Peterborough Astronomical Association
The Reflector

Volume 11, Issue 9 ISSN 1712-4425 November 2012

A Cosmic Tease
Trials of the Herschel Space Telescope Science Teams

by Dr. Marc J. Kuchner

Vast fields of marble-sized chunks of ice and rock spun slowly in the darkness this week, and I sat in the back of a grey conference room with white plastic tables spread with papers and laptops. I was sitting in on a meeting of an international team of astronomers gathered to analyze data from the Herschel Infrared Observatory. This telescope, sometimes just called Herschel, orbits the Sun about a million miles from the Earth.

The meeting began with dinner at Karl's house. Karl charred chorizo on the backyard grill while the airplanes dribbled into Dulles airport. Our colleagues arrived, jetlagged and yawning, from Germany, Sweden, and Spain, and we sat on Karl's couches catching up on the latest gossip. The unemployment level in Spain is about twenty percent, so research funding there is hard to come by these days. That's not nice to hear. But it cheered us up to be with old friends.

The meeting commenced the next morning, as the vast fields of ice and rock continued to spin — shards glinting in the starlight. Or maybe they didn't. Maybe they didn't exist at all.

Samuel Pierpoint Langley, who developed the bolometer in 1878. His instrument detects a broad range of infrared wavelengths, sensitive to differences in temperature of one hundred-thousandth of a degree Celsius (0.00001 C). In 1961, Frank Low developed the germanium bolometer, which is hundreds of times more sensitive than previous detectors and capable of detecting far-infrared radiation.

You see, this team is looking at a series of images of stars taken by a device called a bolometer that is blind to ordinary starlight. Instead, the bolometer inside Herschel senses infrared light, a kind of light that we would probably refer to as heat if we could feel it. But the idea of pointing the bolometer at the stars was not to collect ordinary starlight. It was to measure heat coming from

see "Herschel" on page 16

President's Message

The Year Draws to a Close

It's hard to believe that almost a year has passed since I became president of this organization. We've covered a lot of ground and have had many successes but I will elaborate more on these in the next issue. Our next meeting will be the Annual General Meeting (AGM) where we have some business to wrap up with respect to the election of officers, a welcomed guest speaker and of course a selection of "goodies" to delight the palate.

On the observing front we enjoyed a great evening with Jeanne and Pat Crebar on October 12th. The sky was clear and we had some great observing complemented with some nice cookies and coffee.

Still with observing, the annual Leonid Meteor Shower will be on November 17th. As I recall I've seen more meteors for this shower than I have for the Perseids.

On the election front I'm pleased to announce that the open positions for this coming year will be filled by incumbents for another two-year term unless someone would like to contest these or any other executive position. The election will be held at the AGM. There is one exception with this announcement. The incumbent Treasurer, Pat Crebar, will only serve one more year if acclaimed.

Consider offering your services to the club. You won't be alone and may find it rewarding as I have.

Rodger Forsyth
PAA President

Letter from the Editor

This Space Could be Yours!

As you read your way through this November's issue of *The Reflector* you will notice a stark, blank page 13. Why is it blank you ask? It's to highlight the need for content.

This is the first time in almost four years of editing the newsletter that lack of material to publish a 16 page issue has created such a layout. In the past I have published issues of 8, 12 and 14 pages to accomodate the submissions. Think of this a 15-page newsletter only for this month.

Please consider submitting photos are short articles to share your own take on astronomy. We would love to publish them.

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.
www.peterboroughastronomy.com • rforsyth@nexicom.net
Phone: 705.292.0729
Club Mailing Address
Rodger Forsyth, President
Peterborough Astronomical Association
536 Robinson Road RR #1
Peterborough, ON K9J 6X2

Noreen Grice Teaches the Blind to Enjoy Astronomy

Noreen Grice helps remove barriers for students with disabilities. The universe really is for everyone.

John Crossen

If you still think an astronomer is someone who sits on a mountain top staring through a telescope it's time to trade in your land line for an iPhone. Today's astronomers download data and images collected by telescopes on the laptops in their offices. Data can be printed out in Braille and images can be given surface textures that a blind person can "see" with their fingers. Technology has changed the world, now it's time to change your mind about what a blind person can't do.

Because astronomy "seems" like such a visual hobby many young blind students simply rule it out as an area of interest. But that's not true—not since Noreen Grice.

Noreen grew up in a public housing project, not far from Boston. As a kid in the projects, she learned to cope with the barriers society can unwittingly erect. One of the ways she coped was to immerse herself in school work, especially science and astronomy. That immersion led her to earn a Master of Science in Astronomy from San Diego State University and Certificates in Museum Studies, Non-Profit Management and Assistive Technology Applications.

Noreen worked 26 years as an educator at the prestigious Charles Hayden Planetarium in Boston. But her planetarium career began with a twist, only a few weeks

See "You Can Do Astronomy" on page 15

Auroras Hit Again

Rick Stankiewicz

Not only were the autumn colours peaking in early October this year, but the aurora borealis were peaking too and I am talking about right here in the Kawarthas! On October 8th we had a blast of geomagnetic activity from the Sun that triggered some early evening displays in the northern sky. Even the light pollution from Peterborough could not compete with the intense green and hints of red that were produced around 9:00 p.m. that night. This increase in auroral activity is to be expected as we gear up for the next "solar maximum" over the next year. The Sun is getting more active in its 11-year cycle and we can expect more displays of sunspots during the day and the odd aurora at night, even this far south from the pole.

Images of aurora taken with tripod mounted Canon DSLR cropped ISO 800; 20 to 30 sec. exp.; f/3.5 to 4.0; 6.5 & 34mm. Courtesy Rick Stankiewicz.

Planets in a Beehive

John Crossen

Just a few months ago astronomers discovered two planets orbiting a double star system. That was quite unusual. Now something equally bizarre has been spotted—two super-Jupiter-sized planets orbiting a star in the Beehive star cluster.

Neither of the planets is considered habitable, but if they were, they would definitely have the starriest skies ever. A star cluster is a tightly knit group of stars that have formed together fairly recently on the cosmic time scale. They are still gravitationally bound together and were here-to-fore not considered likely homes for exoplanets. That's up for a rethink now.

The Beehive star cluster lies at a distance of about 550 light years which isn't far by cosmic standards. The cluster can be seen in binoculars from a dark rural location and is close enough that it is best observed in binoculars. You will find it on a star chart between Gemini and Leo in the constellation Cancer the Crab. The cluster itself is relatively young and because the stars in it were birthed from the same nebular cloud they share the same chemical makeup.

Imagine looking up from a planet in the Beehive Star Cluster. Chances are you wouldn't need street lights. Then again would you ever realize that there are other worlds and galaxies out there?

The two new Beehive planets are called Pr0201b and Pr0211b. The star's name followed by a "b" is the standard naming convention for planets. "These are the first 'bs' in the Beehive," said Sam Quinn from Georgia State University in Atlanta.

Quinn and his team, in collaboration with David Latham at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, discovered the planets. They were using the 1.5-meter Tillinghast Telescope at the Fred Lawrence Whipple Observatory in Arizona. The scope can be equipped to measure the slight gravitational wobble the orbiting planets induce upon their host stars. Previous searches of clusters had turned up two planets around massive stars, but none had been found around stars like our Sun until now.

The research team suspects that planets turned up in the Beehive Cluster because it is rich in metals. Stars in the Beehive have more heavy elements such as iron than the Sun. "Searches for planets around nearby stars suggest that these metals act like a 'planet fertilizer,' leading to an abundant crop of gas-giant planets," said White. "Our results suggest this may be true in clusters as well."

The Beehive Cluster is known to astronomers as M44 because it is the 44th item found on Charles Messier's list of deep sky objects. In ancient times it was also known as Praesepe and considered to be a thin spot in heaven's floor that the souls of the dead could float up and through to enter heaven. At any rate, any worlds orbiting a sun-like star in a star cluster would give new meaning to the song "Starry, Starry Night."

Until we meet again keep your outdoor lights dimmed, shielded and aimed down. You'll save energy and our dark Kawartha skies.

There's a New Exoplanet in the Neighbourhood

La Silla Telescope with Milky Way. The 3.6-meter telescope at La Silla captured the light from a Centauri B to detect a slight "wobble" in the star. This barely detectable flip-flop indicated that it had a planet orbiting it. After three years of measurements, the team released their findings online in *Nature*. Courtesy ESO/Serge Brunier.

John Crossen

The new kid in town is orbiting a Sun-like star named *a Centauri B*. After our Sun, *a Centauri B* is the next closest star to us. The Centauri star system is comprised of three stars. They lie 4.3 light years distant, which by cosmic standards is right next door.

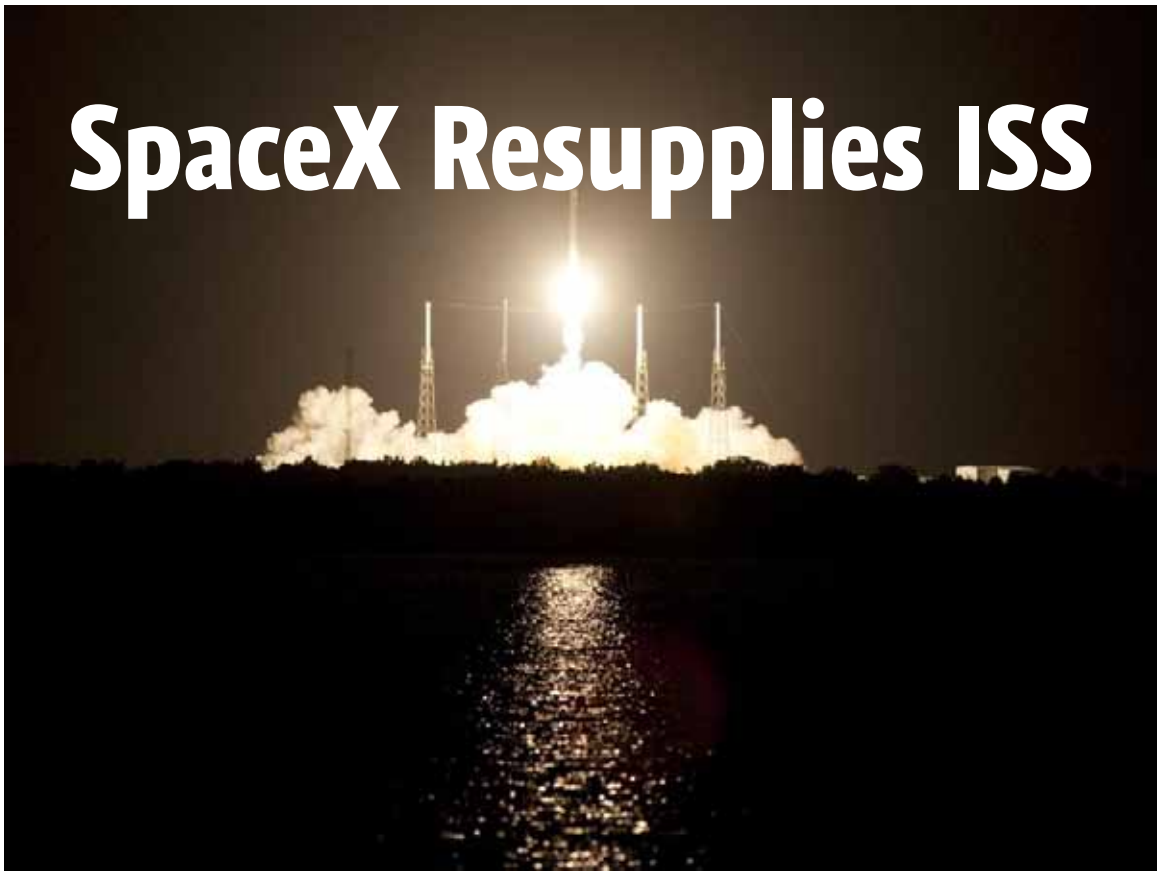
To put things into perspective the light from *a Centauri B* takes 4.3 years to reach us while the Sun's light takes only 8 minutes to hip-hop the 143 million km to Earth. In both cases light is traveling unimpeded through the void of space at 300,000 km/second.

If ET were from that newfound exoplanet and were to call home, it would take 4.3 years for the being at the other end to get his message. That's because radio waves travel at the same speed as light. So a two way conversation would take a total of 8.6 years. "Hi how are you? (Insert 4.3 year gap) Not bad, how are you? (Insert another 4.3 year gap for return greeting.) Wow, 8.6 years just to exchange Howdy-dos! It's no wonder there isn't an interplanetary dating service. And texting wouldn't be any faster.

But having a close neighbour is only one aspect that has scientists intrigued. This is the lowest mass exoplanet yet discovered orbiting a star similar to our

see "Alpha Centuri B" on page 15

SpaceX Resupplies ISS



SpaceX and Dragon Launched October 7, 2012. Spaceman Elon Musk's rocket lifts off for the ISS. This is the second launch in a contract that calls for 10 more from the privately-owned company. Photograph courtesy NASA.

John Crossen

As Curiosity celebrates Sol (Day) 61 on Mars it is still breaking-in some of its systems. The first two scoops of Martian soil were taken at "Rockcrest" a patch of wind-blown sand and dust. But they aren't for analysis. They were for cleaning the internal surfaces of the Rover's sample-handling mechanism. The first scoops will be discarded and the next two will be sent to the Rover's CheMin (Chemistry and Mineralogy) instrument and SAM, the Sample Analysis at Mars instrument. There are no results yet, but it looks like us civilians have a new set of acronyms to learn.

While we're still roaming the Red Planet, the Curiosity Rover has found an ancient stream bed. Visual analysis of the rounded rocks the rover imaged indicates that the stream was higher than ankle-deep when it flowed. The estimated flow rate was nearly 3 metres per second, so the stream was quite vigorous.

There have been numerous other hints of water on early Mars, but this is the first visual proof that a stream actually carried pebbles in its flow.

Meanwhile back on Earth the second SpaceX resupply ship has lifted off and is on its way to the International Space Station. Space Exploration Technology is a commercial enterprise headed by entrepreneur/engineer Elon Musk.

See "SpaceX" on page 14

PHOTO GALLERY

October Observing Session Crebar Observatory

October 12, 2012, was the most recent monthly PAA observing session. The night was cool and clear and the seven PAA members (Jean, Pat, Rodger, Janet, Rick, Ken Sunderland and John Cameron), who attended were treated to a nice evening under the stars. Early in the evening started with a two passings of the ISS. The attached image is the second 2-minute pass. It went right through Hercules and Draco. (Canon 50D & 6.5mm lens tripod mounted on a Vixen Polarie; f/5.6; ISO 500.)

Then came a double Iridium flare which none of us had ever seen before. The evening was off to a great start and the three telescopes were just spinning after this. Jupiter was up and there were galaxies, star clusters and nebulae to be found. The night was a cold one, but the skies were clear and the wind was nonexistent. The coffee and muffins were a hit and everyone was satisfied with a beautiful night at the Crebar Observatory. Thank you once again to our gracious hosts Jean and Pat.

Rick Stankiewicz

Fall Milky Way

It's been awhile since I got outside on a clear night to take photos of the Milky Way. This particular night wasn't clear of the nearly First Quarter Moon just yet, but the faint band of our galaxy can still be imaged. Photo taken with a Nikon D200 DSLR and Nikkor 10.5mm f/2.8G Fisheye lens. Exposure was 30 seconds at f/2.8 using an ISO of 800.

Phillip Chee

PAA Member Recipient of Diamond Jubilee Medal

THE MEDAL

The obverse depicts a crowned image of the Sovereign, in whose name the medal is bestowed. The reverse marks the sixtieth, or diamond, anniversary of the accession to the Throne of Her Majesty Queen Elizabeth II. The anniversary is expressed by the central diamond shape, by the background composed of a pattern of diamonds, and by the two dates. The Royal Cypher consists of the Royal Crown above the letters EIIR (i.e., Elizabeth II Regina, the latter word meaning Queen in Latin). The maple leaves refer to Canada, while the motto *VIVAT REGINA* means "Long live The Queen!"

The ribbon uses a new arrangement of the blue, red and white colours found in the 1953 Coronation Medal, the 1977 Silver Jubilee Medal, and the 2002 Golden Jubilee Medal.

On September 29th, 2012, PAA member Rick Stankiewicz was in Ottawa as a recipient of the Queen Elizabeth II Diamond Jubilee Medal. The Provincial Enforcement Branch of the Ontario Ministry of Natural Resources had received thirteen medals to award during this year, the Queen's 60th anniversary of her accession to the throne. All the recipients in Ottawa were or are Conservation Officers who have contributed to their communities, province and country during their careers. The focus of the awards was community contributions. It was mentioned that with Rick, one highlight of this contribution was his hours of volunteer work with many organizations in his community, province and Canada which includes church, local stamp club, astronomy club, heritage and fundraising projects.

Rick is proud of the fact that one of the reasons for his nomination came from his role in the astronomical community, including the Peterborough Astronomical Association and is thankful for the opportunities to serve in many capacities over the years.

The attached are excerpts from the program in Ottawa that explain the background of the Diamond Jubilee and the medal.

Queen Elizabeth II Diamond Jubilee

This is a historic occasion. Only once in our history has our country marked a diamond jubilee: in 1897 for Queen Victoria. On that day, Lord Aberdeen, then governor general, said *"We offer the glad tribute of loyal devotion and affectionate homage."* More than a century later, Canada once again celebrates the life and service of a monarch, a queen of great conviction who is respected the world over.

Six decades ago, on February 6, 1952, a young Queen began her reign, one focused on service to others. Her Majesty has experienced and seen many hardships, but also many joys. Through it all, she has remained dedicated to serving the Crown and the people of the Commonwealth.

During the year-long Diamond Jubilee celebrations, 60,000 deserving Canadians—whose contributions have changed this country and the world—will be honoured. Today, we once again reaffirm our bond with the Crown, which helps to define our country and what it means to be Canadian.

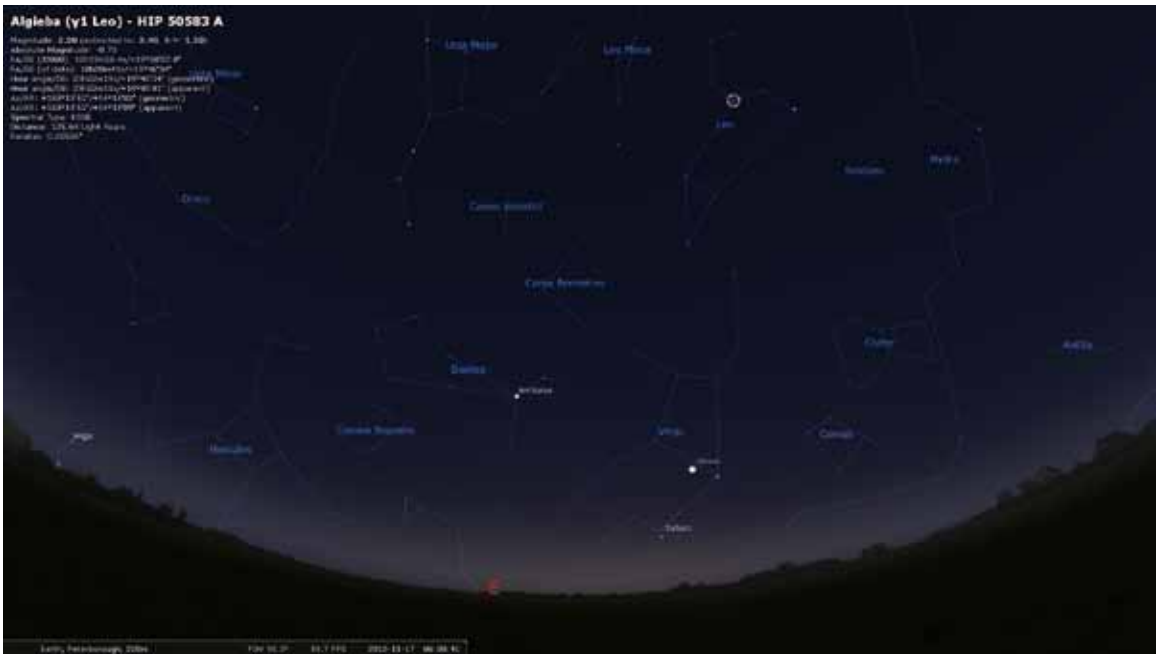
The Queen Elizabeth II Diamond Jubilee Medal serves to honour significant contributions and achievements by Canadians.

Quote

"All of you here—who have been nominated by your peers and colleagues—have made Canada better. Individually, you have improved the well-being of many in your communities, and together, you have helped to create a smarter, more caring nation."

The Right Honourable David Johnston,
Governor General of Canada

Leonids and Minor Long-lasting Taurids Grace November



LEONIDS. Peak time this year is the morning of Saturday, November 17 between midnight and dawn. The first quarter Moon will have set before the peak so if it's clear it should be good viewing.

PHILLIP CHEE

THIS YEAR THE LEONID meteor shower peaks early Saturday morning on November 17. There will be no moon during the peak viewing hours which occur after midnight and before dawn.

The Leonids are the remnants of Comet Tempel-Tuttle. These meteors are not prone to bursts like the Perseids or Orionids, offerring only 10-15 meteors per hour during the peak hours. However there were three recorded meteor storms of hundreds per hour that occurred in 1833, 1866 and 1966.

The shower is named after the constellation Leo the Lion because its radiant appears to emanate from this star group near the star Algieba. The meteors will accentuate an already brilliant casting of planets. Jupiter, Saturn and Venus will all be up during the event.

Two minor meteor shower peaks will also occur early in November. The Southern Taurids peak November 4–5 and the Northern Taurids peak November 11–12. These two showers are of the long-lasting type. The southern showers can be visible from September 25 to November 25 while the northern ones last from October 12 to December 2. At their peaks one might see about 7 meteors per hour.

Since it's November I don't need to remind you to wear warm clothing if you dare to venture out to see these showers.

continued from page 7

SpaceX

SpaceX built both the rocket and capsule for NASA's first Commercial Resupply Services, or CRS-1, mission to the International Space Station.

SpaceX CRS-1 is an important step toward making America's microgravity research program self-sufficient by providing a way to deliver and return significant amounts of cargo, including science experiments, to and from the orbiting laboratory. NASA has contracted for 12 commercial resupply flights from SpaceX and eight from the Orbital Sciences Corp.

Jumping 50 million light years into space we arrive at galaxy M87. This galaxy has a black hole at its centre that astronomers are studying carefully. One of the reasons for their scrutiny is that the black hole appears to be about the same size as the one at the centre of our Milky Way Galaxy.

To conduct their research astronomers have linked radio telescopes in Hawaii, California and Arizona. This creates a virtual telescope of incredible size. As is the case with all telescopes, bigger is better and with radio telescopes it is possible to create continent-spanning arrays. Future plans include linking with another radio scope in Chile to create an instrument with even greater power.

About a year from now, if the world didn't end (again) on December 21, Comet C/2012 S1 (ISON) may become the brightest comet anyone alive has ever seen. How bright it could get is currently the subject of vigorous discussion among planetary scientists and everyday comet-watchers. Keep looking up boys and girls. It should arrive in October of 2013.

The Sky this Month

Mercury is at inferior conjunction on the 17th. It reappears later in the month in the eastern sky before dawn.

Venus in eastern morning sky. On the 11th it is 5° north of the waning crescent Moon. Passes 0.6° south of Saturn on the 27th.

Mars low in western evening sky and passes from Ophiuchus into Sagittarius.

Jupiter rises north of east in mid – evening as it retrogrades in Taurus. Nears opposition on the 2nd and again on the 29th.

Saturn reappears low in the morning eastern twilight by mid – month. Very close to Venus at month's end.

Zodiacal Light visible in east before morning twilight for two weeks from the 13th.

Leonid meteors peak at 3 a.m. on the 17th.

Daylight Savings Time ends at 2 a.m. on the 4th.

Moon Phases

Last Quarter	**7:36 PM**	**November 6**
New Moon	**5:08 PM**	**November 13**
First Quater	**9:31 AM**	**November 20**
Full Moon	**9:46 AM**	**November 28**

continued from page 3

You Can Do Astronomy

into the job when a group of blind students came to her planetarium show. She helped them to their seats and began the pre-recorded program. Afterwards she asked them what they thought. "It stunk" was their response.

Rather than being offended the challenge inspired Noreen. She began working on ways to make astronomy accessible and enjoyable to everyone, blind or sighted as well as those with other disabilities and learning styles. With the founding of You Can Do Astronomy LLC she works with individuals and museums to provide accessible astronomy options.

Noreen tests new ideas and teaching techniques with students. For example, using a ball with one fuzzy side and one smooth side she shows students the phases of the Moon by turning the ball from completely smooth (New Moon) through its phases to the fuzzy side (Full Moon). "Educated fingers" can read the cratered surface on a model of the Moon as well as the eye can see it. And new printing methods are evolving that help the tactile senses replace lost or low vision.

To date Noreen has authored six books; three of the books were created with NASA. Her most recent book, *Everyone's Universe: A Guide to Accessible Astronomy Places (second edition)* recently received the "highly recommended" rating from the National Science Teachers Association in the US.

Noreen also works with other experts so that what she teaches is as current as possible. When she's not writing, teaching or upgrading her skills at a conference, Noreen is a popular guest speaker whose down-to-Earth demeanour and contagious enthusiasm are inspiring to all ages.

To learn more about Noreen's work visit www.youcandoastronomy.com. You will be amazed.

continued from page 6

Alpha Centauri B

Sun. Unfortunately it is orbiting a Centauri B — at about the same distance as Mercury orbits our Sun. So the planet is most likely scorched and barren.

To achieve this remarkable find the team used a tried-and-true technique that measures the "wobble" in the star caused by the gravitational pull of an orbiting exoplanet. It's the same technique used by researchers to find the first exoplanet ever in 1995. That exoplanet was orbiting a star known as *51 Pegasi b* in the constellation Pegasus. Obviously numerous refinements in both technique and equipment have transpired over the intervening 17 years to allow such a low-mass object to be detected.

The discovery was made by Francesco Pepe, from the University of Geneva, Switzerland and a team of colleagues at the European Southern Observatory on La Silla in Chile. To confirm their discovery the group measured the star's radial velocity three times every night for over three years. For those of you who enjoy acronyms the group used the High Accuracy Radial Velocity Planet Searcher, more affectionately known as HARPS. For those planning on taking a Welcome Wagon to visit our new exoplanet neighbour, pack a lunch and a change of shorts. With today's highest speed rocket it will take you about 28,000 years.

Until we meet again keep your yard lights aimed and dimmed down. You'll save money, energy and help protect our dark Kawartha night sky. Save the stars so future generations will have somewhere to hang their dreams.

continued from page 1

Herschel

the vicinity of these stars, like an infrared security camera, in case there was something else to be found lurking nearby.

And lo and behold, for a handful of stars, the bolometer measurements were off the charts! Maybe something was orbiting these stars. From the details of the bolometer readings — which channels lit up and so on — you would guess that this stuff took the form of majestic fields or rings of icy and rocky particles. It would be a new kind of disk, a discovery worth writing home to Madrid about.

There are several teams of astronomers analyzing data from the Herschel Space Telescope. They call themselves by oddly inappropriate sounding acronyms: GASPS, DUNES, DEBRIS. For the time being, the scientists on these teams are the only ones with access to the Herschel data. But in January, all the data these teams are working on will suddenly be released to the public. So they are all under pressure to finish their work by then. The team whose meeting I was sitting in on would like to publish a paper about the new disks by then.

But it's not so simple. The stars that this team had measured were relatively nearby as stars go, less than a few hundred light years. But the universe is big, and full of galaxies of all kinds — a sea of galaxies starting from maybe a hundred thousand light years away, and stretching on and on. Maybe one of those background galaxies was lined up with each of the stars that had lit up the bolometer — fooling us into thinking they were seeing disks around these stars.

The team argued and paced, and then broke for lunch. We marched to the cafeteria through the rain. Meanwhile, vast fields of marble-sized chunks of ice and rock spun slowly in the darkness. Or maybe they didn't.

What else did Herschel recently uncover? Find out at http://spaceplace.nasa.gov/comet-ocean.

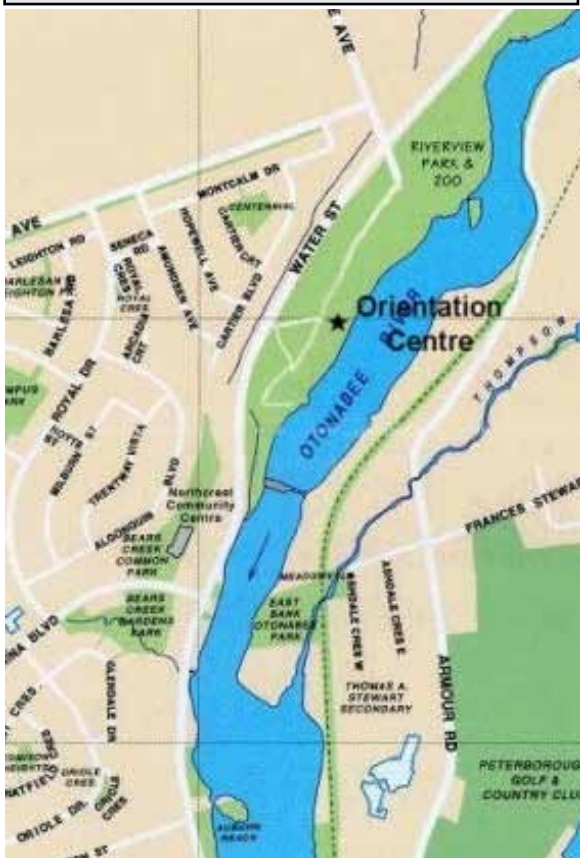
Dr. Marc J. Kuchner is an astrophysicist at the Exoplanets and Stellar Astrophysics Laboratory at NASA's Goddard Space Flight Center. NASA's Astrophysics Division works on big questions about the origin and evolution of the universe, galaxies, and planetary systems. Explore more at http://www.science.nasa.gov/astrophysics/.

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 handwritten 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:
OCTOBER 26, 2012



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.