

A large, white, circular radio telescope dish is the central focus of the image. In the foreground, a person wearing a hat and a dark jacket stands with their hands on their hips, providing a sense of scale. The dish is mounted on a complex metal structure with various platforms, ladders, and railings. The background shows a clear blue sky and a reddish-brown desert landscape with some hills in the distance. In the top left corner, there are two overlapping circles, one blue and one green.

Orbit

The Official Publication of
The Hamilton Centre,
Royal Astronomical Society of Canada
Volume 48, Issue 6: April, 2016

Issue Number 6, April, 2016

Roger Hill, Editor

A message from the President—Gary Bennett

News of Note

A few months ago we announced our 5-year strategic plan and one of the highlights of the plan was to take our public outreach agenda to a new level by building a world-class planetarium. Shortly after that announcement we met with the Royal Botanical Gardens to gauge their interest in a joint venture. Just last week we had a follow-up meeting and got confirmation that RBG is definitely “IN”.

We have a lot of hard work ahead which will begin with developing a Business Plan. That process will likely take 9-12 months. The next hurdle will be to gather the Stakeholders (a board) and begin the process of securing the needed permits. Construction will be the easy part for sure!

Date for premiere “first light” performance? Probably 6 years (Fall 2022) and it will be well worth the wait!

Observatory Improvements

In case you missed the announcements, we have “motorized” the roll-off roof! A big thank you to David Surette who is now qualified to be a professor at MacGyver University.

Our C14 and CGE Pro mount is now fully operational:

New Telrad Finder – no batteries required. We rigged it to be powered from the 12V so no more dead batteries!

New computer monitor and video card

Guide Scope and camera – ready for action!

Some Really Fun Public Outreach Events – RBG, Flowers by Moonlight and Luna Events

We have been invited to participate in a series of fun events at the Royal Botanical Gardens. From April 30 – through July RBG has 7 events featuring all things natural on Earth and in the Heavens. We will be on hand to tackle the “heavenly” part of the program.

We will be asking for some volunteers to take part. Food and refreshments are part of the perks. The event times range from 7:00-10:00 PM. The sky will not be fully dark so we’ll be concentrating on the Moon and Jupiter. That means you don’t need to be an astronomy pro! Beginners are welcome! We will post a formal sign-up in the next 10 days.

AstroCATS Volunteers Needed

We need 10 people for 2 days (or 20 people for 1 day) on May 21 & 22. This is a much smaller number than previous years because this year, AstroCATS is part of the RASC General Assembly being held in London ON. As such, RASC London is providing most of the volunteers, but we still need a few more.

Andy Blanchard has arranged for overnight accommodations. Contact Andy for more details.

A Big Thank you to Ed Mizzi

Ed Mizzi gets the Public Outreach Grand Prize! Ed has been busy mentoring the next generation of astronomers. Ed hosted several Scout events in the last month with the help of Muhammad Ahmad. Ed is a former teacher and now gets to spend his time doing what he loves most. Ed has the special gift of making boring science so much fun for our youth. I think he should start keeping track of how many Scouts now have their Astronomy Badges & Stars thanks to his efforts.

Chile, Te Amo by Roger Hill

I'm still trying to sort out the impressions of Chile that I was left with when I travelled there for Les Nagy's wedding last month. So, rather than try to distill what happened, and because I need to fill space in Orbit, I'll just have to tell the story piecemeal.

I left Canada on Wednesday, March 9, and arrived in Santiago on Thursday morning, stopping at JFK in New York for a connecting flight (I managed maybe 2 hours of sleep on the plane). After that, I took a flight from Santiago to Calama, where Les picked me up. It had been a few years since I'd seen him, and so it was a joyous re-union. Then, off to San Pedro de Atacama, noting a few changes along the way (the wind-farm is new). I quickly unpacked and gave Les his goodies (maple syrup, Timmies coffee, etc.), and we had a bite to eat. We also sampled the Scotch I brought (Talisker Dark Storm, and a 12 year old Bowmore).

Les had a group of tourists that night (he gives talks on Astronomy for San Pedro de Atacama Celestial Explorations—www.spaceobs.com), and invited me along. As we headed out, I put my camera on top of Les' pickup truck, and had it take 30 second exposures (and 30 second dark frame) until the batteries ran out. Each tour takes about 2 hours and consists of a 45 minute long introduction to Astronomy, 45 minutes of looking through telescopes and a half-hour for questions and hot chocolate. Les asked me to help out, and I did, where I could. Les gives a good talk, and it was certainly enjoyable being under the amazing Atacama skies again. After the tourists were gone (two groups, that night), we enjoyed the 72cm (30 inch) telescope, looking at Omega Centauri, Centaurus A, the Tarantula and Eta Carina. About 3am, Les noted that the seeing had suddenly improved, and so we swung the big Dob toward Jupiter.

How many times in your life has a view through a telescope taken your breath away? This was one of those times. The edges of the belts were feathery, there were pale spots in the bands, and detail within the belts. I wish I'd thought to examine the moons for detail, but I was entranced by what I was seeing. Shortly before 4am, we ended the astronomy portion of the evening, had a Scotch and I climbed into bed. Minutes later, a M4.8 earthquake occurred. Relatively close, according to Les because there was only up and down motion!

On Friday, the 11th, we gathered up lunch, water and cameras and headed off to the Rainbow Valley. We met wild herbivores, and domesticated llamas, but as with the last time I was there, it was the landscape that was the star of the show. If you like lush, verdant vistas, then Chile is not for you, but it is one spectacular place. Supper again, and Les had another tour to do. This time, though, he set me up with his mount so I could do some astrophotography.



Little did I know it, but Saturday was going to be an amazing day, in so many ways.

You see, not only does Les do tours at night for S.P.A.C.E., but he also is one of the guides at ALMA (the Atacama Large Millimetre Array). Because of this, he'd managed to sweet-talk the powers that be into getting me up to the site of the antennas, on the plain of Chajnantor, 5,000 metres above sea level. First, though, I had to pass a medical. Also going up to the high site that day was a group of Chilean University Film Studies students doing a final project. Les took me around the various lower installations while we waited for the film crew. We examined the giant crawlers that move the antennas around on the observing site, and I got to sit in one of them.



We wandered around, checked out the control room, saw the UV Exposure meter (Extreme!) and realized that we'd forgotten to bring jackets with us. I remembered to bring a hat...the last time I'd been at those sorts of altitudes, I'd got a very bad sunburn. However, we were going up another 2.5 kilometres in altitude, and that meant a 25° C drop in temperature. Our wonderful guide, Thais Mandiola, managed to scare up a couple of spare jackets for us. First, though, I had to pass the blood pressure test.

I failed. So, they had me lie down, relax, breathe deeply, and tried again...close, so we tried one more time, and I passed, but by the thinnest of margins. I think Les may have said that he'd keep an eye on me, checking my pulse and oxygenation levels every few minutes. The entire group was instructed in the use of oxygen bottles, the signs of altitude sickness, and off we went.

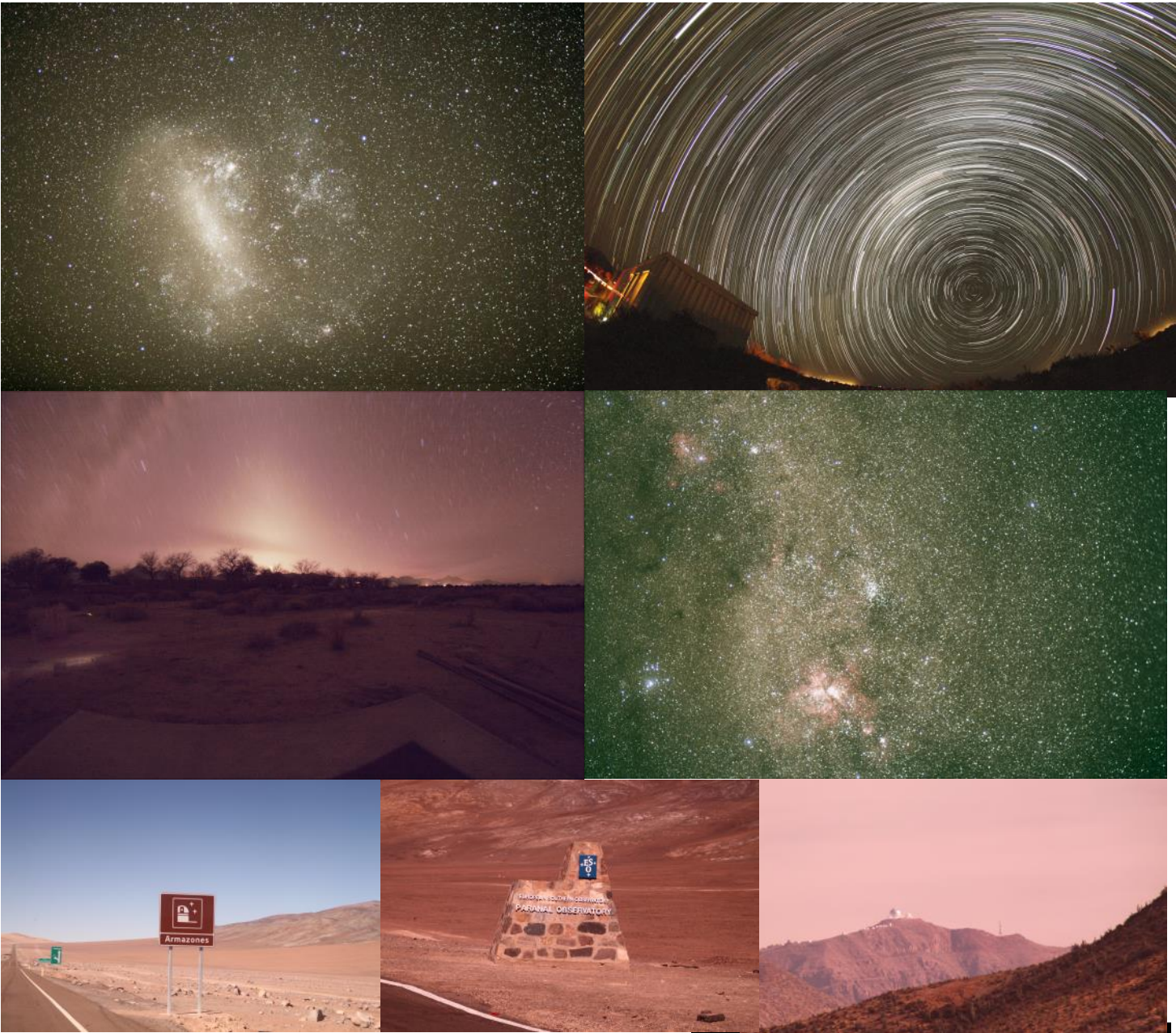
It's a 30 kilometre drive from the main administrative areas to the Array Operations Site, or AOS, where the antennas are located, with Thais and Les being very observant, looking for any signs of distress. When we reached the AOS, we got out, checked in with Security, had a look at the computer room, had some juice and cookies, and out we went. I have used the term otherworldly when trying to describe the Chilean landscape, but nothing else fits. I've been lucky to have seen arid Arizona, the Grand Canyon, dry and dusty Texas, the almost tundra-like peak of Mt. Washington, and the ancient volcanic landscape of Northern Ireland, but there is nothing I have ever seen that matches the desolation of the plain of Chajnantor coupled with the antennas of ALMA. It was brutally cold, with a wind gusting at around 70 kph. I used the oxygen bottle because I really felt the altitude this time. I even had to take a bit of a break to get out of the wind and cold. She and Les and I listened to some Pink Floyd's Dark Side of the Moon (Breathe...the track seemed more appropriate there than any other time I've ever heard it) while the film crew worked outside. My oxygenation levels stayed within tolerance, as did my heart rate, so I was OK. Not so with one of the others, though. He was starting to get very confused and it was decided that it was time to leave the peak and get him down to some thicker air. First stop, though was at the AOS, where some medical facilities exist. He was given oxygen and told to lie down. Another of the film crew was also starting to suffer, too, so they were put under observation and given oxygen. This delayed our leaving the high site. We should have been up there for no more than 2 hours, but by the time everyone had recovered, it had been almost three hours. Safe and sound, though, we all arrived back at the main site, thanked Thais, and headed back. Les gave me his official ALMA hat (has a spare or two), and thus ended part one of one of the great days in my astronomical life.

We had supper in town and when we got back, we grabbed a couple of chairs, a couple of glasses, some spring water, the Bowmore, and headed outside to Les' observing pad. I showed Les how I could connect my camera up, wirelessly, to a small 7" HP Slate tablet, using a TP-Link MR3040 portable router. He lent me his 85mm Canon F/2 lens and after that, we took pictures of the LMC, Orion, the Southern Cross, eta Carina and more.

As the stars wheeled over, punctuated by the occasional meteor, the flash of a green laser from SPACE next door, and the sound of the camera shutter, we shipped Scotch into the wee hours of the morning. The Zodiacal band was seen and the Gegenschein glimpsed, and we got caught up on six years of friendship.

All in all...just possibly the finest day of my astronomical life.

On Monday, March 14, we drove down to La Serena. 14 hours, and we passed by some observatories that are names to conjure with: Paranal, Cerro Armazones, La Silla, and Cerro Tololo. Places I could not get to on this trip...but there's a total solar eclipse there in 2019...



I should also note that at Les' wedding (the real reason I was there), I sat next to astronomer Alain Maury, but I also got a chance to chat with a young guy who is studying to be a professional astronomer. It seems, with all the telescopes down there, that Chile does not use all the time allotted to them. Gotta love a country where Astronomy is a growth industry!

I also missed part of the wedding because I was outside, photographing the Moon, which appeared to be upside down!

Top Left: The Large Magellanic Cloud. Top Right: Star trails. Middle Left: Zodiacal light. Middle Right: Eta Carina area
 Bottom Left: The sign for Cerro Armazones. Bottom middle: Entrance to Paranal; Bottom right: La Silla in the distance. Bottom-most: The Moon from La Serena, March 19, 2016



It Was “Worth the Drive to Acton”: Girl Guides’ Astronomy Lesson by Ed Mizzi

I regularly visit both Elementary and Secondary schools with my astronomy presentations. One of the schools is called Christ the King Secondary School and it is in Georgetown. Well, it just so happens that one of the teachers I know there has a son in the Acton Scout group and asked if I could do my astronomy lesson at one of their weekly meetings. Of course, like so many amateur astronomers, I have a tough time saying “no” so I accepted the invitation. I met with that group back on Feb. 9, 2016, and at the end of the session, the leader told me that his wife was a leader of the Girl Guide group in Acton and was also interested in my talk.



So, up I went to Acton again, this past Mon., March 21, and facing me were 19 energy filled young ladies, keen about astronomy. We began at 6:30 PM and because the sky was totally cloud covered when I arrived, it did not look promising that we would have a chance to observe anything. So I went on with the lesson.

I began with my typical oral quiz about our Solar System, and as with most groups their ages (9 – 12), they knew more than most people would imagine. And, as with most groups there are always a couple of “ringers” who seem to know more than they should at their age. One of the girls had her hand up for almost every question and when I called on her she always had the correct answer. At one point, I asked her how she learned what she knew and she looked at me and, with no fanfare and a humble, monotone voice, she simply said, “reading”.

I then gave them a simple fill in the blank quiz and we went through the answers together. Then I showed them some slides of images I had taken and then images of the relative sizes of objects within and outside of our Solar System. They seemed quite interested and asked many questions and shared several stories with the group.

I then used the program Stellarium to display the night sky as it would appear if it was clear out. I also explained how to find the North Star using pointer stars and showed them other constellations.

We were just about to discuss binoculars and telescopes when one of the leaders (who I had monitoring the sky) came running in to tell us that things had totally cleared up (so much for forecasts?). I’m sure that I was more excited than the girls and I quickly carried out one of the Club’s 8” Dobs, set it up and with the help of the leaders lining up the children, I was able to show them Jupiter (incl. 4 moons) and the Gibbous (almost full) Moon. I heard lots of oohs and awes and I was so pleased that we were able to observe that evening. For me, that’s what I call being “high”!!!

We finished the night by taking a few photos of the group and I was presented with a beautiful card and box of Girl Guide cookies...yes!

Of course, if I had originally said no to these Scouts and Guides, I would have saved two trips up to Acton, the petrol and been able to spend the evening in the comfort of my home in Waterdown. But, in hindsight, absolutely nothing can replace the feeling of satisfaction and gratification that comes with teaching young, eager minds and seeing the smiles on their faces...because they have had an experience they may never have again.

The Chil 26th Hamilton Cub Pack visits the Observatory by Ed Mizzi

Gary Smith is the leader of this Cub Pack. He visited the Observatory over 20 years ago and wanted to see it once again, but more importantly, he wanted his Cubs to experience a first-rate facility and learn about the night sky. We began the evening at 7 PM and I have never before seen the meeting room as full as it was on Tuesday night. Gary indicated that he typically gets 7 or 8 Cub members out to their meetings but this night all but one of 12 Cubs showed up, their parents bringing them all the way from the Hamilton Mountain in the rain...an encouraging sign that astronomy is still a big draw!

I began by introducing two members of our club, myself and Muhammad Ahmad, and explaining that our club's most important mandate was to help others learn about astronomy and that we do so via Outreach Programs such as this. I then fired several questions at the Cubs (8 – 10 yrs. old), most of them dealing with our Solar System, and they answered almost all of them. As I am accustomed to during sessions like these, there are always one or two children who know all of the answers, and more, the result of reading on their own or being inspired by parents, teachers and/or friends. I then showed them several slides of images I had taken and very briefly discussed how that is done. But I always explain to them that their focus should be on observing the sky, first with their naked eyes, then with binoculars, and finally (if they are serious) with a "good" telescope. I showed them more slides in an attempt to give them a sense of scale and size within our solar system and they seemed very interested.

Muhammad and I then led them through a couple of competitive astronomy games and gave prizes to winners. Following that I explained how binoculars worked and what to look for when purchasing them. I was thinking to myself that, with parents in attendance, a future birthday might include binoculars as a gift.

We then described how telescopes worked, the two basic types and the differences between them. Time was waning and, regardless of the poor weather, we still wanted to walk them through the Observatory. So everyone got their coats and hats on and gathered around the two scopes. Both the Cubs and the adults were amazed at our equipment and several questions ensued. On their way out and to their cars, we received many, many thank yous and very positive statements about the session. Gary Smith, the leader, was more than appreciative and said he was so happy that he accepted our invitation.

I think I can speak for Muhammad when I say that it was a great evening and the fun was all ours. It is so gratifying to work with young minds and see the sparkle in their eyes; and who knows, someday some of them may join RASC and maybe even become professional astronomers. Regardless, we gave them a personal experience that cannot be found in books or on the Internet!



Observatory Night – March 11, 2016: by Ed Mizzi

Well, after cancelling 4 nights at the observatory over the past 2 months, we were finally graced with a clear night on March 11. And what an evening it was!

I had the roof off and the 16" fired up by 7:30 PM so we had an early start. Our first visitor was Herb (sorry, no last name) who was at the observatory for the first time and is contemplating joining our club. Herb and I began by viewing M42 and then Mark Smith showed up and set up his 10" Dob, a very nice piece of equipment with clear views.

Gary Bennett arrived a short while later, as did Jeff Booth, Muhammad Basil Ahmad and Gladwin Hui. We treated ourselves to views of Jupiter (with 4 moons), M45, M42 and M1 and we saw these objects through both the 16" and the 14" scopes. Once we had a good look at these beautiful objects Gary B. offered to teach us how to fire up and use the C14 and a few of us practiced the setup steps to get some hands-on experience.

Then the cameras came out. Jeff and I had our DSLRs but really had no expectations of making photos, as this was meant as "visual night" only; but being able to use the C14 as a lens was an added bonus. Gary helped with tips on exposure length, ISO, etc. and it became a real team effort with everyone providing advice and ideas on how to capture the best "single-shot" images of Jupiter and M42. Using the C14 was almost like getting a new toy at Christmas or on a Birthday and it was rather humorous to see these so-called "grown" men all huddled around the scope and cameras and hearing oohs and awes from everyone.

Muhammad has since done some processing of my images and you can see them on the Forum.

Of course, as most amateur astronomers know, time flies when observing and making images and, with the lack of clear nights this winter, it was tough to call it a night. I was the last to leave, along with Gary, Jeff and Gladwin and when I looked at my watch it was 12:15 AM!!!

In the end, it was a wonderful evening, with clear skies, nice equipment and most importantly...like minds sharing a hobby like no other.



Left:
RASC members under the tail of Ursa Major, observing Jupiter and its Galilean moons (which are out of the photo, to the right).

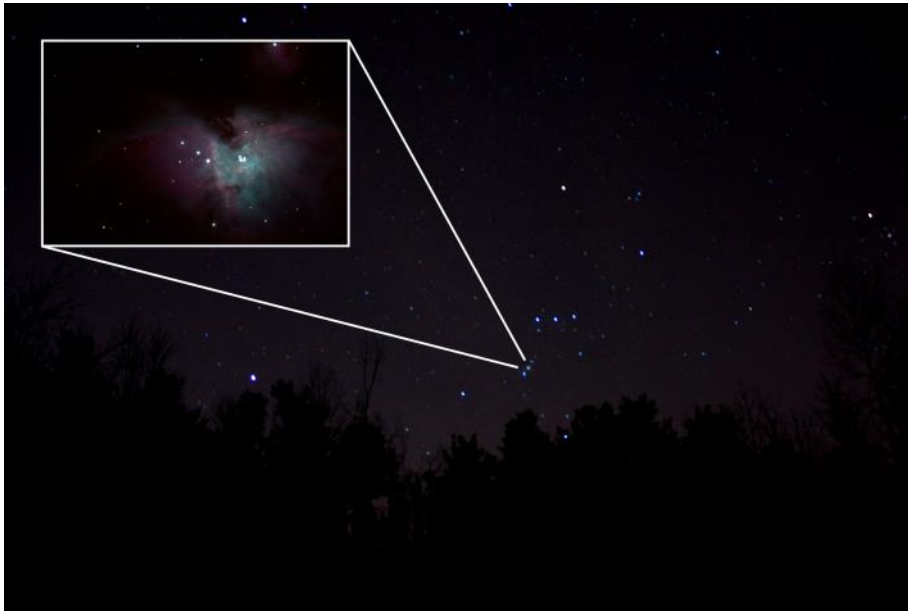
Below:
M42 from a tripod-mounted camera. Canon DSLR with a 250mm lens.

Both images from Jeff Booth.



Muhammad Ahmad sent along the following:

This photo was taken by Ed Mizzi at the Hamilton Centre Observatory on March 11, 2016 with a Canon EOS Digital Rebel XSi and our club's Celestron EdgeHD 14" telescope. Wide angle photo: 30 s, ISO 800. Inset photo: f/3.5, 20 s, ISO 400, 18 mm. Both were single exposures that I processed and edited in Adobe Photoshop CS5 Extended.

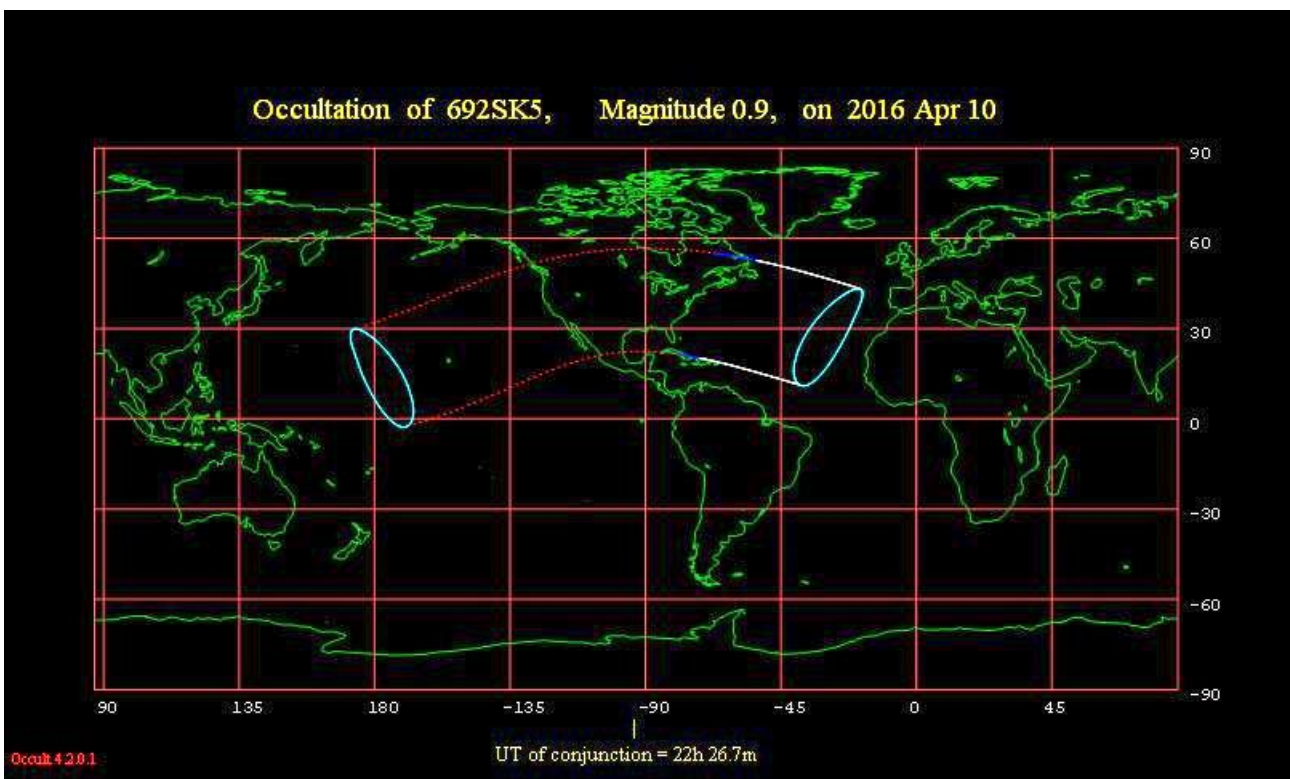


Aldebaran Occultation, Sunday, April 10, 2016

Hamilton disappearance at 22:38:13 (UTC), 18:38:13 (EDT).

Hamilton reappearance at 23:46:59 (UTC), 19:46:59 (EDT).

The chart below shows where the occultation is visible.





Gravitational Wave Astronomy Will Be The Next Great Scientific Frontier

By Ethan Siegel

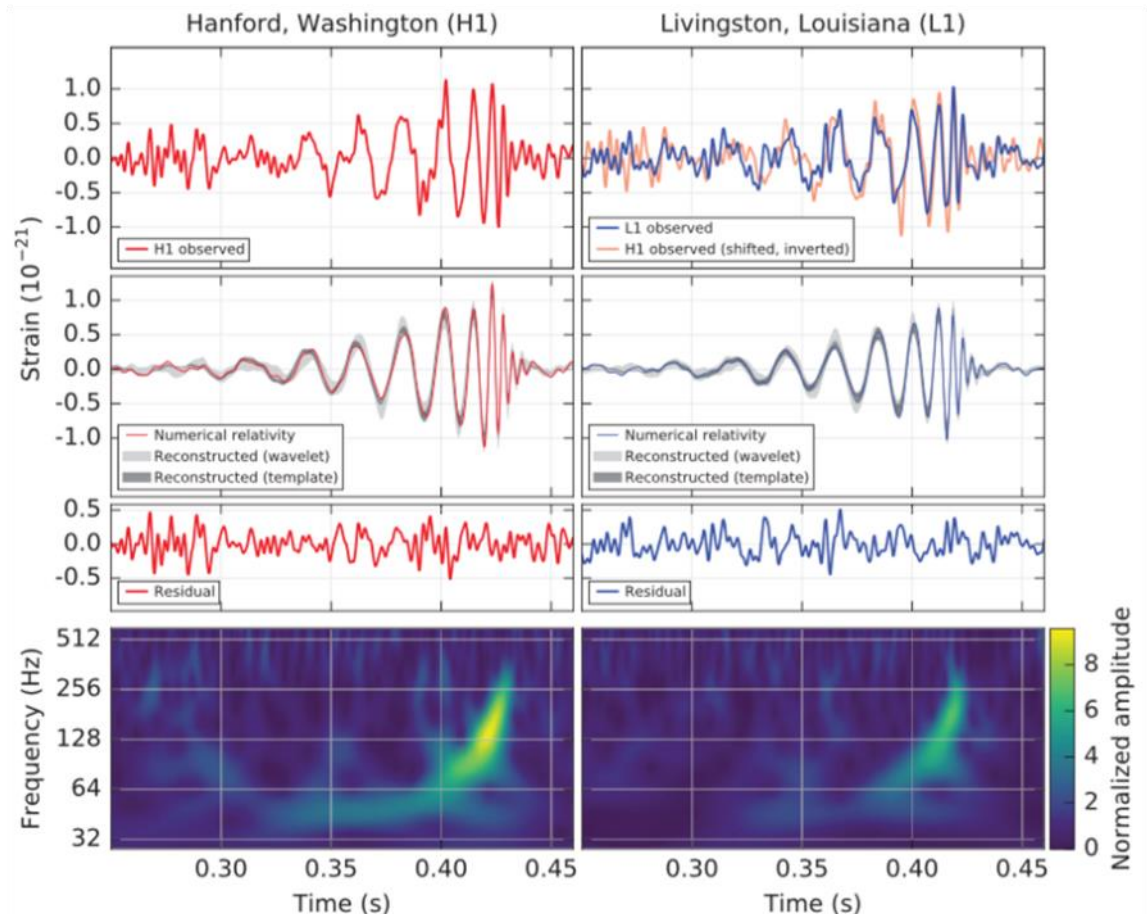
Imagine a world very different from our own: permanently shrouded in clouds, where the sky was never seen. Never had anyone see the Sun, the Moon, the stars or planets, until one night, a single bright object shone through. Imagine that you saw not only a bright point of light against a dark backdrop of sky, but that you could see a banded structure, a ringed system around it and perhaps even a bright satellite: a moon. That's the magnitude of what LIGO (the Laser Interferometer Gravitational-wave Observatory) saw, when it directly detected gravitational waves for the first time.

An unavoidable prediction of Einstein's General Relativity, gravitational waves emerge whenever a mass gets accelerated. For most systems -- like Earth orbiting the Sun -- the waves are so weak that it would take many times the age of the Universe to notice. But when very massive objects orbit at very short distances, the orbits decay noticeably and rapidly, producing potentially observable gravitational waves. Systems such as the binary pulsar PSR B1913+16 [the subtlety here is that binary pulsars may contain a single neutron star, so it's best to be specific], where two neutron stars orbit one another at very short distances, had previously shown this phenomenon of orbital decay, but gravitational waves had never been directly detected until now.

When a gravitational wave passes through an objects, it simultaneously stretches and compresses space along mutually perpendicular directions: first horizontally, then vertically, in an oscillating fashion. The LIGO detectors work by splitting a laser beam into perpendicular "arms," letting the beams reflect back and forth in each arm hundreds of times (for an effective path lengths of hundreds of km), and then recombining them at a photodetector. The interference pattern seen there will shift, predictably, if gravitational waves pass through and change the effective path lengths of the arms. Over a span of 20 milliseconds on September 14, 2015, both LIGO detectors (in Louisiana and Washington) saw identical stretching-and-compressing patterns. From that tiny amount of data, scientists were able to conclude that two black holes, of 36 and 29 solar masses apiece, merged together, emitting 5% of their total mass into gravitational wave energy, via Einstein's $E = mc^2$.

During that event, more energy was emitted in gravitational waves than by all the stars in the observable Universe combined. The entire Earth was compressed by less than the width of a proton during this event, yet thanks to LIGO's incredible precision, we were able to detect it. At least a handful of these events are expected every year. In the future, different observatories, such as NANOGrav (which uses radiotelescopes to the delay caused by gravitational waves on pulsar radiation) and the space mission LISA will detect gravitational waves from supermassive black holes and many other sources. We've just seen our first event using a new type of astronomy, and can now test black holes and gravity like never before.

Image credit: Observation of Gravitational Waves from a Binary Black Hole Merger B. P. Abbott et al., (LIGO Scientific Collaboration and Virgo Collaboration), Physical Review Letters 116, 061102 (2016). This figure shows the data (top panels) at the Washington and Louisiana LIGO stations, the predicted signal from Einstein's theory (middle panels), and the inferred signals (bottom panels). The signals matched perfectly in both detectors.



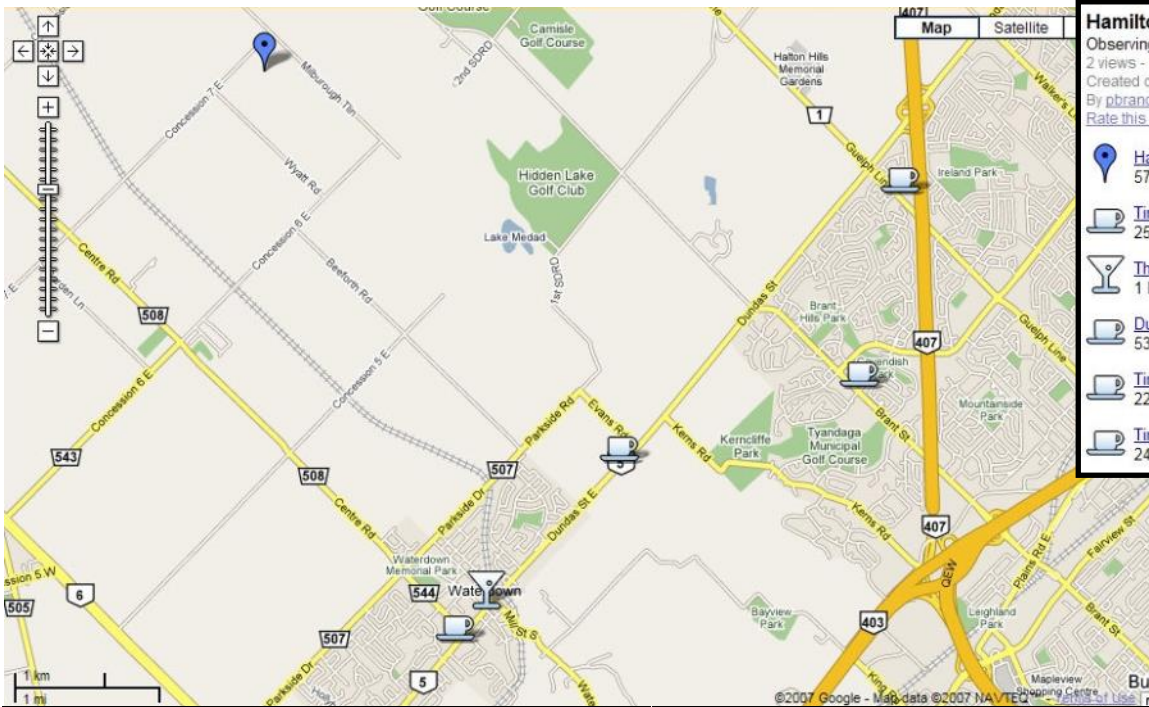
What you missed last month... words by Roger Hill, pictures by Ed Mizzi

Did you miss the March meeting? If you did, you missed Michael Watson give a thoroughly enjoyable talk on "Astrophotography Using Portable Mounts" .

We had a vote for the winner of the February Forum contest: Tripod Astrophotography. Jeff Booth was the winner again!

You should come out to a meeting...you never know what you'll learn!





Hamilton Observing Sites
 Observing site in Hamilton and area.
 2 views - Public
 Created on Oct 18 - Updated Oct 20
 By pbrandon
[Rate this map](#) - [Write a comment](#)

- [Hamilton Centre Observatory](#)
576 Concession 7E, Flamborough, ON
- [Tim Hortons, Waterdown](#)
255 Dundas St E Waterdown, ON L0R, Ca
- [The Royal Coachman](#)
1 Main St N Waterdown, ON L0R, Canada
- [Dundas Street, Tim Hortons](#)
530 Dundas St E Waterdown, ON L0R, Ca
- [Tim Hortons, Brant Street](#)
2201 Brant St Burlington, ON L7P, Canada
- [Tim Hortons, Guelph Line](#)
2400 Guelph Line Burlington, ON L7P, Car

Observatory:
 576 Concession 7 East,
 Flamborough ON
 N43° 23' 27" W79° 55' 20"

Mailing Address:
Hamilton Centre, RASC

President	Gary Bennett
Vice President	David Surette
Secretary	Chris Talpas
Treasurer	Bill Leggitt
Observatory Director	Gary Colwell
Orbit Editor	Roger Hill
Outreach	Mark Pickett
Programs Director	Andrew Blanchard
Special Projects	Bob Prociuk
Webmaster	John Devonshire
Youth Outreach	Ed Mizzi

Mercury is well placed all month in the evening sky.

Venus is moving behind the Sun. It will be hard to spot before sunrise.

Mars rises around midnight. Its disk grows from 12 to 16 arc seconds this month, as it moves towards opposition on May 22. A good telescope will show some of the dark markings on Mars' surface.

Jupiter was at opposition on March 8, so is still visible most of the night, setting around 5 a.m.

Saturn is well placed in Ophiuchus, rising around midnight. Its rings are now spread widely, making it a beautiful sight in a small telescope.

April 2016						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3 - Week 14	4 Events: Armchair Astronomy at the Observatory	5	6	7 New Moon Events: 8pm - General meeting at the Waterdown Legion	8 Events: Visual Astronomy	9
10 - Week 15 Events: Occultation of Aldebaran by the Moon	11	12	13 First Quarter	14 Events: Board meeting: 8pm at the Observatory:	15	16
17 - Week 16 Birthdays: Ed.Mizzi (63)	18	19	20	21 Full Moon	22	23
24 - Week 17	25	26	27	28 Events: Astrophotography at the Observatory	29 Last Quarter	30