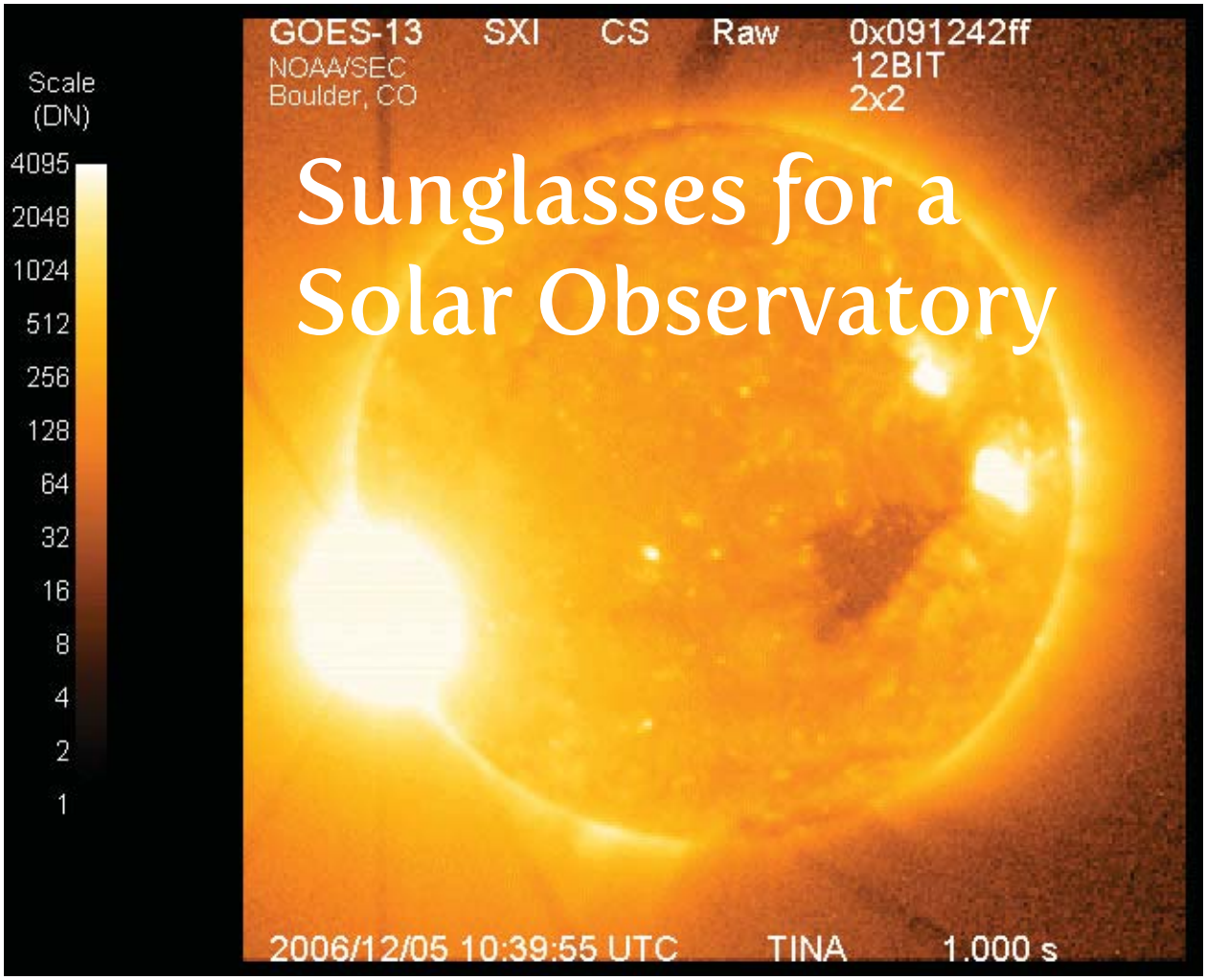
Peterborough Astronomical Association

The Reflector

Volume 9, Issue 1 ISSN 1712-4425 January 2010



X-9 class solar flare December 6, 2006, as seen by GOES-13's Solar X-ray Imager. It was one of the strongest flares in the past 30 years.

Sunglasses for a Solar Observatory

By Patrick Barry

In December 2006, an enormous solar flare erupted on the Sun's surface. The blast hurled a billion-ton cloud of gas (a coronal mass ejection, or CME) toward Earth and sparked days of intense geomagnetic activity with Northern Lights appearing across much of the United States.

While sky watchers enjoyed the show from Earth's surface, something ironic was happening in Earth orbit.

At the onset of the storm, the solar flare unleashed an intense pulse of X-rays. The flash blinded the Solar X-Ray Imager (SXI) on NOAA's GOES-13 satellite, damaging several rows of pixels. SXI was designed to monitor solar flares, but it must also be able to protect itself in extreme cases.

That's why NASA engineers gave the newest Geostationary Operational Environmental Satellite a new set of sophisticated "sunglasses."

The new GOES-14 launched June 27 and reached geosynchronous orbit July 8.

Its "sunglasses" are a new flight-software package that will enable the SXI sensor to observe even intense solar flares safely. Radiation from these largest flares can endanger military and civilian communications satellites, threaten astronauts in orbit, and even knock out cities' power grids. SXI serves

see "GOES-14" on page 16

President's Message

Happy New Year

As I start another term as President of the PAA, I would like to let you all know how honoured I am to be part of this fantastic organization and grateful for the support you as members have given me. I would like to thank the executive members that have completed their terms in office, those who are continuing in office and those new members to the executive. In a large part, you are the glue that helps hold this club together and you serve as great examples for our other members, but it is only in working together that we are able to accomplish as a club the amount we have. We had an amazing year and accomplished more than I ever thought possible, but this is only because so many of you came out and got involved. Thank you again!

With a new year, comes new resolutions. I hope you make one of your resolutions, to renew your PAA membership early in the year? We need your support to keep this club moving forward. One of my resolutions is to keep the momentum of the International Year of Astronomy (IYA) going as we enter 2010. There is so much we can do as a club and the sky is not our limit. I hope you are looking forward to this new year and all it's potential as much as I am. I am anxious to see us add some Skyping to our meetings and expand our horizons to engage speakers from around the world. The executive would like to hear from you regarding ways to fill in our blank observing sessions, monthly speakers or whatever other ideas you might have. Please contact any of the executives in advance of any regular meeting and we will have time to discuss it. Just maintaining a website and monthly newsletter can be enough work, but we can and do so much more.

Remember, our next regular meeting is not until January 8th. See you there I hope and until then, Happy New Year!

Rick Stankiewicz, President

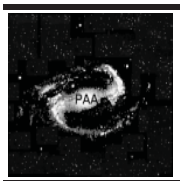
Editor's Message

It's hard to believe that this issue marks the beginning of the ninth volume of *The Reflector* newsletter. I think it's a testament to the dedication of the club membership for continuing to support this publication through articles, reports and photographs.

I can't thank enough the contributions of John Crossen, Rick Stankiewicz, Mark Coady, and John Galle for their regular submissions. The past two years editing *The Reflector* has been made almost effortless with these dependable souls.

As I begin another two-year term as editor I would like to encourage other members to submit articles and photos for consideration. We have some expert and knowledgable amateur astronomers in our midst as well as some very accomplished astrophotographers. It would be wonderful to showcase more of our "hidden" talent.

Phillip Chee, Editor



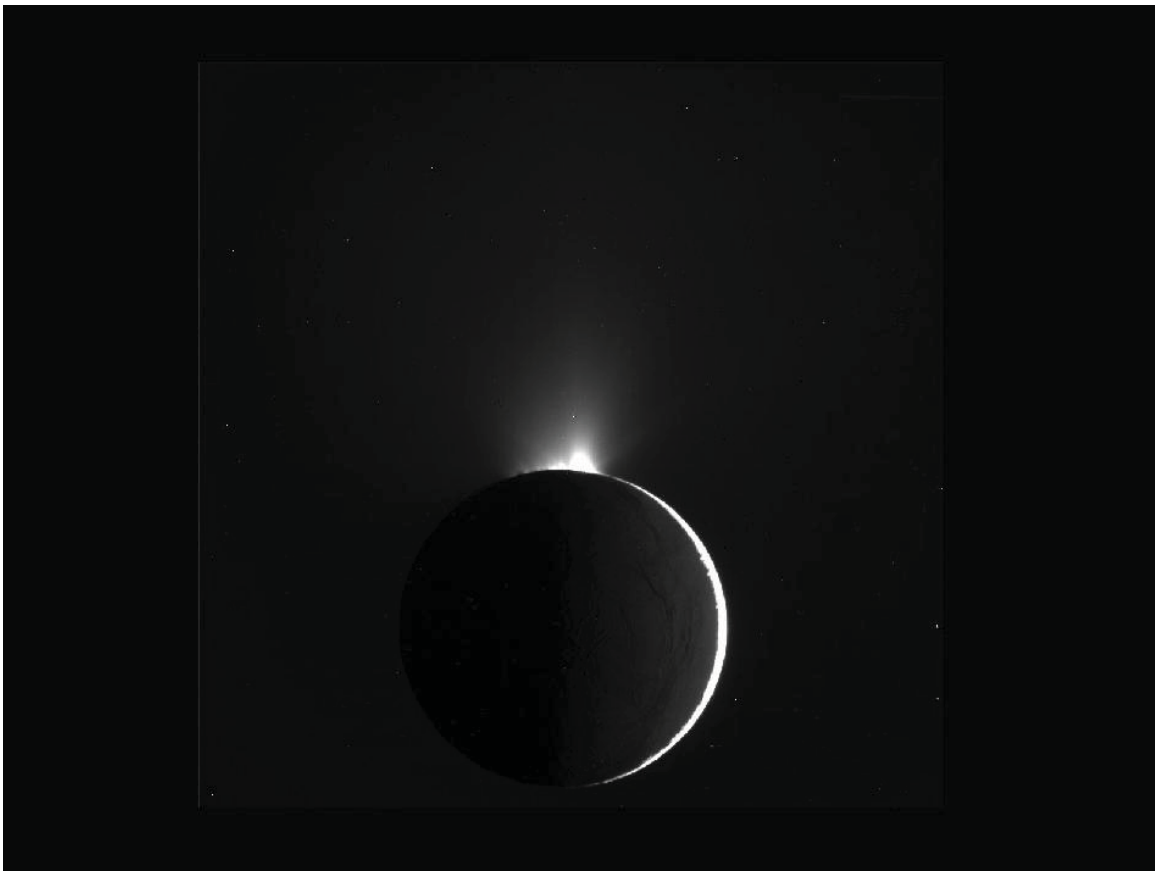
Peterborough Astronomical Association

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.

www.peterboroughastronomy.com
stankiewiczr@nexicom.net
Club Mailing Address
Rick Stankiewicz, President

Peterborough Astronomical Association
10 Hazel Crescent, RR #8
Peterborough, ON K9J 6X9
705.295.6158

The latest news from Mars, Saturn and the Moon



PLUME ON ENCELADUS. This photo taken by Cassini when 160,000 km from Enceladus shows the plume backlit by the Sun. To collect data Cassini flew through the plume to within 100 km of the moon's surface. Photo by NASA/JPL.

As of November 10, the Martian Rover, Spirit is still stuck in the talcum-like dust of the red planet. Unfortunately NASA didn't opt for roadside assistance, so a group of Earth-bound engineers are still working on techniques for Spirit to extract itself from the sand pit. To do so they have created a replica of the Martian sand trap based on photos that Spirit has taken and are experimenting with a duplicate of the rover.

Despite being stuck on Mars, the rover is still photographing the local terrain, performing science experiments and sending the data back to the Jet Propulsion Laboratories (JPL). Considering the

see "Enceladus" on page 6

Green Laser Pointers

Light Fantastic or Light Saber

Green laser pointers are becoming more popular all the time. Their low price, availability and brilliant colour make these quite attractive, but they also have a dark side. This report will discuss the technology, uses and dangers of these devices. We will also examine some of the applicable laws which vary from jurisdiction to jurisdiction. Most of the material in this report is readily available on the internet. It was decided to capture this information from various sources, condense it and assemble it in an article for the Reflector. I hope the reader enjoys the report and learns from it.

The technology

Green laser pointers operate at a wavelength of 532 nm making them much more complicated than standard red laser pointers because laser diodes are not commonly available at this wavelength. The process involves infrared laser diodes, special crystals, frequency doublers etc. to produce the green light. The exact technology gets a bit deep for this article but for those interested you can get a heap of info using "google" or "bing" and search for "green laser pointer". Two distinct features make the green laser pointer attractive. The first is brilliance. At 532 nm the light is 60 times more powerful than a red laser pointer of the same power. This is due to the sensitivity of the human eye at this wavelength. The second, most noticeable, is that the beam itself can be seen in dark environments, not just the dot at the end. These features lead us to the next section on the uses of green laser pointers.

Uses

The bright visible beam of a green laser pointer makes it a popular choice in the following disciplines:

- Professional presentations
- Astronomy
- Bird watching
- Tour guides
- Construction engineers
- Camping
- Hiking
- Search and rescue

Our interest is of course in astronomy. Here the pointer is very effective in pointing out constellations, stars, planets, nebulae etc. in the night sky. A red laser pointer just doesn't cut it here.

So far we've had an introduction to green laser pointers, a high level view of the technology, and some of the uses. With most technologies there are good and bad implementations. The example uses listed above represent the good, not listed is the bad. Enter the dark side of the technology, the "light saber" if you wish. One of the areas of greatest concern is the deliberate or "accidental" pointing of these high power lasers at aircraft flying overhead. It is not well understood that even at 5 mw a green laser pointer has a range between 2900 and 3300 meters (9000 to 10000) feet. Pilots flying aircraft in this range can suffer temporary blindness when exposed to these light beams. I've heard people say that "commercial aircraft fly at 39000 feet, so what's the problem?" Commercial aircraft cruise at 39000 feet. Have you ever noticed that the

jets coming up out of Toronto or heading into Toronto have their landing lights on when they are over the Peterborough area? International aviation law states that all commercial aircraft must have landing lights on when at or below 10000 feet. All of a sudden our little hand held device has just become a weapon.

The preceding has addressed the risk to commercial flights but don't forget that we have many private aircraft in our area that fly typically below 4500 feet. These are the Cessna's and similar aircraft with and without floats that traverse our skies. The risk to the pilots of these aircraft is tremendous. There are also documented reports of these devices being used to "blind" law enforcement officers and even some athletes. This brings us to the final part of the report regarding applicable laws.

Applicable laws

It is interesting to note that in the United States the allowable output power of a green laser pointer is controlled or regulated by the Food and Drug Administration (FDA). I found this rather strange but it stems from the health issue of using these devices. The FDA has determined that permanent damage to the eye can occur from exposure into the beam of a green laser pointer in .25 seconds. More recent studies show that the risk to the human eye from accidental exposure to light from commercially available laser pointers having powers up to 5 mw seems rather small, typically involving deliberate staring into the beam for 10 or more seconds. In Canada there are no laws (yet) restricting the power of green laser pointers and this is evident by the avail-

see "Green Laser" on page 7

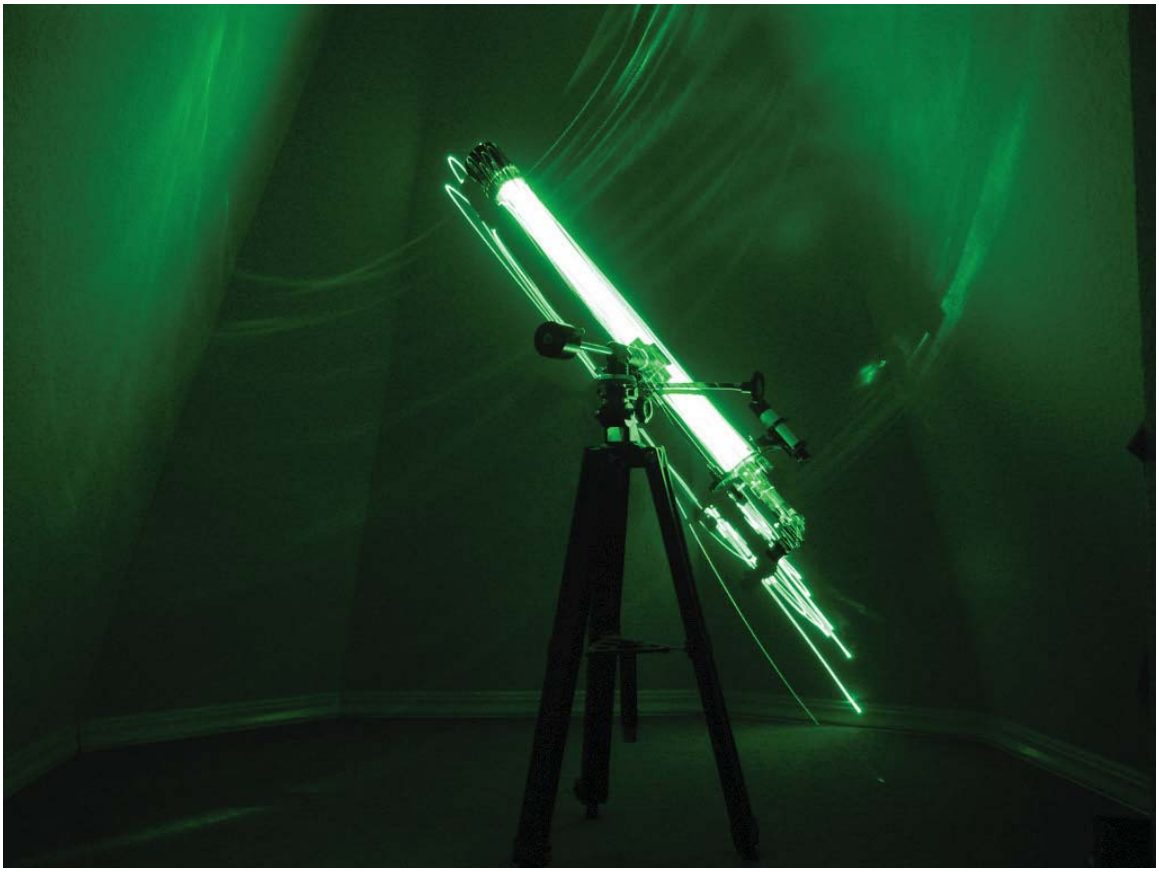


Photo by Flickr user Sam UL. Photo used under a Creative Commons Attribution-Noncommercial-Share Alike 2.0 Generic license.

continued from page 3

Enceladus

fact that both the Martian rovers — Spirit and Opportunity — were only supposed to last three months and are nearing the 5-year mark, NASA and the tax payers are more than getting their money's worth.

Last November 2, the Cassini spacecraft weathered a flyby of Saturn's moon Enceladus. The job was to fly through one of the geysers spouting from the surface of the Saturnian moon. The plume is shooting out from the South Polar Region of Enceladus.

To gather more data on the material in the plume, Cassini flew through it while just 100 km above Enceladus' surface. Previous flybys have detected water vapor, sodium and organic molecules. Scientists are seeking still more information to determine the source of the plumes – possibly a liquid ocean beneath the moon's icy surface. More specific information will also tell them whether it has the conditions necessary for life. Cassini first discovered the plumes in 2005 when making a rendezvous with Enceladus.

On October 9 of this year NASA deliberately crashed the lunar orbiter LCross into our own Moon's surface. The target for the impact was a crater near the Moon's South Pole where the sun never shines. The hope is to find evidence of water ice that was delivered to the Moon via a comet early on in the solar system's formation.

The water ice would be hidden from the sunlight and in the Moon's virtually non-existent atmosphere could have survived for million of years. A second orbiter followed closely behind LCross to photograph the impact and then slam into the lunar surface creating another shower of material.

All of this slam-bang is linked to future plans to establish a colony on the Moon. Having a supply of water close at hand would make the whole project a lot easier. As of this writing scientists are still sifting through the data that was returned for conclusive evidence of water.

That's a very small sample of what has been happening in the emerging world of space travel. The exploration of space now involves on-going missions from the United States, Europe, Great Briton, China, Japan, Russia and India. Many of the missions bring together the best minds and technologies from different nations. Perhaps space exploration will bring us closer to that "One world living in harmony" concept.

John Crossen

Seeing is Believing: Experiment #1

This IYA artistic collaboration is something to see and experience. Click on it and have some fun with it! As a contributor to the project, I was sent the following message recently by one of the co-creators of this project:

"We are arriving at the closing moments of the very successful International Year of Astronomy. As you conjure up visions of tumbling galaxies and glittering stars, my art partner, Brad Miller (College of Fine Arts, University of New South Wales), and I invite you to play with our contribution "Seeing is Believing: Experiment 1" at **http://www.staff.cofa.unsw.edu.au/~bradmiller/seeingrotations.html**.

Please move your mouse around when visiting the site. Zoom out to get the best view. Scroll down to see the contributors and a link to our artists' statement. Please pass this website on to everyone :-)

Jayanne English"

What do you think about it? I would like to get your feedback to pass along to the artists.

Rick Stankiewicz

continued from page 5

Green Laser

ability at most astronomy related stores and other sources of very high power devices. This could change as there have been charges laid in a couple of jurisdictions involving aircraft.

Summary

I hope this limited report causes one to reflect on their use of green laser pointers. It is in no way intended to discourage the ownership and use, but to remind one of the responsibilities associated with their use. I do not own a green laser pointer at this time but I probably will acquire one if enough people visiting the Robinson Road Observatory keep asking "what is that?"

Rodger Forsyth

Addendum

Approximately one month after writing this report, the following article appeared in the **Peterborough Examiner** on Friday, December 4th 2009,

Laser Shined at Copter

"Clarington – A Clarington man is charged with shooting a laser light at the Durham Regional Police Helicopter.

Between Nov. 10 and 25, the pilot of Air1 took evasive action to avoid being hit with the laser while flying over Clarington, police said.

On Wednesday, the light beam was directed at the Air1 while on routine patrol. Officers on the ground were able to find where the laser originated and arrested a man.

Gerald Cote 25, of Concession Rd. 3 is charged with projected a directed bright light at an aircraft, engaging in behavior endangering an aircraft in flight, obstruct police and mischief.

If convicted under the Aeronautical Act, he faces a maximum fine of $100,000 and/or five years in prison.

When directed into the human eye, laser lights can create temporary blindness that may affect the pilot's ability to operate the aircraft safely. Air Support Unit Staff-Sgt. Alan Mack said."

My own observation of the article is that although green isn't mentioned, the fact that ground based police officers were able to find the location of the laser, it suggests that it had to be green.

—R.F.

PHOTO GALLERY

Beware the Solar Pillar!

Solar pillars can appear anytime of year, but they are often associated with the colder months of the year for some reason. This is when I seem to see more and the attached images show what to be looking for. Usually as the Sun rises, sets, or clouds obscure the disk of the Sun, this atmospheric phenomenon can occur. Typically a column of light (pillar) appears to radiate straight above or below the Sun. Ice crystals in the upper atmosphere being stacked on top of each other cause this and this allows the light from the Sun to reflect off the bottom (or tops) of these crystals to your eye and create this amazing sight.

I see more "upper" pillars than I do "lower" pillars, but the attached images illustrate the similarity between the two. On my way home, south of Peterborough, Ontario, Canada on December 16th, around 5:15 p.m. EST, I captured a faint upper pillar after the Sun had set below the clouds on the western horizon. (ISO 400/ 1/400 sec./ f/11 @ 70mm).

However, the real treat was on the 23rd, when I was noticing the Sun still a few degrees above the horizon (5:10 p.m. EST) and a layer of clouds acted as an artificial horizon and in the gap down to the actual horizon, there appeared a lower pillar. My camera (Canon 400D) and lense (Sigma 70-300mm) combination, allowed me to capture the Sun through the veil of clouds and the pillar below. What a sight! My exposures ranged from ISO 200 to 400/ 1,000 to 4,000 sec./ f/8 to 11 and 133mm to 300mm and I was using a polarizing filter too.

Trying to capture an image of what you see with your eye can be very tricky. It really makes you appreciate just how much of a miracle your eye is. With e camera you either have to over expose to capture the pillar best (then the Sun washes out) or under expose to see the disk of the Sun (then the pillar is not as bright) and the subtleties of the clouds, now that is another story altogether. When I actually witnessed this phenomenon, I could see all three things (pillar, Sun and clouds) in more intricate details. Beware, as you just never know when the conditions will be right for a solar pillar experience, but now you know what to look for.

Keep looking up,

Rick Stankiewicz

December 23 Solar Pillar

Rick wasn't the only person to notice the glorious solar pillar on the afternoon of December 23. I was driving home, running errands and noticed the progressively brightening solar pillar. I shot this around 4:37 p.m.

Phillip Chee

Misadventures of an Aspiring Imager

Adventure #1 — The Beginning

Star gazing is great, but what about astro imaging. Well, I got the bug ! Is it ever avoidable? Predestination forced me into it. But why spend countless hours, unbelievable frustration, and thousands of dollars when, in the time it takes to type this line, I can go onto the Web and immediately download a fantastic image of the Orion Nebula that I will never, in a million years, be able to surpass? Foolish question — the answer is obvious — because I just gotta do it (yes, I know your thoughts - pig headed, idiotic, outright stupidity).

So, as I am totally public spirited, I will bore you with my ongoing experiences so as to, hopefully, discourage you from any thought of following me into this addicting hobby. This is an ongoing saga, with no end in site, so I will present my trials and tribulations in an extended series of articles which our esteemed editor may pass on to you, for your 'reflection'.

Some history is worthwhile. I started this misadventure some two years ago when I purchased, lovingly pre-owned, a Losmandy GM-8 mount and a Televue NP101 refractor. My conscious logical and rational mind told me that these toys would be used exclusively for star gazing but, I had read Wodaski's bible on imaging, just for fun, and so a teeny weenie part of my subconscious told me that, just in case, this combination would not be too shabby for imaging, just in case ....

Zip forward about 2 years until this last summer. I had been to many star parties around the country and, while starting off the evenings star gazing, as the nights progressed I'd found myself wan-

dering over to the imagers (they're really easy to find in the dark - they're the ones groaning and uttering dreadful incantations, mostly to themselves). I would attempt to reduce their stress levels by offering friendly comments, such as "Oh, do you have any nice snaps for me to see?" And, you know what, sometimes the next day they would emerge from out of their hiding spots to show us their creations, and I was often quite impressed. Oh, the devil can tempt!!!

I started studying the subject. The internet is flooded with information on every aspect of the hobby. There are also lots of books and various courses available. The important points that I picked up from all this studying include:

1. The Achilles heel of imaging is the telescope mount. Everything else you do in imaging will depend on the quality and capacity of the mount. There is great danger of, for example, saving $1,000 for a mount, and then having to spend $2,000 of ancillary equipment to make for its deficiencies.
2. Image processing can be a big deal, and can take more time & effort than the image capture phase.
3. It can be very expensive for camera equipment (no real surprise), but also for computer hardware & software. The leading software, Maxim DL and Adobe Photoshop CS, can cost over $1,000. However, there are alternatives.
4. For field work a laptop computer is required to operate the image capture software. And this computer needs to have significant processing power, or a second powerful desktop computer, for the image processing.
5. And, most importantly, I picked up the clear message that this was an endeavour requiring lots and lots of patience and plenty of time and effort.

So, forewarned, I made the decision. I just had to do it. I am going to be an astro imager.

I mentioned my scope and mount. Having these particular pieces of equipment definitely made my decision easier.

The Losmandy GM-8 equatorial mount has been around for many years. It is very well made, comes with all the accessories required for imaging, and has excellent GoTo software, called Gemini, that is fully set up for imaging. The weight capacity is not large, a maximum instrument load of 30 pounds, but suitable for light weight imaging.

The Televue NP101 refractor has also been around for a while. Aperture is 101mm, focal length 540mm, focal ratio 5.4, weight 10 lbs. Very popular scope for imaging.

"Oh, the devil can tempt!!!"

In future articles I will touch on some of the highlights. The intent is not to present a detailed description of all the steps to becoming an competent imager, this is very well covered by experts in the field. In particular, I highly recommend the eBook *The New CCD Astronomy* by Ron Wodaski, published in 2002 but definitely not dated.

My intention is to present my personal evolution from total innocent to, hopefully sometime in the future, a reasonably competent imager, with emphasis on aspects that are not normally covered in the expert literature, or are covered in a way that doesn't point out some of the very important nuances. For example,

see "Aspiring Imager" on page 14

Build it and They Will Come
— Despite the Cold Weather

November is normally a quiet time at BHO. The month is usually very cloudy, the weather is cold and the cottagers are gone. This November proved to be a delightful exception. Not only did we have a surprising number of clear nights, we also had a flock of guests to take advantage of the beautiful late fall skies. Three of the more memorable groups were clustered about the New Moon phase, so they both enjoyed Moon-free skies for their observing sessions.

Group one was a family from Peterborough who were home-schooling their three children. Astronomy was one of the subjects in which Mom and Dad hadn't received much background during their school days, so we spent the evening going through the basics of the Moon phases and observing Jupiter.

The children were excited by the view of Jupiter and its moons and were surprised to learn a number of facts about the jovial giant. They also had their first look at the Andromeda Galaxy, and as a parting shot (bedtime comes early for the little people) they took in a low-power view of the Orion Nebula. M42 wasn't high enough to clear the observatory wall for the big scope, but the 80mm refractor riding on top of it had a clear shot at this stellar nursery.

Next on the visitors list was a group of older students from Tanzania. They were visiting Canada as part of a program

GROUP AROUND THE TELESCOPE. Promoting international relations through interstellar relations? This group from Tanzania won the award for traveling the greatest distance to BHO.

GROUP OF 5 STAFF/STUENTS. The Leonids meager showing did little to warm up the night. However, hot coffee and a big box of doughnuts helped hold Jack Frost at bay.

to improve their English language skills. Of course taking in a little Canadian culture was also high on their list.

The observatory visit was a special treat for them and despite my limited skills at French and Swahili we managed to exchange some ideas. The view through the telescopes transcended the language barriers to everyone's delight.

The night of November 16 followed by the morning of the 17th was my time to take in the Leonid Meteor Shower. Then the phone rang and suddenly I had a party of five students from Trent who wanted to join the show. Realizing that this was going to be an all-nighter we stocked up on coffee and doughnuts. Umm, doughnuts!

Start up time was 12:30 a.m. and we all had a good look at the Orion Nebula. Mars was still a bit low, but we ventured a peek at it which was very disappointing.

Next we did some binocular observing and took in M45, the Double Cluster and later that night the Beehive. There was still a trace of the Summer Milky Way visible, so the students did a little binocular cruise down the galactic river.

By 2 a.m. we had only counted six Leonids, so we downed scopes and took to the Star Deck to concentrate on the king of the jungle and his much-anticipated fireworks. Unfortunately after another 45 minutes with twelve eyes glued to the skies we had only raked in another half dozen, the best being a near-fireball that left a nice smoking trail.

By 3:30 the doughnuts were gone and so were my guests from Trent. I toughed it out for another hour before it was time to roll the roof and my eyelids closed. But not before I had a first-of-the-year glimpse of Saturn.

Saturn was still low in the soup, so its rings resembled wings flapping. The rings are no longer edge-on to us, but the tilt still doesn't deliver a very satisfying view.

All in all it was a good night for observing deep-sky objects through the

see "Frosted Scopes" on page 15

continued from page 11

Aspiring Imager

most write-ups will say the scope must be balanced, as a rather casual statement - the truth is that even such a seemingly simple activity can have its challenges. I am not presenting these "misadventures" to scare anyone off from this hobby, but to point out that it is not something to take up on a whim, as a lot of time and expense may be wasted.

Future instalments will include:

- the mysteries of one shot color
- maintaining proper balance (& sanity)
- keeping things in focus
- the real meaning of seeing
- polar align or else ...
- auto guiding ain't so automatic
- backlash really hurts
- what the heck is PEC
- why I am becoming a computer geek
- being color blind doesn't help
- digital developments
- and I thought curves was all about beautiful women and fast cars
- keeping things in balance. and sharp
- presenting the snaps to the world
- and what makes it all worthwhile

Stay tuned,
John Galle

Moon Phases

Last Quarter	5:39 AM	January 7
New Moon	2:11 AM	January 15
First Quarter	5:53 AM	January 23
Full Moon	1:18 AM	January 30

The Sky this Month

Mercury is a morning star in the last half of the month. At inferior conjunction on the 4th. Greatest elongation west on the 27th (25°).

Venus is not visible during the month. At superior conjunction on the 11th.

Mars is visible all evening retrograding from Leo to Cancer. At opposition on the 29th and closest approach on the 27th.

Jupiter low in the southwest in early evening moving from Capricornus into Aquarius and sets by mid-evening.

Saturn rises near midnight and less than 0.5° north of celestial equator. Retrograde motion begins on the 14th. Ring tilt is at 4.9° showing its northern side this month.

Moon at perigee at 4 PM on the 1st. Occultation with Antares 1.1° south at 8am on the 11th. On the 25th 0.03° north of Pleiades.

Quarantid Meteors peak at 2 PM on the 3rd.

continued from page 13

Frosted Scopes

FROSTED SCOPES. The Big Eye and Little Peeper had no coffee or doughnuts. There's a lesson in this photo boys and girls.

telescope. M45 was spectacular. M35 and the trio of clusters in Auriga put on a good show. The Beehive was a nice sight as was its companion the much-overlooked open cluster M67. I managed to catch open cluster M46 and the little planetary nebula embedded in it along with the much courser M47. In spite of its low meteor count, Leo did put on a nice galaxy show with M65/66 as well as the three-some of star cities near the lion's front paws.

And that is how I spent the night/morning of November 17th. It's going to be clear again tonight. But this time I kind of hope the phone doesn't ring.

John Crossen

continued from page 1

GOES-14

as an early warning system for these flares and helps scientists better understand what causes them.

"We wanted to protect the sensor from overexposure, but we didn't want to shield it so much that it couldn't gather data when a flare is occurring," says Cynthia Tanner, SXI instrument systems manager for the goes-nop series at NASA's Goddard Space Flight Center in Greenbelt, Maryland. (GOES-14 was called GOES-O before achieving orbit).

Shielding the sensor from X-rays also reduces the amount of data it can gather about the flare. It's like stargazing with dark sunglasses on. So NASA engineers must strike a balance between protecting the sensor and gathering useful data.

When a dangerous flare occurs, the new SXI sensor can protect itself with five levels of gradually "darker" sunglasses. Each level is a combination of filters and exposure times carefully calibrated to control the sensor's exposure to harmful high-energy X-rays.

As the blast of X-rays from a major solar flare swells, GOES-14 can step up the protection for SXI through these five levels. The damaged sensor on GOES-13 had only two levels of protection—low and high. Rather than gradually increasing the amount of protection, the older sensor would remain at the low level of protection, switching to the high level only when the X-ray dose was very high.

"You can collect more science while you're going up through the levels of protection," Tanner says. "We've really fine-tuned it."

Forecasters anticipate a new solar maximum in 2012-2013, with plenty of sunspots and even more solar flares. "GOES-14 is ready," says Tanner.

For a great kid-level explanation of solar "indigestion" and space weather, check out spaceplace.nasa.gov/en/kids/goes/space-weather.

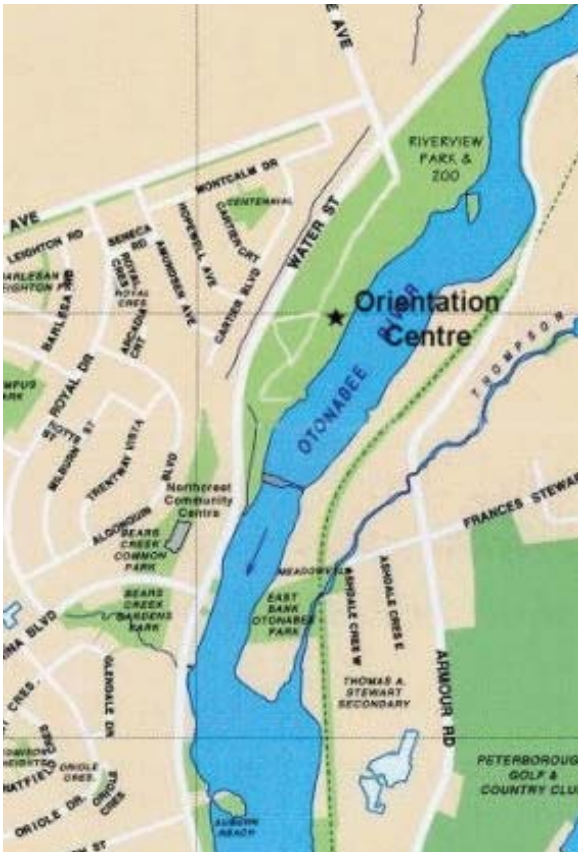
This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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). 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
445 Park Street North
Peterborough, ON K9H 4R1
phillip.chee@gmail.com

Next submission deadline:
January 25, 2010



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 8PM. PAA executive business will be conducted starting at 7:30PM. Members and the public are welcome to attend the earlier time.