

Orbit

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Roger Hill, Editor

We've had a busy month at the Observatory, getting things ready for the winter, and we have a brave, but talented, group of people to thank. More on that later, but the efforts of Gary Colwell, Andy Blanchard, Colin Haig, Kevin Hobbs, Marks Kaye and Pickett, Rick Cudmore are appreciated.

The outhouse is now functional, the gate is working, the security cameras are in place (with more to come), and we'll be doing some training sessions on the 16".

We've got some sidewalk astronomy things going on, too. Mark Pickett is the person who'll be leading this effort, and since he does get email via the discussion list, he's easy to contact. More on this a bit later in Orbit, but it's sidewalk astronomy with a difference!

We're also undergoing discussions about re-doing the very successful series of workshops held in Burlington earlier this Fall. As I said last month, they were one of the high points of my year! The presentations will need some tweaking (some more than others), and taking out some of the observational stuff to add more 'armchair' astronomy.

We sometimes forget just how much our hobby is capable of inspiring awe and wonder. For many of us, we're 'naturalists of the night', more inclined to quiet contemplation of the stunning beauty of the night sky.

I came into astronomy because of a fascination with the US and Soviet space programs, and it was this interest that changed quite quickly into an intense interest in Space and a fascination in things astronomical. It was the incredible distances, sizes, densities, and other numbers that (in the vernacular of the day) blew my mind. It was seeing my first (partial) solar eclipse in 1966 that a curmudgeonly teacher (born when Victoria was still on the throne) reluctantly let me have the morning off to watch...but only as long as I kept notes. I used a 4" F/8 telescope that my parents had bought from a neighbour in Liverpool...the mirror was made of port-hole glass. I still have the telescope. After that, I was hooked, and saw two more partials before my first Total eclipse in 1972 in the Gaspe Peninsula.

I digress...what happened in Burlington during one of the sessions was that I showed a picture (taken by Gary Colwell, if memory serves) of M82, and said that it seemed most likely that a black hole lurked near the centre of the galaxy. Hands shot up throughout the audience, and the discussion wandered all over the place as we veered massively off-topic. It was, however, a lot of fun.

I must admit that at one time I could have quoted the density of the average white dwarf, and the mass limits of neutron stars, the extreme gravity found at the surfaces of such exotica, and other such numbers. It didn't matter much, as a couple of the kids in the audience knew, and they were happy to divulge this data, rather than wait for me to look it up in the Observers Handbook.

When we do these next, I'm going to make sure I build in time to talk about these things. I'll make sure that my notes regarding some of the objects I talk about, and show pictures of, appeal not just to those who contemplate the night sky, but also reference the truly staggering. For instance I should take a black and white TV with me, and tune it so that only static is showing. I recently saw a statistic that said that approximately 10% of the static on a TV screen was attributable to the 4K microwave radiation that is left over from the Big Bang.

We often think that we need large radio telescopes and massive computers to detect what must be faint signals left over from an event that happened 13 billion years ago, but it's quite humbling to think that all you need is an old TV! Of course, if you want to turn that noise into signal, then you do need the extreme hardware!

As you may be able to gather from the front cover, I've started playing around with web cam astronomy again. About ten years ago, I hooked up an old video surveillance camera to a VCR, and was astonished with what I could capture. I managed to cobble together a crude video capture system using an old Pentium PC. With this, I was able to go through, frame by frame and pick out the occasional sharp frame. Considering that this was captured on to video tape initially, the resolution was not the best, but it was far better than the equivalent pictures that people were capturing using 35mm slide or negative film. In fact, they were far better than anything available in book form taken from some of the planets best telescopes. There were, of course, rumours of pictures that had exquisite amounts of detail from the US Naval Observatory 61" telescope, but these were not published, or perhaps it was the publishing process that was not very kind to them?

I bought an old version of Maximum Entropy from the swap table at Starfest, and then started capturing images to the computer directly, eliminating videotape as an intermediary.

I saw Joe O'Neil of London use a Connectix QuickCam to capture images to a laptop, but his images only had 6 bit depth (64 shades of grey). This wasn't to last long, as I found a source of Philips 690K web cams, that worked in colour, and with that set up, along with some free software called Registax (Version 1), I produced a SkyNews picture of the week—<http://www.skynews.ca/pow/pow31.jpg> .

Well the intervening years have produced better cameras, faster connections and computers, and vastly improved software, and apart from managing to capture Phobos and Deimos with a web cam in 2003 (with Les Nagy), I've been playing with other stuff.

What's happened recently is that I purchased a QHY5 CCD camera for autoguiding, but it turns out to be a very sensitive monochrome camera. You can vary the exposure length from 1 millisecond up to about 10 seconds, and the gain can be adjusted, too. There are a few other advantages, too, like the size of the chip—it's a half-inch chip rather than the quarter inch ones I've used in the past; it's resolution is 1280x1024; the data stream is uncompressed; it's a USB 2.0 device, and it has square pixels. The only downside is that it's a CMOS device, rather than a CCD, but that is far less of a problem than it used to be.

So, the other night I decided that I'd give it a try imaging the Moon. There are a couple of odd things about the camera, such as having a bright area at the bottom of the image when exposures are shorter than about 85 milliseconds, but that's what makes playing with new equipment so much fun.

Finding objects was a lot easier with the big chip, but the biggest problem was that I had to use a very short exposure time, and my images had a bright section, like the image to the right. I've since found that this is caused by a "rolling shutter", and that there is a firmware fix for the problem, or I can change the video capture software I use. I may end up doing both. With the Moon being high in the sky in the evenings, particularly when it's near to being full, it seems like this is a good time to play with modern marvel.

When I get some time, I'm looking forward to contrasting the QHY5 with my Philips ToUcam. I'm also curious as to how well the camera will perform on the back end of the Centre's 16" RC.

Clear skies, one and all,

Roger Hill
Orbit editor and President.



The Sky This Month - December 2009 By Gary Boyle, Saskatoon

Perseus The Hero

With sunset nice and early this time of year, one can begin observing after supper hour; just don't forget to help with the dishes. Rising high in the north east is our Hero of the night. In last month's article we saw how Perseus saved Andromeda moments before she was to meet her fate with the Sea Monster Cetus.

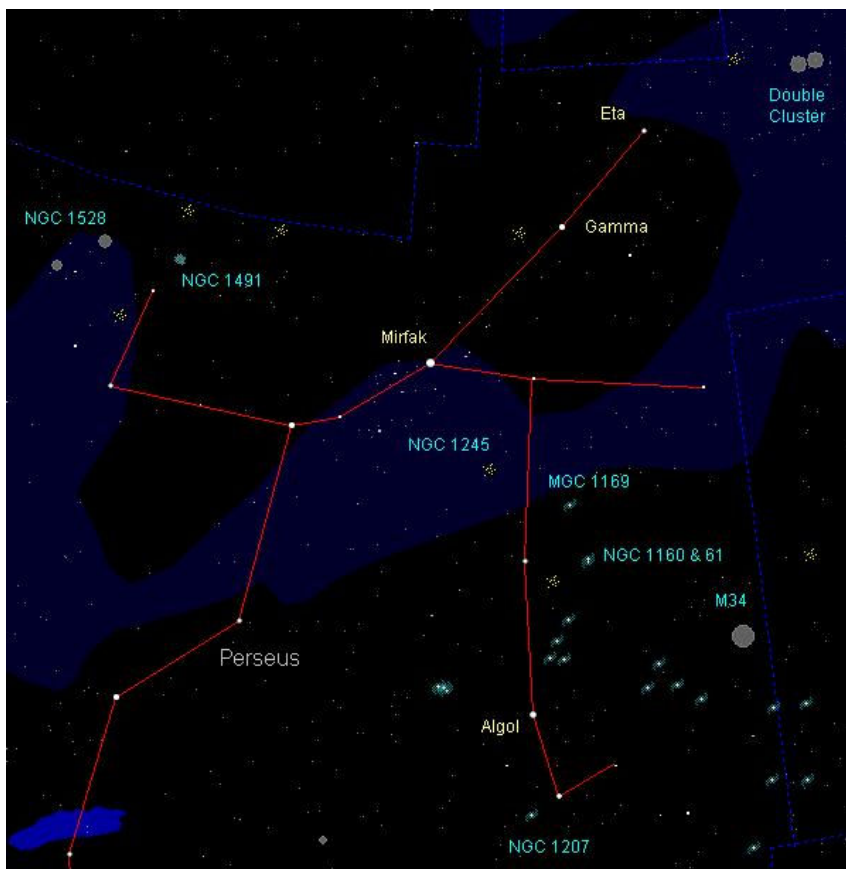
When looking at Perseus, the brightest star to greet you is Mirfak (alpha Persei). The apparent magnitude for this F5 supergiant is listed as 1.75. However, even at its estimated distance of 590 light years, its absolute magnitude is -4.5. This means if Mirfak were 10 parsecs or 32.6 light years from us instead of its true distance, it would be as bright as the planet Venus. Mirfak's surface temperature is around 6,500 degrees Celsius with a luminosity 5,000 times that of our Sun. It measures 64 times the Sun's radius.

Another star that is slightly fainter is Algol – aka the Demon Star. In mythology, Algol signified the Medusa. It holds the term Beta but with a twist. Algol is a very close eclipsing binary star system. A larger orange K giant star crosses in front of the smaller but brighter blue-white star. The magnitude range shifts from 2.1 to 3.4 over a very short period of only 2.87 days. If you have good weather, you can glimpse two complete cycles in a week.

The famous Double Cluster is also located within the constellation's borders. Glimpsed by the naked eye on moonless nights, binoculars or a telescope will reveal a wealth of bright stars appearing in side by side open clusters. These loose clusters catalogued as NGC 869 and NGC 884 are estimated to lie some 7,100 and 7,400 light years respectively. When glimpsed through a large telescope from dark skies, they take on the appearance of brilliant diamonds on black velvet. They squeeze nicely in a wide angle eyepiece.

M34 is a rich open cluster. A little larger than the full Moon in area, it contains about 100 suns and is a naked eye object from the suburbs. This magnitude 5.2 swarm lies 1,400 light years from us and is thought to be 14 light years wide. Its age is estimated at 180 million years. NGC 1528 is another dense cluster of stars but just out of naked eye range. Now move your scope 2 degrees west and find NGC 1491. This is an emission nebula; commonly called a stellar nursery where new stars are forming is some 8,000 light years from us.

For astrophotographers, the California Nebula is a good challenge. Rick Wagner of the Ottawa Centre provides us with a great photo (Next page) showing lots of subtle detail. Catalogued as NGC 1499, the California is also an emission nebula. It was discovered by E.E. Barnard in 1884 and resembles the state of California. It is about 1,000 light years from us.



The Geminid Meteor is one of the most graceful displays of all showers. Moving at only 35 km/sec, you should have a chance to spot these meteoroids as they vaporize some 80 kilometers above us. Another bonus is the new moon occurs two nights after the peak so dark skies are a plus. The shower peaks on the night of the 13th and 14th when Earth passes through a stream of debris from extinct comet 3200 Phaethon. The annual count is usually 120 meteors but could be a higher. By contrast the Ursids only produce 10 meteors per hours on the night of the 21st.



The elusive planet Mercury will reach its highest point of 20 degrees in the western sky on the night of the 18th. Be sure to look for it just after sunset. Moving up the ecliptic is Jupiter. On December 1st, the King of planets is 780 million kilometres from us and receding. At that distance, its light takes over 43 minutes to reach us. A few events occur on the 21st. First look for Neptune one lunar width above Jupiter. Adding to the Kodak moment, a 23% crescent moon will be to the upper left. Also the planet Mars will become stationary in its orbit and appear to move westward against the stars. This dance is a tell tale sign that planet Earth is about to overtake the Red Planet in time for its closest approach next month. This will also be the night of Winter Solstice.

We end off the year with all things – a Blue Moon or the second full moon in the same month on New Year's Eve. The last time this occurred was in 1990 and will not occur until the year 2028.

Well Christmas is just around the corner and you might be thinking of purchasing that special telescope for yourself or someone else. The telescope market has grown over the past decade with more automated, computer driven scopes, CCD cameras as well as numerous eyepieces and accessories. Of course we always want to save a few dollars but those department store cheap telescopes should not be on your list. Search for reputable telescope dealers that know what they their trade and can help you make that difficult choice. This could be a once in a lifetime purchase. You also contact your local Centre members for their advice.

Have a happy and safe holiday season.

Till next month, clear skies everyone.

Sidewalk Astronomy is run by Mark Pickett.

We'll be having a Sidewalk Astronomy event at Westfield Heritage Village on three successive Saturday nights in December: the 5th, the 12th and the 19th. We'd like three or four telescopes for each of the three nights, so if you can help out Mark, please get in touch with him.

Westfield is a fascinating living history museum featuring over 35 historic buildings surrounded by 324 acres of unspoiled natural woodlands and meadows with several well marked nature trails and a rare T.H. & B. Steam Locomotive. The village is located in Rockton—<http://westfieldheritage.ca/>. If you've never been, now is a great chance to go!

Mark went to Westfield on November 26 for a media event, but poor weather saw most people bow out. Unfortunately, CHCH, CTV and Global were missing from the event. Santa looked through his telescope, so perhaps some pictures of the event will surface in local papers, like Cambridge or Brantford. If anyone spots anything let us know.

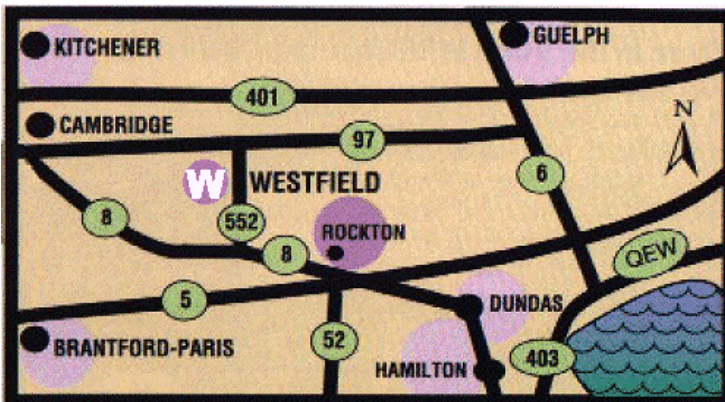
Mark checked out the site and found a good site near the bandstand, with a southern exposure. There is lots of room, but fireworks at 6:30 near the bandstand means a potential problem with space in some areas. He will check further and

He also checked out when we should arrive, and found out that the telescopes have to be in place before 5 pm, when the gates open. At 9 pm, the gates close and after that, the telescopes can then be disassembled and loaded up.

Mark will be there for all 3 nights, and he could use some help. Our esteemed editor (there's a first time for everything—ed.) will only be able to make the final night, so we'll need some other people to help us out. Anyone saying that are with Hamilton Centre of the RASC, and involved with the star party, will get in free. In fact, the wives/husbands/kids will get in free as well.

This is a great idea! Help make it work!

Mark



FROM HAMILTON:

Follow Hwy. #8 north-west through Dundas, cross Hwy. #5 and continue to Kirkwall Road (also referred to as Regional Road 552), just past Rockton. Turn right and follow 1.5 kilometres.

FROM TORONTO: Take QEW west to Hwy. 403. Turn north on Hwy. #6 to Hwy. #5. Turn left on Hwy. #5 and then right on Hwy. #8 to (Kirkwall Road (also referred to as Regional Road 552) just past Rockton. Turn right and follow 1.5 kilometres.

FROM CAMBRIDGE

Follow Hwy. #8 south-east to Kirkwall Road (also known as Regional Road 552). Turn left and follow 1.5 kilometres.

FROM BRANTFORD

Follow Hwy. #24 north to Hwy. #5 east (turn right). Travel through the Village of St. George. Several minutes along Hwy. #5, turn north (left) on Woodhill Road (just past McCoy Foundry). Cross over Hwy. #8 on to Kirkwall Road (also known as Regional Road 552) for 1.5 km to Westfield.

Sandtrapped Rover Makes a Big Discovery

December 2, 2009: Homer's Iliad tells the story of Troy, a city besieged by the Greeks in the Trojan War. Today, a lone robot sits besieged in the sands of Troy while engineers and scientists plot its escape.

Welcome to "Troy" – Mars style. NASA's robotic rover Spirit is bogged down on the Red Planet in a place the rover team named after the ancient city.

So why aren't scientists lamenting?

"The rover's spinning wheels have broken through a crust, and we've found something supremely interesting in the disturbed soil," says Ray Arvidson of the Washington University in St. Louis.

Spirit, like its twin rover Opportunity, has roamed the Red Planet for nearly 6 years. During that time, the rover has had some close calls and come out fighting from each. In fact, it's been driving backwards since one of its wheels jammed in 2006.

Right: Spirit surveys its own predicament. The bright soil pictured left is loose, fluffy material churned by the rover's left-front wheel as Spirit, driving backwards, broke through a darker, crusty surface. At right is the least-embedded of the rover's six wheels.



From the beginning, the rovers' motto has been "follow the water." Both rovers have been searching Mars for minerals formed in the presence of H₂O. Mars appears dry today, but minerals can provide clues that water was once there.

"It's been easy for Opportunity to find such minerals," explains Arvidson. "Opportunity landed in an ancient lake bed. Spirit has had to work much harder. Spirit landed in basaltic plains formed by lava flows chewed up by repeated meteoroid impacts. There's been little evidence of anything that was ever very wet."

But when Spirit reached an area of Mars called the "Columbia Hills," the whole complexion of the mission changed. "Spirit came across iron hydroxide, a mineral that forms in the presence of water. That alerted us to the change. We started coming across more and more rocks formed in the presence of water."

Then Spirit got stuck in a patch of loose soil on the edge of a small crater. Heavy sigh. Stuck again.

But wait!

"Spirit had to get stuck to make its next discovery," says Arvidson.

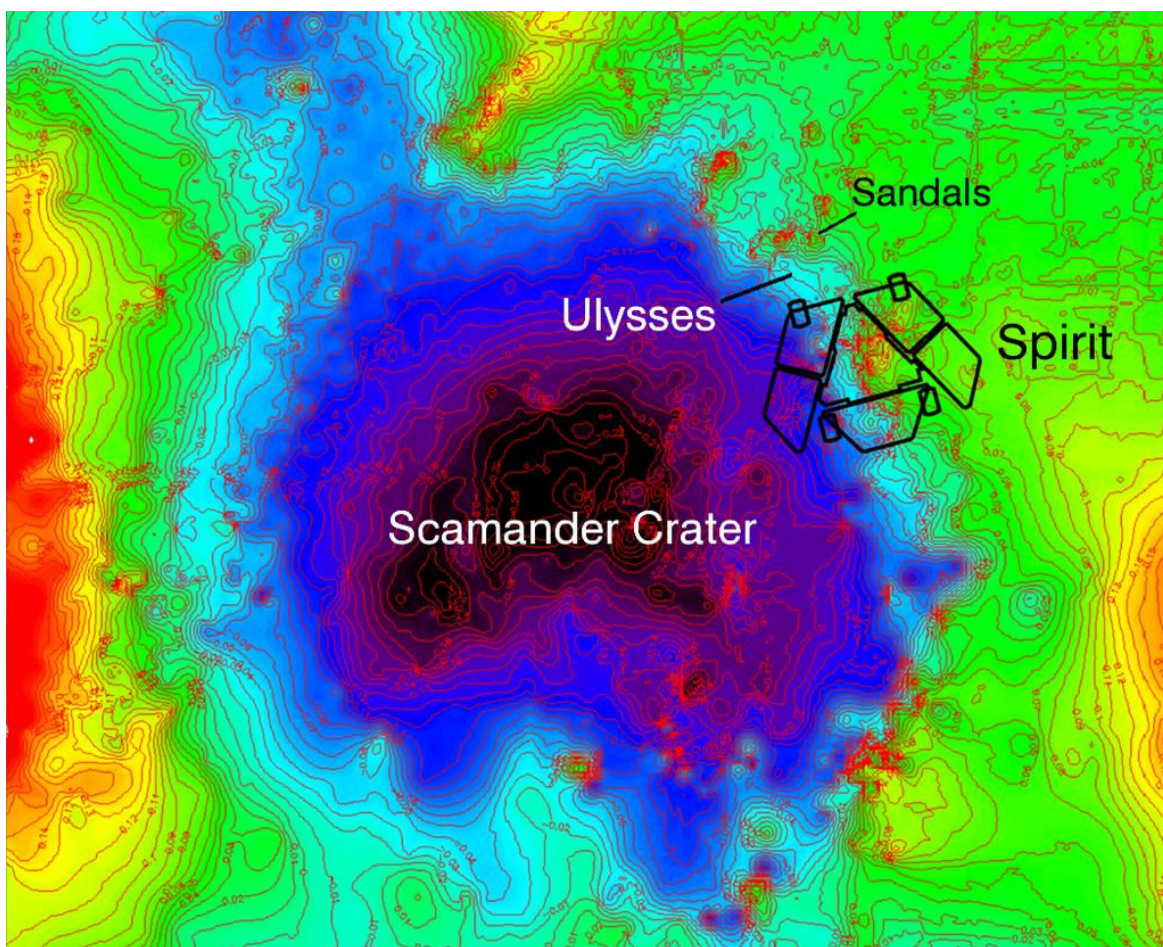
As the rover tried to break free, its wheels began to churn up the soil, uncovering sulphates underneath.

"Sulphates are minerals just beneath the surface that shout to us that they were formed in steam vents, since steam has sulphur in it. Steam is associated with hydrothermal activity – evidence of water-charged explosive volcanism. Such areas could have once supported life."

"And most amazingly, the boundary between the sulphate-rich soil and the soil with just the generic concentration of sulphates runs right down the middle of the stranded rover. Spirit is lodged on the edge of a crater -- sitting astride the boundary!"

Right: A topographic map of Spirit's surroundings at Troy. Spirit is straddling the edge of a small crater. Sulphate materials are located in the crater (from the middle of the rover and extending to the left). The topo map was generated from stereo images taken by Spirit's navigation camera when it was approaching the area in April 7, 2009.

"Also, the robot found that the top of the sulphate material is crusty. Ancient sulphates probably formed this crust as they were processed by variations in climate associated with changes in Mars' orbit over millions of years."



Here's what the scientists think: When a Martian pole faces the sun in Martian summer, it gets warmer at that pole and the water ice shifts to the equator. It even snows there! Warm dark soil under the snow causes the bottom layer of snow to melt. The water trickles into the sulphates, dissolving the water-soluble iron sulphates and forming a crust with the calcium sulphates remaining.

"By being stuck at Troy, Spirit has been able to teach us about the modern water cycle on Mars." Indeed, Spirit's saga at Troy has given scientists material evidence of past water on Mars on two time scales: ancient volcanic times, and cycles ongoing to the present day.

"We've sat here for more than 6 months. That's a long time to take measurements. We've learned a lot. Troy is a good place to be under siege, but we're ready to leave."

Will Spirit break free to continue its incredible journey? Tune in to Science@NASA to find out if the escape plan works.

Author: Dauna Coulter | Editor: Dr. Tony Phillips | Credit: Science@NASA

Ivan Semeniuk's Embedded Universe

Going out in style: How a white dwarf becomes a supernova. (Alliance Center for Astrophysical Thermonuclear Flashes, University of Chicago)

What do exploding stars and presidential politics have in common? The two come together in the person of Donald Lamb, a University of Chicago astrophysicist and director of the “[Flash Center](#)”, where researchers study thermonuclear detonations in space.

Lamb also lives in Hyde Park, the Chicago neighbourhood that has become world famous thanks to another long time resident, Barack Obama. Lamb became an early supporter of the current president going back to Obama's state senator days. He joined the presidential campaign in 2007 and soon became identified as one of the prominent scientists who helped sell Obama to the research community. After the election he was part of the transition team that helped shape the new administration's science and technology agenda.

In the latest episode of [The Universe in Mind](#) podcast, Lamb speaks in detail about his experiences on the campaign trail and about Obama's attitudes toward science. He also speaks about his own area of expertise: Type Ia supernovae, and shares some recent insights into how these cosmic H-bombs work.



Type Ia supernovae have become increasingly important because they are the brilliant standard candles that allow astronomers to measure the distances to galaxies halfway across the universe. A decade ago such measurements led to the discovery of dark energy, the enigmatic phenomenon that is causing the expansion of the universe to accelerate.

Lamb (seen, left) and his colleagues are concerned with exactly how these explosions unfold. It's a science of extremes, involving events of unimaginably high energy playing out over fractions of a second.

One of the most surprising discoveries to come out of this work is that Type Ia supernovae can be thought of as exploding from the outside in. This kind of supernova always occurs in a close binary system, where gas from one star can spill over onto a white dwarf companion. A white dwarf is already about one million times more dense than the Sun. The additional material increases the pressure and temperature in the white dwarf's interior until spontaneous bubbles of nuclear

burning begin to form.

Lamb was part of a team that did the first full 3-D model of a white dwarf exploding under these circumstances. What they found was that the little flame that starts somewhere inside the white dwarf rises very quickly, like a hot air balloon. In an instant it is already at the surface of the star. There, gravity confines it like an invisible lid, so the burning front then races across the surface of the white dwarf and meets itself on the far side. The shock that results is what turns the burning into an all-consuming detonation. You can watch a [video](#) that shows this scenario in action, and it's quite a spectacle.

It's a big change from how these dramatic explosions were once envisioned. And according to Donald Lamb, it's change we can believe in.

Astrophotography truisms:

1. Lodriguss' Laws It's always clear at full moon.
2. If it's completely clear all day, it will be cloudy that night.
3. Three mutually exclusive things: not having to go to work the next day, no clouds, no moon.
4. If it's clear with no moon, it will be bitterly cold and the wind will be blowing like a hurricane.
5. While manually guiding, the mount will track perfectly forever, until you look away for a second.
6. The guiding reticle battery will always die just past the half-way point of the exposure.
7. If you hear a strange noise and startle during an exposure, you will always bump the scope, and ruin the photo, and it will always be just before the end of a two hour exposure.
8. Any speck of dust or dirt inside the tube assembly will end up on the film's emulsion side during the exposure
9. Perfect polar alignment means you will kick the tripod leg in the dark.
10. Perfectly guided two hour exposures will be taken on x-sync shutter setting.
11. Perfectly guided photos will be out of focus.
12. Perfectly focused photos will have field rotation.
13. Perfectly aligned, focused, guided, and exposed photos will be ruined by the lab.
14. No amount of planning, practice or expertise can replace dumb luck.

Now, some of the above are pretty old, and really need to be replaced. For example, perhaps #6 should read:

5. The USB cable in your autoguider will fall out when it shrinks in the cold
6. The battery for your dew heater will die quite some time before you notice water dripping off the corrector plate.

And how about:

13. You will only realize you didn't save the exposures to the laptop seconds until seconds after re-formatting the memory card in the camera.

There's a couple more in there, like numbers 8, 10 and 11, that are now (mercifully) things of the past.

Please, send me some suggestions of what to replace them with!

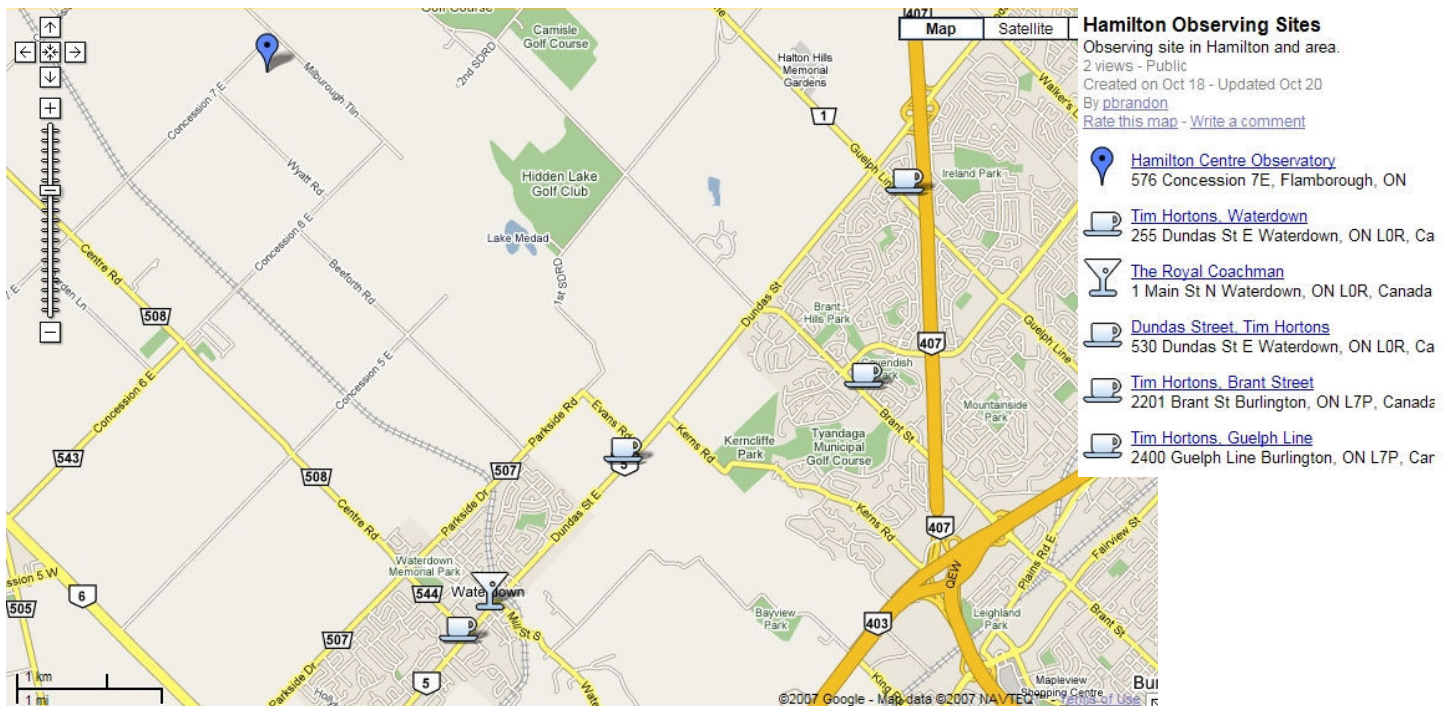
What you missed last Month!

Actually, you'll have to let me know as I missed it too. Since my team and I are responsible the hardware in several million square feet of warehouse space, in multiple buildings across Canada, I have to work the occasional Thursday evening, and this was one of those times. This was a shame as I had tried to get Phil Mozel for a long time, and when that finally happens...I can't be there!

Ah well...such is life!

Here are some pictures, though, from some recent work parties that have taken place at the Observatory.





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Front Cover and What you Missed pictures by Roger Hill

I had a few requests to print the words to Eric Idles song about the Galaxy...so, here it is:

Whenever life gets you down Mrs. Brown, and things seem hard, or tough
 When people seem stupid, obnoxious or daft, and you feel that you've had quite eno-o-o-o-ough...

Just remember that you're standing on a planet that's evolving and revolving at 900 miles an hour,
 It's orbiting at 19 miles a second, so it's reckoned, the sun that is the source of all our power.

The Sun and you and me, and all the stars that we can see, are moving at a million miles a day,
 In the outer spiral arm, at 40,000 miles an hour, of the Galaxy we call the Milky Way.

Our Galaxy itself contains 100 billion stars, it's 100,000 light-years side-to-side,
 It bulges in the middle, 16 000 light-years thick, but out by us it's just 3 000 light-years wide.

We're 30,000 light-years from galactic central point, we go round every 200 million years,
 And our galaxy is only one of millions of billions in this amazing and expanding universe.

The universe itself keeps on expanding and expanding, in all of the directions it can whizz,
 As fast as it can go, at the speed of light you know, twelve million miles a minute, and that's the fastest speed there is.

So remember, when you're feeling very small and insecure, how amazingly unlikely is your birth,
 Pray that there's intelligent life somewhere up in space, because there's **bugger all** down here on Earth.