

Editorial

As the year draws to a close, we are treated to an early Christmas gift. This month, Comet Machholz (C/2004 Q2) will brighten enough to reach naked eye visibility. This is the first reasonably bright comet since the spring. It will not be as bright as Comet Hale-Bopp or Hyakutake, but it will still be worth viewing. Fortunately for us in the Northern Hemisphere, this comet will be well placed for evening viewing. Currently near the constellation Lepus, the comet will continue higher in the sky over the next two months. Around January 8th it will be well placed near the Pleiades, and should make an excellent photo opportunity. On January 16-17, the comet will pass near Algol (β -Per). Discovered on August 27, 2004, in a vintage 6-inch f/8 reflector, C/2004Q2 is the 10th comet found by Don Machholz of California.

For those of you who ordered RASC Handbooks and Calendars, they have arrived, and I will be handing these out at our regular meeting on January 7th. If you cannot pick them up at that time, and would like me to leave them with another member, please let me know.

Next month, we begin a new membership year. Consequently, membership dues for 2005 will be due on January 7th. Membership applications will be available at the next meeting. Individual memberships are \$30.00. If more than one member of your family is interested in astronomy, you might want to consider a Family Membership at \$40.00. Student memberships run at \$10.00/year.

Like many organizations, the PAA depends on volunteers to keep the club running smoothly. We are still looking for someone to take over as treasurer. If

that is not your thing, why not help out in other ways. You need not sit on the Board to help out. Anything you can do would be appreciated. Remember – this is *your* club!

To those who submitted articles over the past year, I'd like to say - Thank You! If it were not for your submissions, this newsletter would not exist. I hope to continue to receive more high quality work from you and other members in the upcoming year.

Clear Skies and a Happy New Year

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Meeting Notes

November 26 Meeting:

The PAA Executive Council met prior to the club gathering. Present were Rene Bowe, John Crossen, Don McDonald, Charles Baetsen and Rob Fisher. Mark Coady, who is now head of the PAA's light pollution committee, joined the group, though he is not a voting member.

It was agreed that the club web site be



Comet Machholz—C2004 Q2 is now visible naked eye near the constellation Lepus.

updated and revised. It was also agreed that if we could not find a club member to handle the updating and design revisions, Janine Anderson, would be hired for the sum of \$300 to do the design and administration work. Janine has designed the SSAA web site, the HSP site, and that of Buckhorn Observatory, so she is familiar with astronomical headaches, last minute

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changes and a universe of outrageous demands.

Given the option of either renting the portable planetarium from Buckhorn Observatory for a fee of \$50 per use, or buying a 1/3 interest in the planetarium, the executive members present voted unanimously to purchase a 1/3 interest for the sum of \$233.34. To assure an unbiased vote, John Crossen, owner of Buckhorn Observatory abstained from voting on the issue.

Meeting dates were finalized for the period from January through June of 2005.

Our next season will be launched on January 7 with guest speaker Ian Wheelband who will discuss light pollution issues and how his club, the Durham Region Astronomy Association is approaching public and political groups.

Our January 26th meeting will mark the club's first Annual Meeting. The focus will be the club's current activities, the club library, our new DVD presentations, guest speakers, group tour ideas, and how we can improve our present offerings, as well as any additional activities we might consider in the future. We will send out an email prior to the meeting to gather opinions.

PAA Treasurer, Rene Bowe, delivered the financial report stating that the club account still had a little over \$200 remaining after investing in the planetarium. This will be carried into the 2005 year. Projected income from dues in the year 2005 (assuming no new members) will be \$1,295 plus the carryover from 2004. This will bring the account balance up to about \$1,500 with which to fund our activities and expenses in 2005. Our current membership has reached 37 paid individual and family members.

REGULAR FRIDAY NIGHT MEETING

Charles Baetsen was our guest speaker and joined the entire group in welcoming potential new members Shawna and

Cheryl to our gathering. John Crossen opened the meeting with an update on new additions to the club video library and the availability of DVD options as well as our usual videotape entries.

Charles' talk took us to the American Southwest where we about the archaeo-astronomy at Chaco Canyon. This is the site of the Anasazi Indian culture over 1,000 years ago. This culture produced some amazing astronomical tools for establishing the changes of the seasons and key astronomical dates like the summer and winter solstices. They were an amazingly sophisticated culture that flourished for a number of years, then vanished. Perhaps they were simply absorbed into the more recent Navajo tribes, but in truth, no one knows what happened.

The second half of Charles' presentation took us to Flagstaff Arizona, home of Lowell Observatory. Here we saw the 24-inch Clark telescope that Percival Lowell used to make his famous (though inaccurate) observations of Mars. Lowell Observatory was also famous for Vesto Slipher's research into the red and blue shifts of galaxies. This research led to Hubble's discovery that the universe was expanding. Also of great importance was Clyde Tombaugh's work to discover the planet Pluto. Yet another significant astronomical personality who spent a great deal of time working at Lowell Observatory was Robert Burnham, author of Burnham's Celestial Handbooks.

The talk wound down with a visit to the Very Large Array (VLA). This is a grouping of 27 radio telescopes with massive 82-foot wide dishes. These telescopes can be arranged in formations that concentrate on different astronomical targets. To eliminate thermal noise which interferes with deep-space radio signals, the central elements in these mammoth dishes are cooled to -18° Kelvin, just 18 degrees above absolute zero. Absolute zero is the temperature at which all molecular movement ceases. Sort of like a winter night in Buckhorn.

A DVD entitled 'Cosmic Voyage' was the final presentation of the evening. While this was a new presentation of the famous 'Powers of Ten' film originally done years ago, it added fresh visual impact thanks to computer graphics. It took us through the early stages of life on our planet.

The meeting ended with the announcement that our next get together will be an observing session at the MacDonald Observatory – Don MacDonald's observatory that is. This will be the last gathering of the 2004 season. May the New Year find you in good health, good company, and good spirits.

Dec 10 Meeting:

The gathering at Don MacDonald's was cancelled, so we met at the usual spot, however, the meeting was sparse on attendance thanks to the weather. Dave Duffus, Charles Baetsen, Colin Cross, Boyd Wood and John Crossen all braved the elements to make the meeting. We reviewed the Winter/Spring Schedule. With the exception of June, all of the speaker spots are filled, and the observing sites have been split up between Armour Hill, Don MacDonald's and Buckhorn Observatory.



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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Dave Duffus raised the possibility of a trip to Stellafane the first week in August. Stellafane is the Great Grand Daddy of all star parties with the focus on telescope building. First held in 1926 and attended by about 20 people, Stellafane has now grown to about 2,000 attendees. The annual gathering is held near Springfield Vermont. Interest around the table was high. We will table the proposition again on January 7th, our first meeting of 2005. With any luck the weather will be better and we can gather more input.

Also mentioned was the possibility of making a return trip to the Trinity College Observatory, Haliburton Forest Observatory, the Holleford Meteor Impact site and the Toronto Science Centre's planetarium. Again, we'll table these possible club outings at our next meeting.

With so few people in attendance we decided to forego the DVD and just shoot the breeze. Comet Machholz was one of many topics tossed about. As of yet it hasn't sprouted a tail, but it is definitely quite visible. Colin and Dave brought in their photographs of last month's aurora. Colin's shots were amazingly good considering the fact that he took them all with a hand-held camera using film – not digital!

Boyd brought back the laser collimator, and John Crossen will be using it over the holidays to get the club's new 6" reflector up and running. It should make its first appearance at the January 7th meeting. Charles Baetsen also mentioned that his wife Patricia's grade 6 class was interested in having the PAA do a presentation using the new inflatable planetarium sometime in the new year. John Crossen will be testing it out over the holidays to make sure all systems are 'go'. It has already been booked via Buckhorn Observatory for a 3-day presentation at one of Peterborough's private schools.

Aside from griping about the weather, taxes and having to work for a living, that was about it for the meeting. And so ended the 2004 PAA year. Counting

our latest family membership, we have grown to just over 40 members this year. And we are looking forward to continued growth in the new year. Whatever you celebrate this holiday season, may you do so in good health and in the company of family and friends. See you January 7th for our first meeting of 2005 when our guest speaker will be Ian Wheelband.

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Early Morning Treats (Venus – Jupiter Conjunctions)

November 4th & 5th, 2004, were shaping up to be good mornings for some planetary conjunctions that were not to be missed. If you checked out these two early morning skies, you were not disappointed. Mind you, they were not without the usual excitement. November 4th was a very foggy/misty morning at 5:00 a.m., at least south of Peterborough it was. I thought it was going to be "thick" enough that I would



On the next morning Venus shifted to the south such that the planets appeared to be horizontal (0.6° separation).

not be able to see much. I quickly drove up to Armour Hill though and was set-up in time for the nice twilight of dawn with Venus perched atop Jupiter. The separation was only about 0.75 degrees. This is less than 1 ½ moon diameters. The illusion of these two worlds being "close" together makes for a memorable pairing. The enclosed image shows what was happening at about 5:45 a.m. on the 4th. It was well worth the early morning and the minus zero temperature.

The next morning was to be a slight shift



Venus and Jupiter on the morning of Nov 4, 2004. The separation was only about 0.75 degrees, less than 1½ moon diameters. The illusion of these two worlds being "close" together makes for a memorable pairing.

south for Venus, so that the planets would appear to be parallel to each other (0.6 degree sep.). Rain and high winds were forecast though. I could hear the wind lashing the house at 5:00 a.m. from the warmth of my bed. I decided not to bother getting up like I did the day before. Was that a mistake! When I did get up close to 6:00 a.m., I was shocked to see that the sky was quite clear, though the wind was fierce. I managed to grab a few images before the sun totally washed out the morning sky, but the twilight was long gone by then. At least you can see what you may have missed (like I almost did).

These were two good reasons recently to have gotten up early and witnessed the early morning treats that the sky had to offer.

Keep looking up,

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Stellar Ideas for Budding Backyard Astronomers

So what do you give to someone with stars in their eyes and a burning curiosity about the night sky? It may not have bright shiny bits and knobs to twirl, but a good book on backyard astronomy is the best beginning. Look for one that explains why the constellations change with the seasons and provides good star charts for locating the constellations.

A top-notch beginner's astronomy book, complimented by what is called a planisphere, makes an unbeatable first step. A planisphere is a large round card that rotates to show where the constellations are overhead at any time of night. It also tells when they will rise and set. Add in a pair of binoculars (optional) and you have the ideal combination for any first-time stargazer.

Once your fledgling astronomer has



Astronomy – no telescope required. A simple start is the best one to make. A telescope may look flashy, but until you learn where to point it, about all you'll find is the Moon. Interesting, but there's lots more up there.

learned the constellations via the book and planisphere, use the binoculars to discover a few of the brighter deep sky objects. Maybe then – and only then – is it time to consider a telescope.

An astronomical telescope, is pretty much limited to astronomy. Depending on the optical design, the images are either upside down or left/right reversed. That's not a problem in outer space. But it's a big problem if you're sightseeing on terra firma. Also, a telescope is not very portable, and takes time to set up.

Binoculars on the other hand deliver a correct view and can be slung around your neck. Plus you can use them at the cottage, sports events, bird watching, camping trips and more. So even if astronomy falls by the wayside, your binoculars will have a life beyond stargazing.

Suggested Books:

NightWatch – Terence Dickinson – Firefly Press
Star-Hopping – Alan M. MacRobert – Sky & Telescope Magazine — Sky Publishing
The Beginner's Observing Guide – Leo Enright – RASC
The Kids Book of the Night Sky - Love & Drake

Binoculars:

Rather than recommend brands, here's what to look for. 7x50 or 10x50 are ideal for astronomy. The '7x' and '10x'* designate the power of magnification. The '50' is the diameter of the front lenses. 50 mm lets in plenty of light for good bright images. If you can find a pair that can be mounted on a tripod, that's an added bonus. If the sales person doesn't know what you're talking about – talk to someone who does.

**Don't buy a pair of binoculars that is more than 10x unless you are prepared to mount it on a tripod.*

More Ways to Make this an Astronomical Christmas:

There's plenty in Santa's sack to help fledgling stargazers learn their way around in the dark. Beyond star charts and a good astronomy book, a red light is one of the most important accessories any stargazer can have. Red light helps preserve night vision. When consulting their star charts, nobody wants to lose their night vision by turning on a bright white light. A red light can be homemade



From hot socks to astronomy computer programs, there's everything under the stars to put under the tree. Other excellent suggestions include a subscription to the new beginner's astronomy magazine Night Sky and Canada's own Sky News.



This telescope is the only reason to be afraid of the dark! It sits on a wobbly tripod that shakes in the slightest breeze. It's eyepieces are based on a dim, narrow field optical design that is now almost 400 years old and it has a finder scope that is impossible to adjust. It is so small you can see better with your naked eye. And while the skinny optical tube is only capable of gathering enough light to allow about 70 power magnification, the manufacturer proudly claims over 300 power is available.

with a red gel over the lens of an ordinary flashlight, or you can purchase a really neat one with both red and white lights (or LED's).

Something else you might like to consider would be one of the astronomy DVD's available. I have one called *Atlas of the Sky*, and it is fabulous for anyone from mid-teen to adult in explaining celestial phenomena from star formation and auroras to planetary exploration. A bit more elementary, but also very useful is an audio tape titled: *Walking Tour of the Night Sky*. Simply drop it into your Walkman®, pop on the headphones and amble out under the night sky. Produced by McLaughlin Planetarium and the ROM, it tells how to use the Big Dipper to find Polaris and the Little Dipper. It also points out Cassiopeia and the double stars Alcor and Mizar in the Big Dipper. In addition, the tape provides a fascinating narrative of mythological information on the constellations.

How about an astronomy program that runs on a computer? All of the following

provide excellent simulations of the night sky and show the relationship of the constellations to one another. Most have an internal clock that can be set so that they will show the night sky as it will appear outside, the instant you turn the program on. Plus you can also print out a star chart based on the section of the sky you wish to observe. Suggested titles include: *Starry Night Pro*, *Starry Night Enthusiast*, *Redshift*, *Earth Centered Universe*, and *The Sky*. Prices range anywhere from well under \$100 to over \$300 for some highly advanced programs designed to interface with a computerized telescope.

Not quite ready to spend that much on the family space program? Nothing beats a pair of good warm socks for standing around on a cold winter night. Ditto a pair of gloves, especially if they're the kind you can pop the finger tips off of so that the Earth-bound astronauts can turn the pages of star charts and turn red lights on and off. And what Canadian astronomer would dare show his or her head to the stars

without the requisite toque?

Nothing ends beginning astronomy like a bad telescope, but if you must...

OK, so you just have to buy a telescope for Christmas. Never mind the fact that you or the recipient has no idea where to point it other than up. After all, telescopes just look cool. A telescope for a beginning astronomer may be a bad idea, but if you're going to do it, at least do it right, so be prepared to spend \$300-\$400 for starters.

Models to **avoid** include just about **any 60 mm refractor** or **114 mm reflector** for sale in **from a big box store, hardware store, or camera shop***. Those retailers are great for the mass-consumption products they specialize in, but even most camera shops (including high-end ones) don't know much about telescopes. Add to that the fact that many stores hire holiday season temps who think that Saturn is a mid-priced car, and well, you get the idea.

**If either telescope comes on what is called a German Equatorial Mount – run for the door – really fast!*

Instead, visit a proper astronomy store. You'll find some listed below. Tell the sales person you or your gift recipient is just getting started. Tell him or her where most of the observing is going to be done. Does the telescope have to fit inside a compact car? Will it have to live on an apartment balcony? And give them a budget to work within.

If you're tempted to buy a computerized telescope because you don't have to know anything about astronomy - know this. **Computerized telescopes still require you to know a couple of alignment stars to set them up.** They also tend to be a bit heavier and more difficult to transport. Plus, you're sacrificing optical quality for the cost of computerization. Fact - a good computerized telescope will cost at least \$2,000!

My recommendation for just about anyone starting out would be to

purchase a 6-inch, f8 Newtonian-style scope on a Dobsonian mount. This combination is relatively compact, the scope has enough aperture to deliver nice bright images, and **it is super simple to use**. This type of scope is usually called a 'Dob'. Models to look for include *Discovery*, *Celestron*, *Sky Watcher*, *Meade*, *New Star*, and *Orion*.

Scope out these quality astronomical shops:

Efston Science:

Ph: 1-888-777-5255

Web: www.telescopes.com

Kendrick Astro Instruments:

Ph: 1-800-393-5456

Web: www.kendrick-ai.com

Perceptor:

Ph: 1-877-452-1610

Web: www.perceptor.ca

Clear skies and have a stellar time in your new hobby.

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Sunspot #696 – Solar Winds and Aurorae

On November 5th, 2004 Sunspot #696 exploded and sent an electrically charged solar wind toward Earth. On the evening of November 7th, we were treated to an auroral display, the likes of which we have not witnessed for sometime. There may have been the odd display over the last few years with more visible colours, but the strength and length of this display was unmatched. All this when we are headed to a "solar minimum" of sunspot activity. It was started before 7:00 p.m. and when the clouds rolled in south of Peterborough a half an hour later, I figured the weak display was over. I decided to check things out at around 9:00 and the skies had cleared and the sky was just starting to "dance". I stayed outside until after midnight and they were still going. They



On November 7th, we were treated to a spectacular auroral display. Here you can see in the upper shot, bright streamers of red, green and blue. The lower shot shows what it looked like overhead.

showed signs of weakening, but they we were not dead. Reports are that this display was seen a far south as Oklahoma!

In my attempt to capture images with my digital camera, I drained a few battery packs, but it was a thrill. I was amazed to find that the displays were so strong that I only needed an ASA setting of 200 and my exposures averaged only about 30 seconds each. I am attaching a few samples of what I got. From arcs of light over my house to colours in the pulses at the zenith, it was all a sight to behold. There was a little bit of everything over the hours that I watched. There were "rays", "glowing", "pulsating" and "patches". There were hints of colour to the naked eye, but the camera captured reds, purples, yellows and greens. I was even treated to the odd early Leonid meteor, though none were captured on film. If I did not have to work the next day, I would have stayed out all night.

I wait patiently for the next opportunity

to watch the dance of the Northern Lights. Maybe it will be tonight or maybe years from now, but either way I know it will be worth the wait.

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Searching for Clear Skies—Part 3 : Meteor Crater

Not far from Flagstaff Arizona is another area of astronomical significance – Meteor Crater. Meteor Crater (officially known as Barringer Crater) is the Earth's best preserved and youngest impact crater. The site is located just south of I-40 on the way to the Petrified Forest National Park. Strangely enough, Meteor Crater is not part of the National (or State) Park system. Apparently it was offered for sale to the National Park Service, but they declined the offer. Consequently, the crater is owned by a private company that runs an info center and provides access to the crater.

The first person to conduct a full scientific survey of the mysterious crater was Grove Karl Gilbert, the chief geologist of the U.S. Geological Survey. His prestige was so great that none of his colleagues or successors were willing to publicly question his conclusions - even though he had been wrong. In 1891, Gilbert became interested in reports of a large collection of nickel-iron meteorites found in the neighborhood of a gigantic circular crater in the Arizona desert. He entertained two possible methods of creation: meteor impact, or volcanic. He assumed that if this was an impact crater, then the iron meteorite that created it would have had to be nearly as big as the crater itself. This meant that a large mass of meteoric iron still should be there. After finding no indication of a large mass of buried iron, he concluded that the crater had to be formed by a volcanic steam explosion and the presence of meteorites in the vicinity of the crater was simply a coincidence. Since there



Meteor Crater as seen from the look out point on the crater's ridge. The crater's diameter is approximately 1 km and is about 40 stories deep. Formed about 50 000 years ago, this is the best preserved (and youngest) impact crater on Earth.

are a large number of extinct volcanoes near Flagstaff, this seemed reasonable to scientists of the day.

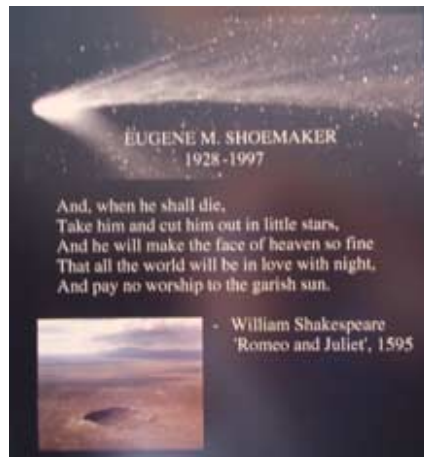
However, in 1902, D.M. Barringer also became interested in the crater. Between 1903 and 1905, Barringer conducted extensive exploration and drilling operations at the crater. Some of his mine shafts are still present today. He obtained new geological information, much of which indicated that the rocks surrounding the crater had been subjected to a sudden and violent shock. Attempts to locate the meteorite, however, were fruitless. Using other geologic evidence, he concluded that the crater was indeed created by a meteor. Unfortunately he met with lots of resistance from the geological community at large. Despite this resistance, Barringer's meteorite impact hypothesis continued to gain ground throughout the beginning of the



Eugene Shoemaker, shown here with his wife Carolyn, conclusively proved that Barringer Crater was created by an impact with a meteor.

twentieth century.

It wasn't until 1963, when geologist



The above plaque commemorates Eugene Shoemaker, who is best known for co-discovering Shoemaker-Levy 9, the comet that crashed into Jupiter in 1994. A brass version of this plaque is attached to a capsule of his ashes onboard the Lunar Prospector spacecraft which crashed into the moon in 1999.

Eugene Shoemaker (of Comet Shoemaker-Levy 9 fame) published a paper analyzing the similarities between the Barringer crater and craters created by nuclear test explosions. He demonstrated that the nuclear craters and the Barringer crater were structurally similar in nearly all respects. His paper provided the clinching arguments in favor of an impact, finally convincing the last doubters.

Gene Shoemaker realized that one day astronauts would go to the moon—and they would need Geologists! From

1948 to 1963 this was his goal. Unfortunately, in 1963 he was diagnosed with a medical condition that kept him out of the astronaut program. He said, "Not going to the moon and banging on it with my own hammer has been the biggest disappointment in my life, but then, I probably wouldn't have gone to Palomar Observatory to take some 25,000 films of the night sky with Carolyn - she scanned them all - and we wouldn't have had the thrills of finding those funny things that go bump in the night." Eventually he did make it to the moon, but not in the way you would expect. In 1999, a tiny capsule carrying a small amount of his ashes onboard the Lunar Prospector spacecraft crashed into the moon.

If you want to see an impact crater up close, Meteor Crater is the place to go.

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Winter stargazing. Bundle up. Then look up.

Stargazing in the winter can be especially rewarding. For starters, all you need is a pair of binoculars to see some fascinating deep sky objects. And, while you have to dress warmly, you won't require any mosquito spray. So grab your binoculars and a star chart. It's time to explore the winter wonderland over your head.

To the east, you'll spot the Seven Sisters of the Pleiades. They're already well up

in the evening sky by the time it's dark. To the naked eye, this star cluster looks like a fuzzy patch about the size of your thumbnail at arm's length. If you have really keen eyesight, you can make out all seven of the brightest stars. In fact, it is said that during WWII the seven sisters were used as a pilot's test for night vision. But if you're like me, a pair of binoculars will bring the sisters into sharp focus.

Also visible in binoculars are the Hyades, another large open cluster of stars. They are located in the same quadrant of the sky as the Pleiades, near the bright star Aldebaran, in Taurus. The Hyades provide a good binocular target. In fact, that's the only way to view them. A telescope has too much power for this large, open cluster of stars.

To the left of the Pleiades and Hyades and almost overhead in early winter is the Double Cluster. It lies midway between the constellations Cassiopeia (the large "W" shaped constellation) and Perseus. To the naked eye it will appear much as the Pleiades do, though a bit dimmer. But a pair of binoculars reveals them as two beautiful sprinkles of stars. And if you're blessed with a telescope, they will burst into two dazzling scatters of stars.

But the real star of winter is the Constellation Orion. Easily recognized by the three stars in a line that represent his belt, Orion contains two visual treats. The first is the star Betelgeuse. Located in the upper left-hand portion of Orion, Betelgeuse is the largest single object



Just under 400 light years distant, the Pleiades are visible to the naked eye. Photo taken with a 500 mm telephoto lens.



The Orion Nebula is a cloud of gas and dust so vast it would take 1.5 million years for the fastest rocket we currently have to travel from one side of it to the other.

that can be seen with the human eye. It is a red giant star, so large that if we replaced our star – the Sun – with Betelgeuse, it's girth would swallow up Mercury, Venus, Earth, Mars, the asteroid belt and Jupiter. That's big!

Also in the constellation Orion is the famous Orion Nebula. This huge star birthing cloud of gas and dust is 1,400 light years away and can be viewed with binoculars. To find it, look for Orion's belt, then below it to what is known as the handle of Orion's sword. There in the sword's handle is the jewel of the winter sky, the Orion nebula. It will appear to your eye as a small misty patch. In your binoculars it begins to take on shape and bulk. And in a telescope, the Orion Nebula is one of the finest sights available to the backyard stargazer.

Also coming up in winter's early evening sky is the constellation Auriga. Auriga is said to represent a charioteer by some. Others, like myself, think of this aggregation of distant suns more as a flattened out football. The brightest star in the constellation is Capella, which also happens to be one of the brighter stars of the winter sky.

Hoisting your binoculars towards the middle of Auriga will reveal three open star clusters in a line that leads down to the final cluster, just below the constellation. The top cluster is M38, next down is M36, and third in the string, is M37. Looking for more clusters? Just wait about an hour and

the twins, Gemini, will be popping over the horizon.

Gemini is home to one of winter's grandest open clusters, M35. It is located near the turned up foot of Caster, the top member of the duo as the constellation is rising. Right next to it is another visual treat, the smaller cluster, NGC2158. While M35 is a good binocular target, it's smaller and dimmer companion is next to impossible to see without a telescope.

As winter progresses, there's even more to see. The early evenings in January will have winter's brightest star, Sirius burning like a beacon in the constellation Canis Major or The Big Dog. It is said to be one of Orion's hunting dogs, Biggus Poochie, is home to M41, another superb open cluster. Easily found almost directly below Sirius, it shows as a compact fuzzy spot in binoculars. In a telescope it is revealed as a large splash of stars.



In a telescope at low power, the Double Cluster bursts into a pair of celestial fireworks displays, side by side.

But we're not done yet. Rising below Gemini, is the planet Saturn with its gorgeous rings and mysterious moons. And to the rear of Gemini, but a bit lower down is the faint constellation Cancer. Cancer is home to two open clusters. Best known is M44 or The Beehive. Just visible to the naked eye, the whirl of stars that make up M44 are a superb binocular sight. And yes, they do indeed resemble bees buzzing about a celestial hive.

Below M44 is yet another cluster of stars known as M67. Visible in binoculars, you'll need a telescope to see this cluster as individual stars.

That's your winter sky tour. At least for early winter. Later in the season you'll meet Leo the Lion with a host of galactic treats, Coma Berenices, a superb naked eye cluster of stars, The Coma Cluster of galaxies, and the Big Dipper will be standing on its handle, making galaxies M81 and M82 tantalizing binocular and telescope targets. Now, let's bundle up and start looking up, because the winter sky is crackling with starry delights.

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Your Guide to the Ten Brightest Stars: Part 4

No 4—Arcturus:

Arcturus is the brightest star in the northern celestial hemisphere. (The first three stars on this list are actually in the southern celestial sphere, though seasonally they are visible from the northern hemisphere of Earth).

Known as the Bear Watcher, Arcturus follows Ursa Major, the Great Bear, around the north celestial pole. The name itself derives from the Greek word *arktos*, meaning bear.

Arcturus is an orange giant, twice as massive and 215 times as bright as the sun. It takes 37 years for the light of Arcturus to reach us, so when we gaze upon it, we are seeing the star as it looked 37 years ago. It glows at magnitude -0.04 in our night skies.

A variable star, Arcturus is in the last stages of its normal life. During a struggle between gravity and pressure, it has swelled to 25 times the sun's diameter. Eventually the outer envelope of Arcturus will be peeled away, and the material ejected as a planetary nebula similar to the famed Ring Nebula in Lyra. What will be left behind is a white dwarf.

Arcturus is the Alpha (meaning brightest) star of the springtime constellation

Bootes the Herdsman. You can find it by using the Big Dipper as your celestial guidepost. Follow the arc of the handle until you come to a bright orange star. This is Arcturus, forming the point of a pattern of stars resembling a kite.

In the spring, if you keep following the arc, you'll encounter another bright star, Spica. If this all sounds a bit confusing remember this phrase: "Arc to Arcturus, speed on to Spica."

In the 1930s, when astronomers were busy measuring the distance to nearby stars, Arcturus was believed to be 40 light-years distant. With emergent photocell technology employed at the 1933 World's Fair in Chicago, the light from Arcturus was collected and used to activate a series of switches. Light believed to originate at the time of the previous Chicago World Fair — the city had hosted it 40 years prior — was used to illuminate and officially open the fair in 1933. We now know Arcturus is 37 light-years away, however.

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Ursa Large

You all know the constellation we call the Big Dipper. But it may surprise you that people in other countries often know it as something else. In England it is called The Plough. In some European countries it is seen as The Wagon. During the 1800's slaves seeking freedom followed The Drinking Gourd to Canada. Ancient Egyptians saw it as the thigh of a bull. In China it is viewed as a scene from *The Tseih Sing*, or government. And to the First Nations, this familiar constellation is known as The Great Bear. With so many different names, it's not surprising that many different tales surround its origin.

The First Nations People saw the three stars that form the dipper's handle as three hunters that were chasing the bear

across the sky. In the autumn they finally shoot the bear with an arrow. The blood from the bear's wound turns the trees red in the fall.



10x50 or 7x50 tripod-mounted binoculars make a great tool to explore the constellations for double stars, star clusters, nebula, even distant galaxies. The homemade dew shields help prevent the lens from fogging over.

The Greeks tell a different tale, saying that it is Callisto, a handmaiden greatly desired by the god Zeus. Hera, his wife got wind of the potential affair and turned the unfortunate Callisto into a bear. Zeus then placed her in the heavens along with her son, Arcas, who became the little bear. And since when do bear have long tails? That's because Zeus lifted them into the heavens by their tails. Perhaps the tails and the truth were being stretched.

On a more factual side, The Big Dipper does contain half a dozen galaxies that are visible through a backyard telescope. Easier to find is the double star Mizar. It is the second star in from the end of the dipper's handle. It is an optical double star. Both Mizar and its companion, Alcor can be seen by sharp-eyed observers with no optical aids. A pair of

binoculars will quickly reveal the duo. Mizar and Alcor are often called the horse and rider, with Alcor being the rider.

Call it the Plough, the Bear, or whatever, every culture in the Northern Hemisphere can point it out and probably has something different to say about it.

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The Sky This Month

MERCURY

Mercury will be a morning object throughout December. It will be best around December 29th.

VENUS

Venus is a brilliant morning object this month. It will be high in the East for the rest of the year.

MARS

Mars is visible in the early morning sky.

JUPITER

Jupiter is visible in the morning hours.

SATURN

Saturn rises after dark and is visible in the constellation Gemini.

URANUS

Uranus is located in Aquarius and will be visible throughout the month. Finder charts are advisable to locate this 5th magnitude planet.

NEPTUNE

Neptune is located not far from θ -Capricorni. It will be visible throughout the month. Finder charts are advisable to locate this 7th magnitude planet.

PLUTO

Pluto is not visible at this time.

METEOR SHOWERS:

Geminids: Peak on December 13. This is a fantastic shower that is often overlooked because it occurs when the weather is very cold. It actually outperforms the more famous Perseid shower in August.

There are several minor meteor showers this summer. For details on these see <http://comets.amsmeteors.org/meteors/calendar.html>.

A Holiday Feast of Far-Out Facts

If you were able to peel one of those black sunspots off the Sun's surface, it would glow brighter than the full moon. The reason it appears so dark compared to the sun is because it is about 1,500 degrees cooler and only produces about 1/7th as much light.

To accelerate one gram of matter to the speed of light would require energy equivalent to burning up all the stars in the universe. And you thought an SUV got bad mileage!

If the Earth were struck by a marshmallow traveling at 99.99% the speed of light, it would create a crater several miles wide. Happily that marshmallow would be roasted by our atmosphere before it could strike us – that's assuming it could be accelerated to anything near the speed of light in the first place.

Researchers studying small – Earth-sized – sunspots that were near temperature of 3,000 degrees have detected a small amount of water vapor in them. That's an amazing discovery to come across on a mammoth blazing gas orb with an average surface temperature of 5,700 degrees K.

The popular double star system 'Alcor

and Mizar' isn't really a system at all. They are line-of-sight double stars with no gravitational connection. The two stars are about 27 parsecs or 88 light years apart.

If sunlight were equal to a 100-watt bulb on Earth, it would only be equal to about 3 watts on Jupiter. That's because Jupiter is about 5.2 A.U. further from the Sun.

Astronomy is a young science. In fact, during its early years there were no astronomy degrees offered in universities. That's why most of the early luminaries were either amateurs or people who held degrees in fields that would eventually become related to astronomy. Some examples:

Wilhelm Temple, a lithographer with little formal education, discovered eight comets and first detected the reflection nebula that surrounds the Pleiades.

Heinrich Schwabe, a German pharmacist discovered the Sun's eleven-year sunspot cycle.

Lord Rosse of Ireland built a 72-inch reflector telescope and observed the spiral patterns in galaxies, then known as galactic nebulae.

Even Astronomy's earliest figures had to ply their skills at other crafts to support their astronomical interests. Johannes Kepler made a living mainly by reading horoscopes. He eventually was credited with determining that the planets take elliptical orbits around the sun instead of perfect circles.

Edmond Halley, Mr. Comet himself was also a self-taught amateur who eventually rose to the position of Astronomer Royal in England.

William Herschel was a successful musician who became fascinated by the stars, built his own telescope, and discovered Uranus.

With the exception of Kepler, all these dedicated amateurs lived in the 1800's. But even today, amateurs like John Dobson, at one time a Buddhist monk,

are making their mark. Ever heard of the Dobsonian telescope?

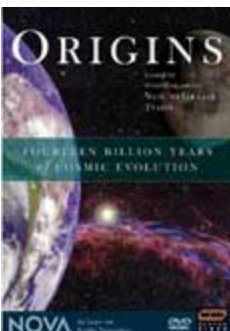
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Moon Fact #2

The light that comes from the moon is sunlight reflected off the moon's surface. It takes 1 1/4 seconds for the light to travel to Earth from the moon. The moon only reflects about 7% of the light it receives from the Sun.

PAA Library Boasts 3 New Titles Plus 5 Familiar Entries Now Available On DVD.

Once again technology serves up some new entertainment and knowledge for PAA members. This time we can offer you both Videotape and DVD formats for a number of our library offerings. And, as 2005 progresses, we'll make even more available in the popular (and more transportable) DVD format. Here's what's new or new to DVD.



Origins – Fourteen Billion Years of Cosmic Evolution. In the 70's Carl Sagan brought us his award-winning *Cosmos* television series. In the 80's and 90's Timothy Ferris sparked

many an imagination with *Creation of the Universe*, and more recently with *Life Beyond Earth*. Both were popular in their original TV formats, and as PBS videotape selections. Now Nova adds *Origins* to the first decade of the new millennium. Filled with stunning computer generated effects, the very latest in scientific theory, and interspersed with comments from some of the scientific community's experts, this new series manages to compress 14

billion years down into an enjoyable 4-hour presentation that the whole family can enjoy.

Hosted by Neil DeGrasse Tyson, an astrophysicist and Director of the Hayden Planetarium at the American Museum of Natural History, the series breaks the history of the universe down into one 24-hour day. As time marches on it shares startling new findings that help to explain how the universe, Earth and life all began. It's a great series, but you'll want to watch it more than once, just to make certain you didn't miss anything.

Origins is available from the PAA library on videotape. A DVD copy is coming soon.



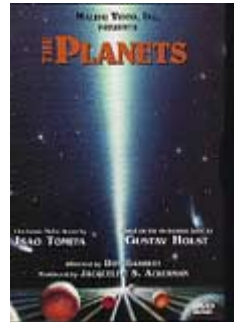
Magnetic Storm from the mind-altering people at NOVA takes you straight to Earth's molten core to find out why Earth's magnetic field has **w e a k e n e d** dramatically across the globe. Will our

new world be one with many small magnet fields? What will this mean to our traditional directional devices such as the compass? Will we lose all our modern forms of communications? How will this affect our satellites, space travel, Earth travel?

The questions are many, but there are some answers. And this isn't the first time planet Earth has been through this experience. In fact, evidence of previous polar shifts have been discovered in ancient pottery. But all of the previous generations of mankind that survived these changes were relatively primitive. Certainly none of the modern day electronic devices we depend on so heavily were around in the past. In fact, previous generations of mankind would never have noticed this dramatic shift.

Join NOVA to find out some of the answers on a journey that takes you from Hawaii's molten lava flows to the

mountains of Oregon and into the far reaches of outer space. You'll learn about Earth's magnetic history and its potentially deadly future. Available on videotape and DVD in the PAA Library.



The Planets takes you on a musical grand tour of our solar system. And, yes, the familiar music of Gustav Holst provides the background. But instead of the 1916 original, Isao Tomita has rearranged the pieces for electronic keyboard with dramatic results.

Director Don Barrett uses actual footage returned by space probes, combined with supercomputer animation and special digital effects to whisk you on your interplanetary journey. Originally released in 1991, the hour-long film delivers an enjoyable blend of music, imagery and scientific fact. However, some of the facts have changed and many new discoveries have been made since the film was completed. The Pathfinder/Sojourner visit to Mars was still in the future as was the Cassini Mission to Pluto when the film was made. Still, *Planets* makes for a refreshing change from commercial TV's regular grind of programming. Available on videotape and DVD from the PAA library.

Also newly available on DVD are these PAA Library favorites:

Asteroids Deadly Impact
Stephen Hawking's Universe – Black Holes and Beyond
Stephen Hawking's Universe – On the Dark Side
Stephen Hawking's Universe – The Big Bang
Life Beyond Earth with Timothy Ferris

John Crossen
JohnCstargazer@aol.com

ARTICLES

Submissions for *The Reflector* must be received by the date listed below. E-mail or “sneaker-net” (i.e., floppy disk) submissions are preferred (Microsoft Word, ASCII and most graphics 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 this address:

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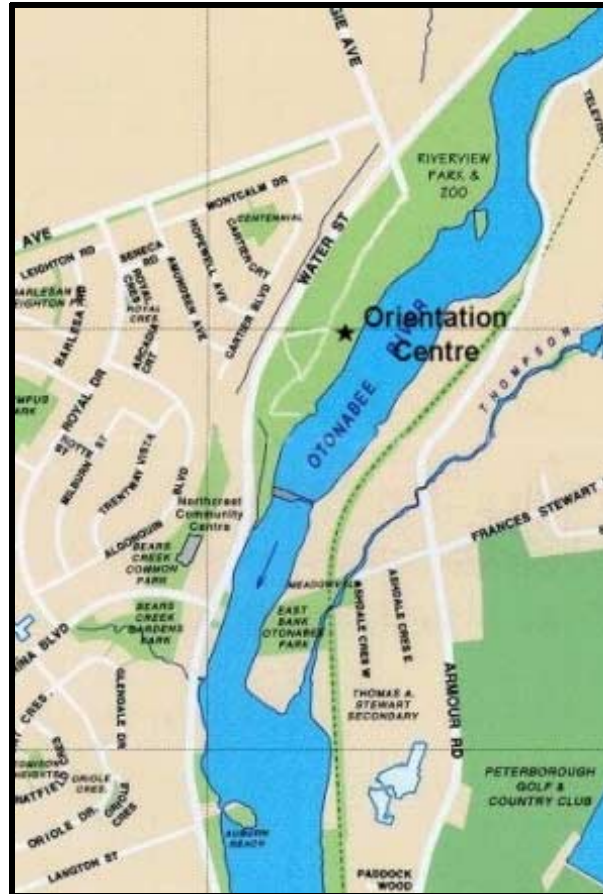
or via e-mail at:
va3ngc@rac.ca

**NEXT ISSUE'S
DEADLINE IS
Jan 2nd, 2005**



MEETINGS

The Peterborough Astronomical Association meets every second Friday at the Peterborough **Zoo Orientation Centre** (Next to the PUC Water Treatment Plant) at **8:00 pm**.



☐ CALENDAR OF EVENTS ☐

- December 10, 2004 **General Meeting** — Observing Session - Don McDonald’s
- December 24, 2004 **No Meeting**— Christmas Eve
- January 7, 2005 **General Meeting** — Ian Wheelband on Light Pollution
- January 21, 2005 **Annual Meeting**— Council Reports, Proposals for 2005

☐ MOON PHASES ☐

- | | | |
|-------------------|-------------------|------------------|
| Last Quarter (☾) | December 4, 2004 | January 3, 2005 |
| New Moon (●) | December 11, 2004 | January 10, 2005 |
| First Quarter (☽) | December 18, 2004 | January 17, 2005 |
| Full Moon (☉) | December 26, 2004 | January 25, 2005 |