# Orbit

The Official Publication of
The Hamilton Centre,
Royal Astronomical Society of Canada
Volume 49, Issue 5: March, 2017

# Issue Number 5, March, 2017

# Roger Hill, Editor

We actually got some clear skies in February, but not on either of the two NOVA nights we had. Hopefully, we can get some time under the stars on March 1st.

I also decided that I needed some time under the stars, too. I told the NOVA attendees that I'd be at the observatory on the 16th about 8pm. I had to drop off a couch in Guelph for a friend (the perils of having a pickup truck!), and took a very convoluted route back to Kilbride and made it to the Observatory at 8:03pm. I was the first one there, so I opened the gates, opened up the observatory, and turned the heat on. I then tried to open the roof on the Chilton Building, but I couldn't get it to open more than half way. I changed the battery in the cordless drill we use now instead of the winch handle, but no matter how much I tried backing it up and having another run at it, the roof stubbornly refused to open more than half way. I checked the tracks to see if there was any snow or ice that would stop the roof from rolling, but there was nothing in the way. So I left it half open, and started up the Paramount that drives the 16" around the sky. After a bit of a delay, the mount started beeping, about twice a second. Not good.

I used my phone to look up what the issue was, and found that there were two possibilities: the mount was frozen, or badly out of balance. I thought of trying to balance it, but trying to do this in the dark, by myself, was not a good idea. It took a bit of time to get the roof closed, as I'd drained one drill battery and almost drained the other. I left about 10pm, after a couple of fruitless hours.

I had the Friday off, so I went back to the Observatory at lunchtime, which was a lovely, sunlit, warm day. I took up a 120V Makita impact drill, which made short work of the roof. I rebalanced the scope, and rotated the tube in its rings so the balance screws (with the protective orange road hockey balls) wouldn't catch the roof when the 'scope is parked.. By then, the Sun had warmed up the mount and when I started it up it promptly worked.

I pointed the scope at Venus, and I could see it in the finderscope. I parked the scope, turned off the mount and closed the roof.

I went back on Saturday night, hoping to do some astrophotography. When I tried to pull into the driveway, there was a car almost blocking the way, and a couple of guys with binoculars. Don Gordon, one of the NOVA guys was one of the people, and of the other two, one was a guy I was in High School with and the other a member from the mid '80's whose name escapes me at the moment. We spent a good hour looking at M42, M35, M1, and chatting in the dark. Don took one of the Centre's loaner scopes home with him to Kilbride, and then I was alone again (naturally).

I'd taken my 300mm F/4 SMC Takumar (mid 80's version), and I put a light pollution clip-in filter in my camera, and proceeded to try to focus. No matter what I tried, I could not get it to focus properly. The stars always had a red halo around them, or were essentially out of focus. I eventually tried taking an hours worth of exposures of M42, with the stars having red haloes, but in the end I wasn't too happy. After that, I put my 6nm Hα filter in, and this helped tremendously. I used Betelgeuse (a nice, bright and deep red star) to focus, but by then (after midnight), Orion was so low in the sky, I had to try another object. I'd already done the Rosette last year, so I pointed the scope at the Cone nebula, and tried a 2 minute exposure at 3200 ISO to see if there was anything there. I was surprised to see a lot of red nebulosity, so I took another hour of exposures of the area. It turned out that this wasn't enough, either...I could use about 4 hours of exposures, so I'll have to save this for another night. I'd also like to try longer exposures, but the guide camera that used to be on the 16" is missing, so I don't think I can go much longer than 2 minutes without trailing.

Anyway, shortly after 1:30am, I headed for home. Oddly, I was back the following day because I'd left my Losmandy to Vixen dovetail adapter attached to the scope.

See you next month,

Roger

The front cover image is from Jacek Strakowski, who took this image of the Horsehead and the area around Alnitak (easternmoststar in the belt of Orion). It was just under 1.5 hours of exposure with a Nikon D5300, Heq5 Pro (with issues). The scope was a Megrez 90 with a Televue TRF-2008 reducer. He took the usual bias, flats and darks, and used Pix Insight for processing. Jacek has variously been called an "Imaging Powerhouse" and "Yoda" by his appreciative fans on the Forum. What I like about this image is the way the star colours are emphasized.

**Solar Eclipse Provides Coronal Glimpse**

By Marcus Woo

On August 21, 2017, North Americans will enjoy a rare treat: The first total solar eclipse visible from the continent since 1979. The sky will darken and the temperature will drop, in one of the most dramatic cosmic events on Earth. It could be a once-in-a-lifetime show indeed. But it will also be an opportunity to do some science.

Only during an eclipse, when the moon blocks the light from the sun's surface, does the sun's corona fully reveal itself. The corona is the hot and wispy atmosphere of the sun, extending far beyond the solar disk. But it's relatively dim, merely as bright as the full moon at night. The glaring sun, about a million times brighter, renders the corona invisible.

"The beauty of eclipse observations is that they are, at present, the only opportunity where one can observe the corona [in visible light] starting from the solar surface out to several solar radii," says Shadia Habbal, an astronomer at the University of Hawaii. To study the corona, she's traveled the world having experienced 14 total eclipses (she missed only five due to weather). This summer, she and her team will set up identical imaging systems and spectrometers at five locations along the path of totality, collecting data that's normally impossible to get.

Ground-based coronagraphs, instruments designed to study the corona by blocking the sun, can't view the full extent of the corona. Solar space-based telescopes don't have the spectrographs needed to measure how the temperatures vary throughout the corona. These temperature variations show how the sun's chemical composition is distributed—crucial information for solving one of long-standing mysteries about the corona: how it gets so hot.

While the sun's surface is ~9980 Fahrenheit (~5800 Kelvin), the corona can reach several millions of degrees Fahrenheit. Researchers have proposed many explanations involving magneto-acoustic waves and the dissipation of magnetic fields, but none can account for the wide-ranging temperature distribution in the corona, Habbal says.

You too can contribute to science through one of several citizen science projects. For example, you can also help study the corona through the Citizen CATE experiment; help produce a high definition, time-expanded video of the eclipse; use your ham radio to probe how an eclipse affects the propagation of radio waves in the ionosphere; or even observe how wildlife responds to such a unique event.

Otherwise, Habbal still encourages everyone to experience the eclipse. Never look directly at the sun, of course (find more safety guidelines here: https://eclipse2017.nasa.gov/safety). But during the approximately 2.5 minutes of totality, you may remove your safety glasses and watch the eclipse directly—only then can you see the glorious corona. So enjoy the show. The next one visible from North America won't be until 2024.

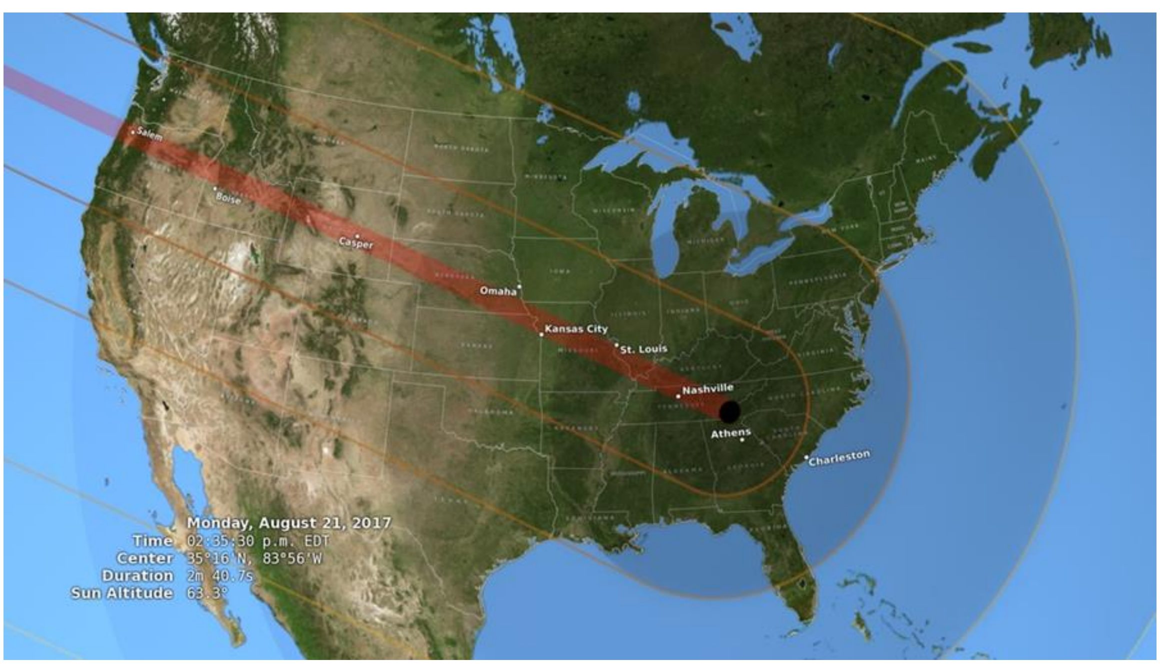
For more information about the upcoming eclipse, please see:

**NASA Eclipse citizen science page**
https://eclipse2017.nasa.gov/citizen-science

**NASA Eclipse safety guidelines**
https://eclipse2017.nasa.gov/safety

Want to teach kids about eclipses? Go to the NASA Space Place and see our article on solar and lunar eclipses! http://spaceplace.nasa.gov/eclipses/

*This article is provided by* ***NASA Space Place.*** *With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited*



# Hamilton Centre visits Mississauga Centre by Ed Mizzi

Dave Dev recently invited members from the Hamilton Centre to join him for one of the Mississauga Centre's events on Friday, Feb. 24. Dave is also a member of the Miss. Ctr. and Dave has generously given the same talks to them as he has done at our monthly meetings.

The meeting took place at the University of Toronto's Mississauga campus and those in attendance included Hamilton Centre members Jeff Booth, Gary Colwell, Murray Romisher, Bob Prociuk and myself. We were treated to a fascinating talk by Dr. Marianne Mader, entitled "Hunting meteorites at the End of the World". She had visited Antarctica as part of the U.S. ANSMET (The Antarctic Search for Meteorites) program and her slide show and talk were very enlightening and entertaining.

Dr. Mader answered several questions form the audience of about 70 people and she also encouraged us to visit the ROM, where she works, as the ROM has an excellent display of meteorites of all kinds. She discussed the differences among meteorites from the Moon, Mars and the Asteroid Belt and even brought one along to show us.

I was able to obtain one of her business cards and I am hoping that she will accept an invitation to our club sometime in the future.

On another note, the president, Jo VandenDool of the Mississauga Centre was kind enough to advertise AstroCATS 2017 at the end of the meeting. Here is the link to the ANSMET website: http://caslabs.case.edu/ansmet/

Above: Dr. Marianne Mader in Antarctica

Right: An Antarctic Meteorite

# Start Planet-Hunting Right Now - Star Data and Search Tools released to Public

If the discovery of 7 new exoplanets with potential for life that were found just outside our solar system got you excited, there's now something you can do personally to help find faraway worlds. A team of research institutions that includes MIT and Carnegie Institution for Science recently made a giant amount of observations available to the public. They are hoping folks can help find exoplanets, which are basically planets that orbit stars outside our solar system.

The dataset ( http://home.dtm.ciw.edu/ebps/data/ )was collected over two decades by the W.M. Keck Observatory in Hawaii and contains close to 61,000 measurements from over 1,600 stars about 325 light years away from us. Along with it you should download the open-source software package ( http://www.stefanom.org/console-2/ ) , which will help process the data and an online tutorial.

> *"This is an amazing catalog, and we realized there just aren't enough of us on the team to be doing as much science as could come out of this dataset," says Jennifer Burt, a fellow in MIT's Kavli Institute for Astrophysics and Space Research. "We're trying to shift toward a more community-oriented idea of how we should do science, so that others can access the data and see something interesting."*

The scientists have themselves identified 100 potential exoplanets within the data, with Burt saying that there are "no shortage of exoplanets" and a "ton of science to be done."

> *"We recently discovered a six-planet system orbiting a star, which is a big number. We don't often detect systems with more than three to four planets, but we could successfully map out all six in this system because we had over 18 years of data on the host star," says Burt.*

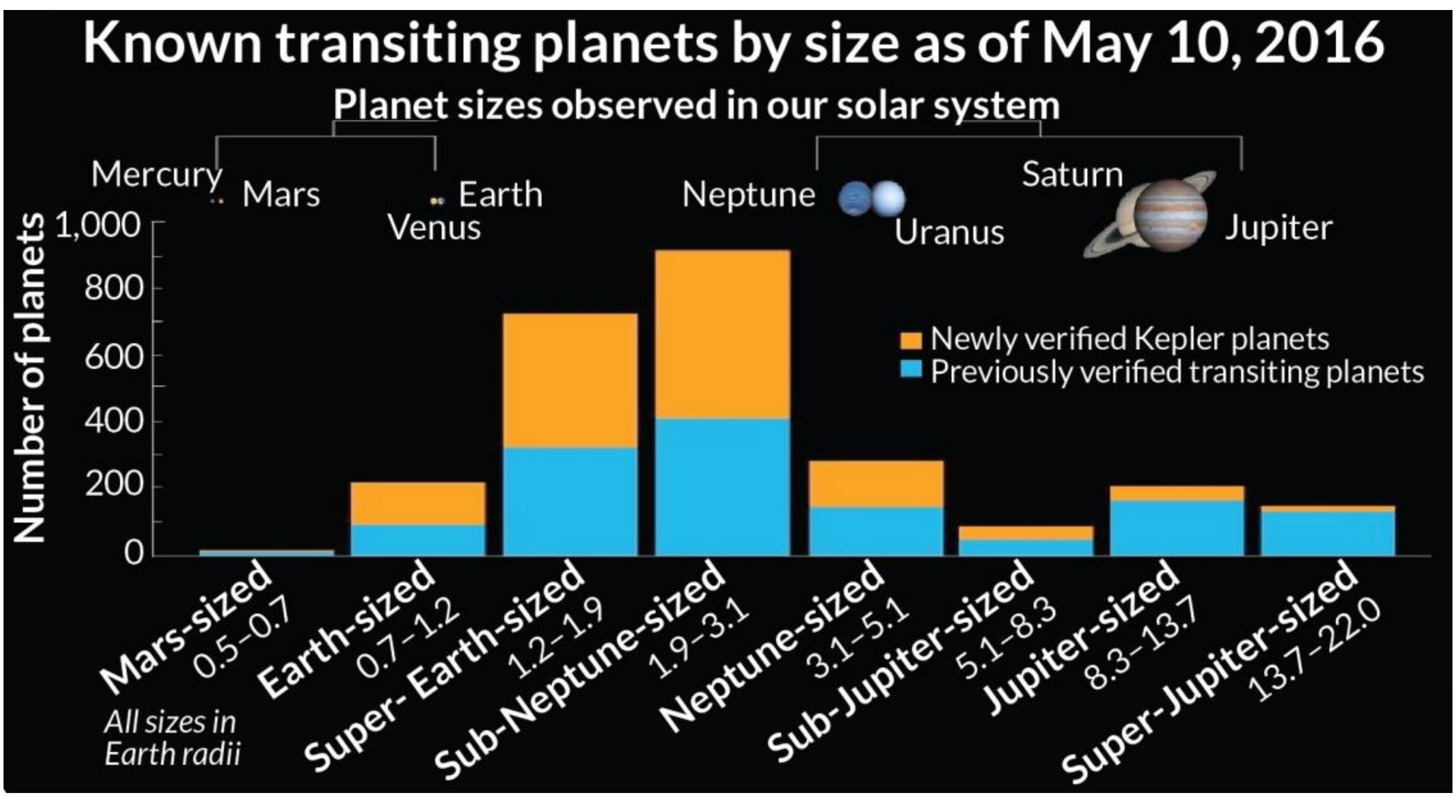
A special spectrometer (called HIRES) mounted on a 10-meter telescope splits a star's incoming light into color components - the intensity of the colors allow the scientists to figure out other starlight characteristics. Of particular use is a star's radial velocity, which reflects the star's movements. A regular pattern of movement reveals the presence of an orbiting exoplanet as the gravity of the exoplanet changes the star's velocity.

The dataset currently released will actually continue to grow. It includes a lot of information like the date, measured velocity and other measurements of the star's activity. Armed with the data, the software and the tutorial, any enthusiast can start going through the data to see if they can locate an exoplanet.

Burt sees the release of the data as a significant event -

> *"I think this opens up possibilities for anyone who wants to do this kind of work, whether you're an academic or someone in the general public who's excited about exoplanets," Burt explains. "Because really, who doesn't want to discover a planet?"*

Happy hunting!



# Waterloo Region technology to aid search for life on new planets By Terry Pender

WATERLOO REGION — Hardware and software produced in the region for the most advanced telescope ever built will be critical to the search for life on newly discovered planets orbiting a red star.

When the James Webb Space Telescope launches in October 2018, it will use a guidance system, cameras and other technology built in Cambridge and Ottawa by Honeywell Aerospace, formerly known as Com Dev International.

That technology will focus on a red star called TRAPPIST-1 that is in the constellation Aquarius. Astronomers announced Wednesday that they found seven, Earth-size planets orbiting the small star.

Using a spectrometer — equipment that collects light coming from distant objects — astronomers can learn about the atmosphere of distant planets. The spectrum of light contains different colours with different levels of brightness. And from that astronomers can detect carbon, water, oxygen and nitrogen and other signs of life.

"There is a huge range of information that comes when you take a spectrum," said Mike Hudson, a University of Waterloo astrophysicist.

"And to do that you need an instrument that can collect this very faint light and then split it up into its constituent colours."

That's where the engineers working at Honeywell Aerospace play a crucial part. They won a contract from NASA in 2004, and delivered hardware and software in 2012 for a spectrometer that collects and analyzes light in the infrared band.

That light is so old human eyes cannot see it.

A device called the Near Infrared Imager and Slitless Spectrograph will be used to find light that has travelled from the early parts of the universe and new planets, and study the starlight that passes through the atmospheres of those new planets.

The first planet outside the solar system that includes Earth was not discovered until 1995. Since then, hundreds more have been found. They are called exo-planets. The study of exo-planets is now one of the hottest fields in astronomy, and the technology on the James Webb Space Telescope will advance it.

"We now think that every star in the galaxy has planets," said Brian McNamara, the astrophysicist who heads the physics and astronomy department at UW.

It is believed that planets are the leftover debris that never made it into stars.

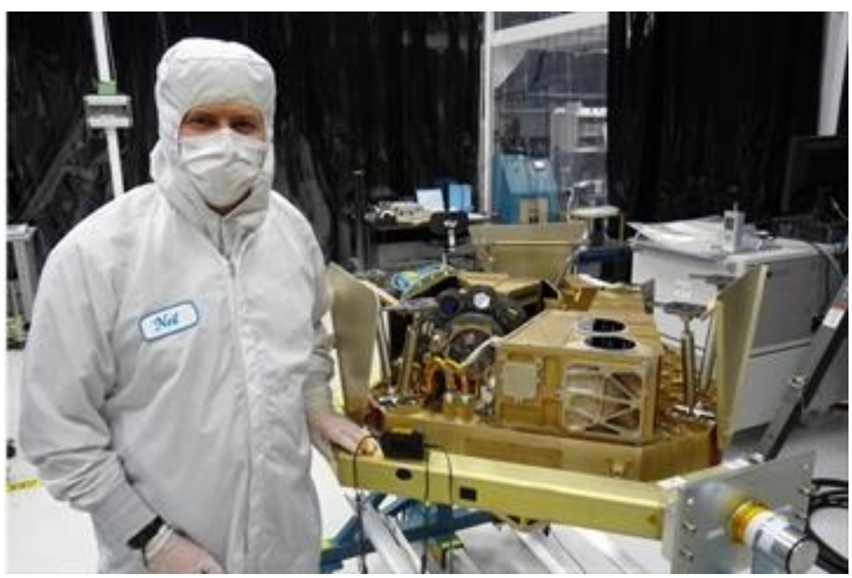
"Turns out these debris fields exist around all stars, and we are now just learning how planets formed," said McNamara. "That's a big area of research now."

Collecting the light and images from objects in deep space means the telescope must be aimed with mind-boggling accuracy. The engineers at Honeywell designed and made equipment called a Fine Guidance System to aim and steady the telescope.

The system uses a glorified camera to get all of the scientific equipment on the telescope focused on a single point light years away, said Neil Rowlands, engineering fellow at Honeywell Aerospace in Ottawa.

"Any jitter or drift in the way the telescope is pointing can be taken out and corrected," he said.

That is critical because the shutters on the cameras will be open for long periods of time to collect enough light to produce sharp images of distant objects. Any movement will result in blurry, useless pictures.




*Neil Rowlands, engineering fellow at Honeywell Aerospace, stands next to the Fine Guidance System/Near Infrared Imager and Slitless Spectrograph before its delivery to NASA.*

"You don't want drift during the time shutters are open," said Rowlands.

The technology is so sophisticated it can accurately aim the telescope, which is the size of a tennis court with a four-storey building on it, at points that are billions of light years away. Rowlands likens that to getting a hole-in-one in golf from 3,000 kilometres away.

"That's how precisely you have to aim," he said.

The newly discovered planets around TRAPPIST-1 are 39 light years away. A light year is the distance light travels in one year; light travels at 299,792 kilometres per second (186,000 miles per second).

The telescope's Fine Guidance System includes two cameras, in case one breaks down.

"That is important because it is mission critical that this pointing information gets provided to the telescope," said Rowlands.

Researchers at most universities in the country will apply for time on the James Webb Space Telescope, making it the largest space science project in Canadian history, Rowlands said.

Some of the researchers will want to study how and why oceans formed on Earth. Life came out of the oceans. And scientists believe the Earth's oceans came from the ice on comets that hit the planet during its formation.

"Where does the water come from? How does it get on the planet?" said Michel Fich, a UW astrophysicist. "We are always looking for planets that might have life on them, and the only kind of life we know exists where there are oceans, where there is water."

The James Webb Space Telescope is called the most advanced technology ever developed by humans. After many delays and cost overruns, the telescope is now scheduled to launch in October 2018.

NASA scientist Amber Straughn will deliver a lecture about the telescope at the Perimeter Institute for Theoretical Physics in Waterloo on Wednesday at 7 p.m.

The telescope is 100 times more powerful than anything before it. Astronomers such as McNamara and Fich get excited about its potential because they were part of groundbreaking discoveries with earlier space-based telescopes.

The Chandra X-ray Observatory is a space telescope that collects and studies the high-energy bands of light called X-rays. Using data from Chandra, McNamara was part of the research team that proved black holes are at the centre of all galaxies.

"We developed quantitative methods to figure out how much power was coming out of the black hole, and we were able to show it was enough to regulate the growth of galaxies," McNamara said.

Cold clouds of nitrogen gas are sucked into black holes. The clouds of gas accelerate to nearly the speed of light, giving off huge amounts of heat. That heat drives away cooler gases around the black hole, and shuts down the formation of new stars.

Fich was heavily involved in the Herschel Space Observatory, which was launched by the European Space Agency in 2009. He built the instrument on Herschel that advanced the science around the formation of oceans on Earth.

Oceans are made of heavy water, hydrogen atoms that have an extra neutron. The ocean water did not match any of the ice found on comets, though. That baffled astronomers who theorized for the past 50 years that ice from comets created earth's oceans.

Herschel focused on a single comet from the Jupiter Family of Comets. These are short-lived comets that last about 20 years. Their orbits are determined by Jupiter's gravity.

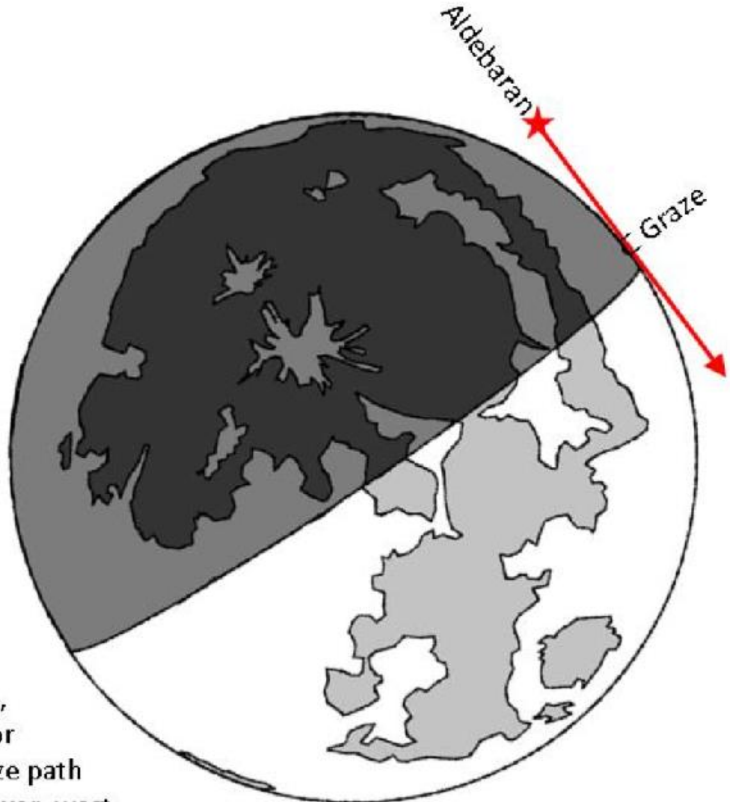
"And in its heavy water content it matches the earth's oceans perfectly," Fich said. "Now they are trying to figure out how that Jupiter comet that matches the Earth's oceans fits into the overall picture of how our solar system forms."

The presence of that extra neutron in the frozen water of that comet has astronomers rethinking the early days of the solar system.

"This whole idea of how our solar system formed, and how we made an earth with oceans on it, fits into all the research that is going on these days into exo-planets, or planets around other stars," said Fich.

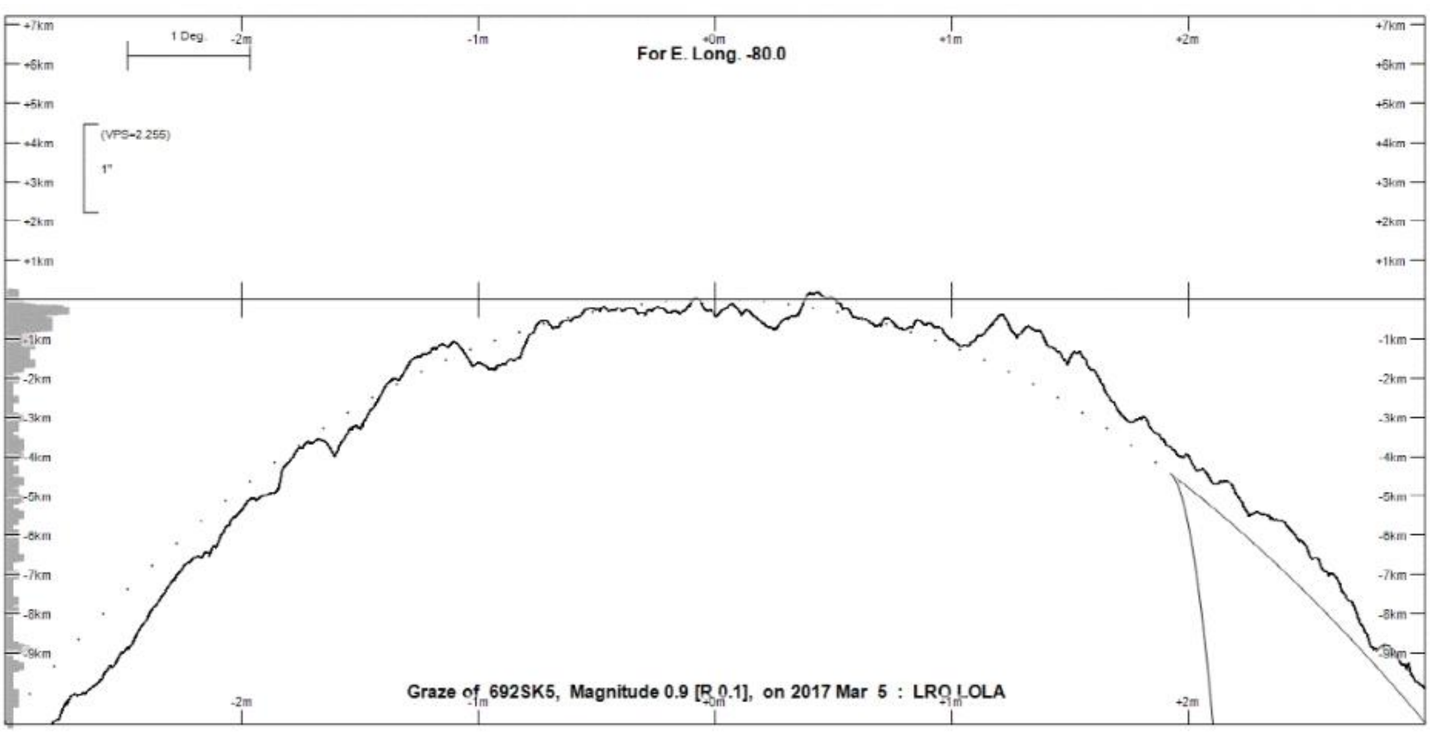
Just like the seven exo-planets orbiting the red dwarf star called TRAPPIST-1.

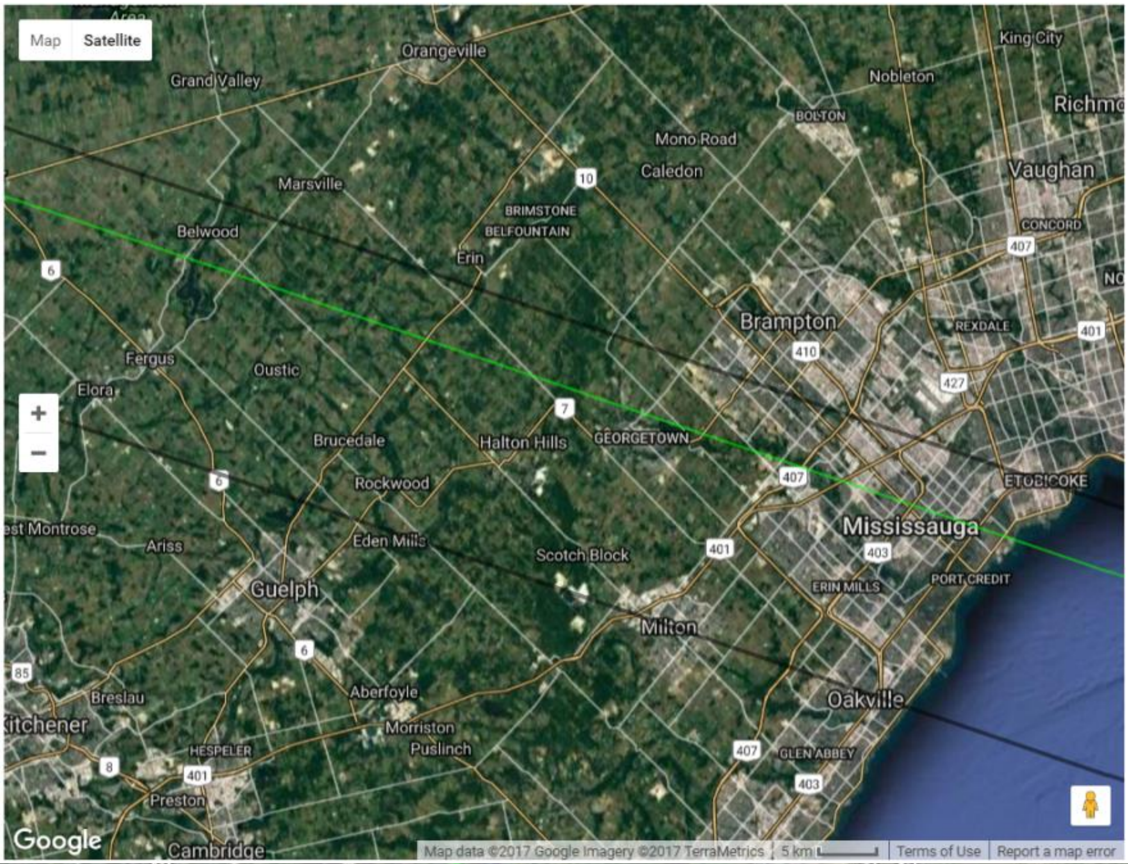
# Aldebaran Grazes the Moon: March 4, 2017, 11:16pm, EST

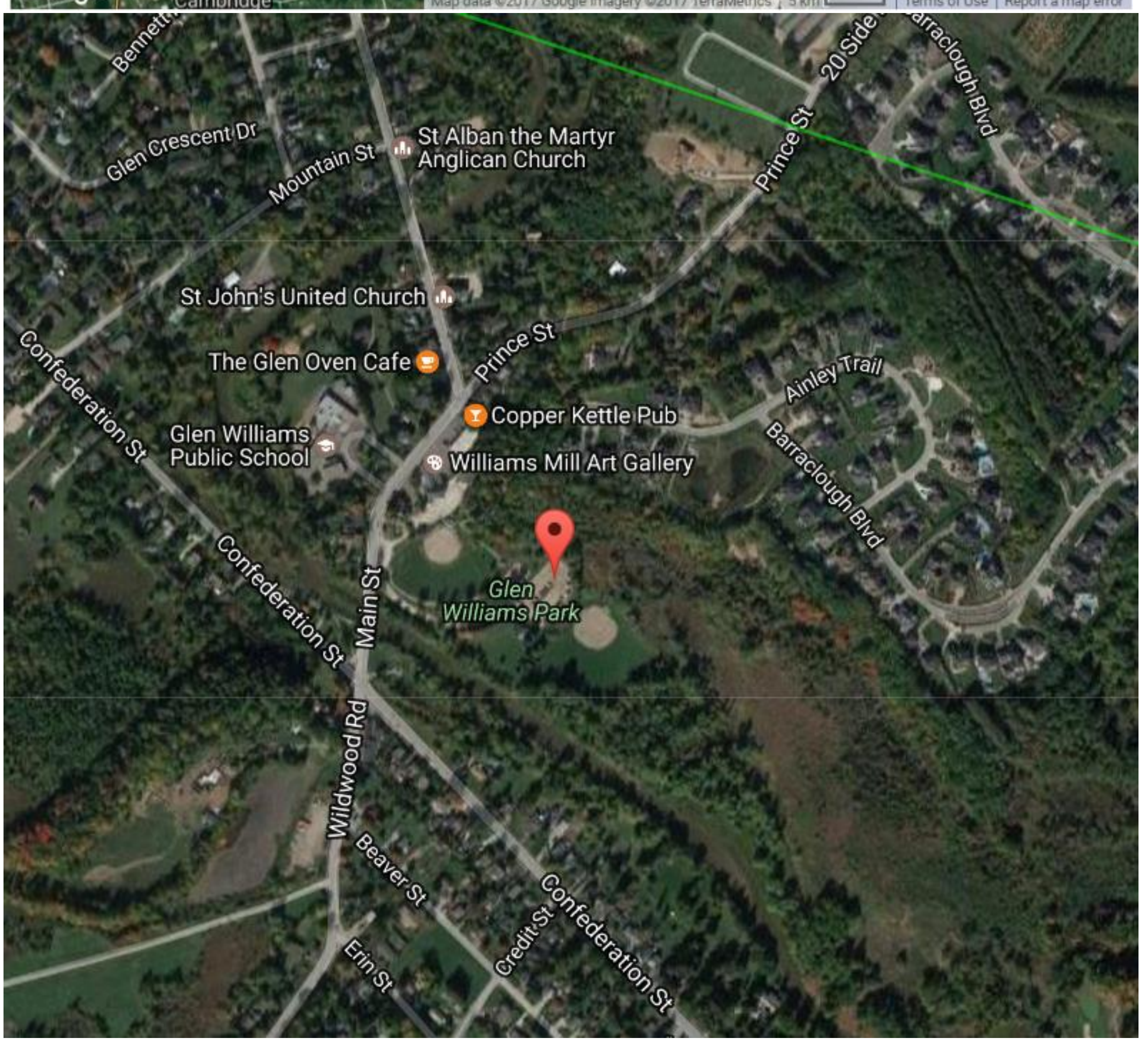



This is the view of the 46% sunlit waxing first-quarter Moon as seen from Michigan, but the view will be similar for other locations along the graze path Across North America. However, west of Montana, the graze will be mainly on the sunlit side of the northern cusp. The orange star will appear to approach the Moon from the dark side, passing very close to the northern cusp. The star might be seen even with the naked eye before the graze, and in the East, during at least the first part of it, but binoculars will give a better view, and a small telescope will be needed to see the events that occur among sunlit features. The dark side of the Moon is faintly illuminated by "Earthshine" with the "maria" (lava-filled "seas") appearing darker.

The Moons limb, below, is exaggerated for clarity.






This event should lend itself very well to videography. At the moment, I'm planning to use my 6" RC, possibly with a Barlow lens, with my modified Canon T1i in video mode to try to capture this event.

The Moon will be 20 degrees above the horizon and almost exactly due west at 274 degrees azimuth.

You want to find yourself as close as possible to that green line, and for the best view, it looks like you should be about 1/2 of a kilometer south of it.

For me, that looks to be just north of Georgetown. I've checked Google Earth and there is a great public park called Glen Williams park, which is where I plan to be should it be clear, hopefully about 60 to 90 minutes beforehand.

In true (g)astronomical fashion, there is even a pub nearby called The Copper Kettle, where I might warm up afterwards.

So...if anyone wants to join me...feel free. You should also check the Forum to see what plans are in case it's cloudy in Georgetown and clear further west.

Happy hunting!

Roger Hill

# Hamilton Centre RASC, February 2, 2017: “Monthly Meeting” By Ed Mizzi


David Surette welcomed everyone to the meeting and outlined the agenda.

Bob Prociuk provided an update on present membership numbers. He also welcomed the new members present in the audience.
Ed Mizzi discussed Outreach, past, present and future. He encouraged members to get involved and offered assistance to anyone who needed tips on how to make group presentations. Ed also mentioned a meeting that he and Bill Leggitt attended at Westfield Heritage Village. He told the group that Westfield is still interested in having the Hamilton Centre provide outreach during Hallowe’en, Christmas and their summer star party.

Bob Prociuk discussed a meeting (organized by Ed Mizzi), with a representative from the City of Hamilton regarding tree removal at the observatory. He indicated that the rep. promised to proceed with the process to obtain a permit for the club, making it possible to remove some of the taller trees to give better sight lines for viewing and astrophotography.

David Surette then used a series of slides to discuss AstroCATS 2017. He told the audience about the venue, including vendors, sponsors, location and the volunteer program. He is very excited about this year’s event and is hopeful that it will be the best AstroCATS ever. David invited Andy Blanchard to speak about the second annual CAPS (Canadian Astrophotography School). Andy explained how the courses will run and that there are three great speakers lined up to provide lessons for beginners and experts alike. David invited Colin Haig to discuss a new piece of equipment he is using in his Milton observatory. It involves a Micro-Start battery with several attachments, making power retrieval and management much easier, especially when in a remote location.

There was a 15 minute break that gave club members and members of the public a chance to meet others, take a closer look at Colin’s new toys and discuss both visual astronomy and astrophotography.

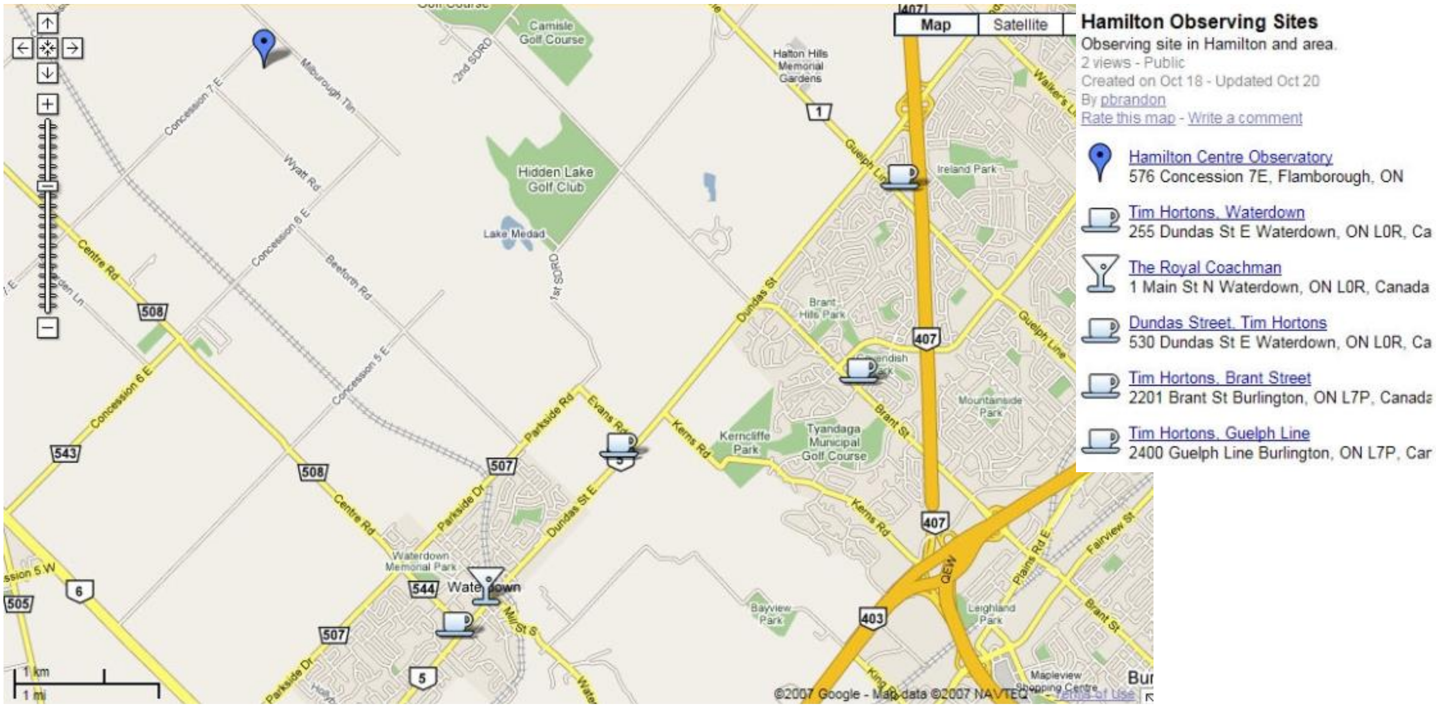
David introduced the guest speaker for the evening. Chris Talpas, one of the Hamilton Centre’s members and Directors, had prepared a talk about Radio Telescopes. Chris provided an in depth discussion of everything from the history of radio astronomy to the latest technology. He explained how radio telescopes function and what they can provide that optical equipment cannot. Chris used several informative and interesting slides to complement his description of this fascinating topic. Kudos to Chris for all the time he spent preparing this talk and giving those present an enlightening look into radio telescopes.

Thanks to Roger Hill for, once again, videotaping the meeting’s events so that those who could not attend could view it on You Tube and so that those in attendance could review it.

David asked if there was any “other” business and seeing none, he invited everyone to the Royal Coachmen for refreshments and further discussion and adjourned the meeting.

From Top right (Clockwise) David Surette talked about AstroCATS; Colin Haig's MicroStart; Chris Talpas starts his talk while Roger fiddles with the video camera; Chris' title slide; Colin Haig and his (very light) battery box.




576 Concession 7 East, Flamborough ON
N43° 23’ 27”  W79° 55’ 20”
Our mailing address is:
**RASC Hamilton**
**P.O. Box 969**
**Waterdown, Ontario**
**L0R 2H0**

| | |
|---|---|
| President | Gary Bennett |
| Vice President | David Surette |
| Secretary | Chris Talpas |
| Treasurer | Bill Leggitt |
| Observatory Director | Gary Colwell |
| Orbit Editor | Roger Hill |
| Special Projects | Bob Prociuk |
| Youth Outreach | Ed Mizzi |
| Councillor | Dino diSabatino |

At right is Mark Smith’s first successful attempt at imaging and processing. He took this on the weekend at his family’s cottage near Bala, ON. He used a Nikon D5300 and a 55-200mm Nikon lens set to 160mm F5.3with the camera set to ISO4000. He mounted the camera and lens on a regular camera tripod with an iOptron Skytracker.

He took around 200 subs @ 30s each but could only use 47 of them because he didn't notice the thick dew until afterwards. He then stacked the images using Deep Sky Stacker and processed the result with startools.

He claims it's nowhere near the calibre of image he’s seen on the forum, but it's his best shot so far and he’s looking forward to learning more and improving his technique with the help of the people on the Forum!

Great work, Mark...I wish my first digital M31 had turned out so well!