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# PETERBOROUGH ASTRONOMICAL ASSOCIATION

# THE REFLECTOR

Volume 6, Issue 8 October 2007

## Editorial

If you were unable to make it to the Oct 5th PAA meeting, you missed a real treat! Dr. Elizabeth Griffin, an astrophysicist with the Dominion Astrophysical Observatory (B.C.), joined us to discuss her work with ozone. Ozone is the layer of gas surrounding our planet that helps keep out harmful rays.

Ordinarily, we astronomers don't like the gases in our atmosphere, as they hinder our view of the universe. Dr. Griffin, however, has incorporated this one gas, in particular, in her studies. She is using the spectrums of light from distant stars, as it passes through the ozone, to calculate how much of this gas is in our atmosphere.

Dr. Griffin has traveled around the world comparing her finds to historical data. In the end, her research will be valuable. For example, it may show specific weather patterns are linked to certain quantities of ozone in the atmosphere. Who knows, maybe we'll finally understand the exact causes of global warming.

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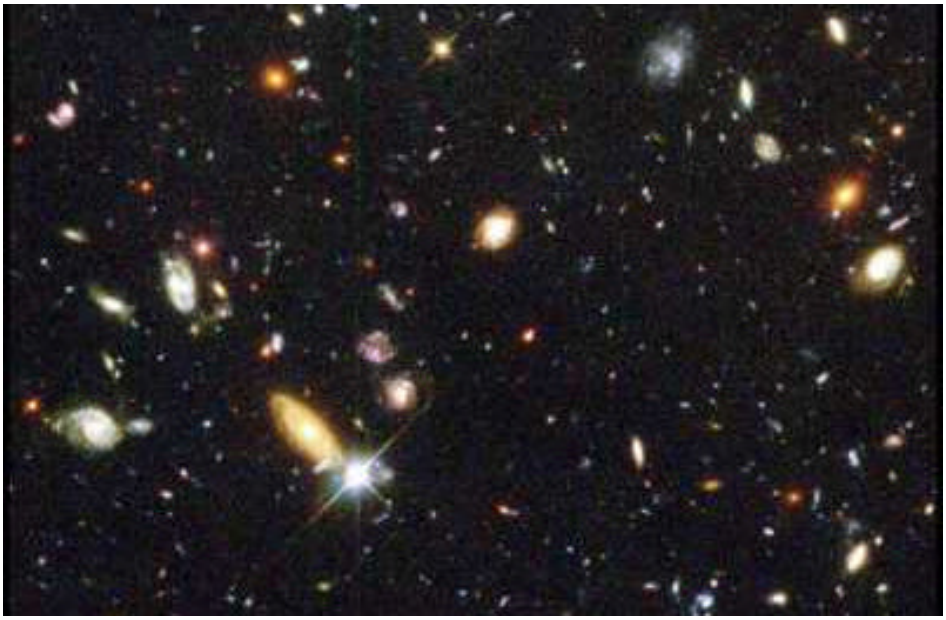
## Radio Bursts From The Distant Universe

While David Narkevic, a West Virginia University undergraduate student, was re-analyzing data from observations made several years ago, he made a startling discovery. A radio "hyperburst" was present in three of the beams. The telescope which made these observations was the CSIRO's radio telescope at Parkes in New South Wales.



*Somewhere out there, we have a new cosmic occurrence to explain! (Each dot in this picture is a galaxy.) Image credit: NASA*

These bursts of radio energy came from an object less than 1500 km in size, and located millions of light-years away! The bursts only lasted about 5 milliseconds, but are strong by astronomical standards. It was thought that radio energy of this magnitude would faint over extremely long distances, but this was so bright it saturated the equipment making the observations.

There are a couple of theories as to what caused these occurrences. One is the collision between two neutron stars, and another is the "death" of a black hole. These are still only guesses. Astronomers really don't know what caused them, exactly. With their results, astronomers have estimated that hundreds of similar radio hyperbursts occur over the sky each day. This find could be as big as when gamma rays were first discovered in the 1970's. It may even open up a new field of astronomy!

For more information, go to:
http://www.swinburne.edu.au
(under media releases)

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### *Inside This Issue*

# Former Apollo Astronaut Buzz Aldrin Aims For Mars

Buzz Aldrin was one of the first humans to set foot on the Moon. It's an honour most people would be content to retire with. But Buzz Aldrin still looks for future challenges.

In a recent speech at the 10th annual International Mars Society Convention, Aldrin tabled a series of plans for reaching beyond the Moon and setting up a permanent community on Mars. It may sound like science fiction, but isn't that what they said about sending men to the Moon in 1969?

Today lunar landings are the stuff of coffee table books. A step we took over 30 years ago, then forgot about. America beat the Russians to the Moon, so public interest sagged. With the exception of Apollo 13's near tragedy, the rest of the missions slipped silently between the pages of time.

Now we have a new challenge. Not only are we returning to the Moon with plans to establish a colony, scientific labs and an array of different telescopes, we're looking farther out to Mars. Buzz Aldrin is one of the men leading the way.

In Aldrin's opinion, Mars is a far more habitable place than the Moon, especially for a long-term community. After discussing a number of lunar landers and surface vehicles that he is helping to design, Aldrin spoke at length on an exciting new concept called the Aldrin Cycler.

The cycler is actually a series of deep-space vehicles that would travel continuously between Earth, the Moon or the International Space Station and Mars. They would act as shuttles, carrying cargo and passengers to decent vehicles orbiting Mars. The Mars decent vehicles would be designed specifically to land and take off from Mars, then orbit the red planet until the next cycler arrives.

This allows for a continuous flow of personnel, supplies and heavy cargo. Scientists who wanted to visit Mars would simply rocket up to a cycler, hop aboard and head to Mars. Once in Mars orbit, they would transfer to one of the decent vehicles and be transferred to the Martian surface. Ditto any cargo or supplies along for the ride.

The Aldrin Cycler is being co-developed by Aldrin, Damon Landau of the Jet Propulsion Laboratory and Professor James Longuski of Perdue University. Plans are still in the early developmental stages, but Aldrin was emphatic that such a system or any mission to Mars be used to send humans for the long term. In Aldrin's own words, "the plan is for Mars to be continually inhabited."

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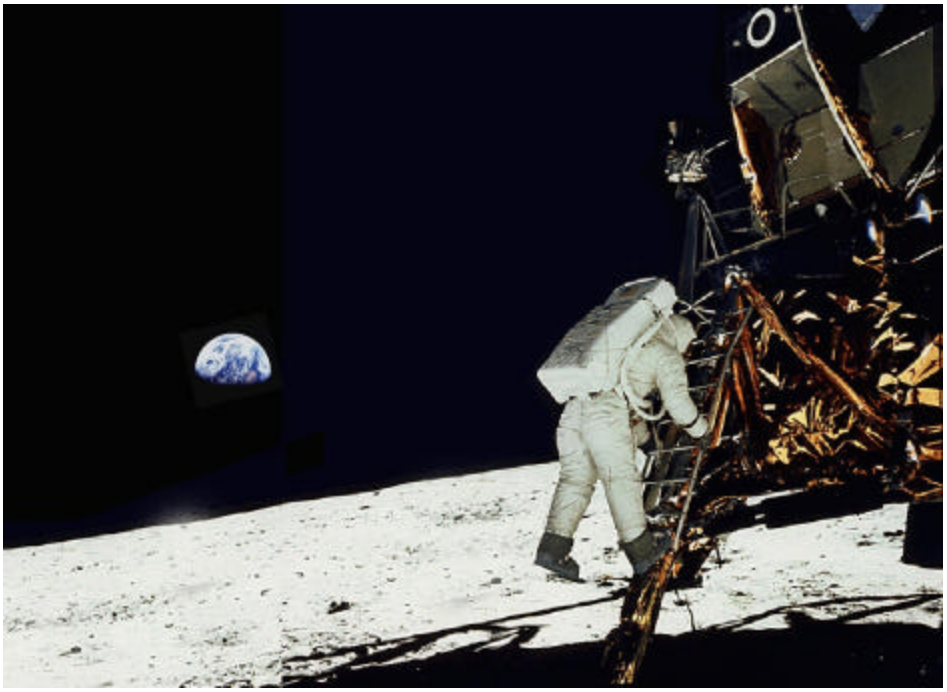

*On July 21, 1969 Buzz Aldrin stepped down to the lunar surface. Now the second man to walk on the Moon has his eyes set on Mars. Photo: NASA*

# That's No Cloud It's The Milky Way – Where We Live

As the summer drew to a close I finally had time to reflect on the summer's activities at Buckhorn Observatory. One sight that captured nearly everyone's attention was the Milky Way arching up from the North to Cassiopeia and through the Summer Triangle, then swooping down to the Southern horizon in Sagittarius.

For city dwellers who must contend with heavily light polluted skies, the sight of even a few stars can be an epiphany. So when they see the Milky Way for the first time, it's not unusual for them to think that the clouds are rolling in. But that beautiful glow across the sky is no cloud it's our celestial home, the Milky Way Galaxy.

Think of our galaxy as a big cinnamon bun with swirls of frosting radiating out from the centre, and you'll have a rough idea of how our galaxy is structured. It's a big bun, 90,000 light years across, so eat your heart our Tim Horton's.

*Continued...*

*Our neighbour galaxy M33 is a spiral galaxy much like our own. This photo was taken by Gord Rife of Schomberg, Ontario using a Canon Digital SLR and his home-built telescope.*

You, I, the Sun, and our solar system live in the sixth arm out from the centre. It's called the Orion Arm. Most of the little points of light twinkling over our heads are stars in our arm of the galaxy. The dim glow that stretches from North to South during the summer months is the fifth arm of our galaxy, the Sagittarius Arm. We see most of the stars in the Sagittarius Arm as distant collective glow that culminates at the Southern horizon where we are looking straight in towards the core of our galaxy.

While no one knows precisely what our galaxy looks like from outside, astronomers have been able to deduce the Milky Way's shape and size by observing other galaxies around us. It's like trying to figure out what the barn looks like from the inside.

To put things on a more manageable scale, imagine our galaxy as two CD's on top of each other. That gives you the proper thickness to width ratio. Now imagine a speck of dust about 2/3rds of the way out from the centre of the CD's. That's our Sun.

Our galaxy is just one of an estimated 50 billion galaxies in the universe. Some are over 100 times larger than our home galaxy, while others are much smaller. At 90,000 light years across, our galaxy contains about 40 times as many stars as there are people scuttling across the surface of our planet. So our Sun is just another speck among hundreds of billions of others.

Those of you who live in small towns and villages can probably still see our home in the universe from your backyards. But its glow is invisible to anyone who lives in a medium-sized city like Peterborough. Light pollution from poorly-designed outdoor fixtures, over-lit car lots, and ignorant use of outdoor lights has taken one of the most beautiful and awe-inspiring sights in the night sky away from us. Plus it costs over $2 billion in wasted energy yearly. Visit www.darksky.org for some solutions.

Next time you're in the country on a clear summer night, look up. That's not a cloud drifting overhead. That's our home in the universe, the Milky Way.

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# Welcome To Mars - Population 6

One night I was driving back from a speaking engagement in Omemee when I happened to spot a bright reddish object low in the eastern sky. It was Mars and the sight reminded me that yet another mission was on its way to the red planet.

Launched in August, 2007 and known as the Phoenix Lander, it's the latest Mars shot from NASA. The Lander will be in good company, joining the Rovers Opportunity and Spirit on the planet's surface. Both Rovers are still functioning and sending data back to Earth. Overhead, our newest addition to the population of Mars will have the 2001 Mars Odyssey, Mars Express and the Mars Reconnaissance Orbiters as companions.

The Phoenix Lander won't be traveling around like the two Rovers. As its name implies, it's a Lander. Its job is to touch down on the Martian surface and drill for evidence of water beneath the Martian surface. That's important because our current data indicates very strongly that Mars once had oceans. In fact many scientists say there definitely was water on Mars at one time. Lots of it! NASA is hoping that the Phoenix Lander will drive its drill and the final nail into that debate.

Phoenix will land near the Martian North Pole. It's a region that shows up in photographs as one of Mars' white polar caps. It is also a region thought to be rich in water-ice beneath the surface. Finding water, even in the form of ice, on the Martian surface will go a long way towards promoting colonization of the planet in the future.

With this in mind, Phoenix will be searching for answers to three important questions. Can the Martian artic support life? What is the history of water at the landing site? And, how is the Martian climate affected by polar dynamics?

*Continued...*

To answer these questions Phoenix uses some of the most advanced equipment ever sent to Mars. A robotic arm will dig through the soil to the water-ice layer beneath to bring soil and ice samples up for examination. On its deck, Phoenix has miniature ovens and a mass spectrometer sensitive enough to provide chemical analysis for even trace elements in the soil samples. This "chemistry lab-in-a-box" is just part of the project. Special imaging cameras feature an atomic microscope capable of magnifying and examining matter to the power of 10. Plus there's a Canadian connection in the form of a meteorological station onboard. This is our first significant involvement a Mars mission.

Touch down on Mars is expected on May 25 of 2008. Shortly thereafter we should be receiving data for analysis. Who knows, Phoenix may be the first mission to actually touch water on Mars. And as we all know, water is an essential element for sustaining life as we know it – anywhere. It may only be microbes or microbe fossils, but it would be proof that life can take roots elsewhere in the universe. And no matter how humble our neighbors may turn out to be, we will know at last that are not alone.

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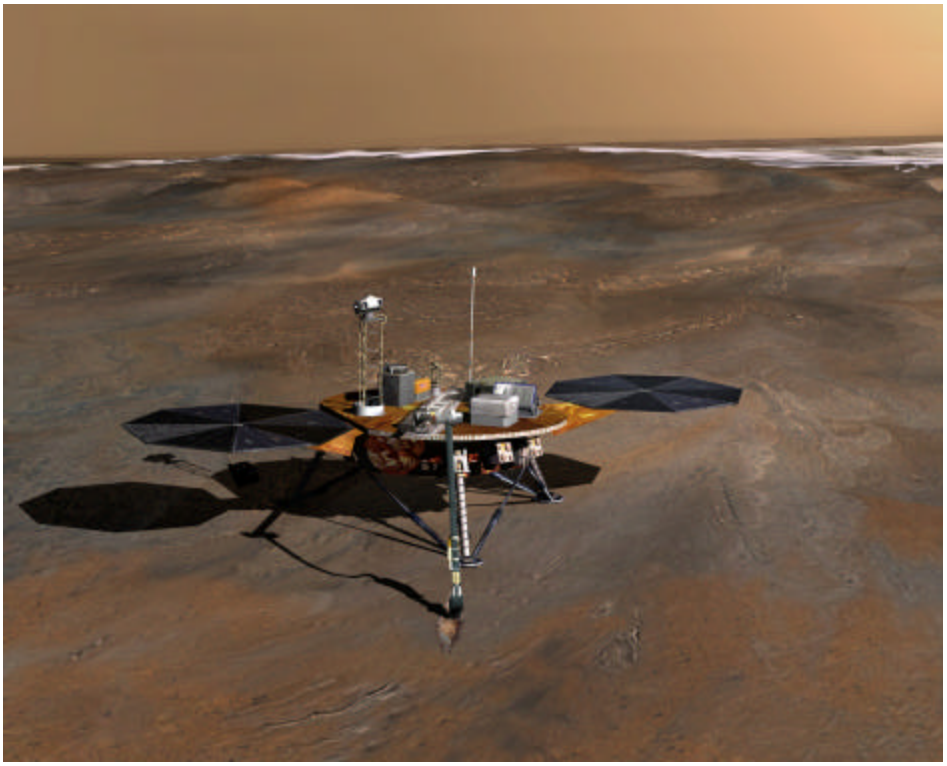

*Mister Wizard goes to mars in the form of the Phoenix Lander. The Lander will drill for water in an area near the Martian North Pole. Also onboard is Canada's first meteorological lab on Mars.*

# NASA Facts

www.nasa.gov

- NASA's Environmental Research Aircraft and Sensor Technology program (known as "ERAST") develops pilotless airplane technology. It also works on making science instruments very small so that they can be carried on remote-controlled aircraft.
- The Mercury, Gemini, and Apollo spacecraft landed in the Atlantic and Pacific Oceans when they returned to Earth.
- Have you ever heard a sonic boom? When an airplane travels at a speed faster than sound, density waves of sound emitted by the plane accumulate in a cone behind the plane. When this shock wave passes, a listener hears a sonic boom. Large meteors and the Space Shuttle frequently produce audible sonic booms before they are slowed to below the speed of sound by the Earth's atmosphere.
- In the mid-1960s the Jet Propulsion Laboratory developed digital image processing to allow computer enhancement of Moon pictures. Similar technology is now used by doctors and hospitals on images of organs in the human body.

# NASA Space Place

## Cosmic Cockroaches

Cockroaches are supposed to be tough, able to survive anything from a good stomping to a nuclear blast. But roaches are wimps compared to a little molecule that has recently caught the eye of biologists and astronomers—the polycyclic aromatic hydrocarbon.

Polycyclic aromatic hydrocarbons (PAHs for short) are ring-shaped molecules made of carbon and hydrogen. "They're all around us," says Achim Tappe of the Harvard Center for Astrophysics. "PAHs are present in mineral oils, coal, tar, tobacco smoke and automobile exhaust." Aromatic, ring-shaped molecules structurally akin to PAHs are found in DNA itself!

That's why Tappe's recent discovery may be so important. "PAHs are so tough, they can survive a supernova."

The story begins a few thousand years ago when a massive star in the

*Continued...*

*Using the IR spectrometer on the Spitzer Space Telescope, scientists found organic molecules in supernova remnant N132D.*

Large Magellanic Cloud exploded, blasting nearby star systems and interstellar clouds with hot gas and deadly radiation. The expanding shell, still visible from Earth after all these years and catalogued by astronomers as "N132D," spans 80 light years and has swept up some 600 Suns worth of mass.

Last year "we observed N132D using NASA's Spitzer Space Telescope," says Tappe. Spitzer is an infrared (IR) telescope, and it has a spectrometer onboard sensitive to the IR emissions of PAHs. One look at N132D revealed "PAHs all around the supernova's expanding shell. They appear to be swept up by a shock wave of 8 million degree gas. This is causing some damage to the molecules, but many of the PAHs are surviving."

Astronomers have long known that PAHs are abundant not only on Earth but throughout the cosmos—they've been found in comet dust, meteorites and many cold interstellar clouds—but who knew they were so tough? "This is our first evidence that PAHs can withstand a supernova blast," he says.

Their ability to survive may be the key to life on Earth. Many astronomers are convinced that a supernova exploded in our corner of the galaxy 4-to-5 billion years ago just as the solar system was coalescing from primitive interstellar gas. In one scenario of life's origins, PAHs survived and made their way to our planet. It turns out that stacks of PAHs can form in water—think, primordial seas—and provide a scaffold for nucleic acids with architectural properties akin to RNA and DNA. PAHs may be just tough enough for genesis.

Cockroaches, eat your hearts out.

Find out about other Spitzer discoveries at www.spitzer.caltech.edu.

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

By Dr. Tony Phillips

## A Missile in Your Eye

Satellite technology designed to catch ballistic missile launches may soon help doctors monitor the health of people's eyes.

For the last 15 years, Greg Bearman and his colleagues at JPL have been working on a novel design for a spectrometer, a special kind of camera often used on satellites and spacecraft. Rather than snapping a simple picture, spectrometers measure the spectrum of wavelengths in the light coming from a scene. From that information, scientists can learn things about the physical properties of objects in the photo, be they stars or distant planets or vegetation on Earth's surface.

In this case, however, the challenge was to capture snapshots of short-lived events—like missile launches! The team of JPL scientists designed the new spectrometer, called a computed tomographic imaging spectrometer (CTIS), in collaboration with the Ballistic Missile Defense Organization as a way to detect missiles by the spectral signatures of their exhaust.

But now the scientists are pointing CTIS at another fast-moving scene: the retina of an eye.

Blood flowing through the retina has a different spectral signature when it is rich in oxygen than when it is oxygen deprived. So eye doctors can use a spectrometer to look for low oxygen in the retina—an indicator of disease. However, because the eye is constantly moving, images produced by conventional spectrometers would have motion blurring that is difficult to correct.

The spectrometer that Bearman helped to develop is different: It can capture the whole retina and its spectral information in a single snapshot as quick as 3 milliseconds. "We needed something fast," says Bearman, and this spectrometer is "missile-quick."

CTIS is even relatively cheap to build, consisting of standard camera lenses and a custom, etched, transparent sheet called a grating. "With the exception of the grating, we bought everything on Amazon," he says.

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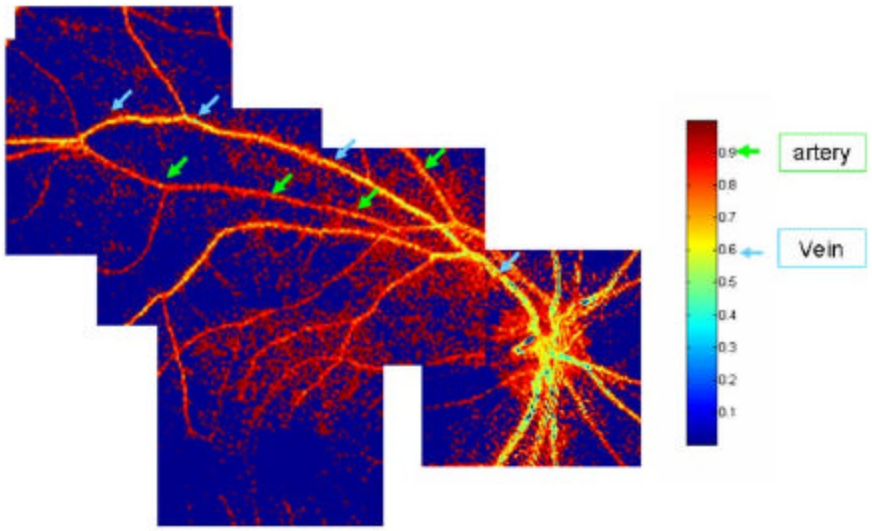


*This three-color composite image from the computed tomographic imaging spectrometer shows the oxygenation of the blood in the arteries and veins of a human retina. (Arteries appear red, veins appear yellow.)*

The grating was custom-designed at JPL. It has a pattern of microscopic steps on its surface that split incoming light into 25 separate images arranged in a 5 by 5 grid. The center image in the grid shows the scene undistorted, but colors in the surrounding images are slightly "smeared" apart, as if the light had passed through a prism. This separation of colors reveals the light's spectrum for each pixel in the image.

"We're conducting clinical trials now," says Bearman. If all goes well, anti-missile technology may soon be catching eye problems before they have a chance to get off the ground.

Information about other NASA-developed technologies with spin-off applications can be found at http://www.sti.nasa.gov/tto .

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

By: Patrick L. Barry

# The Sky This Month

**MERCURY**

Mercury is difficult to view this month as it heads for inferior conjunction on October 23.

**VENUS**

Venus is bright and well placed in the eastern sky before dawn. It is found in Leo.

**MARS**

Mars is found in Gemini, near the Twins' feet and the star cluster M35. It rises in the late evening.

**JUPITER**

Jupiter is very low in the southwest at nightfall and is no longer particularly well placed for viewing.

**SATURN**

Saturn rises several hours before the Sun, in Leo near the bright star Regulus.

**URANUS**

Uranus is in Aquarius. This green-colored gas giant sets before dawn.

**NEPTUNE**

A telescope is usually necessary to view the most distant planet in the solar system. It is found in Capricornus.

# Dunlap Observatory Soon To Close Due To Light Pollution

On September 10, 2007 the David Dunlap Observatory in Richmond received its death sentence. Sighting the fact that local light pollution had rendered the facility relatively useless for research and teaching, and the fact that it

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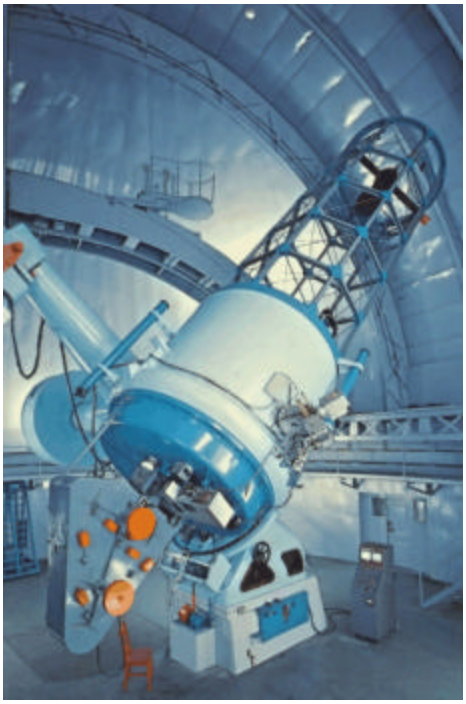

*David Dunlap Observatory was one of the leading observatories in North America. Today the Richmond Hill landmark is no longer useful due to energy-wasting light pollution. Thanks to Angela Barbetta for the heads up on this story.*

cost nearly $800,000 annually to operate, the University of Toronto announced its closure.

The funds to build the observatory were donated to the U of T in 1936 by Jessie Dunlap in memory of her husband, David. That was in the 1930's and Toronto had yet to sprawl north to Richmond Hill. Today, despite light pollution laws in Richmond Hill, the glare of Toronto's lights have caught up to the venerable old site and ended to its life.

I find this a bit ironic when you consider the fact that Toronto is screaming for more operating funds. I say that because curbing light pollution is one of the easiest ways to save municipal dollars… millions of dollars every year.

Calgary used a $2,000,000 federal grant to begin replacing old street lights. The new units were fully shielded and shine all the light downward on streets and sidewalks. With the light concentrated where it should be, the wattage could be greatly reduced.

At the end of the second year, they had saved enough money in Hydro expenses to fund the next phase of the program. Add to that the savings in air pollution (Calgary uses oil to fuel its generators) and you have a very important environmental bonus.

The new lighting system also provides a safer environment for drivers and pedestrians. Because the light is aimed down, there is less unwanted glare in a driver's eyes. Hum, safer, more economical, less pollution. What's not to like?

So would a more up-to-date lighting system in Toronto and strict light pollution laws have saved the David Dunlap Observatory and millions in expenses? Yes!

In Tucson, Arizona where light pollution (read waste) is forbidden by strict laws, you can still see the Milky Way from downtown. The last time North York citizens could see the Milky Way was 40 years ago.

So what will happen to DDO? The facility will remain open and operational until further notice. But if you've always wanted to book a tour to see what was once North America's largest telescope you'd better do it now. The 74-inch behemoth is quite a site.


*John Crossen has gotten into the Halloween spirit and decorated the entrance to his Buckhorn Observatory.*

All is not lost for students. The U of T's astronomy and physics programs have produced a number of outstanding scientists over the years. The graduates now head up research programs in Canada and throughout the world. That heritage will continue at the new Dunlap Institute which will be established at the U of T's Saint George Campus.

If you'd like to learn more and help prevent light pollution from taking over the beautiful Kawartha night skies, visit www.darksky.org .

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J O K E ! J O K E ! J O K E ! J O K E !

It's a good thing the guy in charge of naming galaxies was into chocolate bars and not Chinese food. Otherwise, the Milky Way might have been named Moo Goo Gui Pan, and who wants to have to learn about that?

! J O K E ! J O K E ! J O K E ! J O K E

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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# 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:
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**Please contact me first if you are sending a large file.**

**NEXT ISSUE'S DEADLINE IS**
**Oct. 30, 2007**
⌘

# MEETINGS

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


## Moon Phases

| | | |
|---|---|---|
| **Last Quarter** | **October 3, 2007** | **November 1, 2007** |
| **New Moon** | **October 11, 2007** | **November 9, 2007** |
| **First Quarter** | **October 19, 2007** | **November 17, 2007** |
| **Full Moon** | **October 26, 2007** | **November 24, 2007** |