solstice arrives on the 21st at 6:38 p.m.

Geminid Meteors peak on the morning of the 14th.

Total Lunar Eclipse peak on the morning of the 21st.

Moon Phases

New Moon	11:29 PM	December 5
First Quarter	8:59 AM	December 13
Full Moon	3:13 AM	December 21
Last Quarter	11:18 PM	December 27

continued from page 6

Eclipse

shadow) at 12:29 a.m. on Tuesday morning. The outer shadow is caused by Earth's atmosphere. Our atmosphere doesn't cast a dark shadow, just a very dim one. It is difficult to see, but it is there.

At 1:32 a.m. Tuesday morning the real fun begins as Earth's inky shadow—the dark umbra starts to take a bite out of the Moon. Forty-four minutes later at 3:16 a.m. Earth's shadow will have completely covered the Moon, rendering it a dark red. The red colouring is also caused by Earth's atmosphere because it bends the long red wavelengths of light into Earth's dark shadow giving it a reddish glow. If you were standing on the Moon looking back towards Earth you'd see our planet within a red circle.

During totality you will notice that the stars are big and bright because the Moon glare is gone. You may even be able to take in the winter Milky Way.

The dark or umbral portion of the eclipse ends at 3:53 a.m. and the whole shootin' match is over at 6:04 a.m. That's when you—yawn—call in sick for work and catch up on a few winks of sleep.

The next total lunar eclipse takes place on June 15, 2011, but you'll have to be in Europe, Africa, Asia or Australia to see it. West coasters will be able to catch the Moon as it is setting and totally eclipsed on the morning of December 10, 2011. The rest of Canada will have to wait until April 15, 2014. So before you decide that staying up all night for the eclipse is not worth the bother, remember you'll have to wait another 4 years to observe the next one from Ontario.

continued from page 13

Moon

the lower gravity in space causes astronauts to become a little taller in space. Less gravity means their bones are less squashed together. While we're talking astronauts, wrap your brain around this one. The astronauts' footprints and Lunar Rover tire tracks will stay on the Moon for millions of years because there is no wind to blow them away.

Did you know that falling stars aren't stars and they aren't falling? For starters, our Sun is a star and it is one million times larger than the Earth. Most stars are even larger than the Sun. Plus there is virtually no gravity in outer space. So nothing falls—it just floats. Instead what we call falling stars are just bits of debris drifting in space. When they strike Earth's atmosphere the friction causes them to burn up in a bright streak in the night sky. So falling stars are neither falling nor are they stars. Anyhow, good luck with that wish you made.

The planet Saturn is about 800 times larger than Earth. But, because it is primarily made of gas it is very light. In fact, if you had a large enough bath tub Saturn would float in it. Kind of makes your rubber ducky feel inadequate.

It only takes sunlight about 8 minutes to travel from the Sun's surface to Earth. Yet when it reaches us it is 30,000 years old. How come?

It's because the energy produced by fusion in the Sun's core must travel through many dense and successive layers to reach the Sun's surface before it escapes into space as sunlight. So the 143 million kilometer journey from the Sun to the Earth is just a sprint compare to the arduous 30,000-year trek from the Sun's core to its photosphere or surface.

I hope these facts have tweaked your curiosity about the weird and wonderful universe we call home. I also want to wish you a very happy holiday season whatever you are celebrating and an astronomically great 2011.

continued from page 1

To investigate, Salim and Rich used NASA's Galaxy Evolution Explorer satellite to identify 30 red elliptical galaxies that also emitted the strongest UV. Then they captured a long, detailed picture of each galaxy using the Hubble Space Telescope.

"Hubble revealed the answer," says Salim. The UV radiation was emitted by enormous, flat bluish rings that completely surrounded each reddish galaxy, reminiscent of the rings of Saturn. In some cases, the bluish rings even showed a faint spiral structure!

Because the bluish UV rings looked like star-forming spiral arms and lay mostly beyond the red stars at the centers of the elliptical galaxies "we concluded that the bluish rings must be made of hot young stars," Salim continued. "But if new stars are still being formed, that means the red-and-dead galaxies must have acquired some new gas to make them."

How does a galaxy "acquire some gas?" Salim speculates that it was an act of theft. Sometimes galaxies have close encounters. If a gas-rich irregular galaxy passed close to a gas-poor elliptical galaxy, the gravity of the elliptical galaxy could steal some gas.

Further studies by Galaxy Evolution Explorer, Hubble and other telescopes are expected to reveal more about the process. One thing is certain, says Rich: "The evolution of galaxies is even more surprising and beautiful than we imagined."

The press release is available at http://www.galex.caltech.edu/newsroom/glx2010-03f.html. The full published article is "Star Formation Signatures in Optically Quiescent Early-Type Galaxies" by Samir Salim and R. Michael Rich, ***The Astrophysical Journal Letters*** 714: L290–L294, 2010 May 10.

Point the kids to the Photon Pile-up Game at http://spaceplace.nasa.gov/en/kids/galex/photon, where they can have fun learning about the particle nature of light.

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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). 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:

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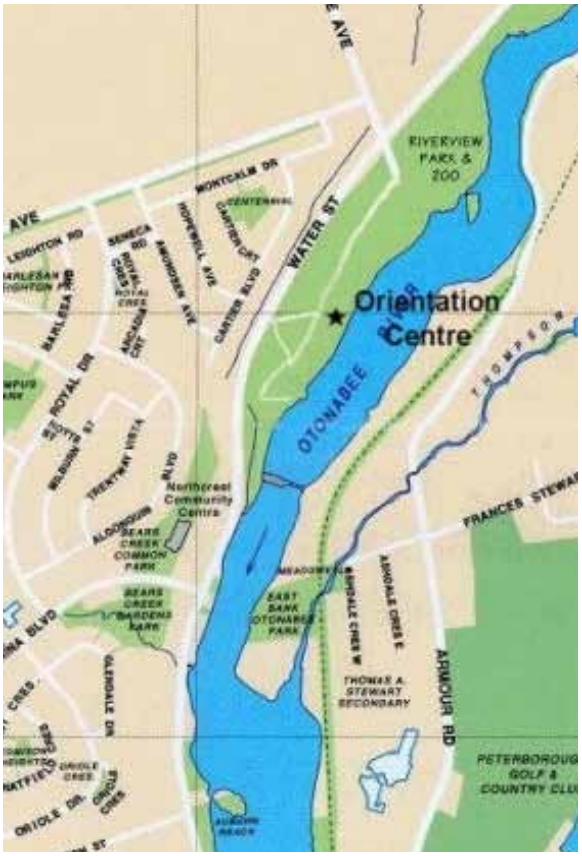
Next submission deadline:
December 24, 2010



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 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.