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PETERBOROUGH ASTRONOMICAL ASSOCIATION

THE REFLECTOR

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Editorial

Summer is here at last and that means—summer Milky Way, Scorpius, Sagittarius and deep sky wonders! It also means that this will be the last Reflector until the Fall. I'd like to take this opportunity to thank all those who have contributed to the newsletter over the past year. In particular, I'd like to thank John Crossen, Rick Stankiewicz, Mark Coady, Robert Fisher, Anton Jopko (of the NSEAA), Shawna Miles and all else who contributed. You've all made a difference to the PAA!

Besides being the prime deep-sky season, summer is also Star Party time! Here is the line up on what is going on this summer:

July 8-10: PAA StarBBQ: Buckhorn Observatory – Guest Speaker - Jim Kendrick. See *www.geocities.com/paa_ca* for details.

August 4-7: Starfest. See www.*nyaa-starfest.com* for details on this year's event.

August 5-7: Stellafane. The PAA will be arranging a trip to the grand-daddy of all star parties. See *www.stellafane.com* for pricing and details. Also check out our website as we will be posting details there as well.

August 10-14: Great Manitou Star Party. See *www.manitoulindarksky.com* for more information.

September 8-11: Huronia Star Party. See *http://www.cois.on.ca/~ssaa/home.html* for details.

Clear Skies

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Summer is the ideal time to gaze at the Milky Way. Located in Sagittarius and Scorpius, the center of our galaxy is a treasure trove of deepsky objects. Everything from nebulae, globular and open clusters can be found here, even with binoculars or a modest telescope. If you get a chance to get away from the city lights, remember to take your equipment.

Meeting Notes

May 13, 2005:

May 13th was scheduled to feature a talk by Thomas Kovacs. Unfortunately the same back problems that caused Tom to miss Astronomy Day, also kept him sidelined on the evening of his talk.

John Crossen filled in with a tour of some of the Messier sights in the Dipper and Hercules via the digital projector and the Starry Night program on his laptop. Brett Hardy assisted with some personal computer experience, and we actually succeeded in animating Jupiter to watch its moons dance about it.

Peter Shewchuk and Rick Stankiewicz brought along a box of books to add to the PAA astronomy library and John Crossen added two DVD's to the club's

Inside This Issue

Earth Sciences collection.

Mark and Susan Coady brought us up to speed on their latest episode with Peterborough Council and the light pollution issue. Thus far, we're still waiting to get on the speaker's list. Procedure reigns at City Hall, so we'll just be patient. But it was a huge disappointment not to have the opportunity to present our case after being assured that we would. Thanks to Mark and everyone who pitched in at our executive meeting to get ready for our night before council. At least the beer and food at the Old Stone was good!

May 27, 2005:

At the May 27th get-together, Tom Kovacs delivered an excellent talk on discovering new open star clusters. That night we gained two new members, but only a couple of stars managed to shine through the clouds, so the observing session was a wash out.

Tom Kovacs of Haliburton Forest Observatory gave us a presentation based on the concept that most stars are born in groups – clusters if you like. Thus, they are related to each other in composition as well as age. Over the millions of years after they are born, the star family tends to drift apart. So how can we tell that two stars are related? Their spectra can reveal similarities between stars. Age and composition are one indication of relationships, as is the star's motion and speed. In some instances the stars can even be traced back to their origins by interstellar gas analysis. Tom likened this to tracing people by their DNA.

The May 27th meeting was held at the Buckhorn Observatory. Guest speaker, Tom Kovacs of the HFO gave a fantastic talk on star births.

In addition to stretching our collective brain power with his concepts, Thomas also returned his speaker's fee to the club via becoming a member and donating the balance to the club account and another new book to the library. So we triple-thank new member Thomas Kovacs.

Yet another former member rejoined the group Friday night. Dean Shewring was last a PAA member in 1979. He has his original membership card to prove it. Dean is one of our founding fathers and was at one point in time editor of the club's newsletter. Dean also brought along a box of books for our library. Thanks Dean, and welcome aboard.

Items discussed over the course of the night involved our commitment to sponsoring a science prize and the establishment of a dark sky preserve in the Kawartha Lake area. Rick Stankiewicz and the Coadys (Mark & Susan) will be looking after the dark sky site, while John Crossen will push forward on the science prize front.

The club's recently acquired Cave telescope went up for grabs with Peter Shewchuk winning the toss of the coin over Harold Briggs to become its new owner and hence responsible for the scope's restoration. With sufficient TLC, we should see that scope at some of our public observing sessions by summer's end.

Deb and I extend our thanks to Fran Goshl and John Cameron for the gorgeous flowers and an additional tweak to John for the munchies. Also on the list to be thanked are Peter Shewchuk and Linda Shephard for their literary contributions. We will now have to add an 8th box to hold our library collection! A rough guess tells me we're over the 200 title mark.

By 11:00 it was apparent that the clouds were taking over the sky, so we bid a fond farewell to all. A half an hour later the clouds burst into a downpour. Total attendance for the night hit the 15 member mark which isn't bad considering he drive and the weather forecast. Thanks to all who made the trek.

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Black Holes Pt V - The Final Installment

Escape Velocity

Even if a planet or a star has a really strong gravitational pull, it doesn't mean that you can never get away from it. If you are moving fast enough, you can pull away from a large object because gravitational pull weakens with distance. The speed that is needed to get away from the gravitational pull altogether is called the escape velocity.

The escape velocity for the Earth is 11 km/s. That's fast, but not so fast that we can't send shuttles into space. The escape velocity for Jupiter, a much larger planet, is 59.5 km/s, and the Sun is 617 km/s. For a neutron star with the mass of our sun, the escape velocity from its surface would be about 200 000 km/s!

Let's say you were very close to a neutron star with your feet pointing toward

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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it. Your feet would be closer to it than your head, so your feet would feel a stronger pull. With your head and feet being pulled at different strengths, you'd be stretched with considerable force. This stretching is called a tidal effect. Similar to the way the Moon's gravitational pull creates tides on the earth. The water facing the Moon gets pulled toward it, making the water heap up a little.

Black Holes

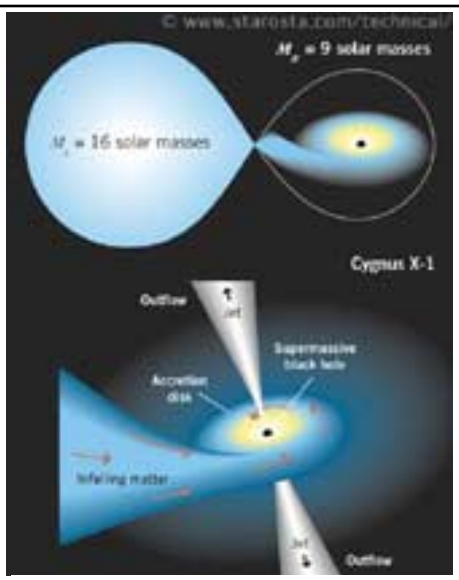
The more massive a neutron star is, the stronger the inward gravitational pull is. If you had a neutron star that had a really powerful gravitational pull, might it not smash the neutrons making up the star? Or can neutrons withstand anything?

In 1939 an American physicist, J. Robert Oppenheimer, considered this question. To him it seemed that neutrons could not stand anything. It was calculated that if a collapsing object were more than 3.2 times the mass of our Sun, then it would smash not only the electrons, but the neutrons as well. After the neutrons were smashed there would be nothing at all that could stop the object from collapsing to zero.

As an object collapses past the neutron star stage, the escape velocity rises until it becomes greater than 300 000 km/s, which is the speed of light. When this happens, nothing, not even light or radiowaves can leave the object. They're just not moving quickly enough.

When an object collapses to the point where light cannot escape it, the distance from the surface to the centre is called the Schwarzchild radius. This was named after Karl Schwarzchild, a German astronomer who first calculated it. A black hole with a mass ten times the Sun's would have a radius of 30 kilometers.

Anything that passed close enough to a small object, like the Sun's example would get ripped apart into tiny fragments by its tidal effects. The fragments would then circle the object in an accretion disk and eventually fall in. Once anything fell into it, it could never get out.



Canadian Astronomer, Thomas Bolton of the David Dunlap Observatory, was one of the first to see evidence of a black hole in Cygnus X-1. Today we look for other indirect evidence such as stars circling at a faster rate than they should be. Wendy Friedman, another Canadian astronomer has been studying the black hole at the centre of our galaxy in such a manner.

This tiny object would be a hole in space, and because no light or any form of radiation can come from the object, it would be black. It was therefore named a 'black hole' by John Wheeler, an American physicist.

How Do You Find Black Holes?

If a black hole was close enough we would feel the gravitational effects. But, we if it was out among the stars It would be very small in diameter, and what's more, a black hole wouldn't be sending out any pulses of radiation. With so small a size and no radiation coming off of it, how can we possibly detect a black hole?

Although no radiation can come from the black hole itself, matter that falls into a black hole would give radiation (x-rays) as it fell.

There are other ways to detect black holes. For example, let's say we have a binary system (two stars circling each other). The larger of the stars runs out of fuel, expands into a red giant, then explodes as a supernova. What is left after the supernova would collapse into a black hole? Some of the mass tossed outward in the explosion would fall into the other star, making it much more massive. The star and black hole would continue to circle each other. The star, now more massive, would use up its fuel and start to swell into a red giant. The outermost layer of the new red giant would be pulled on the side facing the black hole, give up large quantities of x-rays in every direction as it did so. This could go on for thousands of years.

Astronomers would watch x-rays from the sky. If they came from a single point, it would mean they were coming from a collapsed star, either a neutron star or a black hole.

If it were a neutron star, the x-rays would be coming out in pulses as it rotated. If it were a black hole, the x-rays might be coming out in different quantities in an irregular way.

The first black hole to be discovered in this way was Cygnus x-1 in 1969. A satellite picked up irregular x-rays coming from this object, which was very close to a star called HD-226868. This star was about 30 times the mass of the Sun and in order for the object giving off x-rays to be circling it as it did, the object would have to be 5 – 8 times the mass of our Sun. But astronomers couldn't see it. A white dwarf and neutron star were ruled out because neither could be that massive without collapsing further.

Another way to detect black holes is the way they bend light. A black hole has such a strong gravity that light is noticeably bent towards it, causing some unusual visual distortions. Near the black hole you can see the whole sky; light from every direction is bent around and comes back to you.

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Another Day-Another School

The PAA/BHO Planetarium has been busy indeed. Its most recent visit was to the grade 5 and 6 students at St. Teresa's school in Peterborough. During the morning, the students toured the night sky in the Planetarium. Three classes each enjoyed a 30-minute sky tour with a question period afterwards.

During the afternoon the grade 3 and 4 classes joined the grade 5 and 6 students for a slide presentation and a lengthy question and answer period. The kids really latched on to the concept that their generation will be the first to colonize the Moon. And they were really knocked out by the idea that they may even be the grandparents of the first humans not born on Earth. Yep, they could have Martians for grandchildren!

A major thrust of my talk centered around the idea that you can be involved in space travel without having to be an astronaut. The numbers prove it. For every person who travels to the International Space Station or makes a flight in one of the Space Shuttles, there are thousands of people involved in jobs on Earth that are necessary to support that exploration.

I also challenged the kids to think about how a career on Earth might differ if you were doing the same thing in space. Surgery for instance. In zero gravity, things could become very messy in the operating room. So who is going to invent the tools and techniques we'll need for medical care on extended space flights? There's another area for exploration – without having to be an astronaut.

Every school visit brings a different set of questions. And from time to time I'm stuck for an answer. The kids at St. Teresa asked how fast a comet travels. Add that to the growing list of things I have to look up. After all, even the teacher has to pass a few tests.

Next up for the Planetarium will be a presentation at Buckhorn Elementary School on June 30th followed by a July 1st show at the Buckhorn Canada Day celebrations. After that we're off to Lindsay for a show at the Library and another show in Cambray in late August. Looks like a busy summer ahead.

The students from St. Teresa's were filled with enthusiasm, energy and questions. It was my pleasure to talk with them and their instructors.

In fact, I think I'm busier now than I ever was when I was working. My advice – never retire!

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When It Rains, It Pours

I refer to this old adage because the month of May was like this for me. It started when I picked up a book from our club library to read (reviewed in this months Reflector) and there was quite a few references and focus on Einstein. The book was mostly on the concept of an expanding universe. Then I received the May/June issue of SkyNews. This special 10th anniversary issue had a poster on the "Evolution of the Universe", which fit quite nicely with the book I was reading, as it illustrated the concept of an expanding universe. Shortly afterwards, I received my June issue of the National Geographic magazine and you guessed it, there was an article on "Einstein and Beyond", beyond the Big Bang and Einstein's evolving universe.

If you take the time to follow the same "literary evolution" (reading these three pieces in the same order) as I did, I think you will see how nicely everything fit. First I got the backgrounder for how we developed the Big Bang theory and the expanding universe concept. Then the visual concept of how we see our universe having evolved up to the present and finally the real brainteaser, where our universe may be headed.

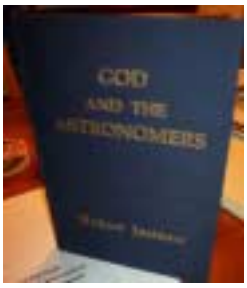
Could we be going from the "big bang" to a "big rip"? It appears that instead of the expansion of the universe slowing down, it may be speeding up, which means that once we stretch beyond the effects of gravity's pull (for that feeling that binds us), we could be torn apart right down to the atom. Not to worry though, this may take untold billions of years to happen, but quite the concept nonetheless.

I recommend you track down the sources as I found them and experience them for

yourself. Then see if you don't agree that, when it rains, it pours!

Rick Stankiewicz

Book Review



God and the Astronomers, by Robert Jastrow (1978)

At our last club meeting, a new book in our library caught my eye, and I didn't regret taking this one home. At 129 pages, lots of pictures and large print, it made for a quick read. However, this book is not what it appears to be.

I was expecting more on God and less on science, but the opposite was true. The focus of the book was mainly about the scientists over the last century that shaped the current understandings of the "expanding universe" theory. It is a good recap and overview of the thought process that got us to where we are today.

I was surprised at how a book written in the late 1970's could be so relevant today (with all our great advances). Yes, there are a few aspects in the content of the book that are a little "dated", but not enough to take away from the historical context and background explanations of how we got to our current understanding of the universe. There are a few nice pictures included throughout, but the gems are in the brief, but insightful descriptions of the scientists that helped shape modern thought around the concept of an expanding universe. People like Slipher, de Sitter, Humason, Sandage, Hubble and Einstein. There is a bit more time and detail spent on the later two geniuses, but I was surprised to learn of the connections between all the aforementioned trailblazers.

Now, I am not saying there is not any discussion or mention of God throughout the book, but the author is a professed "agnostic" (belief that nothing can be or is known about God, beyond material phenomenon).

If you read this book, you will be challenged a bit (as any scientist is) to reflect on the "religion of science" and questions like "What came before the beginning?" In my view it comes down to faith in either case, but whether you have faith in science verses religion, the bottom line is the same, you can't touch either concept in a physical way, you have to accept what you cannot prove yourself.

However, I have no problem with this, but maybe being a Christian gives me more practice at the concepts involved? I tend to agree with the British theorist, Edward Milne, who wrote a mathematical treatise on relativity which concluded by saying, "As to the first cause of the Universe, in the context of expansion, that is left for the reader to insert, but our picture is incomplete without Him."

I recommend this book for any of our club members. It is an easy read, very informative and a little thought provoking. See what you think, I have faith you will come to your own conclusions.

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Welcome To the Cottage – And Our Galaxy

In addition to escaping the noise and crowding of the city, a visit to the cottage also sets you free from the city's glut of lights. Suddenly the night sky can take on real meaning. On a clear, moonless night, the stars put on a fireworks display to rival anything manmade. And one of the most spectacular fireworks in nature's arsenal is the Milky Way arcing across the midsummer sky.

When you see the Milky Way you are actually looking at just one arm of the giant spiral galaxy that is home to our solar system. In July that visible arm (known as the Sagittarius Arm) stretches from the east/northeast horizon across to the constellation Sagittarius in the south. Around midnight it shoots almost straight overhead in a dim glow that many people mistakenly assume is a thin band of cloud. What they are really seeing are dim and distant stars that the city light pollution simply washes out.

On a good night in cottage country you can see over 3,000 stars with the naked eye. In the city, that can drop to less than a hundred stars. From my old home in Toronto, a grand total of 63 stars were visible from my backyard. Up here… well more than I'd care to count dot the night sky above the observatory. Now that you can see the Milky Way, here are some interesting facts about it.

For starters, our home galaxy is big. It is about 90,000 light years in diameter and approximately 10,000 light years thick at its core. Well out from the core, where we humans live, the Milky Way is only 3,000 light years thick. Then again, 1 light year is equal to 10 trillion kilometers in distance. So that's still a long hike.

How many stars are there in our galaxy? An exact count is impossible, but the best estimates indicate that several hundred billion stars would seem to be a responsible figure. And we have recently discovered that the core of our galaxy is also home to a star-hungry black hole.

The Milky Way Galaxy is classified as a spiral galaxy. That means it has long star-filled arms that spiral in towards its central bulge or core. The spiral arm we live in is called the Orion Arm and is home to star clusters such as the Pleiades and the Beehive Clusters as well as the famous Orion Nebula.

Our galaxy also spins, so that over the course of 220 million years our sun makes one complete orbit around the Milky Way's core. To put that into perspective, the only life forms on our planet during the last orbit around the galactic core were single celled creatures. And given the life expectancy for the

This view of the Milky Way looks towards the southern horizon and the constellation Sagittarius. Just to the right of center is the view towards the core of our Milky Way.

average species, we humans probably won't survive long enough to make the next orbital loop.

How many galaxies are there in the universe? Again the best we can do is to estimate, but 50 billion wouldn't be a preposterous guestimate. The last Hubble Space Telescope deep sky image took a 10-day exposure of a portion of the sky about as large as a grain of sand held at arm's length. The galaxy count within that speck of sky was 5,000.

So next time you're standing on the end of your dock, look up. If you see the Milky Way…welcome home.

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The Sky This Month

MERCURY

Mercury is visible in the evening near the end of June, and in the morning sky, in August.

VENUS

Venus is visible after sunset. It will remain an evening object for the rest of the year.

MARS

The red planet will be an evening object this summer. It can be found between Aquarius (in June) and Aries (in August).

JUPITER

Jupiter is located near γ-Virginis and will remain visible as an evening object throughout the summer.

SATURN

Saturn is located in the constellation Gemini. It sets around just after 9 pm. By July, it will be invisible due to the sun's glare.

URANUS

Uranus is located in Aquarius and will be visible throughout most of the summer.

NEPTUNE

Neptune is located near ι-Cap and will be visible throughout the summer. A finder chart like that published in S&T or the RASC Observer's Handbook is required to locate this faint bluish planet.

PLUTO

Pluto is located in Serpens Cauda near the star ξ-Ser. It will be visible throughout the summer months. You will need a finder chart like those published in Sky & Telescope to find it.

METEOR SHOWERS:

There are a number of major showers this summer:

June Lyrids:	Jun. 10-21
Southern δ-Aquarids:	Jul 14-Aug 18
Perseids:	Jul 23-Aug 22

There are also several minor meteor showers this month. For details, see *http://comets.amsmeteors.org/meteors/calendar.html*.

Happy Summer Observing Everyone

This marks the last issue of the Reflector before summer break. Thus far it's been a landmark year. We have made progress on a number of fronts.

The PAA library is growing steadily with new books, videotapes, and DVDs. I think we'll top the 200 title mark soon. And each week sees a new video or DVD added to the list.

The Reflector continues to be one of the finest club newsletters I have had the pleasure of reading and contributing to. Editor, Charles Baetsen, has done a terrific job. And we must also thank Rick Stankiewicz, Mark Coady, and new member Shawna Miles for their contributions. Shawna's article on black holes wraps up in this issue. Not bad work for someone who has just made 17 orbits of our Sun.

We've added an extra 6-inch Dob to the club's "loaner scope" category for beginning members – we're up to 3 now if you include the PAA peashooter. Plus we have just picked up a freebee 8-inch f5 cave mirror and homemade optical tube. Does any one want to volunteer some TLC?

Most importantly, membership is climbing. Counting the family members we now have over 40 clubbies, and we're averaging about 60% attendance at our meetings. Along the way we've picked up a few gems. Richard Matthews, Mark and Susan Coady, Brett Hardy, John Cameron as well as Don and Carol McDonald jump to mind. But many others are actively participating and contributing to the club's overall level of excellence. My thanks to all.

Once again our Astronomy Day event was a big success. This year's effort received excellent media coverage and with about double last year's turnout, it was quite a feather in the PAA cap. Thanks again to you folks who made it all come together. And that includes our new observing partners, the Peterborough Centennial Museum and Archives as well as Peter McMahon, science writer and space camp promoter from the Discovery Channel.

The addition of the PAA/BHO planetarium has really sparked the

imaginations of teachers and students alike. Thus far we've made presentations to six schools in the Peterborough/ Hastings/Douro area and we have three more on schedule before the school year ends. Not only that, but we're taking booking for the planetarium and astronomy talks in August as I write this. As a result we'll be in Lindsay, Fenelon Falls, and Cambray this summer. Plus we'll do our usual public observing sessions in Emily Provincial Park and at the Langley Scout Camp.

At this point, donations from school boards have paid off our cost of acquiring the planetarium, so the PAA bank account is beginning to grow. This will give us the financial freedom to sponsor some youth astronomy programs in the next year. Mark Coady already has some suggestions on this topic.

Speaking of Mark (a.k.a. The Prince of Darkness), we are still on the waiting list to present our light pollution proposal to Peterborough Council, but we are making progress. Mark reports that four full cutoff streetlamps have been installed near Chemong Road and Tower Hill. Somebody out there is listening! And we will have our day in council – soon!

So as we head into the summer observing months, we seem to be riding the crest of a wave. At this point in time last year, only a small portion of what we now have going for us was under way. I am going to work hard to see to it that that wave carries us into an exciting new year filled with fascinating speakers, exciting club activities, and even greater commitment to public outreach and community interaction.

So, enjoy the summer nights. We'll have the club's summer activity schedule posted on the website in a couple of weeks. Thanks again to all of you who have donated your time and talents to the club.

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Astronomy in Philately

In 1965, forty years ago on June 3rd, astronaut Edward White made the first U.S. spacewalk. Tethered to his Gemini IV capsule, White is pictured above holding a compressed gas "zip gun" for maneuvers in his right hand. His spacewalk began over the Pacific Ocean near Hawaii and ended 23 minutes later above the Gulf of Mexico. Of course, the term spacewalk is a bit deceiving as White was falling freely in low earth orbit alongside his capsule manned by fellow astronaut James McDivitt. In free-fall, White was able to control his motions by firing bursts from his gun until its supply of compressed gas ran out. He ultimately returned, exhausted, to the two-man Gemini capsule. (The following description accompanied the Astronomy Picture Of the Day – APOD- for June 3, 2005)

The attached stamps issued by the U.S. Postal Service on September 29, 1967, commemorates this momentous occasion of 40 years ago. The stamp on the left is based on the image of Ed White captured on film (check out the APOD image from June 3rd and you will see what I mean). These pair of stamps (called a "se-tenant" pair) were issued to commemorate "U.S accomplishments in space". It is interesting to note that the U.S. has never marked its accomplishments in space the way the U.S.S.R. did in the years of the "space race". It would not have taken the Russians over two years to mark such accomplishments on their postage, nor would they have only marked the event once over the years.

We can learn a lot from stamps and even more form history, but together you can't lick the lessons to be learned from both.

This pair of stamps, issued by the US Postal service, commemorates the first American space walk, by astronaut Ed White.

Your Astronomical Philatelist
Rick Stankiewicz
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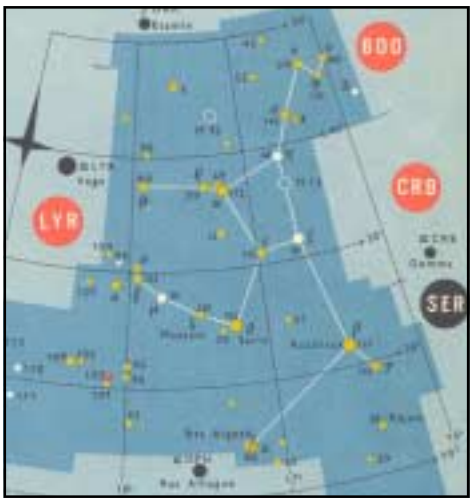
Great Balls Of Fire, It's Hercules

Last month you learned to star-hop from the handle of the Big Dipper to Arcturus in the constellation Bootes (boo-oh-teez). Just follow the arc of the Dipper's handle and "arc to Arcturus" the first bright star you come to. Arcturus is the brightest star in Bootes, the herdsman. Now we'll take it one step further and "head for Hercules."

Once again, there are some stars that point the way. It's a small arc of stars stemming from the side of Bootes. They are called Corona (just like the beer) Borealis (bor-ee-al-us) which stands for the Northern Crown. As you can see in the chart, Corona Borealis points to a lop-sided square of stars. Slightly pinched at one end, like the keystone in a stone archway, these four stars represent the body of Hercules, the mythical strongman. But this constellation has more going for it than strength. Hercules



Corona Borealis points directly to the body of Hercules. Hercules is home to two bright star globular star clusters (M13 and M92) that can be seen as fuzzy dots in handheld binoculars.

Globular star clusters such as M13 contain some of the oldest stars in the Universe. Imagine living on a planet orbiting a star in a globular cluster! In a word, you'd be toast.

is home to two beautiful globular star clusters.

The first is called M13 and is the brightest globular star cluster visible in the Northern Hemisphere. A globular star cluster is just what its name implies – it is a big glob – or ball – of stars. M13 is thought to contain about a half a million stars. It hangs in the night sky like a Christmas tree ornament that is 27,000 light years away and 27 light years across. Those of you with binoculars can easily spot it from a dark sky spot. Some even claim to be able to see it with the naked eye. Test your eyesight to see if you can spot M13 – sans binocs. If so you have great eyes and a good, dark observing location.

While M13 is the star of the Hercules show, don't overlook the second globular cluster in the neighbourhood. Just north of the wider pair of stars in Hercules' body, about mid-way between the two is M92, another spectacular ball of stars. While not quite as bright as M13, this cluster is still visible in binoculars as a fuzzy dot that won't come to focus. Through a telescope, it is almost as spectacular as its larger and more famous brother.

Globular clusters contain some of the oldest stars in our Milky Way galaxy. Most are estimated to be about 10 or 11 billion years old. That means they were some of the earliest stars formed. From what we can observe from our spot in the galaxy, there are 140 globular clusters, all residing near the outer edge of our galaxy.

That's it until September from this scribe. The Reflector presses will roll again, and we'll all be back from a summer filled with starry nights, star parties, and scarcely a mosquito. Well, I can dream. Stars up. Lights Down.

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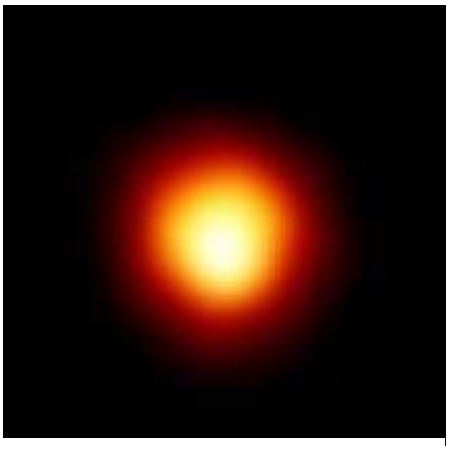
Your Guide to the 10 Brightest Stars—#10

Betelgeuse

Don't let Betelgeuse's ranking as the 10th-brightest star in the sky fool you. Its distance — 430 light-years — hides the true scale of this supergiant. With a whopping luminosity of 55,000 suns, Betelgeuse still shines bright in our skies at a magnitude of 0.5.

Betelgeuse (pronounced "beetle juice" by most astronomers) derives its name from an Arabic phrase meaning "the armpit of the central one."

The star marks the eastern shoulder of mighty Orion the Hunter. Another name for Betelgeuse is Alpha Orionis, indicating it is the brightest star in the winter constellation of Orion. However, Rigel (Beta Orionis) is actually brighter. The misclassification happened because Betelgeuse is a variable star (a star that changes brightness over time), and it might have been brighter than Rigel when Johannes Bayer originally categorized it.



Betelgeuse is so big, that it's surface can actually be imaged from Earth. The above image was taken from the Hubble telescope in 1996.

Betelgeuse is an M1 red supergiant, 650 times the diameter and about 15 times the mass of the sun. If Betelgeuse were to replace the sun, planets out to the orbit of Mars would be engulfed!

Betelgeuse is an ancient star approaching the end of its life cycle. Because of its mass it might fuse elements all the way to iron and blow up as a supernova that would be as bright as the crescent moon, as seen from Earth. A dense neutron star would be left behind. The other alternative is that it might evolve into a rare neon-oxygen dwarf.

Betelgeuse was the first star to have its surface directly imaged, a feat accomplished in 1996 with the Hubble Space Telescope.

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It's Going to Be a Great Summer for Planet Gazing

From June through October there'll be plenty of astro-action happening over your head. The season begins now with the planet Jupiter almost straight up at dusk. Jupiter will be the brightest star-like object in the night sky. So if it's really bright, it's Jupiter. And that makes it easy to find even before the sun has fully set.

This year Jupiter is in the constellation Virgo and for the duration of the summer it will be highly visible. The planet itself is made mostly of the gases hydrogen and helium, with a bit of ammonia and methane thrown in. With the exception of Pluto, all of the planets beyond Mars are

Your last opportunity to view Saturn this summer will be in June. After that, the ringed thing will be below the horizon at dusk.

called gas giants due to their composition. And giant they are. Jupiter is about 1,000 times larger than the Earth. In fact many astronomers believe that if Jupiter were just 80 times larger it would have become a brown dwarf star. As it is the planet generates more heat from within itself than it takes in from the Sun.

Another special treat during the early summer months is Saturn. During June it will be visible in the glow of the dusk just after sunset. Saturn is about half Jupiter's girth, which is still huge. But despite its mammoth proportions Saturn's gaseous composition renders it lighter than water. So if you could find a bathtub about 400,000 km across, you could float the ringed planet in it. Beats the old rubber ducky! But be quick if you're going to view Saturn. It's in the constellation Gemini which is a winter constellation. On June 9th it will be just to the left of the thin crescent Moon at sunset. To the right of the lunar sliver will be the stars Pollux and Castor, the Gemini twins. On June 24th Saturn will be in a very close conjunction with the planet Venus. Both will be low in the evening sky.

Just as we wave bye-bye to Jupiter and Saturn, Mars arrives on the scene at summer's end. In early October, the planet will be rising in the eastern sky about 9:00 p.m. On October 29th the warrior planet will make its closest approach to Earth for the year. As I write this, the lunar rover Opportunity is still stuck in the Martian sand. Here's hoping that by the time you read this, it'll be back up and rolling.

But wait a minute. Why am I talking October? Let's get back to summer. I haven't even had my first mosquito bite yet.

John Crossen
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Many Books-Many Thanks !

Everything about the PAA is growing. Membership now tops the 40 mark. Our bank account is nearing the $1,000 mark. And our library now boasts 224 titles on its list of books. Recent literary additions come to us courtesy of Dean Shewring, Thomas Kovacs, Rick Stankiewicz, Denis Gauthier, Peter Schewchuck, and L.J. Calvert.

Not only am I impressed with people's generosity, it is also delightful to know that we are becoming well enough known and that we are on their gift lists. Just recently we received a free telescope, thanks to Don Jamison who contacted us though the Peterborough Library System. Raising our public profile is definitely paying off. So we extend our thanks to everyone who donated books, telescopes, and eyepieces. We'll see to it that they are well used and cared for.

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Our thanks to Mrs. L.J. Calvert for the donation of these three text on behalf of her late husband. Our members will enjoy reading them.

DISCOVERIES!

Welcome to another edition of Discoveries. Remember that if you find some news about an astronomical discovery - send it along to me

Another Challenge to Relativity
(from NASA)

Ever since he first released it 100 years ago, scientists have been trying to disprove Einstein's General Theory of Relativity. The latest challenge comes in the form of an earth orbiting satellite called the Gravity B Probe (or GP-B).

Einstein's theory indicates that the Earth produces a dimple in the space-time surrounding it - much like a bowling ball would on a sheet of spandex. Earth's rotation turns that dimple into a shallow vortex.

The Gravity B Probe uses 4 gyroscopes to examine this space-time because they will gradually change their direction of spin, or tilt, with respect to the stars. This difference can be used to determine the structure of space around the Earth.

The mission is approaching the halfway mark. Preliminary results indicate "so far, so good" with Einstein's theory.

Mars Rovers Mission Extended

The Mars Exploration Rovers, Opportunity and Spirit, were supposed to have died 11 months ago but they keep on going like the Eveready Bunny. Because of this NASA has decided to extend their mission to September 2006.

The rovers are showing some wear and tear, though. Spirit's rock grinding abrasion tool's grinding teeth have worn away and Opportunity's thermal emission spectrometer is faulty.

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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:

Charles Baetsen
4094 Squair Rd
Orono, ON
L0B 1M0

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

NEXT ISSUE'S DEADLINE IS

Sept 13, 2005

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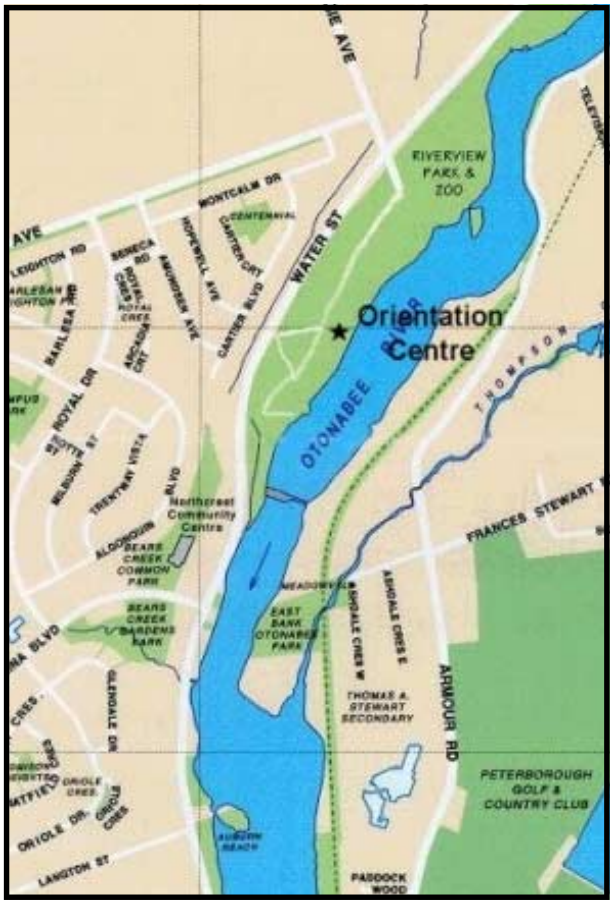
MEETINGS

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

June 10, 2005	**General Meeting—** Public Observing Night – Armour Hill .
June 24, 2005	**General Meeting—** John Crossen – Treasures of the Summer Sky - Orientation Center at the Riverside Zoo.
July 9, 2005	**PAA "Star-b-que"** – Buckhorn Observatory – Guest Speaker - Jim Kendrick
July 14, 2005	**Peterborough Summer Star Party** – Armour Hill – night show only
July 22, 2005	**General Meeting—** Peter McMahon – Exploring Our Solar System
August 5, 2005	**Public Observing Night** – Armour Hill
August 19th, 2005	**General Meeting—** Douglas Angle of the Kingston RASC – Building a 24" scope
September 2, 2005	**Dark Sky Observing Night** – Buckhorn Observatory