Peterborough Astronomical Association

The Reflector

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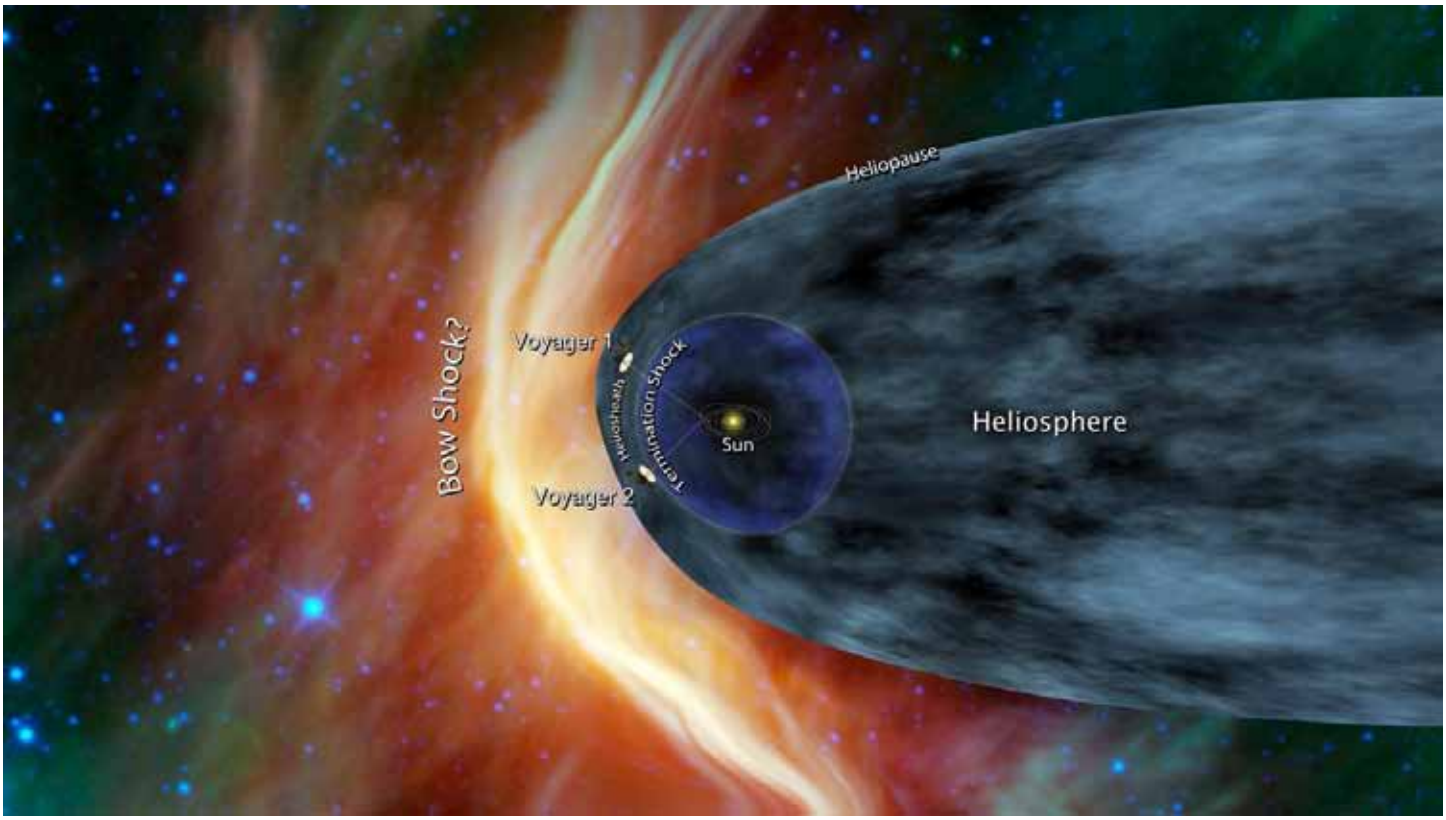
Solar System Size Surprise



This artist's concept shows NASA's two Voyager spacecraft exploring a turbulent region of space known as the heliosheath, the outer shell of the bubble of charged particles around our sun. Image credit: NASA/JPL-Caltech.

by Dr. Tony Phillips

News flash: You may be closer to interstellar space than you previously thought.

A team of researchers led by Tom Krimigis of the Johns Hopkins University Applied Physics Laboratory announced the finding in the June 2011 issue of Nature. The complicated title of their article, "Zero outward flow velocity for plasma in a heliosheath transition layer," belies a simple conclusion: The solar system appears to be a billion or more kilometres smaller than earlier estimates.

The recalculation is prompted by data from NASA's Voyager 1 probe, now 18 billion kilometres from Earth. Voyagers 1 and 2 were designed and built and are managed by NASA's Jet Propulsion Laboratory. Aging but active, the spacecraft have been traveling toward the stars since 1977 on a heroic mission to leave the solar system and find out what lies beyond.

To accomplish their task, the Voyagers must penetrate the outer walls of the heliosphere, a great bubble of plasma and magnetism blown in space by the solar wind. The heliosphere is so big, it contains all the planets, comets, and asteroids that orbit the sun. Indeed many astronomers hold that the helio-

see "Voyager" on page 16

President's Message

Welcome Back!

I hope you are feeling good and had a great summer. I know I have, but then being newly retired from work is a good reason to be. Let's get "fired up for fall" as we kick off our last half of the year at the PAA. After coming off the high of the observing session we had last night (Auguguest 26), at the Robinson Road Observatory (Thanks to Rodger and Louise Forsyth) it is hard not to be "pumped" about out upcoming season. We have another great issue of *The Reflector* (no doubt) as you read on and we have a great line-up of speakers and Skype presentations to look forward to as well. Starting with a special presentation by the Canadian Space Shuttle expert, Randy Attwood, for our season opener (September 2), at Emily Provincial Park, to talk about the 30-year history of the Space Shuttle Program. With any luck we will have a public observing session to follow that will rival last night? For this to happen though, we will need to see more than a transit of the ISS, many bright meteors, galaxies, nebulas, open/globular clusters, double stars, planets and comets.

So, get fired up about the PAA and our activities we have planned for the rest of the year! Complete your Membership Survey and get it into Dean Shewring right away and this will help us see how well we are doing as a club and ensure that we are meeting your needs. Without your input, we are "in the dark" (pun intended)! Get out to the meetings and special presentations and our scheduled observing sessions. We are there for you, but you first have to get involved in some way. I look forward to seeing you out "under the stars" in the months to come.

Rick Stankiewicz
President

Letter from the Editor

Changing Seasons

PHILLIP CHEE, EDITOR

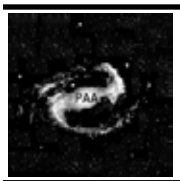
Summer is slowly drifting away. The cool night air is most welcome after the hot dry summer we've had. At the same time, our observing sessions have not been exactly spectacular this season, save the most recent one at Robinson Road Observatory.

The consolation is that now we return to our monthly meetings and a resumption of *The Reflector*. I see that our regulars have not slacked off and we have articles and reports and photos aplenty. Of pertinent interest to the membership is Mark Coady's update on Transport Canada's regulations with respect to the use of green laser pointers (p. 14). The new regulations were made in consulation with the Royal Astronomical Society of Canada and therefore take into account the needs of astronomers. Please take the time to go over these new rules.

Brian McGaffney was an opportunistic astrophotographer and set his scope and imaging sensor on Comet Garrad. This comet is expected to bright by February, perhaps becoming naked eye visible. We shall see.

So, welcome back and enjoy this month's reading and reflection on things astronomical.

Phillip Chee
***Editor,* The Reflector**



Peterborough Astronomical Association

The Reflector is a publication of the Peterborough Astronomical Association (P.A.A.) Founded in 1970, the P.A.A. is your local group for astronomy in Peterborough and the Kawarthas.
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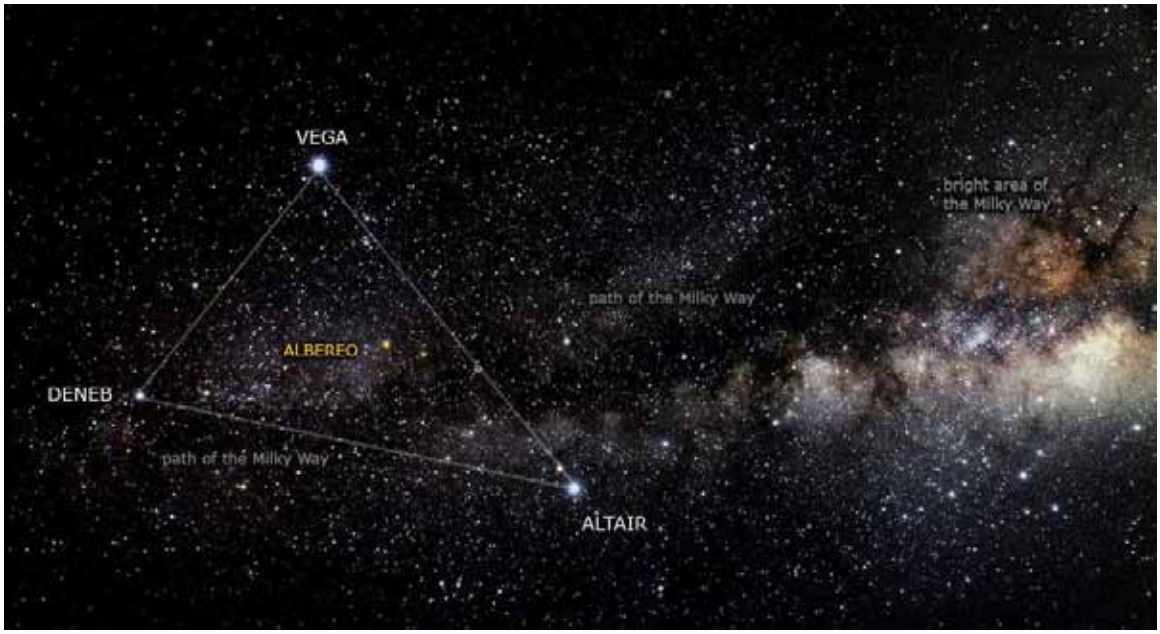
September Skies Are For Naked Eyes

John Crossen



For the naked eye astronomer September is crowded with targets, most of which are easy to spot from a dark rural location on a Moonless night. If you have a star chart for autumn or a planisphere they will be very helpful in locating the stars and in the case of the constellations, connecting the dots.

SkyNews Magazine is available at any of the big box book stores in Peterborough and the book *NightWatch* is on hand at Happenstance Books and Yarn in Lakefield. Other options include *Astronomy Magazine* as well as *Sky & Telescope Magazine*.

Directly overhead the stars Vega, Deneb and Altair mark the corners of the Summer Triangle. Vega and Altair are very bright and easy to spot. Deneb is a bit dimmer. The bright star that the handle of the Big Dipper is arcing towards is Arcturus which is very bright, but not a part of the Summer Triangle.

While you're looking straight up, you will notice a misty white cloud-like object cutting through the centre of the Summer Triangle. That's an inner arm of our Milky Way galaxy. Those with good dark skies will notice that the Milky Way arcs from the northern horizon all the way to the southern horizon where it appears to end just off the tip of the constellation Sagittarius. At that point you are looking straight into the core of our galaxy. Unfortunately the core is only visible in infrared (heat sensitive) light because it is obscured by clouds of dust thousands of light years thick.

As darkness falls the Big Dipper is sliding down the northern sky and will soon be parallel with the horizon. To find the North Star and the Little Dipper locate the two stars at the end of the cup of the Big Dipper. Take the distance between those two stars and, using them as point-

See "September Nights" on page 15

PAA Scores an APOD!

Rick Stankiewicz

After trying off and on for twelve years, I finally scored a picture on the Astronomy Picture of the Day (APOD) website. If you are not familiar with this website it is a great one to start your day off with, as it is always an interesting picture of some sort and just a single paragraph to follow which explains what it is that you are looking at. It is the Reader's Digest of astronomy. Typically, the images used are from the Hubble Space Telescope or some large facility around the world.

Since 1995 Robert Nemiroff and Jerry Bonnell have written, coordinated, and edited APOD. The APOD archive contains the largest collection of annotated astronomical images on the Internet. In real life, Bob and Jerry are two professional astronomers who spend most of their time researching the universe. Bob is a professor at Michigan Technological University in Houghton, Michigan, while Jerry is a scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Most people are surprised to learn that they have developed the perfect random number generator. Checkout the site for yourself at: http://apod.nasa.gov/apod/astropix.html and make it your favourite.

On August 18th they ran the following image.

I submitted a few other images too and my story was changed, but this is all "part of the game" and well worth the wait. The link to the article if you don't want to use the on site archives is: http://apod.nasa.gov/apod/ap110818.html. They even linked to our club website!

Fire Under the Teapot

Rick Stankiewicz

On the evening of July 31 I was fortunate enough to be just the right distance away from an electrical storm that swept to the south of my house near Keene. The famous asterism of the Teapot in Sagittarius was due south of my location and I set-up for over an hour to try and capture what is a rare set of conditions. There was a clear night sky above a cloud band of thunder and lightning below. As the clouds drifted slowly eastward I was able to capture the odd bolt of lightning. The attached image shows my only successful attempt to line everything up. It takes a lot to heat up a teapot this size, but considering that lightning can reach temperatures of 30,000 K (55,000 °F) degrees, it is no wonder that you can see the steam starting to come out of the spout (otherwise known as the Milky Way)!

I love the challenge of getting lightning images because you never know what you will end up with, but here are a few tips to try your hand at the task and increase the element of "luck".

First, you need the right conditions, not too much rain (preferably, none at all) or a sheltered location to shoot from. Secondly, a tripod and a camera that shoots manually are a must. Next, set your lens to infinity (the symbol, ∞) and aim where you think the "action will be", based on where you have been seeing strikes previously. Lastly, set your camera for ISO 100 or 200 and the f-stop at about 8 or 11 and leave your shutter open for as long as you need to in order to get a "strike" or two. If you monitor the timing between strikes you can reduce the wait time because the less your shutter is open the better. Shoot away and hope for the best. Maybe someday you will have a fire under your teapot? This image was taken with a Canon 400D, Sigma 17-70mm lens, 25mm, ISO 800, 33 seconds, $f/4$.

Lucky strike!

A Different Kind of Public Outreach:

Spreading the News About Fighting Light Pollution

Mark Coady

Mark Coady addressing the June meeting of RASC Hamilton Centre.

Most of you are aware of the PAA's public outreach mission whether that be on Armour Hill for Earth Hour, Astronomy on the Hill, or the Perseid meteor shower; at Kinsmen Park for the Peterborough Housing Kids; or at Emily Provincial Park for National Parks Day. This year we added Warsaw Caves to that list as a group of Grade 9 and Grade 12 students from Cawthra Park Secondary School in Mississauga were treated to telescopic views of the heavens, courtesy of Boyd Wood and yours truly, under fairly pristine skies—unlike the light polluted skies these students are used to. With the enthusiasm generated with the teachers and students this might become an annual event.

One aspect of our public outreach mission that is an underlying theme at all events is the need for light pollution abatement. That can consist of a full-blown presentation with posters and video displays or simply the passing out of our brochures and answering questions while an observing session is in progress.

With the progress that our light pollution abatement program has enjoyed, it was decided long ago that we need to help other astronomy clubs establish their own programs. This has been done as presentations at two star parties (Fall 'n' Stars in 2006 and HSP in 2007) and meetings of both RASC Belleville and Kingston Centres.

Thanks to the progress we have made and the fact that I sit on the national light pollution committee of the RASC, I was invited to make a presentation on how to go about fighting for light pollution abatement at the monthly meeting of RASC Hamilton Centre on Thursday June 2—the night before Terry Dickinson addressed our June meeting. As well as the presentation, I also had our brochures and a couple of our displays on hand. Representatives from RASC Toronto, Mississauga, Niagara, and Kitchener-Waterloo (K-W) Centres took in the presentation, as well. As a result, Hamilton, Niagara, and K-W Centres now have light pollution abatement committees and RASC Mississauga is interested in having me address their Centre sometime in the fall as a reciprocal speaker for us being treated to Randy Atwood's talk on the Space Shuttle program.

This was a very different kind of public outreach but, as it follows part of the mandate of the club, as expressed in its constitution, to raise awareness of light pollution, it certainly casts a favourable light on the Peterborough Astronomical Association just as much as every other form of public outreach does.

Is Andromeda headed for a galactic smack down?

John Crossen

If so she's hurtling toward the Milky Way at a 120 km/s clip. That means in about 2.5 billion years the two may collide. We can't be sure until we know Andromeda's transverse velocity—and that's something which can't be directly measured.

When someone says colliding galaxies you imagine gigantic stars slamming together and flying all over like billiard balls in space. The truth is the stars in a galaxy are so far apart that most, if not all of them, will pass by each other.

The closest star to our Sun is Proxima Centauri, and its 4.3 light-years (43 trillion kilometres) away. If our Sun was the size of a golf ball, and the universe was shrunk in size relative to it, Proxima Centauri would be 1,247 kilometers away. That's plenty of passing room.

The real drama when galaxies have a close encounter is a long, drawn out gravitational tug-o-war. These celestial taffy pulls can take millions of years as the two and sometimes three galaxies dance around and through each other. The galaxy with the greatest mass is the ultimate winner.

Astronomers studying our Milky Way have found evidence that it has consumed a number of dwarf galaxies over its lifetime. Until recently the Large and Small Magellanic Clouds, two of our satellite galaxies had interacted with the Milky Way. Now we know that they passed through each other, leaving a debris trail between them. The encounter turned them into irregular shaped galaxies. By irregular I mean that they are no longer pretty little spirals. Instead their gravitational pulling match has left them ragged and stretched. The Milky Way is now gravitationally pulling them towards it.

ANTENNAE GALAXY INTERACTION. This NASA image demonstrates how gravity can stretch two galaxies out of shape when they rub shoulders. These two combatants are called the Antennae Galaxies for obvious reasons. The winner will be declared millions of millions of years of years from now.

The Milky Way's other satellite galaxies include the Canis Major Dwarf, the Fornax Dwarf, the Ursa Major Dwarf, the Sagittarius Dwarf and the Sculptor Dwarf.

Globular star clusters may be another sign of the Milky Way's galactic cannibalism. Many astronomers think that they are the remaining cores of galaxies which the Milky Way has consumed in its past. So we're big and hungry and dangerous—if you're a smaller galactic neighbour.

But there's always a bigger galaxy somewhere around, and Andromeda is it. It's about half again larger than the Milky Way. So if we do tangle, I'm putting my money on Andromeda. At the present time, astronomers think that if the Milky Way and Andromeda don't collide directly, the dark matter halos of the two galaxies may have a bit of a tussle. Either way I won't be around to collect on my bet.

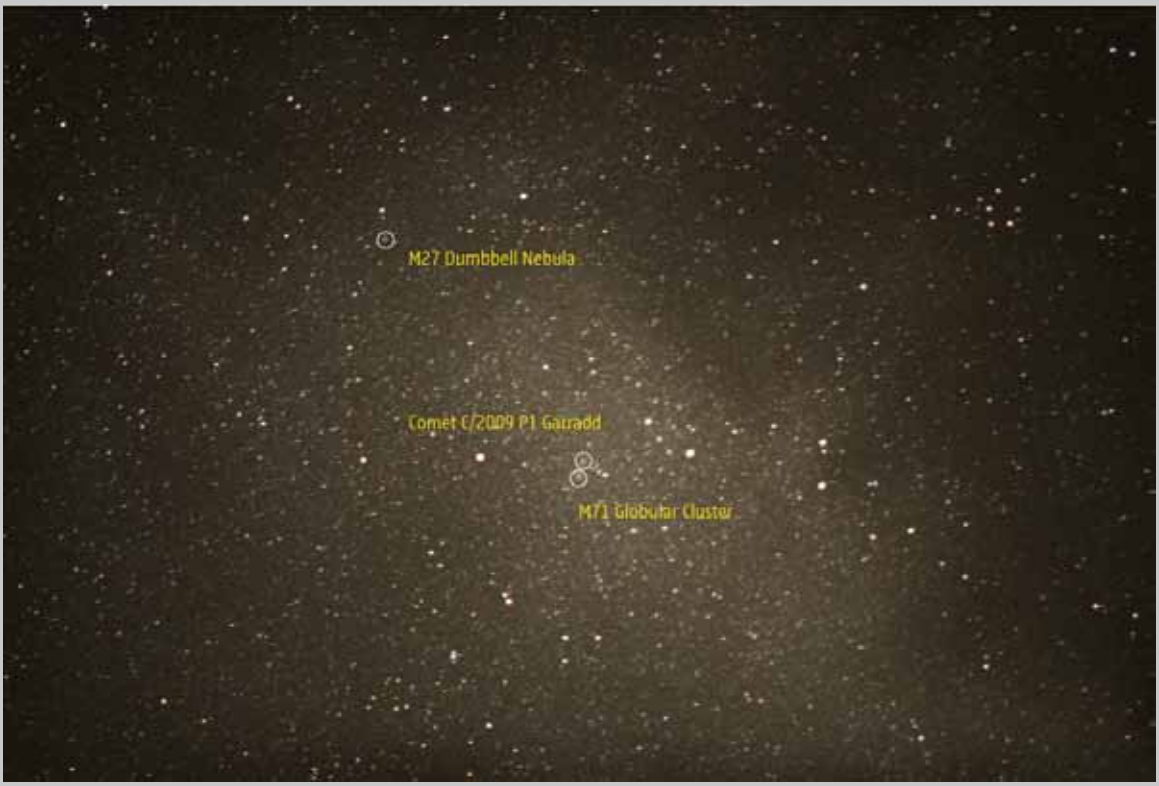
PHOTO GALLERY

Comet Garradd

Brian McGaffney submitted some photos he made from his observatory with his 14 inch f9 SCT scope at 11 pm on Friday, August 26 as it neared star cluster M71. We chose to publish this one nice example here. He writes: “To show detail of the comet and M71 without the movement blur of the comet, the camera was set up to take quick LRGB images and I then re-positionned the comet backwards againt the digital frame board.”

Near and Far

At the August 26 PAA Members Observing Session, Phillip Chee used a Nikkor 85mm f/2 lens to quickly capture some notable images. Top, the conjunction of Comet Garradd and M71. The Dumbbell Nebula (M27) wasn't shy either. Bottom, a satellite sneaks into the portrait of the Double Cluster in Perseus. Both exposures were 10 seconds at ISO 3200.



A Star in Daylight? No Way!

My wife and I went to my sister's place on Easter Sunday and as always I took my 114mm reflector for some daytime viewing. I have a full aperture solar filter so we were able to get a good look at the resurgence of sunspots. While my nephew was at the eyepiece I said "you know we can also see stars during the daytime." His reaction, "no way." Well I wasn't about to be proven wrong so I said "we can see Sirius for example." Yeah he said, "are you serious?" A small play on words.

The little reflector is mounted on an iOptron CubePro and I have found this mount to be extremely accurate once it has been synced to a known star. At 4:30 in the afternoon not a lot of choices out there so of course I chose the sun to sync the mount. I entered the star number for Sirius and there in all its glory was our target, not dead center in the eyepiece but quite visible. My nephew found it hard to believe. Soon the rest of the family were at the eyepiece to see the star. We spent some more time after dinner with the hand controller and then used my laptop running Stellarium Scope/Stellarium and captured Betelgeuse, Capella and Procyon between 7:00 and 7:30 p.m. with the sun still shining brightly.

–***Rodger Forsyth***

Rodger Forsyth's nephew looking at Sirius in broad daylight.

Terence Dickinson visits the PAA

We had a special guest speaker for our last club meeting before the summer hiatus. Famed astronomer and writer, Terence Dickinson held us spellboud with his lecture on finding the darkest skies in the world. His astrophotographs were breathtaking. Rick Stankiewicz submitted some photos, below, of the meeting. It was well-attended, filling the orientation centre to capacity.

–Phillip Chee

Talk nerdy to me

It's OK to be smart

Canadian Wendy Freedman met her career at the age of 10. She and her family were at Lake Simcoe, Ontario. Looking up at the starry sky, her father introduced Wendy to the concept of the speed of light. She was fascinated by the idea that it takes so long for star light to reach us that some of the stars we see may no longer exist. Freedman went on to study astrophysics at the U of T. She is now the Crawford H. Greenewalt Chair and Director of The Observatories of the Carnegie Institution of Sciences in Washington, D.C. Yep, it's OK to be smart.

John Crossen

The other day I was reading an article in *Astronomy Magazine*. The article was analysing why North America was falling behind the rest of the world in science and math education. One of the principal points was that science and math are perceived as being not cool.

If you're good at science or math the other kids think you're a nerd. Whether it's true or not, the nerd moniker conjures up images of a bow-tie-wearing geek or ugly Betty with thick glasses. We can thank Hollywood for that bit of stereotyping. It's a sad situation, because young people want desperately to be accepted by their peers. Some bright kids will even dumb themselves down to fit the norm.

Take the pulse of contemporary society and you'll find that our value system is way out of whack. What do "cool people" think rocks the most: making a scientific discovery or driving a big SUV? Who earns the mega bucks, scientists or sports heroes? Would you rather be Caroline Moore, the young American who discovered a supernova at the age of 14 (Canadian Kathryn Aurora Gray at the age of 10 is now the youngest supernova discoverer) or a pop star whose fame evaporates faster than water in a frying pan?

A young lady I know had a terrible time during her early school years. She was highly enthusiastic about learning, read a lot and always knew the answers in class. She was punished by her peer group

See "Geeks are Cool" on page 15

Peterborough Kids 2011

A summer of astronomical fun would not be complete without the annual get together with the Peterborough Kids group. For about four years in a row now the PAA has been approached to give a talk on astronomy for the Peterborough Housing Corporation summer kids program. These kids don't normally have access to special programs, so the PAA has helped provide a unique opportunity for them every year usually in August around the time of the Perseid Meteor Shower, but this year they wanted to try late July.

On July 27th Brett Hardy, John Cameron and I planned to do an outdoor telescope session with the kids, but as you can guess, we were clouded over. A big "Thanks" to Brett and John for being ready, willing and able to help out. As back up, I did an indoor slide show for the 20 youngsters and their leaders. As you can imagine, they are full of questions and had some answers too. I handed out do-it-your-self star finders and they had a big Thank You card for me at the end of it all.

The attached picture captures the joy in their faces and the fun they had. This is what keeps us coming back.

The Safe Use of Green Lasers

The Royal Astronomical Society of Canada, in conjunction with Transport Canada, has come out with revised guidelines for the safe and lawful use of Green Lasers (GLPs). Since we use green lasers in our public outreach and a number of PAA members are in possession of them, it is time that we cover the following with the membership.

Note—italics are the author's comments and all references to RASC members can also mean PAA members.

1. Ensure that GLPs are operated only by designated, responsible adults, preferably RASC members who are familiar with the potential hazards of laser light. During public events, consider assigning one or more RASC members to help GLP operators spot oncoming air traffic—*along with vehicular traffic control this requires many more members out at public outreach operations than just the few who show up with telescopes.*
2. Take special care not to shine GLPs in the direction of any person, vehicle, aircraft, or wildlife.
3. Avoid using GLPs near an airport or airport runway approach. We suggest that GLPs not be used within 10 km of any airport. *Transport Canada is proposing the 10 km rule be made law. In the case of Peterborough Airport, this zone of exclusion would range from Stockdale Road in the north to the boundary with Northumberland County in the south; from County Road 10 in the west to Crowley Line in the east; from the hamlet of Mount Pleasant in the northwest to Hall Landing on Rice Lake in the southeast; and from Millbrook in the southwest to Riverview Park and Zoo in the northeast. Armour Hill thus falls in this zone of exclusion.*

see "Green Laser Update" on page 15

The Sky this Month

Mercury in dawn skies at beginning of the month. Greatest elongation west (18°) on the 3rd. Passes 0.7° N of Regulus on the 9th. Superior conjunction on the 28th.

Venus reappears in the evening sky near mid-month.

Mars in eastern morning sky moving from Gemini into Cancer.

Jupiter rises due east in Aries in late evening.

Saturn vanishes into evening twilight during the month.

Equinox arrives at 5:05 a.m. on the 23rd.

Zodiacal Light visible in the eastern sky before morning twilight for next two weeks from the 25th.

Moon Phases

First Quarter	1:39 PM	September 4
Full Moon	4:27 AM	September 12
Last Quarter	9:39 AM	September 20
New Moon	7:09 AM	September 27

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September Nights

ers, measure five times that distance in a nearly straight line. You should now be at the North Star which is the first star in the handle of the Little Dipper.

A lot of people think the North Star is the brightest star in the night sky, but that's an urban myth for city-dwellers who can't see many stars thanks to their dome of light pollution. The North Star is only magnitude 3.3 which makes it quite visible from a rural site, but almost impossible from large urban centre.

Another naked eye target is the constellation Cassiopeia. She's the Queen in the movie *Clash of the Titans*. Just look for a giant "W" shaped constellation about half way up the northeast sky as darkness falls.

Streaming out from Cassiopeia is the constellation Andromeda, yet another character from *Clash of the Titans*. Two other characters from the same movie, King Cepheus and handsome Perseus are also visible as autumn approaches.

So, for the grand expenditure of a few dollars for a magazine or book, you're an official naked-eye astronomer. It's the ground floor and a great place to start before moving up to binoculars or a telescope.

Until we meet again by the backyard telescope, keep your yard lights dim and the starry Kawartha night skies dark.

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Geeks are Cool

for being too smart. She was sneered at, pushed and shoved. The other students misinterpreted her enthusiasm for learning as being a show off. Perhaps she was a bit overly enthusiastic and maybe they were a little jealous, too.

Her parents switched schools and sent her to one in which the students were held to higher scholastic standards. In a complete turn of events she was accepted by her new group of peers. She earned awards as a model student and by the time she graduated the universities were lining up with scholarships. For a summer job she works at a nuclear facility. That sure beats flipping burgers, though any job is good when you're a student.

Maybe it's time we told our kids that it's OK to be smart. Bumbling through life is like a pinball bouncing off the bumpers only you don't have the flippers to relaunch the ball. One shot is all you get. And success doesn't just happen to people, they earn it. Benjamin Franklin once said; "the harder I work, the luckier I get". But it doesn't hurt to start out smart.

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Green Laser Update

4. Use the minimum power to do the job: if a 5 mW laser is bright enough, why use a stronger one?
5. Be aware that distraction and distress can be experienced by anyone illuminated by green laser light, even if the level is well below that which would cause physiological damage.
6. Use good sense in storing GLPs. Don't leave lasers accessible to children—*by children, the RASC is also including most teenagers*.
7. Consider removing the batteries when you are done using a GLP. Hopefully, by everyone adopting safe operating practices for GLPs we will not have their use further regulated, or banned, by government.

Mark Coady

continued from page front page

Voyager

sphere defines the boundaries of the solar system. Inside it is "home." Outside lies the Milky Way. For 30+ years, the spacecraft have been hurtling toward the transition zone. Voyager 1 is closing in.

Much of Voyager 1's long journey has been uneventful. Last year, however, things began to change. In June 2010, Voyager 1 beamed back a startling number: zero. That's the outward velocity of the solar wind where the probe is now.

"This is the first sign that the frontier is upon us," says Krimigis.

Previously, researchers thought the crossing was still years and billions of kilometres away, but a new analysis gave them second thoughts. Krimigis and colleagues combined Voyager data with previously unpublished measurements from the Cassini spacecraft. Cassini, on a mission to study Saturn, is nowhere near the edge of the solar system, but one of its instruments can detect atoms streaming into our solar system from the outside. Comparing data from the two locations, the team concluded that the edge of the heliosphere lies somewhere between 16 to 23 billion kilometres from the sun, with a best estimate of approximately 18 billion kilometres.

Because Voyager 1 is already nearly 18 billion kilometres out, it could cross into interstellar space at any time — maybe even as you are reading this article.

"How close are we?" wonders Ed Stone, Caltech professor and principal investigator of the Voyager project since the beginning. "We don't know, but Voyager 1 speeds outward a billion miles every three years, so we may not have long to wait."

Stay tuned for the crossing.

For more about the missions of Voyager 1 and 2, see http://voyager.jpl.nasa.gov/. Another Voyager project scientist, Merav Opher, is the guest on the newest Space Place Live cartoon interview show for kids at http://spaceplace.nasa.gov/space-place-live.

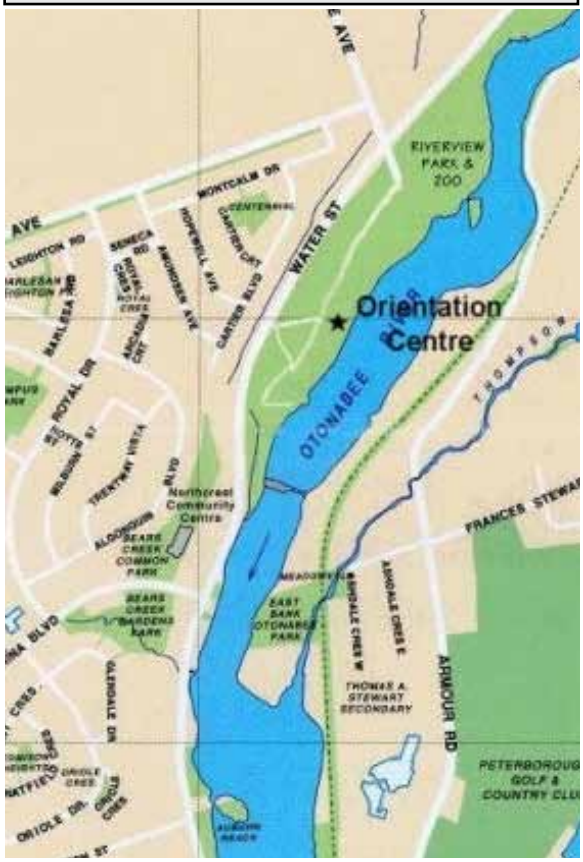
This article was provided courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Articles

Submissions for *The Reflector* must be received by the date listed below. E-mail submissions are preferred (Microsoft Word, OpenDoc, ASCII and most common graphic formats are acceptable). If your article contains photso or graphics, please provide a separate file for each. Typed or hand-written submissions are acceptable provided they are legible (and not too long.) Copyrighted materials will not be published without written permission from the copyright holder. Submissions may be edited for grammar, brevity, or clarity. Submissions will be published at the editor's sole discretion. Depending on the volume of submissions, some articles may be published at a later date. Please submit any articles, thoughts, or ideas to:

phillip.chee@gmail.com

NEXT SUBMISSION DEADLINE:
SEPTEMBER 23, 2011



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 p.m. P.A.A. executive business will be conducted starting at 7:30 P.M. Members and the public are welcome to attend the earlier time.