Peterborough Astronomical Association
The Reflector
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A Brand New Age: Queue Observing at Mt. Paranal

EurAopean Southern Observatory at Mt. Paranal, Chile. Photo courtesy of NASA.

by Dr. Marc J. Kuchner

First a caravan of white observatory cars arrives, winding up the narrow road to the 2600m (~8500-foot) high summit. Then the shutters around the domes open, and rays from the setting sun alight on colossal mirrors and metal struts. It's the beginning of another busy night at Mt. Paranal, Chile, where I am learning about new, more efficient ways of managing a modern observatory.

I stepped into the observatory's control room to soak up some of the new, unfamiliar culture. Here, under fluorescent lights and drop ceilings are banks of computer screens, one bank to control each of the four big telescopes on the mountaintop and a few others too. At each bank sits two people, a telescope operator and an astronomer.

The layout of this workspace was not unfamiliar to me. But the way these Mt. Paranal astronomers work certainly was. When I was cutting my teeth at Mt. Palomar observatory in California, I would only go to the telescope to take my own data. In stark contrast, everyone observing at Mt Paranal tonight is taking data for someone else.

The Mt. Paranal astronomers each spend 105 nights a year here on the mountain performing various duties, including taking data for other astronomers. The latter, they call "executing the queue." Headquarters in Germany decides what parts of the sky will have priority on any given night (the queue).

see "ESO" on page 16

President's Message

Goodbye Summer, Hello Meetings

August 25th a sad day for all with the passing of Neil Armstrong. To be the "first man on the Moon" capped a very rich and full career. I still look at the Moon in awe and wonder what it was like to stand there and look back at the Earth. Well done Neil, may you rest in peace.

The PAA had a busy summer with the transit of Venus, the Perseids meteor shower and our annual visit to Emily Provincial Park. Let's keep up the good work and start thinking about next year's outreach agenda.

Dean Shewring has done an outstanding job organizing the September 22nd bus trip to the DDO. We basically have a full bus. This promises to be a great trip, thank you Dean. A reminder that payment for the bus trip is due at the Sept. 7th meeting.

Rodger Forsyth
PAA President

Letter from the Editor

Fall Felicitations

Welcome back to *The Reflector*, the newsletter of the Peterborough Astronomical Association. I trust you had a wonderful summer of fun, frolick, and fancy.

As we went to press we learned about the passing of Neil Armstrong, the first human to set foot on the Moon. The "Reluctant Hero" inspired a generation of kids to look to the skies and wonder, dream and pursue careers in space, engineering and science. His influence is not to be diminished as he fades from our collective memory.

Our intrepid past-president, Rick Stankiewicz, has been busy this summer, especially during July when he documented the Summer of Conjunctions. His photos in the gallery are a treat to behold.

The Transit of Venus across the Sun was a once in a lifetime event for many of us (although veterans will say it was twice in a lifetime since they saw it in 2004, too!) Again, Rick photographed and wrote about the PAA's public viewing on June 5.

As always, John Crossen graces our fine pages with fun facts and figures and by figures I mean his article on "big numbers" relevant to astronomy.

We'll see you at the next meeting on the 7th and let's make the upcoming months memorable.

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

First "Man on the Moon" Dies at 82

Rick Stankiewicz

On August 25th a true space hero, Neil Armstrong, died at the age of 82. He just had his birthday less than three weeks earlier (August 5th) and it was a surprise for most of the world that Armstrong was seriously ill. He died from complications after recent heart bypass surgery. I guess he was "flying under the radar?"

In honour of a great man I have put together a philatelic tribute using stamps from around the world to show how he and his fellow astronauts (Buzz Aldrin and Michael Collins) have been recognized in the past. Just take a moment to study the following First Day Cover from the U.S.A. of their historic lunar landing on July 20, 1969. Note the use of the Lunar Excursion Module (LEM) "Eagle" in the cachet. Armstrong piloted this to the lunar surface. The cancellation is a double commemoration of both the actual landing date and the first day of issue for the 10-cent airmail "First Man On The Moon" stamp (September 9, 1969). I included an overlay on this cover of an Armstrong stamp from a series issued by Qatar on December 6, 1969, that shows him in his flight suit. Beside this is an airmail stamp from Ras Al Khaima showing Armstrong in a suit with the LEM descending to the lunar surface in the background.

What a mission, what a crew, what a man. "One small step for a man, one giant leap for mankind." God speed Neil Armstrong!

A Rare Transit, Indeed!

Rick Stankiewicz

Astronomers are contantly making new discoveries, so here's a brief review of some recent newsy items. Let's start with the wild and wonderful world of exoplanets.

Where were you on June 5th, 2012? I will never forget where I was, as June 5th 2012 will go down as a rare event indeed in the annals of the PAA. The last of the two transits of Venus this century occurred on this date and the membership was out in full force to share this event with members of the public. On Armour Hill and Ashburnham Memorial Park, in Peterborough, there were a total of five telescopes equipped for solar viewing, sets of binoculars, numerous welders glasses and "eclipse shades" too. There were at least a dozen members out to man their stations from traffic control to PR, answering questions and running equipment.

Mark Coady was doing some major "sidewalk astronomy" elsewhere in Peterborough and on his own drew about 75 to his solar equipped scope.

Brian McGaffney was hosting a big public viewing at Nutwood Observatory south of Bancroft and they had clear skies right through to 8:30 p.m. that evening! About another 28 (along with some elk and deer) attend this very successful gathering.

What a great show of support for this huge event. The media and public were

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Continued from previous page

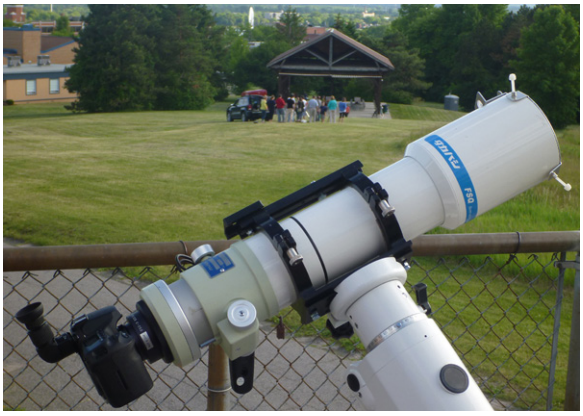
well primed and it showed with the hundreds that showed up, lined up and looked up, at what for most of them, was a once in a lifetime event.

On all fronts and by all accounts, this event was the biggest and best the PAA has ever mounted. The media, the members and the public were all on side. Only the weather could have been better, but the clouds did not prevent the crowds from showing up, taking their chances and being wowed! The clouds prevented seeing anything for most of the 3-hour window we were to have, but the start of the transit was definitely better than the end (when it rained on us all), as the images show. The clouds actually added some depth and another dimension to some of the images. I liked the "smoky" quality it gave. The sunspots were a nice touch that was missing eight years ago during the last transit.

The "planet and star" aligned for this one and we are all happy they did because few if any of those in attendance (including the babes in arms), will be around in 105.5 years to see the next transit in December of 2117.

I know that there are a few members, like me, that feel doubly blessed to have witnessed two Venus transits in our lifetime. What a difference eight years made in the technological changes to our hobby.

The attached images were taken with a Canon 50D, Takahashi FSQ-106, EQ6 mount and Kenrick solar filter (ISO 100; 1/2000 to 1/2500 sec; some cropping) or Nikon Coolpix 4500, Meade ETX90 and Thousand Oaks filter (ISO 100; 1/30 to 1/60 sec.; f/3.5; some cropping).



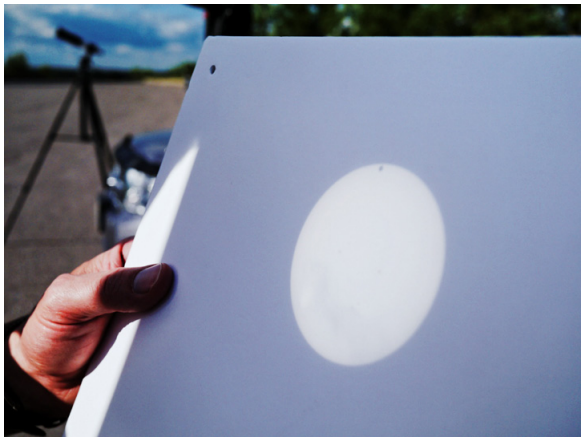
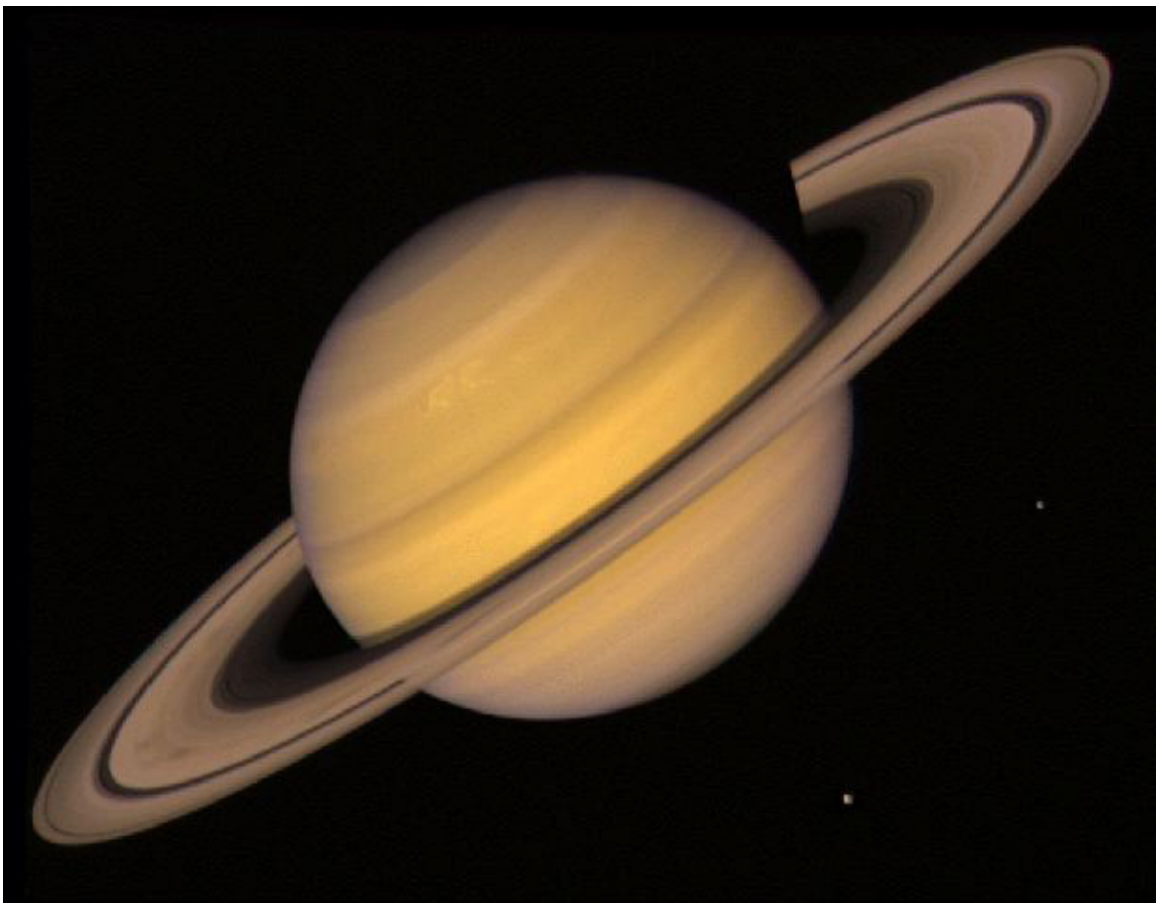


Photo credits. Previous page (top and bottom) and top two this page, Rick Stankiewicz. This page bottom two, Phillip Chee.

When talking astronomy, big numbers = a big mistake



SATURN. Imagine a sheet of paper the size of a football field and as thin as the paper the Herald is printed on. That's the width to thickness ratio of Saturn's ring system.

JOHN CROSSEN

THE NUMBERS USED IN astronomy can be so vast and mind-numbing that they become meaningless to us mere mortals. For instance some tweedy young Professor tosses off the term "light year" and expects the great unwashed "we" to snap it up like beer and doughnuts at a Homer Simpson reunion.

Telling the folks at "Jiffy Shine" that one light year is actually a distance equal to about 10 trillion kilometres isn't much help either. But when you say that it would take you over 31 years to count from 1 all the way up to 10 trillion you've dropped the terms of reference down to 31 years. Suddenly the unimaginable becomes a bit more so.

One of my favourite subjects to explain is the Hubble Deep Sky Image. It is a 10-day exposure of a speck of the sky that appeared to contain nothing. Yet at the end of the ten days astronomers discovered that they had imaged over 5,000 galaxies. And how big was that speck of sky? No bigger than a grain of sand held at arm's length.

The distance between our Sun and the next nearest star, Proxima Centauri is 4.3 light years — once again a near meaningless measurement to Mom and

see "Big Numbers" on page 15

Milky Way Home Sweet Home

John Crossen

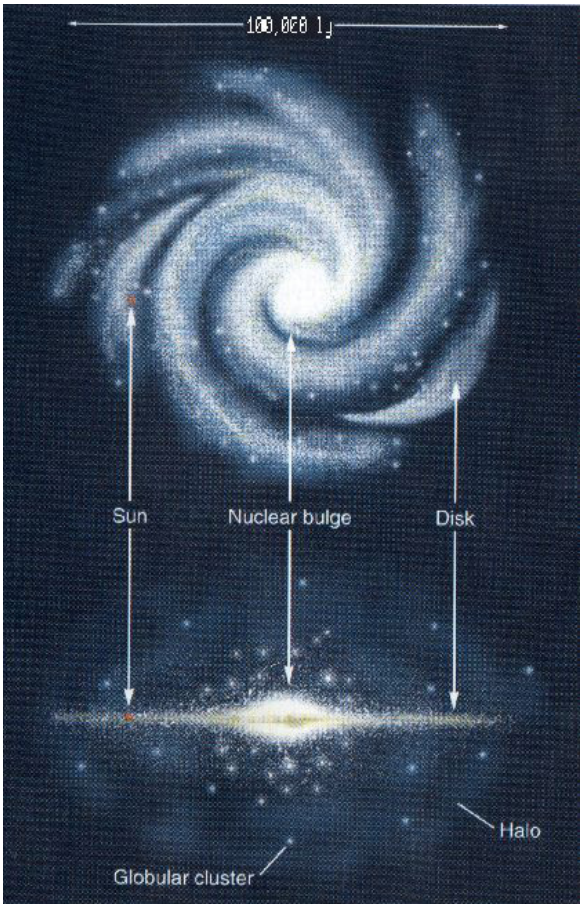
One of the joys of living under dark rural skies is being able to see home. By home I'm referring to the Milky Way Galaxy. It's where we and all the planets in our solar system live. For us country folk, the night sky is alive with wonders, the most amazing of which is our 400-billion-star home, the Milky Way Galaxy.

Our galaxy is just one of billions more that make up the universe and during the summer months the Milky Way is at its grandest. To give you an idea of where within the Milky Way we are, here are some amazingly big numbers.

The Milky Way Galaxy is about 100,000 light years across and our solar system is positioned about 25,000 light years from the core at its centre. So if our galaxy was a giant star city, we'd be living in the suburbs.

Our galaxy is also about 30 light years thick at its core and tapers out into a huge disk that would look like two dinner plates inverted and stacked on top of each other if we could fly out an snap a picture of it edge-on. Planet Earth along with the Sun and other planets in our solar system are at about the half-way mark between the top and the bottom levels.

Were we to zoom out and view the Milky Way looking straight down we'd discover that it consists of numerous arms that spiral out from its central core. Technically it is classified as a barred spiral galaxy because there is a large bar-like section of stars extending out from its core.



Milky Way Galaxy. Based on calculations and observation of other galaxies, this is what our Milky Way would look like if we could fly out and snap its picture.

In the summer months we see one arm of our home galaxy arcing from Sagittarius on the southern horizon, overhead through the Summer Triangle and down again to the northern horizon. When viewing Sagittarius we are looking straight in towards the galactic core, so why can't we see our bright downtown centre? Chalk it up to dust and distance. Being 25,000 light years from the centre of the galaxy means there's a lot of dust and gas between us and it. Even a few specks of space dust

see "Milky Way" on page 15

PHOTO GALLERY

Summer of Conjunctions

July 11, 2012, 3h22

July 14, 2012, 3h40

2012 might be the year of Venus, but this summer is the Summer of Conjunctions. Venus played a roll in this plethora of celestial alignments, but it was not alone. You would have had to have gotten up early throughout July and August, but there were mornings that were worth the effort, at least I thought so. The following images track some of the nicer conjunctions of Jupiter, Venus, Aldebaran in Taurus and the Moon, as they slowly danced in the morning twilight. Jupiter remained high and Venus was lowest, with the crescent Moon coming and going from mid-July to mid-August, while the asterisms of the Pleiades and Hyades framed their movements. It was a sight to behold and your can witness their choreography in the chronology of the images. These images were all taken between 3:22 and 5:19 a.m. EDT.

The evening sky was not without it's excitement too. Saturn, Mars and Virgo's alpha star Spica, jockeyed for position with the Moon later in July. I missed some of the action in August due to clouds, but the attached image from July 24th, at 9:50 p.m. helps illustrate the point. I hope you caught part of the show during the Summer of the Conjunctions, as we are not always treated to such displays at the frequency that was presented to us this season.

Rick Stankiewicz

July 24, 2012, 21h50

July 15, 2012, 3h49

July 21, 2012, 4h09

Photos by Rick Stankiewicz

August 13 2012, 5h19

There's Still a Lot of Travel in Space Travel

Where No Human Has Gone Before. From an airplane that could barely fly, to the wingspan of a 747 jet, we've gone to the Moon, Mars, Jupiter, Saturn and are on our way to Pluto. That's in the last 100 years. What will the next century hold?

John Crossen

When I was a teenager, the idea of rocketing to the moon or another planet was strictly science fiction. It might be possible in 50 years, but not in the near future.

John Kennedy, the Russians and what became known as "the space race" pared that down to just a few years. And on July 16, 1969 science fiction became science fact when Neil Armstrong set foot on the lunar surface. I was 25 by then.

But exploring planets in other solar systems was still the stuff of wild-eyed dreamers. In fact we didn't even know if planets orbiting other distant stars existed. It was just grist for the Hollywood film mills.

Change struck again in 1995 when a team of Swiss astronomers discovered a super-Jupiter sized planet orbiting a star known as 51 Pegasi. Since then the techniques for discovering these "exoplanets" has progressed to the point that we now list 700 of them as confirmed and there are thousands more under study. Exobiology and identifying galactic areas where it is most likely to find exoplanets have become university majors. Terms like "habitable zone" now frequent the conversations in high school and amateur astronomy clubs. But today there is still one formidable hurtle to jump—the giant leap called space travel.

see "Space Travel" on pae 14

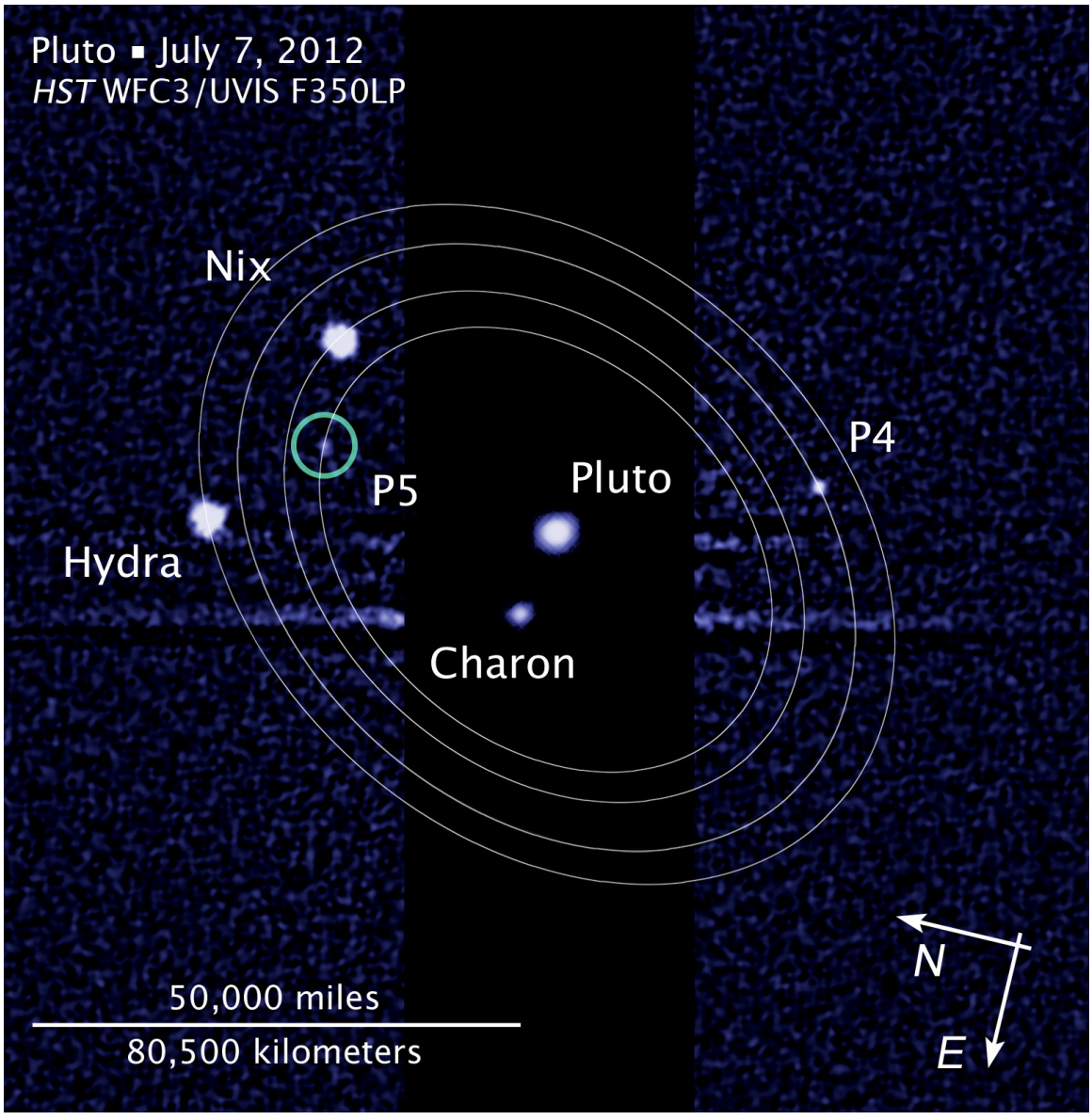
Pluto Bags or Brags Another Moon

Rick Stankiewicz

Since its relatively recent discovery in 1930, the once ninth planet in our solar system (now a dwarf or minor planet), Pluto, ruler of the underworld, has not stopped surprising us. Pluto is so "far out" that it usually appears as a magnitude 15.1 star that moves so slowly that to ensure that you have actually seen it in even a large aperture telescope, you have to view it on separate occasions to be sure that it moved against the fixed star field.

The moons of Pluto started to rack-up in 1978, when Charon, the ferryman of the River Styx was discovered using the 1.6m Flagstaff Telescope. At just over half the

see "P5 Moon" on pae 13



Pluto moon P5 discovery with moons' orbits. Hubble image of all five known moons, with estimated orbits. The brightness of Pluto and Charon are damped to bring out the dimmer moons Hubble Space Telescope discovery image of S/2012 (134340) 1, or P5 (encircled), with the outer moons' orbits depicted. Image courtesy of NASA.

Iridium Flares

Iridium flare photographed by Rick Stankiewicz at Crebar Observatory.

For years I have from time to time tracked the International Space Station (ISS) across the night sky amazing friends, family and public with my magic powers of predicting the appearance and disappearance of this bright and quick moving satellite. Of course the only "magic" is knowing when and where to look and this is achieved if you can access www.heavens-above.com. But this is easy and though always neat for impressing people that are not "in the know", I have found a more challenging pastime. Try finding an Iridium Flare. Start by accessing the same website as above (Heavens-Above), but not only are these "flares" less common compared to ISS transits across the sky, but they last only

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seconds verses minutes and they are often much brighter. Consider that the planet Venus doesn't get much brighter than visual magnitude –4.6 and the ISS doesn't usually get brighter than –4.7, while Iridium Flares can reportedly reach –9.0. Now that is bright!

Iridium's get their name from the fact that they are the communications satellites for the Iridium phone service. There are dozens of these satellites orbiting the Earth and they are highly reflective, but small, compared to the ISS. Each satellite has three door-sized polished panels that are 120-degrees apart and at a 40-degree angle making for a predictable bright spot for a viewer on Earth on a 10km wide swath. The further away you are from central path the dimmer the flare will be. If you are on the right place on Earth when one of these satellites transits, you will be treated to a brilliant display of reflectivity. You know you are looking at an Iridium flare if you see the following signature pattern. A faint (mag. 6.0) "moving star" will appear in a patch of sky and quickly get brighter, to the point of "flaring" at it's maximum brightness and then it will dim as quickly as it brightened until it disappears. The attached cropped image illustrates what a classic flare will look like during an approx. 20-second time exposure. This was captured at the Crebar Observatory on July 18, 2012; at 11:25 p.m. EDT, using a tripod mounted Canon DSLR (ISO 800; f/3.2; 17mm lense setting). This particular flare was from Iridium Satellite #65 and was only at magnitude –2.0

Next time you are heading out under the stars have a look beforehand to see if you just might be in for a quick show from a Iridium flare. Try it, you'll like it, it's a nice way to be "flashed".

Now you see it, now you don't!

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P5 Moon

diameter of Pluto, this 1,200+ km icy satellite is not something you will expect to see being a faint magnitude 16.8.

In 2005 there was the Hubble Space Telescope Team discovery of the next smallest moons, Hydra and Nix. Hydra is the many-headed guardian of the underworld and Nix is the Greek goddess of the night. These moons are somewhere between 46 and 167 km in diameter and are only magnitude +23.

Then in July of 2011 the Hubble team discovered the 4th moon of Pluto. P4 has not been given a Greek name yet but this will likely follow. This tiny moon is between 13 and 34 km in diameter and a dim magnitude +26.

Now the biggest and latest news is just in. On July 12, 2012, Hubble confirms Pluto's 5th moon! P5 is a diminutive satellite of between 10 to 25 km in diameter and between the orbits of Charon and Nix. At magnitude +27 it is no wonder that it has been the last to be discovered by even Hubble. What still lies ahead?

It just so happens that the New Horizons space probe mission is currently on its way to the Pluto, with a flyby scheduled for 14 July 2015. The discovery of yet another small Plutonian moon has raised concerns that this region could have many more bodies yet too small to be detected, with fears that the probe may be damaged by an untedected body as it enters the system at a speed of over 13 km/sec. Only time will tell, but maybe July 2014 will hold another surprise in store from the frozen reaches of our solar system.

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Space Travel

A trip to the Moon is a scant 400,000 km jaunt and we've done it six times with a manned mission and seventy-eight more times with landers and orbitting satellites. Five different countries have either landed on or are orbitting dear old Luna as I write this.

Mars is a step or two further out. It takes about one year to land a rover there. Ditto applies to sending an orbiter to scout out the local weather and geography. Sending the photos, data and commands can take between three minutes and seven seconds to twenty minutes depending on the distance separating Earth and Mars at the time of transmission.

Moving out to Saturn where the Cassini mission is stationed took six years from launch to arrival. And the mission to Pluto began before the planet was demoted to dwarf status. It won't arrive until 2015. I'll have gone from a teenager to 70 by then.

So how long will it take to reach one of those exoplanets we keep discovering? Let's start with the second closest star to Earth after our Sun. It's called Proxima Centauri and is 4.3 light years (39.9 trillion kilometres) distant. Were there an "Earth II" exoplanet orbiting it, we'd be there in about 76,000 years using our current rocket technology. That's longer than any known civilization has existed on Earth and about half the time since our ancient ancestors swung down from the trees. Is anyone up for a banana?

Obviously we are going to need some major advances in propulsion technology. But look how far we've come in the last century. Given the speed at which technology multiplies, we're not far from another one of those pivotal discoveries that will open up the universe to us. Who knows, I may even live to see it.

The Sky this Month

Mercury not visible in Northern Hemisphere during the month. At superior connjunction on the 10th.

Venus in eastern morning sky. Near waning crescent Moon on the 12th. One a.u. from Earth on the 23rd.

Mars low in western evening sky and sets mid-evening. Occulted by waxing crescent Moon on the 19th.

Jupiter rises north of east at midnight in Taurus.

Saturn disappears into western evening twilight by end of month.

Zodiacal Light visible in east before morning twilight for two weeks from the 14th.

Autumnal Equinox arrives at 12:49 a.m. on the 22nd.

Moon Phases

Last Quarter	**9:15 AM**	**September 8**
New Moon	**10:11 PM**	**September 15**
First Quater	**3:41 PM**	**September 22**
Full Moon	**11:19 PM**	**September 29**

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Big Numbers

Dad Frontporch. But astronomy populariser Terry Dickinson explains it this way. First, you shrink our galaxy down so that the Sun is the size of a golf ball and Proxima Centauri is the same. To maintain the same scale, you would have to place the golf ball representing our Sun on Terry's office desk near Kingston, Ontario and the one representing Proxima Centauri on another desk in Winnipeg, Manitoba.

Here's the same story Sun/Proxima Centauri story on a smaller scale. Our Sun is now the size of a grain of salt. Place it in the centre of the palm of your hand. All the planets out to the orbit of Mars will fit within the palm of your hand on this scale. To squeeze in the outer planets (we'll even include Pluto) arc your arms out so that your finger tips just touch. How much farther is it to Proxima Centauri on this scale? A mere 6 kilometres.

How big is the Sun? I can tell you that it's so large that you could fit the Earth into it 1 million times over. Or I could tell you that if you hollowed the Sun out like a great big Halloween pumpkin there would be room inside to fit the Earth with the Moon orbiting around it … and the Moon would never touch the inside wall of our Pumpkin/Sun.

Right now Saturn is a prime target at Buckhorn Observatory. Many people spot the Cassini Division in Saturn's ring system. So, after giving them the details on Giovanni Cassini, the next question is how wide is the gap? Rather than tell them the distance in kilometres I simply say that you could fit our Moon into the gap — it's also easier to remember.

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Milky Way

per cubic metre eventually stack into a 25,000-light year thick wall that light cannot penetrate.

But we can see what's going on at our galactic core thanks to the highly-advanced infrared imaging the Spitzer Space Telescope is capable of. Infrared relies on heat, not visual light for imaging. And what we've seen says "Black Hole" long and loud. Images of stars whipping around something with an immense gravitational pull tell us that there must be a black hole at the centre of it all.

If you like analogies, the Milky Way is like many big cities. Its downtown core is bright, crowded with stars and dangerous thanks to a massive black hole. Further out in the suburbs where our solar system dwells things are less hectic and more tranquil.

So the next time you have the opportunity to view the night sky from a dark rural location, look up and see the Milky Way. Welcome home!

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ESO

Then the Mt. Paranal astronomers march up the mountain and carry out this program, choosing calibrators, filling the log books, and adapting to changing conditions. They send the data back to headquarters, and from there it makes its way out to the wider astronomical community for study.

This new way of working allows the Mt. Paranal astronomers to specialize in just one or two telescope instruments each. Surely this plan is more efficient than the old-fashioned way, where each of us had to learn every instrument we used from scratch — sifting through manuals at 3:00 AM when the filter wheel got stuck or the cryogen ran out, watching precious observing time tick away. Here at Mt. Paranal, much of the work is done in a big room full of people, not off by yourself, reducing some dangers of the process. Also, queue observing cuts down on plane travel, an important step for cutting carbon emissions.

It's a brand new age, I thought as I watched the giant domes spin in the silent, cold Chilean night. And maybe with queue observing, some of the romance is gone. Still, my colleagues and I couldn't help saying as we stared out across the moonlit mountains: I can't believe how lucky we are to be here.

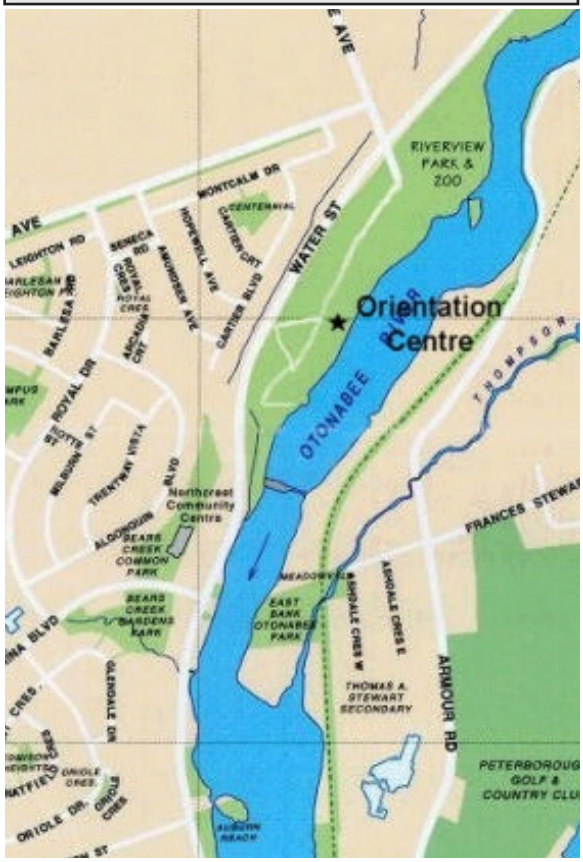
Dr. Marc J. Kuchner is an astrophysicist at the Exoplanets and Stellar Astrophysics Laboratory at NASA's Goddard Space Flight Center. NASA's Astrophysics Division works on big questions about the origin and evolution of the universe, galaxies, and planetary systems. Explore more at http://www.science.nasa.gov/astrophysics/.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

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:
SEPTEMBER 24, 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.