Peterborough Astronomical Association

The Reflector

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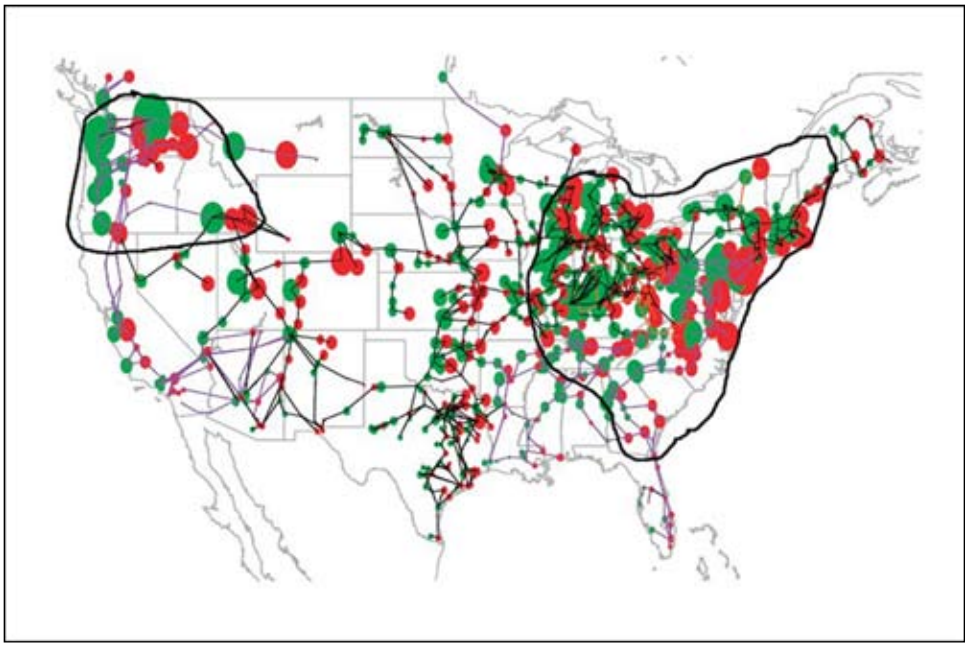
Severe Space Weather

by Dr. Tony Phillips

Did you know a solar flare can make your toilet stop working?

That's the surprising conclusion of a NASA-funded study by the National Academy of Sciences entitled *Severe Space Weather Events—Understanding Societal and Economic Impacts*. In the 132-page report, experts detailed what might happen to our modern, high-tech society in the event of a "super solar flare" followed by an extreme geomagnetic storm. They found that almost nothing is immune from space weather—not even the water in your bathroom.



Power grid map shows areas of particular vulnerability to the destructive effects of a severe solar storm.

The problem begins with the electric power grid. Ground currents induced during an extreme geomagnetic storm can melt the copper windings of huge, multi-ton transformers at the heart of power distribution systems. Because modern power grids are interconnected, a cascade of failures could sweep across the country, rapidly cutting power to tens or even hundreds of millions of people. According to the report, this loss of electricity would have a ripple effect with "water distribution affected within several hours; perishable foods and medications lost in 12-24 hours; loss of heating/air conditioning, sewage disposal, phone service, fuel re-supply and so on."

"The concept of interdependency," the report notes, "is evident in the unavailability of water due to long-term outage of electric power—and the inability to restart an electric generator without water on site."

It takes a very strong geomagnetic storm to cause problems on this scale—the type of storm that comes along only every century or so. A point of reference is the "Carrington Event" of August-September 1859, named after British amateur astronomer Richard Carrington who witnessed the instigating solar flare with his unaided eye while he was projecting an image of the Sun on a white screen. Geomagnetic storms triggered by the flare electrified telegraph lines, shocking technicians and setting their telegraph papers on fire; Northern Lights spread as far south as Cuba and Hawaii; auroras over the Rocky Mountains were so bright, the glow woke campers who began preparing breakfast because they thought it was morning!

"A contemporary repetition of the Carrington Event would cause …

see "Space weather" on page 12

President's Message

International Year of Astronomy

Our local Peterborough kick-off was a success despite the clouds

We are in the grip of winter as I write this message, but we are a hardy group and Canadian astronomers are noted for their ability to brave the elements (if we didn't, it seems we would never do any astronomy). Just a friendly reminder to renew your membership, as I am sure you do not want to miss an issue of *The Reflector* and you will start to, if you don't renew soon.

Last month we had a great International Year of Astronomy (IYA) launch in Peterborough on January 10th. The skies might not have cooperated, but the public sure did (standing room only) and the members sure got behind it too and I want to thank you all for that. There will be lots of other opportunities to get involved during IYA 2009. I will be using this space in every issue of *The Reflector* this year to promote and encourage our membership to get involved and do something or lots of things, during the IYA. Almost every month we will have at least one event or opportunity to pitch in and help out the cause. While you help the PAA educate the public, you too will have a chance to learn about the heavens and all it has to offer. Remember, the PAA is you.

New PAA members or those new to the hobby of astronomy, will be pleased to know that we plan to include basic (newbie) presentations or information, at our monthly meetings. However, don't wait for these sessions, instead come out to an observing session or public event and join in with the public and ask questions of those that know. If you have questions of any member (executive or not), just ask and we will get the information for you. If you have questions, we have answers. The only dumb question, is one that is not asked. Many basic questions and answers are covered in every issue of *The Reflector* too. Have a look back over the many years worth that now reside in our archives and you might be surprised at how much information is there waiting to be re-discovered.

Keep looking up!

Rick Stankiewicz, President

A packed house at the Peterborough IYA 2009 Kick-off event at the Peterborough Museum on January 10, 2009. Photo by John Crossen

Peterborough Astronomical Association

The Reflector is a publication of the Peterborough Astronomical Association (PAA). Founded in 1970, the PAA is your local group for astronomy in Peterborough and the Kawarthas.

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Party it up with the twins tonight

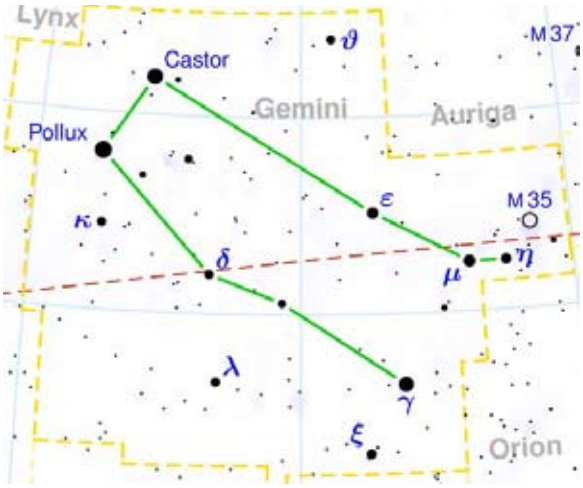
One way to warm up a cold February night is to throw a party. In this case let's make it a star party and invite the most famous twins in the winter night sky – Castor and Pollux.

The twin brothers make up a constellation known as Gemini. You'll find Gemini rising in the east just after sunset in early February and well up by the end of the month. The brothers are standing side-by-side with the star Castor representing the head of one brother and Pollux, a slightly brighter star, representing the other sibling.

In the early evening their bodies stretch out parallel to the horizon with Castor being the uppermost of the partners. Two lines of dimmer stars mark their torsos with the boys' feet splayed outwards. By the way, Pollux says that brother Castor is a fat head, but that's only because the star that plays the role of his celestial noggin is a gorgeous double in a small telescope. Closer scrutiny shows yet another related star nearby. Peer a little deeper and each member of the trio is also a double star. So what started out as a single star became a double, then a triple and finally a six-star system. Castor just grows on you.

The constellation Gemini is a member of the Zodiac and is one of the first winter constellations after Orion that beginners learn to recognize. If you have a pair of binoculars, Gemini offers some nifty treats that are quite easy to find.

Towards the bottom of the constellation (near Castor's feet) is one of winter's brightest and richest open star clusters. First catalogued by Charles Messier, M35 is almost bright enough to be seen naked eye from a dark sky location. Ranked at magnitude 5.0, the cluster hovers on the brink of visibility for all but the most sharp-eyed observers. But a pair of binocs will bring the cluster out nicely for one and all. M35 is truly spectacular in a small telescope and a 6–inch scope will also capture enough light to reveal yet another more distant cluster – NGC 2158.



With just a little imagination, Gemini really does look like twin brothers.

For you number tumblers, M35 lies at a distance of 2,800 light years and the distance across the cluster is 30 light years. Put another way, the light that reaches your eyes on the night that you view the cluster took 2,800 years to complete the journey – and that's traveling at 300,000 kilometers per second.

Hopping into the way-back machine, mythology tells us that the brothers are the sons of Leda – wife of the King of Sparta – and that they came to be after she was seduced by Zeus while disguised as a swan. No wonder the boys were said to have been hatched from an egg.

Do a little culture hopping to China and Castor and Pollux are also associated with yin and yang – the dual forces of nature. Zip back to western culture and you'll also discover that the boys are said to represent the Roman numeral II. And as long as we're in Rome, the two are sometimes confused with Romulus and Remus, the legendary founders of the city. After all, they are portrayed on ancient Roman coins with each wearing half an eggshell.

OK, now that you've been introduced, why not get out and party with the boys. They may have been hatched, but they sure weren't born yesterday.

John Crossen also owns Buckhorn Observatory (buckhornobservatory.com)

February's chilly sky holds some sights to warm you up

Hopefully you received lots of warm outerwear for Christmas, because February's stargazing will give you lots of opportunities to try them out. So bundle up, head out and look up. There's a lot to see.

Full Moon arrives on February 9th, but unlike last December and January's Full Moons, it won't be at perigee, so dear old Luna won't appear to be exceptionally big and bright like it did in its last two cycles. Still, it's well worth a look in your binoculars to see if you can spot the huge trails of debris streaking out and across the Moon's surface from Crater Tycho. Tycho appears like a belly button in the lower central portion of the Moon. The debris trails appear as bright stripes because they were made by a recent impact – only a few hundred million years old.

If you happen to be on the west coast of Canada there will be a penumbral eclipse of the Moon at sunrise. In a penumbral lunar eclipse the Moon only dips into the Earth's faint outer shadow, so chances are it won't be visible to most people. Toss in a rising sun to bleach out any shadow you might have seen and the event will probably rank –5 on a scale of 10. So if the media start harping about a lunar eclipse the next morning, I suggest you roll over and sleep in.

Feb 16th brings the Last Quarter Moon. Like the First Quarter phase it has the same viewing merits of contrast and shadows apply. But you'll have to stay up to the wee hours to view it (*or get up real early —the editor.*)

Speaking of the wee hours, early risers on Feb 17 will be treated to a planetary double-header. Jupiter and Mars will be low in the eastern predawn sky. They'll be just a half a degree apart, so it should make for an interesting sight. Try your binoculars and you'll have an even more impressive tale to tell over morning coffee.

Ceres is a great challenge for binocular astronomers. It rises in northern Leo as the Sun sets and will be up all night long. To make sure you're looking at Ceres and not a star you'll have to monitor it a couple of hours for movement. Lots of coffee and warm boots are recommended.

The following night – Feb 18 – Venus shines its brightest for the year. At magnitude –4.5 it will be the brightest object in the evening sky by a long shot. By the way, the minus sign means brighter. A magnitude of 4.5 (no minus sign) would be near the limit of most people to see it. Think of it as a thermometer turned upside down. It's confusing, but hey, I didn't invent it.

February 24th means New (or no) Moon which will make it a great night to check out some of winters star clusters in your binoculars or a telescope. And the following night the Dwarf planet Ceres (formerly an asteroid) will be at opposition, which means that it will rise at sunset and set at sunrise. Thus, it will be visible at magnitude 6.9 in binoculars all night long.

February winds down with the Crescent Moon and Venus being just 1.5° apart in the evening sky on the 27th. It should be a beautiful sight and a great end to February. Until we meet again in the backyard, keep your lights aimed down and the stars up bright.

John Crossen

Astronomy Day Raffle 2009

This is a heads up to all PAA members that we will once again be running our annual Astronomy Day Raffle. For the last several years we have run a very successful raffle, thanks to members like you. We have another great line-up of prizes including family passes to the Buckhorn Observatory, lots of space and astronomical related books, gift cards for Efston Science Superstore in Toronto and of course the grand prize of a 114mm (4.5") telescope. At the time of this writing, the number of tickets to be printed has not been finalized, but it will likely only be about 1,200 tickets total. This means that if each member takes and sells or buys 2 books of tickets (10/book), almost all the tickets are sold, just like that. We have sold out almost every year, so it is not a tough sell. There will be a surprise draw for all those members who meet their minimum quota of 2 books of tickets and every book beyond that you sell (or buy), you get another chance at the draw prize (some members need more incentive than others). If we have not already gotten a hold of you, Rene Bowe and I will be running the raffle again this year. Once you get your books of tickets, we really just want money and stubs back (not unsold tickets, get the message?) If this is too much to ask, then get us the tickets back well before the May 3rd draw date!

The prize telescope will be on display at the Peterborough Museum and Archives, but if you have an event or venue to sell tickets, you are free to sign out the scope and display board to help you sell tickets and return it when you are done.

All proceeds from this years raffle will go toward our public outreach and light pollution abatement programs. This is our only fundraiser for the year, so help us make a difference and do your part as a member of the PAA.

Remember, you can't win without a ticket!

Rick Stankiewicz, President

Moon Phases

First Quarter	6:13 pm	February 2
Full Moon	11:49 am	February 9
Last Quarter	4:37 pm	February 16
New Moon	8:35 pm	February 24

The Sky this Month

Mercury is a morning planet and reaches greatest elongation west (26°) on the 13th. From our latitude it is only 1° above the horizon at nautical twilight. Passes 0.6° south of Jupiter and 3.5° away from Mars on the 24th. Mercury catches Mars on March 1st.

Venus is a −4.8 "evening star" throughout February. It will make a nice pairing with the crescent Moon on the 27th.

Mars is in Sagittarius and passes into Capricornus on March 3rd. Meets up with Jupiter and Mercury in the latter part of the month.

Jupiter begins the month too close to the sun but rises higher as the month progresses. Mars passes 0.6° south of it on the 17th and then Mercury on the 24th.

Saturn in Leo and will be in opposition on the March 8th. Transits at 1:49 am on the 14th.

Moon will be in a penumbral eclispe on the 9th but visible on in Western Canada.

Ceres in opposition on the 25th at mag. 6.9 and is at its closest approach to Earth since 1857 and won't be this close until 4164.

Zodiacal Light visible in the Northern hemisphere after evening twilight starting on the 12th for the next two weeks.

see "Star Parties 2009" on pag

PHOTO GALLERY

Four Planets, a Moon and a Double Conjunction!

The year of 2008 ended with a grand finale of a double conjunction. Did you see it? Just in case you missed it, because you needed a clear western horizon to fully appreciate it, I have included a few images to show you in some detail what happened on the evening of December 31st, 2008.

On this evening's twilight, we were blessed with a clear western horizon. High in the southwest was Venus hanging just 2 degrees below a lovely crescent Moon (below left). It was so noticeable that the image shown here was taken before the Sun had even set!

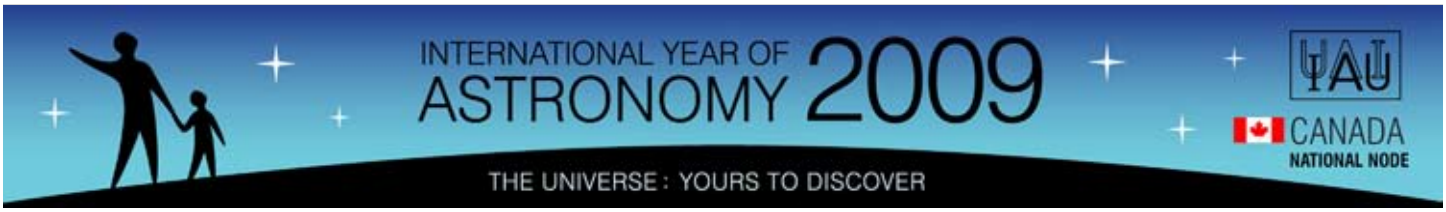
On the other hand, low in the west was the other conjunction of Mercury at the same angle off from Jupiter as Venus was from the Moon, but they were at only 1 degree of separation! However, in this case I had to wait until well after the Sun had set, before I could see them good enough to photograph them. This close-up (next page top) shows these two planets hugging the horizon between a pair of white pine trees.

Then I had to rush to find just the right elevation in my backyard to capture this double conjunction in one image. I found just the right spot, but only had a few moments to do so, as Mercury and Jupiter were quick to disappear into the western twilight. You have to look very closely to see Mercury and Jupiter (below right) compared to the obvious brilliant pairing of Venus with the Moon. If you can see all this, then you have seen four planets and a Moon, in a double conjunction. You might be asking where is the fourth planet? The silhouetted white pine tree is rooted on it and thus represents it (Earth).

After Mercury and Jupiter set below the horizon the fun continued for about another hour as Venus and the Moon put on their show. I had people a week later still talking about what they saw that same night. The image that I took later that night (next page bottom left) shows Venus with the Moon showing a nice case of "earthshine". This is where the side of the Moon not illuminated by the Sun, is actually lit by sunlight reflected off the Earth, enabling you to see the darkened portion of the Moon. To capture this effect (that your eye can easily see or in binoculars is simply stunning) a longer exposure is required, which over exposes the Sun lit crescent portion.

The show did not stop there for me that night. I came in from cold, windy photography session to see that right from inside my living room I could see the beauty of the Venus-Moon conjunction in my crescent shaped window above my Christmas tree (above right). What a neat sight! This was the perfect way for an astronomer to close out the old year and welcome in a new one. This bodes well for 2009 I thought, the International Year of Astronomy. You can also appreciate now why I live where I do.

Rick Stankiewicz



IYA2009
What's Next?

Good question? The PAA – IYA Committee would like to hear what you would like to do. What do you see us doing this year that is special and doable for the PAA and it's members?

We had a great launch on January 10th at the Peterborough Museum and Archives (PMA) and by the time you read this, I trust we had a great public observing night at Armour Hill on the weekend of January 30 & 31st, but what is next?

There are a ton of possibilities and all you have to do is look at the national website of the IYA (www.astronomy2009.ca) and see what others are doing and what they are suggesting are possibilities for others to do. What do you see there that interests you?

I can tell you that we will be getting some Astro Cards; we might get some official Star Finders (planispheres) even though we are looking a having our own made via www.star-finder.ca; we have ordered a few Galileo Telescope Kits and we will get good use out of all these items. Do you see other possibilities?

March 28th this year will bring us "Earth Hour" and the following week (April 2nd to 5th) is potentially "100 Hours of Astronomy"! A month later is our annual Astronomy Days weekend (May 2nd & 3rd). More details are sure to come, but we would like to hear from you as a member of the PAA. If you have any ideas or thoughts about what you have seen or heard, please conatct a member of the PAA – IYA Committee. Check the PAA website at: www.peterbooughastronomy.com and look under IYA 2009 and all the member of the committee are directly linked for your comments and input.

We would love to hear from you and discuss your ideas or thoughts.

Rick Stankiewicz, President
PAA

PAA member B.Wood setting up telescope.

photo by John Cameron

Potential astronomer seeing telescopes.

photo by John Cameron

A Show Not to be Missed – Tafelmusik Concert

As part of IYA 2009, there is a unique opportunity to experience music and astronomical images at the same time and only have to travel a far as Lindsay or Belleville to do so. Check this out for yourself: http://www.tafelmusik.org/concerts/galileo.htm

This Galileo Project is an amazing presentation of music from the time of Galileo, spoken excerpts from his correspondence and that of others and wonderful projections of astronomical images (sourced with the help of Alan Dyer and his colleagues at the Calgary Planetarium). The Galileo Project is touring Southern Ontario now and will likely tour elsewhere, too. If you are interested, here are the dates

Ontario Tour 2009 Dates: February 27, 2009 Cambridge St. United Church Lindsay, ON; February 28, 2009 Niagara Centre for the Arts Niagara Falls, ON; March 4, 2009 Education Concerts at Calvary Hall Belleville, ON; March 5, 2009 Grant Hall, Queen's University Kingston, ON; March 6, 2009 Dominion Chalmers United Church Ottawa, ON

Anyone else interested? Want to carpool?

Rick Stankiewicz, President PAA

Hastings Astronomy Event

Prior to the beginning of 2009, I spoke with Hastings Library staff about putting up a display of information on Astronomy for the IYA 2009. The month of January 2009 was selected. I provided information in the form of books, magazines, pictures, posters and RASC calendar. The Libarian, Ann Sullivan, erected the display in a centeral location in the library where it will be very visible to all who use the library. The display opened on January 6th, 2009, and is intended to be in place for the month of January 2009, or as deemed necessary by future events.

The display consist of the following:

BOOKS: Majestic Universe, NG-Encyclopedia of Space, Universe in Your Pocket, Astonomy for Dummies, RASC Observers Handbook 2009 and The Beginners Guide, Astronomy-A Visual Guide, 50 Years in Space.

MAGAZINES; Sky News, Astronomy, Sky and Telescope, Night Sky (out of Print), Discover and Scientific American.

INSTRUMENTS: Bushnell Scope (suitable to site location), Biniculars 10x50, PAA 10" Telescope.

OTHERS: RASC Calendar, IYA 2009 Poster, photos from PAA website.

After the display was opened I was contacted by YMCA Northumberland Ontario Early Years Centre of Hastings to provide an "Astronomy Event" at Hastings Civic Center for the March School Break. In discussions with the Early Years Centre, the Hastings Library staff, and myself, it was decided to schedule the "Astonomy Event" for Friday March 20, 2009. The tenative schedule of the event would be as follows: 8:30 am – 11 am: activities for early years children; 1 pm – 5 pm: solar viewing; 7:30 pm – 9 pm: event similar to IYA kickoff held at the Museum in Peterborough — i.e., planetarium viewing, slide photo presentation, followed by question period; 9 pm onwards: night sky viewing and PAA Observation night.

Other groups that appear to be interested in participating include: The Boy Scouts and Cubs, The Back to Basic Group from the Anglican church, and Grade 6 from the public school, who study astronomy in this section of their school year.

John Cameron

Did you know?

The University of Toronto launched an ad campaign that put 3,000 ads on Toronto Transit Commission buses, subways and streetcars last month to celebrate International Year of Astronomy. Running till Februray 10 a series of 5 colourful posters tells us that trillions of ghost-like neutrinos pass through us every moment or that we owe our existence to dead stars.

You can see the ads and read the stories behind them at http://coolcosmos.com.

Phillip Chee

Comet Lulin

Discovery a team effort by China and Taiwan

While relations between China and Taiwan are less than cordial on many fronts, astronomy isn't one of them. The discovery of Comet Lulin was made during a joint effort by China and Taiwan to locate Near Earth Asteroids (NEA).

The discovery was facilitated via the "Lulin Sky Survey," a Lulin Observatory-based program that pools the efforts of Taiwanese and Chinese star-gazers to catalogue the sky. Chinese astronomers contributed to the program by selecting areas of the sky for the Lulin Observatory in Nantou County, Taiwan to watch and photograph. By analyzing the photos Chinese astronomers and Lin Chi-sheng, a Taiwanese professional astronomer, not only found two new near Earth Asteroids, but a chunk of ice and rock "a few kilometers" in diameter heading our way.

Said Lin, "this is the first time a celestial object has been named after a location in Taiwan." Lin also credits the Chinese participants with being the first to detect the comet and the NEA in the photographs. It was a lucky catch—two asteroids and a comet in one photo. This marks a highlight in the astronomical cooperation between the two countries.

LULIN OBSERVATORY. Comet Lulin was discovered by Chinese and Taiwanese astronomers. Lulin Observatory is shown above. Let's hope for clear nights on and either side of Feb. 24th for binocular and telescope views.

You and I will be treated to views of Comet Lulin throughout February as it ambles across the sky from Virgo towards the area beneath Leo. But on the night of the 24th, it will be just 2.5 degrees (about two finger widths at arms length) beneath Saturn which will be the brightest object near the cat constellation.

As we approach February 24th, the comet will gradually brighten until it is directly opposite the Earth and Sun on that night. Lulin is expected to reach magnitude 6 on the 24th. That puts it right on the edge of naked-eye visibility in a rural dark sky area.

Also in your favour on the 24th is the fact that we will be at New Moon phase. So there will be no bright Moon to wash out the starry sky. Even then, a pair of binoculars will be a great help in sweeping the sky to find pinpoint it. If (a big word at this time of year) we get a string of clear nights you might want to go out in the mid-evening to track Lulin as it roams through the constellations.

On the night of the 24th Comet Lulin will be just 61 million kilometers from Earth heading away from the Sun. What that means is that the solar wind will be blowing the comet's tail in the direction opposite the Sun. So Lulin will be heading in the same direction its tail is pointing.

Will Lulin burst into naked-eye visibility like Comet Holmes did last year? No one knows. After all, comets are like cats. Both have tails and both are unpredictable. We do know that Lulin will be high enough up in the sky that you will have good seeing.

Until we meet again by the backyard telescope, keep those outdoor lights dim and pointed down. Light pollution drowns out the stars, and a sky without stars is a sky without dreams.

John Crossen

Comet Lulin Alert!

Near the end of January I was up early in the morning (5:00 a.m.) to see if I could spot this "new" comet. I had tried earlier in the month and was unsuccessful when it was still in Scorpius. I was lead to believe that binoculars would be all you needed at this point. Well, on the cold morning of January 25th (–14 plus wind-chill) I was successful in just making out a very faint fuzzy spot in the southern sky in Libra with my 10x50 binoculars. I set-up my 90mm ETX telescope to confirm my finding and sure enough, there in my 32mm eyepiece (39 power) was the definitive fuzz ball of Comet Lulin (C/2007 N3). It was much fainter than I expected, even with the telescope. Of course comets move daily throughout the sky and the experts say that as this comet moves through Libra, into Virgo and Leo by late February, it should be getting brighter. The peak should be February the 24th if all goes according to plan, but comets are notorious for not following anyone's predictions or expectations. Will Comet Lulin be any different? Only time will tell, but here is hoping.

One thing for sure, this comet will help you learn the constellations that make up the zodiac (those located along the ecliptic), as not only will it have gone through four different constellations by late February, but in March it will be heading into Cancer and so on. Why not take a sky tour, learn your constellations and follow a comet all at the same time? I plan to and my fingers are crossed that it will get bright enough to at least be naked eye brightness later this month. Enjoy the show!

Keep looking up!

Rick Stankiewicz, President and part-time comet chaser

The Peterborough Astronomical Association meeting schedule for 2009 is presented below. At press time some of the dates have not been filled in with a guest speaker. Please check the club website at http://peterboroughastronomy.com for updates.

January 9	Mark Coady – LPA, John Crossen, Prof. Dave Patton (Trent U.)
February 6	John Crossen/Colin Cross – Newbie Night – Getting Started in the Sky
March 6	Rick Stankiewicz – Observatories of Mauna Kea
March 28	Earth Hour 8:30 pm – Armour Hill
April 3	Rodger Forsyth – Construction of the SkyShed
May 1	T.B.A.
June 5	Club Observatory Locations – John Crossen BHO
July 3	No Meeting – Summer Recess
August 7	No Meeting – Summer Recess
September 4	T.B.A.
October 2	T.B.A.
November 6	T.B.A.
December 4	Annual General Meeting

PAA Observing Session & Newbie Night Sky Tours are tentatively scheduled on June 19, July 17, and August 17 at Buckhorn Observatory.

continued from page 1

Severe weather

extensive social and economic disruptions," the report warns. Widespread failures could include telecommunications, GPS navigation, banking and finance, and transportation. The total economic impact in the first year alone could reach $2 trillion (some 20 times greater than the costs of Hurricane Katrina).

The report concluded with a call for infrastructure designed to better withstand geomagnetic disturbances and improvements in space weather forecasting. Indeed, no one knows when the next super solar storm will erupt. It could be 100 years away or just 100 days. It's something to think about … the next time you flush.

One of the jobs of the Geostationary Operational Environmental Satellites (GOES) and the Polar-orbiting Operational Environmental Satellites (POES) operated by NOAA is to keep an eye on space weather and provide early warning of solar events that could cause trouble for Earth.

You can keep an eye on space weather yourself at the National Weather Service's Space Weather Prediction Center, www.swpc.noaa.gov. And for young people, space weather is explained and illustrated simply and clearly at the SciJinks Weather Laboratory, scijinks.gov/weather/howwhy/spaceweather.

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

THE UNIVERSE
YOURS TO DISCOVER

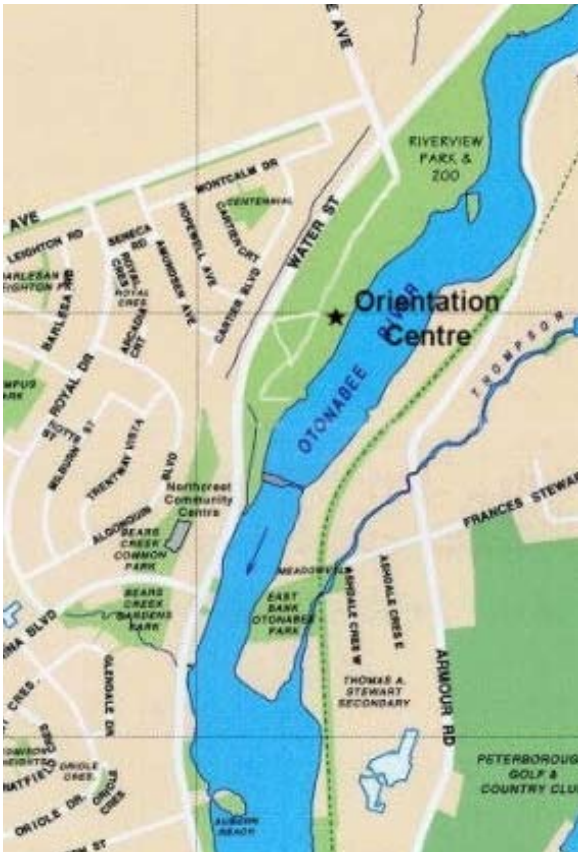
INTERNATIONAL YEAR OF
ASTRONOMY
2009

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:

Phillip Chee
445 Park Street North
Peterborough, ON K9H 4R1
phillip.chee@gmail.com

Next submission deadline:
February 23, 2009



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 8PM. PAA executive business will be conducted starting at 7:30PM. Members and the public are welcome to attend the earlier time.