

### Editorial

After attending the January 6th PAA meeting, it looks as though we will have a busy year ahead of us. Some guest speakers to look forward to will include Professor David Patton from the Trent University, Peter McMahon, Graham Wilson, and Steve Dodson. International Astronomy Day comes on May 6th this year. There was talk of trying to have a Canadian Astronaut, such as Roberta Bondar or Chris Hadfield, come for the day!

At the January 6th meeting we also welcomed back our PAA President, John Crossen, from his heart surgery and recovery. We're glad to have you back, John!

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### Possible Life Beyond Earth?

Astronomers at the W.M. Keck Observatory have found the chemicals acetylene and hydrogen cyanide in a planet-forming disk, using NASA's infrared Spitzer Space Telescope.

What is so special about these chemicals? Well, they are some of the building blocks of life. When they are mixed with water in a laboratory, these chemicals create a soup of organic compounds, including amino acids and a DNA base called adenine.

This planet-forming disk is around a young star called "IRS 46," about 375 light-years from Earth. IRS 46 is located in the Milky Way galaxy in the constellation Ophiuchus.



An artist's impression of the planet-forming disk orbiting IRS 46. Image credit: NASA/JPL-Caltech/T. Pyle (SSC)

You cannot use a normal telescope to find these chemicals around a newly forming star. The dust and gas surrounding it blocks visible light, but longer wavelengths, such as infrared light, can still pass through. The Spitzer Space Telescope picks up infrared light and astronomers can then find out what this gas and dust is made of, by separating the light into its component wavelengths, or colors.

Spitzer has looked at more than 100 sources and this is the first time these

chemicals have been found within the inner regions of a planet-forming disk. FACT: These prebiotic organic molecules have been seen in comets and gas giant planets in our own solar system, even in the atmosphere of Saturn's largest moon, Titan!

For more information, go to: [www.keckobservatory.org/news/science/051220\\_irs46/051220.html](http://www.keckobservatory.org/news/science/051220_irs46/051220.html)

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## New & Improved BHO Coming This Spring

The first in a series of improvements for Buckhorn Observatory went into place this weekend. The Celestron CG-5 Advanced GoTo Mount met the observatory's 6-inch Celestron refractor. The big refractor presses the mount's stability to the limits, but it is a good and stable unit. Add any fancy stuff, and it would be in trouble. But as a straight up point and see scope, it'll be fine. Any of you with an old EQ-5 will be impressed with the CG-5 in either its GoTo or regular format. The new tubular leg tripod adds immensely to its stability.

This set up will become the observatory's portable scope for presentations outside the observatory. So look for it at International Astronomy Day and various school and scout presentations. The mount has a slewing speed of 3-degrees per second and a data base of 40,000 objects including the NGC Catalogue, Messier Catalogue, Caldwell Catalogue, The IC Catalogue and the solar system.

Those of you who think this mount looks a lot like the old EQ-5 mounts that Synta has been selling with Skywatcher, Celestron and Orion nameplates are absolutely correct. Even the polar alignment scopes are interchangeable. But the



*The new CG-5 can just handle the big Celestron Refractor. It may be below the mount's 35-pound weight capacity, but the scope's length and front-heavy balance make it bulky and awkward for any mount. I used to run a 5-inch refractor on an old EQ-5 version of this mount. There is no comparison. The CG-5 is way more solid and steady.*

similarity ends there. This new mount is remarkably stable. And with its auto-guider plug-in, it is more than up to long-exposure astrophotography.

It all arrives in two boxes, and set-up time is about a half hour with coffee breaks thrown in. In essence assembly is a simple matter of mating the mount to the tripod and plugging in a few cords. Yes, even a gear-and-nut-challenged person like myself could put it together in the dark.

Also new to the observatory's guest program is the addition of 4 pair of 8x40 and 2 pair of 7x50 Optisan binoculars for use during our constellation tours. These tours are a part of every observatory visit and take guests through the current constellations as well as some of the brighter Messier objects that can be seen in binoculars. Once people discover how useful binoculars are in astronomy, that urge to buy a telescope first quickly subsides.

Last on the Observatory's list of improvements will be the addition of a computerized NexStar11 fork mount. This new scope will also have an equatorial wedge, so hopefully I will be able to get back to my astrophotography.

The computer's 40,000 object data base will speed up our presentations and help us greatly on those not-so-clear nights when finding things is hit and miss. Being a fork mount design, the new scope also eliminates the pain of counterweight clunks at night. Telescopes and people should never meet in the dark.

We will also be upgrading the planetarium with a new digital star projector, too. But that's another story for another time to be coming soon. I have already missed one booking because of ill health and there's another scheduled for March. All this without an ounce of promotion!

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## The Apollo Chronicles

*Acquired from science.nasa.gov*

The moon is utterly familiar. We see it all the time, in the blue sky during the day, among the stars and planets at night. Every child knows the outlines of the moon's lava seas: they trace the Man in the Moon or, maybe, a Rabbit.

This familiarity goes beyond appearances. The moon is actually made of Earth. According to modern theories, the moon was born some 4.5 billion years ago when an oversized asteroid struck our planet. Material from Earth itself spun out into space and coalesced into our giant satellite. Yet when Apollo astronauts stepped out onto this familiar piece of home, they discovered that it only seems familiar. From the electrically-charged dust at their feet to the inky-black skies above, the moon they explored was utterly alien.

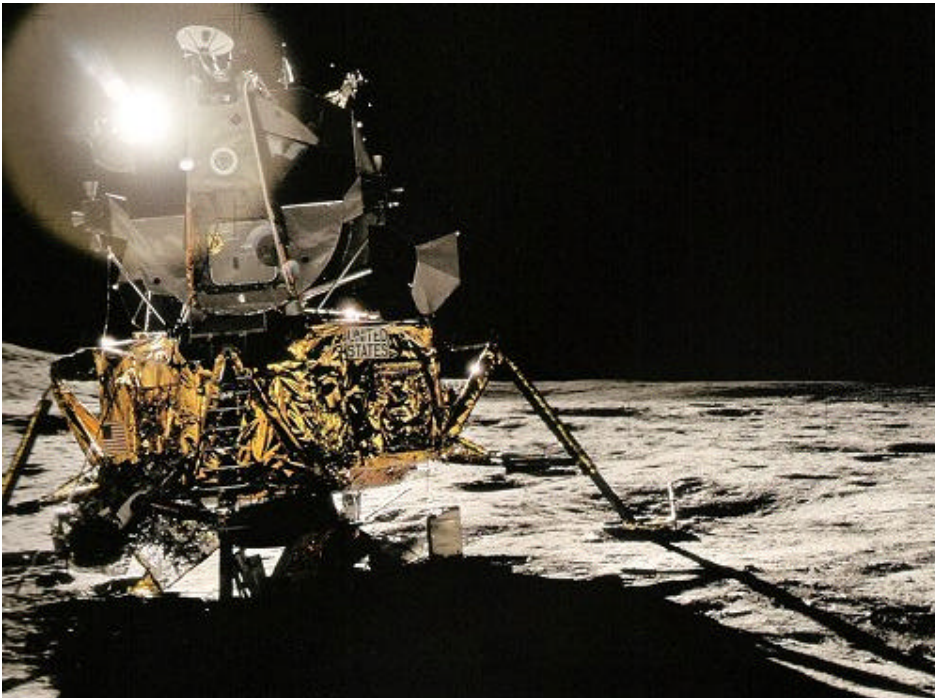
Thirty years ago their strange experiences were as well-known to the public as the Man in the Moon. Not anymore. Many of the best tales of Apollo have faded with the passage of time. Even NASA personnel have forgotten some of them.

Now, with NASA going back to the moon in search of new tales and treasures, we revisit some of the old ones, with a series of Science@NASA stories called "Apollo Chronicles" This one, the first, explores the simple matter of shadows.

*Continued...*



*The moon. Image credit: NASA*



*Blinding sunshine, dark shadows and the lunar lander Antares. From the book FULL MOON by Michael Light, Alfred A. Knopf ©1999*

### Dark Shadows

On the next sunny day, step outdoors and look inside your shadow. It's not very dark, is it? Grass, sidewalk, toes--whatever's in there, you can see quite well. Your shadow's inner light comes from the sky. Molecules in Earth's atmosphere scatter sunlight (blue more than red) in all directions, and some of that light lands in your shadow. Look at your shadowed footprints on fresh sunlit snow: they are blue!

Without the blue sky, your shadow would be eerily dark, like a piece of night following you around. Weird. Yet that's exactly how it is on the Moon.

To visualize the experience of Apollo astronauts, imagine the sky turning completely and utterly black while the sun continues to glare. Your silhouette darkens, telling you "you're not on Earth anymore."

Shadows were one of the first things Apollo 11 astronaut Neil Armstrong mentioned when he stepped onto the surface of the moon. "It's quite dark here in the shadow [of the lunar module] and a little hard for me to see that I have good footing," he radioed to Earth.

The Eagle had touched down on the Sea of Tranquility with its external equipment locker, a stowage compartment called "MESA," in the shadow of the spacecraft. Although the sun was blazing down around them, Armstrong and Buzz Aldrin had to work in the dark to deploy their TV camera and various geology

"It is very easy to see in the shadows after you adapt for a while," noted Armstrong. But, added Aldrin, "continually moving back and forth from sunlight to shadow should be avoided because it's going to cost you some time in perception ability."

Truly, moon shadows aren't absolutely black. Sunlight reflected from the moon's gently rounded terrain provides some feeble illumination, as does the Earth itself, which is a secondary source of light in lunar skies. Given plenty of time to adapt, an astronaut could see almost anywhere.

Almost. Consider the experience of Apollo 14 astronauts Al Shepard and Ed Mitchell: They had just landed at Fra Mauro and were busily unloading the lunar module. Out came the AL-

SEP, a group of experiments bolted to a pallet. Items on the pallet were held down by "Boyd bolts," each bolt recessed in a sleeve used to guide the Universal Handling Tool, a sort of astronaut's wrench. Shepard would insert the tool and give it a twist to release the bolt--simple, except that the sleeves quickly filled with moon dust. The tool wouldn't go all the way in. The sleeve made its own little shadow, so "Al was looking at it, trying to see inside. And he couldn't get the tool in and couldn't get it released--and he couldn't see it," recalls Mitchell. "Remember," adds Mitchell, "on the lunar surface there's no air to refract light--so unless you've got direct sunlight, there's no way in hell you can see anything. It was just pitch black. That's an amazing phenomenon on an airless planet." (Eventually they solved the problem by turning the entire pallet upside down and shaking loose the moon dust. Some of the Boyd bolts, loosened better than they thought, rained down as well.)

Tiny little shadows in unexpected places would vex astronauts throughout the Apollo program--a bolt here, a recessed oxygen gauge there. These were minor workaday nuisances, mostly, but astronauts were jealous of the minutes lost from their explorations.

Shadows could also be mischievous: Apollo 12 astronauts Pete Conrad and Al Bean landed in the Ocean of Storms only about 600 yards from Surveyor 3, a robotic spacecraft sent by NASA to the moon three years earlier. A key goal of the Apollo 12 mission was to visit Surveyor 3, to retrieve its TV camera, and to see how well the craft had endured the harsh lunar environment. Surveyor 3 sat in a shallow crater where Conrad and Bean could easily get at it--or so mission planners thought. The astronauts could see Surveyor 3 from their lunar module Intrepid. "I remember the first time I looked at it," recalls Bean. "I thought it was on a slope of 40 degrees. How are we going to get down there? I remember us talking about it in the cabin, about having to use ropes." But "it turned out [the ground] was real flat," rejoined Conrad.

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What happened? When Conrad and Bean landed, the sun was low in the sky. The top of Surveyor 3 was sunlit, while the bottom was in deep darkness. "I was fooled," says Bean, "because, on Earth, if something is sunny on one side and very dark on the other, it has to be on a tremendous slope." In the end, they walked down a gentle 10 degree incline to Surveyor 3--no ropes required. A final twist: When astronauts looked at the shadows of their own heads, they saw a strange glow. Buzz Aldrin was the first to report "...[there's] a halo around the shadow of my helmet." Armstrong had one, too.



*A silvery glow surrounds the shadow of an Apollo astronaut's helmet. From the book FULL MOON by Michael Light, Alfred A. Knopf ©1999.*

This is the "opposition effect." Atmospheric optics expert Les Cowley explains: "Grains of moon dust stick together to make fluffy tower-like structures, called 'fairy castles,' which cast deep shadows." Some researchers believe that the lunar surface is studded with these microscopic towers. "Directly opposite the sun," he continues, "each dust tower hides its own shadow and so that area looks brighter by contrast with the surroundings."

Sounds simple? It's not. Other factors add to the glare. The lunar surface is sprinkled with glassy spherules (think of them as lunar dew drops) and crystalline minerals, which can reflect sunlight backwards. And then there's "coherent backscatter" --specks of moon dust smaller than the wavelength of light diffract sunlight, scattering rays back toward the sun. "No one knows which fac-

tor is most important," says Cowley.

We can experience the opposition effect here on Earth, for example, looking away from the sun into a field of tall dewy grass. The halo is there, but our bright blue sky tends to diminish the contrast. For full effect, you've got to go to the Moon.

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## Wendell Beckwith (Genius or Not?)

**Y**ou may not have heard of Wendell Beckwith until now, but this story may inspire you to dig a little deeper into this enigma of a man. I had not heard of Mr. Beckwith either until an article ran in the *Globe and Mail* (October 11, 2005) "Odd man's odd home now facing extinction". A fellow I work with in Peterborough shared the article with me and gave me some background on the story because he had worked in the Thunder Bay area many years ago and he knew of Mr. Beckwith and his unusual life in the wilderness north of Thunder Bay.

The focus of the story is on Best Island, in Whitewater Lake, within Wabakimi Provincial Park, about 60 km north of Armstrong (by aircraft), which is a 250 km drive down Hwy.#527 to Thunder Bay. We are talking way up north! This is where Wendell Beckwith decided to become a recluse back in 1961. It is said that he came up to this country from the United States, to solve the scientific mysteries of the universe (among other things). Beckwith created his living quarters (3 cabins) from the land that he came to call home. This included a 35-ton fireplace and hexagonal shaped wood floor tiles. He felt that only by becoming a recluse could he solve the universe's conundrums. Apparently, Albert Einstein was an inspiration to his own complex astronomical, mathematical and gravitational theories.

Beckwith recorded observations of the moon and stars from his remote outpost. Talk about dark skies, this would be the best! He reportedly made a model of Stonehenge on the ice one winter using cedar logs. He was convinced that this was a means by which astronomical measurements could be made.

Over the next decade Mr. Beckwith became a bit of a magnet for those that happened his way. Rumors had spread that he had been the person that invented the ballpoint pen (probably because he previously worked for the Parker Pen company). People would drop by and stay for weeks or even months and help both create and maintain the cabins of his "settlement".

In 1978, Mr. Beckwith made the news when he appeared in the *National Geographic Magazine* (Vol.154, No.6 – Dec.1978, pages 780-1). This had to do with an article on "Ontario, Canada's Keystone". In this article, there are two pictures of Beckwith and only one of Premier Bill Davis (Go figure!). However in 1975, Mr. Beckwith developed cataracts, which would have greatly affected his "research". He died in 1980 of a heart attack. He had bequeathed his documents to the province of Ontario. The Thunder Bay Historical Museum Society has the majority of his documents to this day ([www.thunderbaymuseum.com/personal.htm](http://www.thunderbaymuseum.com/personal.htm))

There is much debate these days about whether to preserve the remains of the "settlement" that Wendell Beckwith created on Best Island, or to let it go back to nature as it is now. This debate

*Continued...*



*This is the cabin where Wendell Beckwith spent his remaining years.*

continues, but one thing that is not debated, is the enigma of a man that Wendell Beckwith came to be.

My source says that Mr. Beckwith believed that Whitewater Lake was the "center of the universe". We are not sure whose universe, but this may speak volumes in the grand scheme of things. Whether Wendell Beckwith was a genius or not is debatable, but whether he was an interesting person, there is no doubt, but don't take my word for it.

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## Addressing The Township on Light Pollution

On Tuesday January 10th, I made a presentation on light pollution before the council of the Township of Smith-Ennismore-Lakefield, which is a municipality on the northern boundary of the City of Peterborough, Ontario. It went really well. The following are some of the points of my oral presentation to them:

"Reeve Millen; Deputy Reeve Cavanagh; and Council Members. My name is Mark Coady and I am the chairperson of the Light Pollution Awareness Committee, a public education arm of the Peterborough Astronomical Association - which is a local group of amateur astronomers. I am here before you tonight to discuss light pollution issues with you as they pertain to the township.

It is true that astronomers were the first to notice light pollution as they are the ones most directly affected by it. But, it is far more than just trying to enjoy our hobby. Light pollution, although largely unknown and unreported, is a major environmental problem. Each year over \$2 billion is wasted, in North America alone, illuminating everything including the intended target area. Amateur and professional astronomers around the world are active, through the Interna-

tional Dark Sky Association of which the Peterborough Astronomical Association is a proud member, in getting light pollution abatement bylaws passed and in getting inefficient outdoor lighting replaced with far more efficient full cut-off fixtures which produce better and safer lighting, that is less costly, less damaging to the environment, and reclaims our opportunity to view the night sky.

Section 2 of the Noise Bylaw Number 2003-97 it states that "No person shall within the limits of the Corporation of the Township of Smith-Ennismore-Lakefield, make or permit any noise, vibration, odor, dust and outdoor illumination, including indoor lighting that can be seen outdoors, likely to disturb the inhabitants thereof."

This section of the bylaw simply indicates that outdoor illumination cannot disturb neighboring properties or the general public. This covers light trespass and glare which are the main components of light pollution.

Section 4 of this same bylaw sets out some restrictions such as not requiring light fixtures used in conjunction with commercial, industrial, institutional, agricultural, or recreational uses to be turned off at any time the use is actually being conducted. The same applies to illuminated outdoor advertising signs and, of course, security lighting.

While this section seems to imply that lighting should be turned off when it is not needed or when a business is closed for the night, it is not spelled out exactly.

Section 5 of the Property Standards Bylaw Number 2002-72 states that "All non-residential establishments shall install and maintain sufficient windows, skylights, and lighting fixtures necessary for the safety of all persons attending the premises or as may be required by the Occupational Health and Safety Act for industrial and commercial properties. However, lighting shall not be positioned so as to cause any impairment of use or enjoyment of



*Mark Coady addressing the Township of Smith - Ennismore - Lakefield on light pollution.*

neighboring properties."

This section re-iterates the provisions of Section 2 in the Noise by-law. In a recent, but brief, discussion with Doug Head, the building inspector, I understand that this bylaw is also the basis for approving the site plan regarding outdoor lighting for new commercial properties. So, basic light pollution abatement is on the books here in the township. So what are we asking of you, the township?

Number One - We ask that the noise bylaw be strengthened with the following language in Section 4: Notwithstanding the above restrictions, all commercial signage and other lighting, including parking lot illumination, must be turned off or dimmed down to an acceptable level when the business is not open or the activity is not being undertaken.

Number Two - we ask that the noise and property standards bylaws be enforced when complaints are lodged. This might require further education or training of the building inspectors and bylaw enforcement officers, but such information is readily available from the International Dark Sky Association and, more

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importantly, from the Illuminating Engineering Society of North America who set standards for outdoor illumination. Their websites are:

<http://www.darksky.org>  
<http://www.iesna.org>

Number Three - we ask that the township assist in educating the public about light pollution and how they can do their part to reclaim the night sky while saving on electricity waste. The Light Pollution Awareness Committee of the Peterborough Astronomical Association has produced a brochure on the topic that could be made available in the township and chamber of commerce offices. We are in the process of developing one strictly aimed at seasonal properties such as cottages that should be ready sometime in the next couple of months.

It's interesting to note that, in areas where electricity is generated by burning coal, one 100 watt light bulb, such as a porch light, left on all night will be responsible, over one year, for generating over 390 kilograms of carbon dioxide - enough to fill 44,000 party balloons.

Number Four - we ask that the township embark on a program to require that all new roadway lighting be of full cut-off design and that all existing roadway lighting be changed over a period of 5 years.

Using your own figures on the costs of streetlights, I note that in 2004 you spent \$38,240 on electricity charges, \$265 on permit fees, and \$12,800 on maintenance charges. Using full cut off fixtures with flat lenses would allow for the wattage of the bulbs used to be cut in half. Therefore your energy costs would be in the \$19 to \$20,000 range resulting in an overall reduction of the cost to the township by some 30 to 35 per cent.

The capital outlay for replacing the streetlights would range between \$200 and \$300 per unit, mainly depending on who your contractor is. The PUC in Peterborough gave me these figures due to our work putting together the Light Pollution Handbook for the City of Peterborough's council. With the streetlights replaced, as well as cost savings, the

township would have safer and better lit roads with all of the light directed where it is needed and no glare or light trespass on adjacent properties.

A couple of exceptions to the township's streetlights, however, must be noted. The ornamental streetlights in Lakefield with the large cap (we like to refer to them as witches' hats) can remain as they eliminate any upwards glow and the ornamental lights in Bridgenorth in and around Heritage Park can stay as they are full cut off. Unlike the ornamental street lights in downtown Peterborough, these lights have an internal reflector that restricts horizontal and upwards glow.

With the above four recommendations implemented, the township would be better off with increased security, better vision at night, and cost savings for the taxpayer.

A brief question and answer period followed then council passed a resolution ordering their staff to draw up changes to the planning rules that will require all new development to use full cut off streetlights and to have staff draw up plans for the replacement of all existing streetlights with full cut off fixtures.

I was not expecting them to act this fast but we will definitely take this small victory. We have offered our assistance to their planning and roads department and it has been accepted.

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## Space Junk

Space junk is debris left behind by rockets and spacecraft. They range in size from microscopic specks of paint and metal to whole spacecraft.

The Haystack X-Band Radar is operated by the MIT Lincoln Laboratory in Lexington, Massachusetts. It can track debris from 1-30cm across. By "staring" at a selected part of the

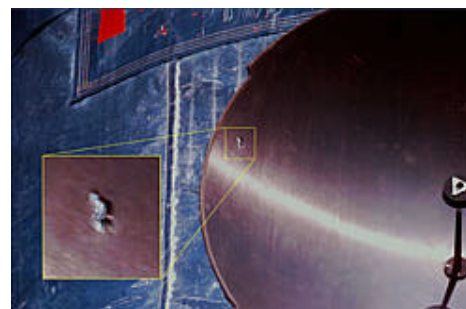


*Haystack X-Band Radar  
 Image Credit: NASA*

sky, Haystack can detect an object the size of a pea over 600 km away! Any craft in the area can then be alerted.

To measure the debris, scientists use a combination of ground-based radars and optical telescopes, space-based telescopes, and analysis of spacecraft surfaces returned from space. It has been found that more than 100 000 pieces of debris are 1-30cm across and tens of millions of particles are smaller than 1cm across, all traveling speeds of about 18 000 mph (29 000 kph). At these speeds, even the tiniest particles can cause damage!

This orbital debris eventually re-enters earth's atmosphere and burns up, but some of the largest pieces, like old space stations, just break up. For example, the US Skylab space station re-entered the atmosphere on July 11, 1979. Pieces as big as 1 000 lb landed in the Indian Ocean and Australia!



*This impact from debris went completely through the antenna dish of the Hubble Space Telescope. Image credit: NASA*

For more information, go to:  
<http://sn-callisto.jsc.nasa.gov>

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# Luminous Intensity, Candela, Luminous Flux, And All That

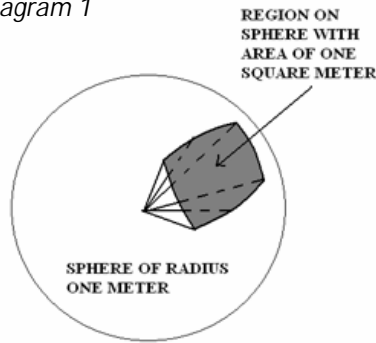
Little did I know that by trying to understand these terms of photometry that it would consume so much of my time in thought and research. My only desire was to learn the meaning of these terms which appear in "The Observers Handbook" regarding properties of the Sun. Considerable frustration arose because the meaning of intensity in physics is different from its meaning in photometry. In fact, intensity in physics means illuminance in photometry. We use the photometric meanings here.

This article will be the first of two parts. This part relates to determining the amount of light from a point source which is incident on a surface. This is called **illuminance which has units of lux**. The second part will investigate the amount of light reflected or emitted by a surface. The term brightness or luminance describes this. (This is different from illuminance)

In photometry, the word luminous is used to describe light that is visible to the human eye. We have therefore terms such as luminous flux or luminous intensity.

**SOLID ANGLE IN STERADIANS:** The first concept we need is the meaning of a solid angle. In Diagram 1, above, the radius of the sphere is one

Diagram 1



meter and the gray portion on the surface of the sphere has an area of one square meter. Viewed from the center of the sphere, the gray area subtends a solid angle of one steradian. Since the surface area of a sphere of radius R is  $4\pi R^2$ , the center of the sphere is **surrounded by a solid angle of  $4\pi$  steradians**.

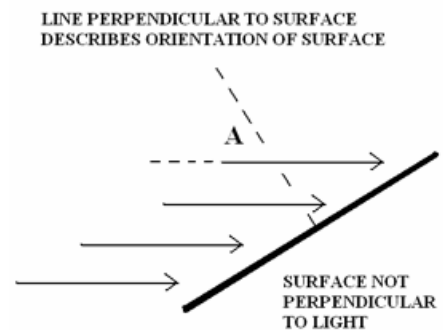
**LUMINOUS FLUX:** Now imagine a point source of light at the center of the sphere. Suppose this source emits a very large number of photons of visible light per second uniformly in all directions. We call this the **total luminous flux F and it has units of lumens**. This value does not depend on distance from the source. It represents the strength or power of the source. One lumen is approximately  $4 \times 10^{15}$  visible photons per second.

**LUMINOUS INTENSITY:** The luminous intensity **I**, of the source, is the total luminous flux divided by the total solid angle of the sphere. Luminous intensity therefore has units of **lumens per steradian which is now**

**given the name of candela**. In our example, the luminous intensity is  $I = F/4\pi$  candela. (This value does not depend on distance from the source either.) Conversely if the luminous intensity in candelas is known, the total luminous flux in lumens is obtained by multiplying the intensity by  $4\pi$ .

**ILLUMINANCE:** Now consider an even larger sphere of radius R meters. The total luminous flux of F lumens must pass through this larger sphere so the number of lumens passing through one square meter of its surface is  $E = F/4\pi R^2$  or  $I/R^2$ . We call **E the illuminance on the surface** and it has units of **lumens per square meter**, which is given the name **lux**. Illuminance does depend on distance from the source as it varies inversely as the square of the distance R

Diagram 2



from the source. Note in Table 1, left, that the star Vega has a greater luminous intensity than the Sun but its illuminance on earth is extremely small compared to that of the Sun since Vega is 25 light years away. If the surface illuminated is inclined to the direction of light, then the illuminance decreases. In Diagram 2, above, the light is incident horizontally from the left and strikes the inclined surface. Let the light make an angle of A degrees with the line perpendicular to the surface. The illuminance of the surface is now reduced by a factor of  $\cos(A)$  since the same amount of light illuminates a larger surface. This same factor is the reason that the earth's surface at the equator is hot but the poles are cold. In particular, if the angle A were 90 degrees then  $\cos(90) = 0$  and the illuminance of the surface would be zero.

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Source	Luminous Intensity I (candela)	Surface Location	Illuminance E (lux)
Sun	$2.8 \times 10^{27}$	horizontal surface at earth's equator	100,000
Sun		horizontal surface at our latitude	70,000
Car Headlight High Beam	20,000	vertical wall at 100 meters	2
100 W bulb	140	10 meters from light bulb	1.4
Wax Candle	about one	1 meter from candle	about one
Star Vega	$1.4 \times 10^{29}$	on earth	0.0000025

Table 1. A list some of typical intensity and illuminance values.

## Fifty Times Bigger Than Earth, Saturn Floats In Your Tub.

Size wise, Saturn is the second largest planet in our solar system. It's about 500 times the size of Earth and half the size of giant Jupiter. But despite its girth, Saturn is a lightweight – literally.

The ringed thing is classified as a gas giant – one of the four gas-comprised planets that make up our outer solar system. Its gaseous neighbors include Jupiter, Uranus and Neptune.

Spectrographic readings show that Saturn is composed mostly of hydrogen, methane, and traces of other gasses. In fact, Saturn is so light that it would float in water! You'd need a mighty big tub though. From one side of its rings to the other is a distance of about 400,000 km. That's equal to the distance from Earth to the Moon. Say, that would be a bathroom almost large enough to house my wife's shampoo collection.

Saturn's rings, however, are not composed of gas. Instead, they are lumps and clumps of rocks, ice, and dust particles. And they are not a solid mass. The Cassini space craft has flown through the rings and you can hear the clatter of ring material hitting the exterior of the craft.

So how did a gas planet come to have rings made of solid materials? Astronomers are counting on the Cassini space craft to confirm some of their theories. Presently it is thought that the rings are either the remains of two moons that slammed into each other long ago or the



Illustration of the Cassini space probe.

result of an ancient moon/comet collision. Cassini will be orbiting Saturn and studying its rings and major moons for the next four years, so we should have an answer soon.

Cassini has already been orbiting Saturn for over a year, and we've learned a great deal already. For starters, Cassini launched the Huygens probe to Saturn's moon, Titan. From the photographs the probe sent back we were able to see Titan's mysterious surface for the first time. Normally the surface of Saturn's largest moon is hidden behind a misty cloud of reddish orange methane. What lay beneath was pure speculation. For starters, we were able to land, which told us that Titan's surface wasn't totally liquid. And from the photographs relayed back to us we could see the shoreline of a huge methane lake.

Upon landing we discovered that Titan's surface temperature was so cold that water froze into chunks as hard and rock-like as granite. Methane, normally a gas, was cooled to the point that it took on the characteristics of water and formed pools, fell in the form of rain and provided the moisture that gave Titan its clouds. Many scientists also believe that Titan's present-day surface is a lot like Earth's early environment. So once again, studying a distant object today may help us understand our planet's origins in the past.

If Saturn catches your imagination, you might wish to purchase the book, *Exploring Saturn* by Dan Bortolotti. It is published by Firefly and should be available through HappenStance Books and Yarns in Lakefield, any Chapters or Coles outlet or The Canal Book Store in Bobcaygeon.

Those with internet access will find a great deal of information and a number of photographs at [http://www.jpl.nasa.gov/solar\\_system/](http://www.jpl.nasa.gov/solar_system/). You'll also get the latest updates on the Deep Impact, Cassini, and Star Dust missions.

John Crossen  
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## New Movies for the PAA Library

Those of you who have yet to see *March of the Penguins* had best crawl out from under that rock and have a peek. This spectacular family film from National Geographic features some of the most awe-inspiring footage of the Antarctic ever made.

Filmed over the course of a year, *March of the Penguins* tells the story of birth, life and death in a tribe of penguins. Capable of surviving temperatures of minus fifty degrees, the males of the tribe huddle together to keep warm and guard the eggs while the women are off feeding. It's a long winter and some don't make it, but eventually the females return to take over from the males. At this point the baby penguins are hatched, walking and – what else – fantastically cute. Remarkably the penguins are monogamous and can identify each other via their voices. Ditto for the children, so there are never apples and oranges in the same family tree.

This movie makes for a great evening's entertainment with the family. There are ample helpings of humor, danger, and death, but life still finds a way, even at fifty below. And the scenery is beyond imagination. In short, ya gotta see this one!

**Coming attractions.** Two new films will be joining our PAA Library in the near future. The first, called "*Hubble. 15 Years of Discovery*" takes us through the HST's decade and a half of revolutionizing our knowledge of the universe. From its namesake, Edwin Hubble, through to its discoveries about the planets, stars, and distant galaxies, this film is one spectacular image after another.

The DVD contains the official ESA (European Space Agency) documentary, a CD of the original soundtrack, and ten bonus tracks including how the Hubble images are made and simulating the universe.

*Continued...*



The latest editions to the PAA library.

With the Hubble Space Telescope's days being potentially numbered, the DVD may be the last cry from an instrument many have called "the most valuable scientific tool of the 21<sup>st</sup> century."

The other film, "Welcome to Mars," is history that is still in the making. At the time of this writing, both the rovers – Spirit and Opportunity – are still functioning at near full efficiency and continue to cram their daily diaries with new discoveries. This DVD takes up where "Mars. Dead or Alive?" left off with the search for water on Mars. It also takes us through the drama and excitement of the rover landings, the first wobbly steps (rolls?) as the rovers began their exploration of the Martian landscape. To date the rover's have extended their tour of duty to about twice what was expected. Now the only problem is finding the money to continue funding a project that just won't quit! Hey Energizer bunny, are you listening?

In the next Issue of The Reflector you'll get the highlights on two more coming DVD offerings, "The Dream is Alive" and "Space Station" as narrated by Tom Cruise. You won't find these types of films at the local video store, not even the big block buster stores stock informative, science-oriented entertainment. But then again, isn't this one of the reasons you joined the PAA?

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## The Sky This Month

### MERCURY

Mercury is early in the morning, before dawn. It is in superior conjunction on the 26<sup>th</sup>, thus becoming an evening object.

### VENUS

Venus will rise shortly before sunrise by the third week of this month and become the "morning star" in Sagittarius.

### MARS

Mars is still well placed for observing, high in the constellation Aries.

### JUPITER

Jupiter is now in Libra and rises several hours before the sun. It has a magnitude of about -1.9.

### SATURN

Saturn is still in Cancer and rises not long after sunset. It reaches opposition on the 27<sup>th</sup>. The magnitude is about -0.1.

### URANUS

Uranus is located in the center of Aquarius. At a magnitude of about 6.0, it is at the limits of naked eye visibility.

### NEPTUNE

Neptune is in the constellation Capricornus, but is a low 8.0 magnitude. 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 not visible this month.

### METEOR SHOWERS:

The Quadrantids will peak on January 3<sup>rd</sup>/4<sup>th</sup>.

For details, see <http://comets.amsmeteors.org/meteors/calendar.html>.

## Meeting Notes

January 6th, 2006

### THE FIRST MEETING OF 2006 GOT OFF TO A GREAT START.

About 20 members braved the cold and threats of snow to attend our launch meeting. This was also club President, John Crossen's first chance to attend a meeting since his heart surgery last November. Needless to say he was delighted to be out and about a group of friendly and familiar faces.

**CHARLES BAETSEN HON- OURED.** After 5 years as the editor of the club's newsletter – The Reflector –

*Continued...*

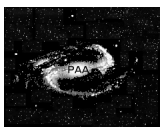


A big part of our "thanks" to Charles Baetsen came in the form of a 3-part IMAX DVD series.

Charles Baetsen has chosen to take a break. Charles' revitalization of the club's newsletter was the first step in revitalization of the club. Since those days we've grown to over 50 members and become involved in a number of public activities. Charles has been a moving spirit behind that change and this was our chance to thank him.

**NEW MEMBERSHIP SECRETARY.** We welcomed Susan Coady on board as our Membership Secretary. As such, Susan will be in charge of collecting member dues, updating the member list, collecting personal data on new members and issuing New Member Kits.

**PAA TO GET A REAL WEBSITE.** That's right a real [www.paa](http://www.paa) website. No more geocities with their big, forgettable addresses and annoying little ads. Club Treasurer Rene Bowe released the funds to move ahead. Peter McMahon will do the original design. Boyd Wood will look into getting our site name registered and hosting the site. Deb Crossen will be in charge of maintaining the site and adding to it. The club's involvement in light pollution abatement precipitated it all. We started out by proposing to add a light pollution page to our current site and things just went on from there. We'll have a new site to announce by the end of January...we hope.



## 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.

### Website

[www.geocities.com/paa\\_ca](http://www.geocities.com/paa_ca)

### Email

[Paa\\_ca@yahoo.com](mailto:Paa_ca@yahoo.com)

### Club Mailing Address

John Crossen  
2254 County Road 507  
Buckhorn, ON, Canada K0L 1J0

### KRISTINA BERGAN ARRIVES.

Peter McMahon does have a better half! And tonight she joined him in attending the meeting. Kristina shares Peter's love of astronomy and science. In fact, she is an active member of The Canadian Science Writers. We look forward to seeing her at more club functions.

### OTHER NEWS.

John Crossen outlined our observing and tour schedule for 2006 and requested additional ideas for inclusion. They are arriving as this is being written. The club added **March of the Penguins** and **Star Atlas** to its current DVD library. That brings us up to over 80 video titles alone. Mark will also be making a light pollution presentation to the Smith Ennismore Town Council on Tuesday, January 10<sup>th</sup>.

John Crossen  
[JohnCstargazer@aol.com](mailto:JohnCstargazer@aol.com)

## Scope Stuff For Sale

### ◆ TUTHILL SMART CHART

Any of you who remember the late Roger Tuthill (a.k.a. Tutty) may recall the Tuthill Smart Chart that reads off the R.A. and Declination of the Messier objects. This handy observing tool was the predecessor to digital setting circles which were the precursors to today's computerized GoTo telescopes. This little gem runs on a 9-volt battery and how it works is your guess. **Take it home for \$10.00** and figure it out. It's a small chunk of amateur astronomer history that looks techy and neat just sitting on your desk.

### ◆ THOUSAND OAKS SOLAR FILTER

Designed for a 5" scope this visual-use, all-glass solar filter has an inside diameter of 5.75" that should result in a snug (safe) fit. The rim is lined with felt that compresses and should fit scopes with just under a 6" outside diameter. Perfect for and EXT 125, **it's yours for \$55.00.**



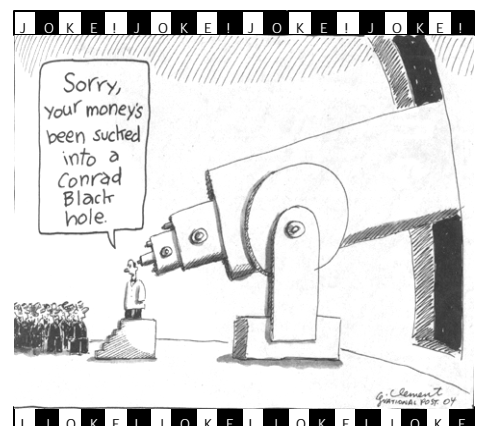
### ◆ VINTAGE VERNONSCOPE PLANETARY FILTER SET

This set of six filters will only thread into Brandon eyepieces. The set consists of #8 yellow, #12 yellow, #25 red, #38A blue, #21 Orange, and a polarizing filter with some dew marks on it. If you have the Brandon's, I've got a rare set of filters in a leather case for just \$50.00.

### ◆ ORION STEADYPIX CAMERA MOUNT (Not shown)

This is the perfect setup for a focal (through the eyepiece) photography with either a film or digital SLR camera. It sells new for \$35.00 U.S. plus shipping and duties. **Yours for \$20.00 CDN.**

For more details, contact John Crossen at [johncstargazer@aol.com](mailto:johncstargazer@aol.com) or Buckhorn Observatory at 705-657-7718.



## ARTICLES

**S**ubmissions 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:

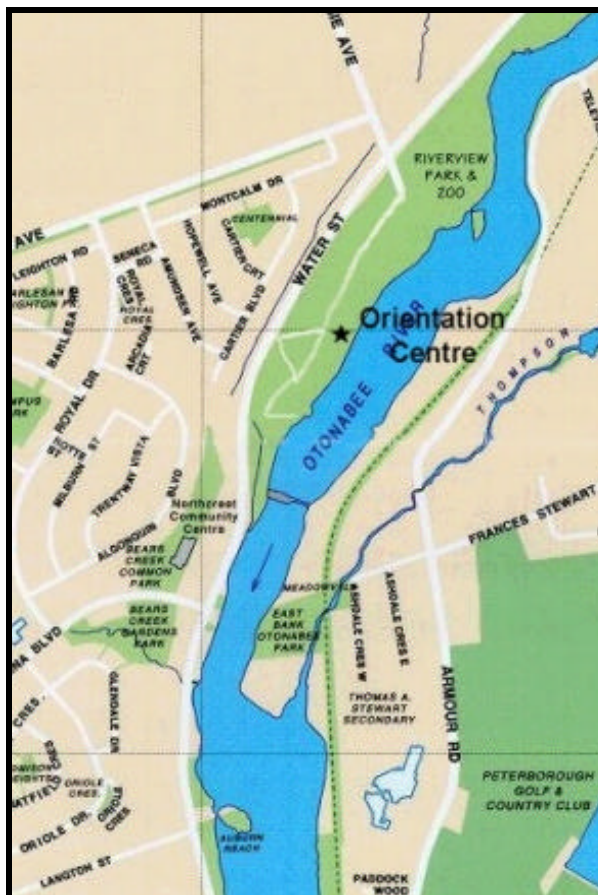
Shawna Miles  
2192 Bass Lake Rd.  
Bobcaygeon, ON  
K0M 1A0

or via e-mail at:  
[shawna@property-list.net](mailto:shawna@property-list.net)

**NEXT ISSUE'S  
DEADLINE IS  
Feb. 13, 2006**  
⌘

## 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**.



### 1 CALENDAR OF EVENTS 1

- |                   |  |
|-------------------|--|
| January 20, 2006  | General Meeting—Space Station DVD - Riverside Zoo                            |
| February 3, 2006  | General Meeting—Observing Night - Jaan Teng’s                                |
| February 17, 2006 | General Meeting— Professor David Patton - Topic to be Chosen - Riverside Zoo |

### 1 Moon Phases 1

- |   |                  |                   |
|---|------------------|-------------------|
| First Quarter  | January 6, 2006  | February 5, 2006  |
| Full Moon      | January 14, 2006 | February 13, 2006 |
| Last Quarter   | January 22, 2006 | February 21, 2006 |
| New Moon       | January 29, 2006 | February 28, 2006 |