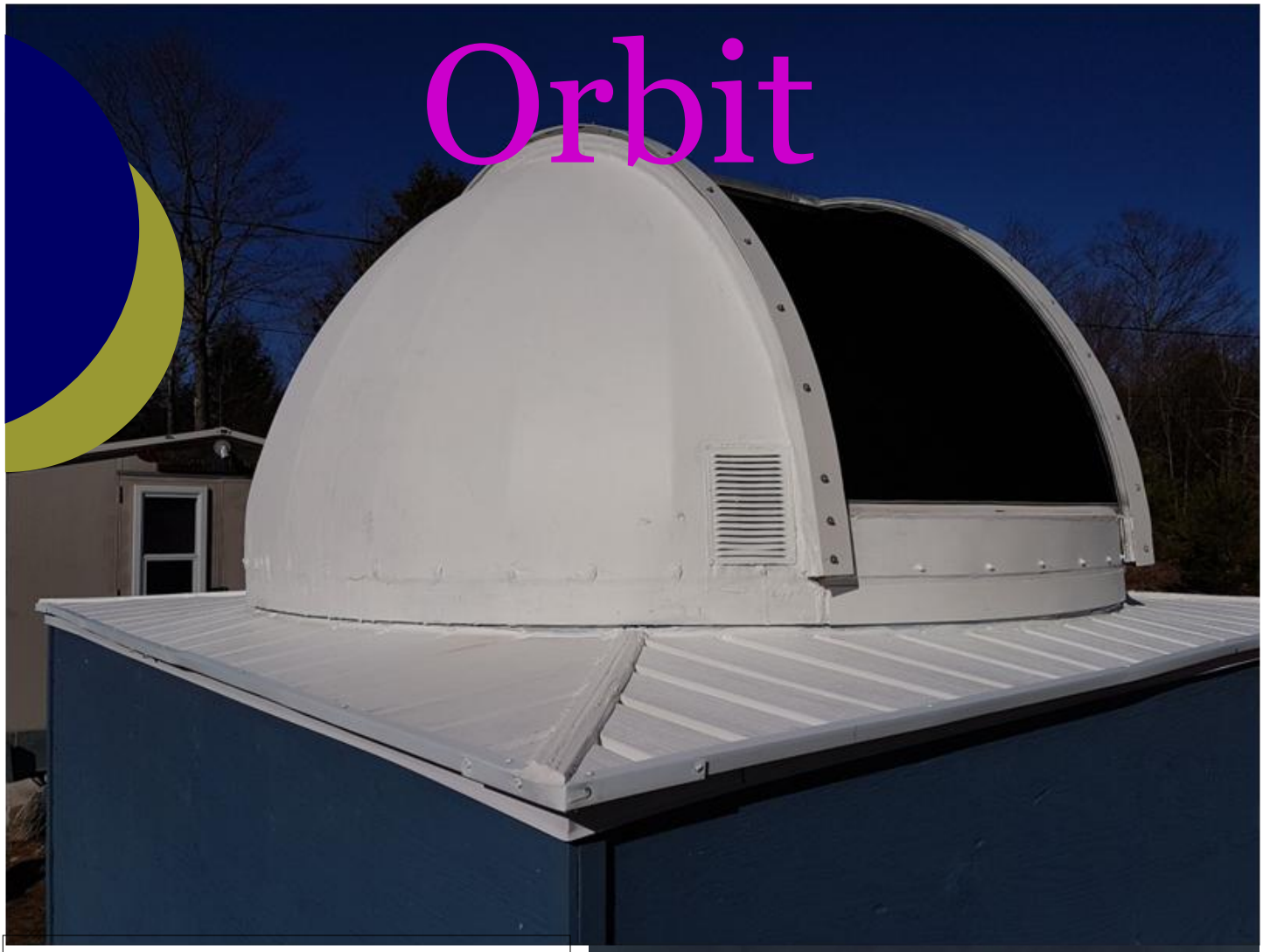
Orbit



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Roger Hill, Editor

Been doing some more testing of my Eclipse set up. The Right Ascension motor for my EQ5 has been acting up. Actually, it's been that way for a couple of years, but had resisted all attempts to repair it. I'd even found an old, round, step-down gear box that I'd used by swapping the R.A. and declination motors, but that didn't work well at all. One of the things I got for a recent birthday was a new motor. I installed it last week and I even managed to test it...and it seems to work quite well.

My next step is to get my Canon T1i cleaned at Henry's. I'll need to tell them to take extra special care, because the IR filter in front of the sensor is a special one from AstroDon filters, which allows about 98% of Hα to pass through. In other words, they have to put the same filter back in if they have to remove it for cleaning. I'd be really annoyed if they don't...it cost me a fair chunk of change to alter my camera, between shipping to the States, the filter itself, the labour to install it, and shipping it back. I don't want to pay for all that again!

I'll be taking my son's camera as well, a Canon 40D, along with the little camera I've used to record some of the Hamilton Centre meetings. This latter unit is capable of time-lapse recordings, so I'm thinking of setting it to 2 frames per second and having it record a movie. I'm hoping that it will record the astonishing drop in light level in the final few seconds before second contact. The Sun itself during totality is about as bright as a Full Moon, but you also experience a 360° sunset, as light from outside of the Moon's shadow leaks into the area of totality. This means that you have enough light to see in colour, but some stars and planets are visible. And the light level drops down to this in just a few seconds.

The first time I ever presented anything to the Hamilton Centre was in December, 1970 at the annual Members Night. Many people showed their slides from the March 7th total eclipse of that year, whether they were at the clouded-out site in Florida or were among the three people who headed up to North Carolina overnight hunting clear skies. I showed the light level and temperature readings that my friend Wayne McPhail and I took from my front yard in Burlington. What I remember most from that meeting, though, was Ken Chilton dimming the lights in the big lecture hall in the McMaster Physical Sciences building trying to give everyone an indication of how quickly the light fades away. I thought he was exaggerating until I experienced my first visit to totality in July, 1972. Hopefully, many of you will get the full experience in August.

Solar eclipses occur in cycles, with the most noted one being the Saros Cycle...a period of approximately 223 synodic months (approximately 6585.3211 days, or 18 years, 11 days, 8 hours). So if you see one solar eclipse, the next in the series will take place a third of the way around the world. I've been involved with Astronomy for a considerable period of time, with the first solar eclipse I observed being on May, 1965, which is Saros 127. I was checking to see when the next eclipse in this cycle is, and it turns out that it's on July 2nd, 2019. This is the eclipse I mentioned last month as one I really want to see with Les, and now I have another reason.

Before that, however, is August 21st, 2017. Ever since we met over 35 years ago, I've been hoping that I'll manage to see one of these incredible spectacles with my wife. I was hoping we'd see the July, 1991 event together, and then the one in the Caribbean in 1998, the 1999 eclipse in England or Hungary, but something always seemed to get in the way. Hopefully, this year I can cross that off my bucket list, with the added delight of our son being with us.

By the way, keep an eye open on the calendar in the Forum for dates for tree cutting at the observatory. We'll need chain-saws, chains, 4x4's and people who know what they're doing! It's time to cut down some old Christmas trees!

See you in September,

Roger

The front cover shows Gary Colwell's new observatory. The story about it can be found on page 7.

The Fizzy Seas of Titan By Marcus Woo

With clouds, rain, seas, lakes and a nitrogen-filled atmosphere, Saturn's moon Titan appears to be one of the worlds most similar to Earth in the solar system. But it's still alien; its seas and lakes are full not of water but liquid methane and ethane.

At the temperatures and pressures found on Titan's surface, methane can evaporate and fall back down as rain, just like water on Earth. The methane rain flows into rivers and channels, filling lakes and seas.

Nitrogen makes up a larger portion of the atmosphere on Titan than on Earth. The gas also dissolves in methane, just like carbon dioxide in soda. And similar to when you shake an open soda bottle, disturbing a Titan lake can make the nitrogen bubble out.

But now it turns out the seas and lakes might be fizzier than previously thought. Researchers at NASA's Jet Propulsion Laboratory recently experimented with dissolved nitrogen in mixtures of liquid methane and ethane under a variety of temperatures and pressures that would exist on Titan. They measured how different conditions would trigger nitrogen bubbles. A fizzy lake, they found, would be a common sight.

On Titan, the liquid methane always contains dissolved nitrogen. So when it rains, a methane-nitrogen solution pours into the seas and lakes, either directly from rain or via stream runoff. But if the lake also contains some ethane—which doesn't dissolve nitrogen as well as methane does—mixing the liquids will force some of the nitrogen out of solution, and the lake will effervesce.

"It will be a big frothy mess," says Michael Malaska of JPL. "It's neat because it makes Earth look really boring by comparison."

Bubbles could also arise from a lake that contains more ethane than methane. The two will normally mix, but a less-dense layer of methane with dissolved nitrogen—from a gentle rain, for example--could settle on top of an ethane layer.

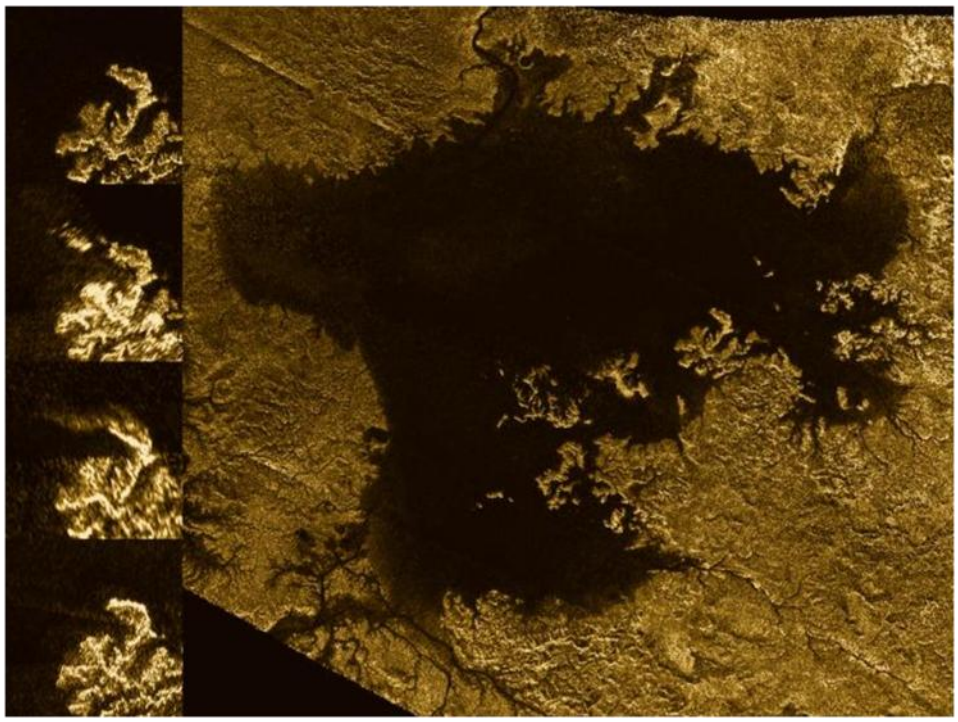
In this case, any disturbance—even a breeze—could mix the methane with dissolved nitrogen and the ethane below. The nitrogen would become less soluble and bubbles of gas would fizz out.

Heat, the researchers found, can also cause nitrogen to bubble out of solution while cold will coax more nitrogen to dissolve. As the seasons and climate change on Titan, the seas and lakes will inhale and exhale nitrogen.

But such warmth-induced bubbles could pose a challenge for future sea-faring spacecraft, which will have an energy source, and thus heat. "You may have this spacecraft sitting there, and it's just going to be fizzing the whole time," Malaska says. "That may actually be a problem for stability control or sampling."

Bubbles might also explain the so-called magic islands discovered by NASA's Cassini spacecraft in the last few years. Radar images revealed island-like features that appear and disappear over time. Scientists still aren't sure what the islands are, but nitrogen bubbles seem increasingly likely.

To know for sure, though, there will have to be a new mission. Cassini is entering its final phase, having finished its last flyby of Titan on April 21. Scientists are already sketching out potential spacecraft—maybe a buoy or even a submarine—to explore Titan's seas, bubbles and all.



Caption: Radar images from Cassini showed a strange island-like feature in one of Titan's hydrocarbon seas that appeared to change over time. One possible explanation for this "magic island" is bubbles. Image credits: NASA/JPL-Caltech/ASI/Cornell

The solar eclipse that ended a war by Chris Higgins

The Greek philosopher Thales lived in the seaside town of Miletus. He hypothesized that water was the source of all matter, and according to several accounts, he predicted the solar eclipse of May 28, 585 BCE. It's unclear whether he really called it—or how he understood eclipses to work, especially given that he thought the Earth was a flat disk floating in water. But according to writings by Herodotus and the philosopher Xenophanes, Thales predicted a total solar eclipse.

In 585 BCE, King Alyattes of Lydia was at war with King Cyaxares of Media. They had been fighting for six years with neither side making significant progress. Their war was particularly bitter because a group of hunters working for the Medes had killed one of Cyaxares's sons and served him up as a meal (yikes). This fight was personal.

On May 28, during a battle along the Halys River, the eclipse arrived. Herodotus wrote an account of this battle in The Histories, reporting that Thales had predicted the eclipse:

> *...[A]nd as they still carried on the war with equally balanced fortune, in the sixth year a battle took place in which it happened, when the fight had begun, that suddenly the day became night. And this change of the day Thales the Milesian had foretold to the Ionians laying down as a limit this very year in which the change took place. The Lydians however and the Medes, when they saw that it had become night instead of day, ceased from their fighting and were much more eager both of them that peace should be made between them.*

The warring armies saw the eclipse as an omen indicating that they should stop fighting. They dropped their weapons, called a truce, and ultimately sealed the peace with a royal wedding between Alyattes's daughter and a living son of Cyaxares.

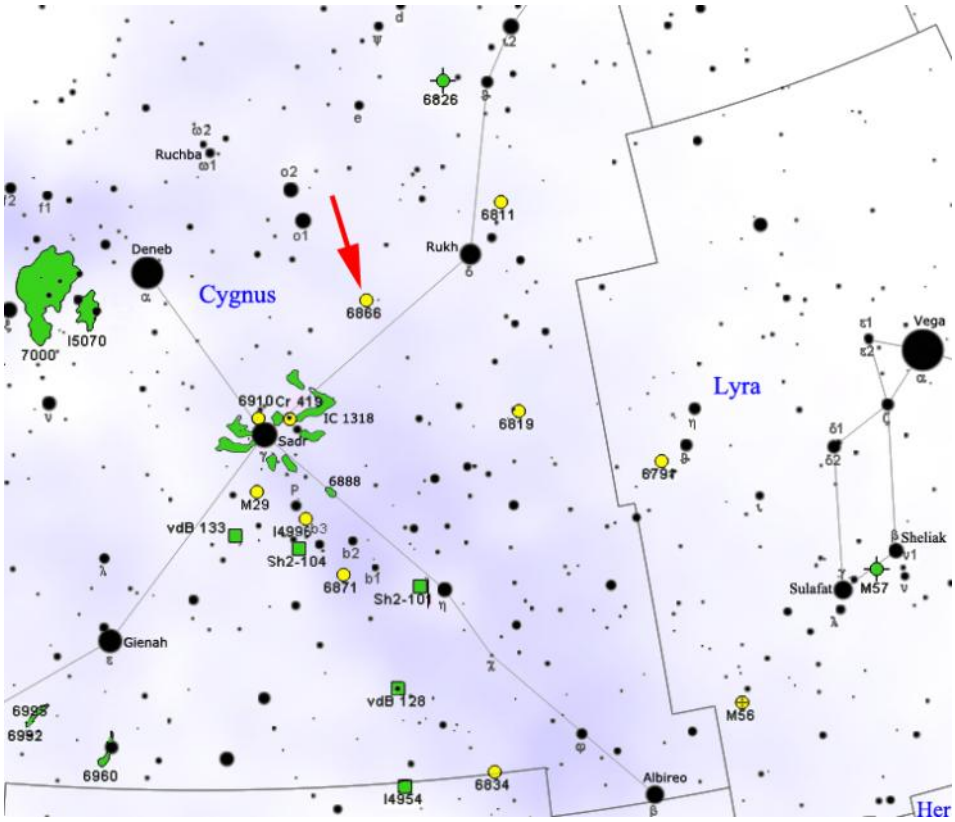
Writer Isaac Asimov believed that the eclipse of Thales was the first scientific experiment. Assuming we believe Herodotus, Thales hypothesized that an eclipse would occur on a given date and tested that hypothesis by observation. Whether it happened that way, we will likely never know—but it makes for a great story.

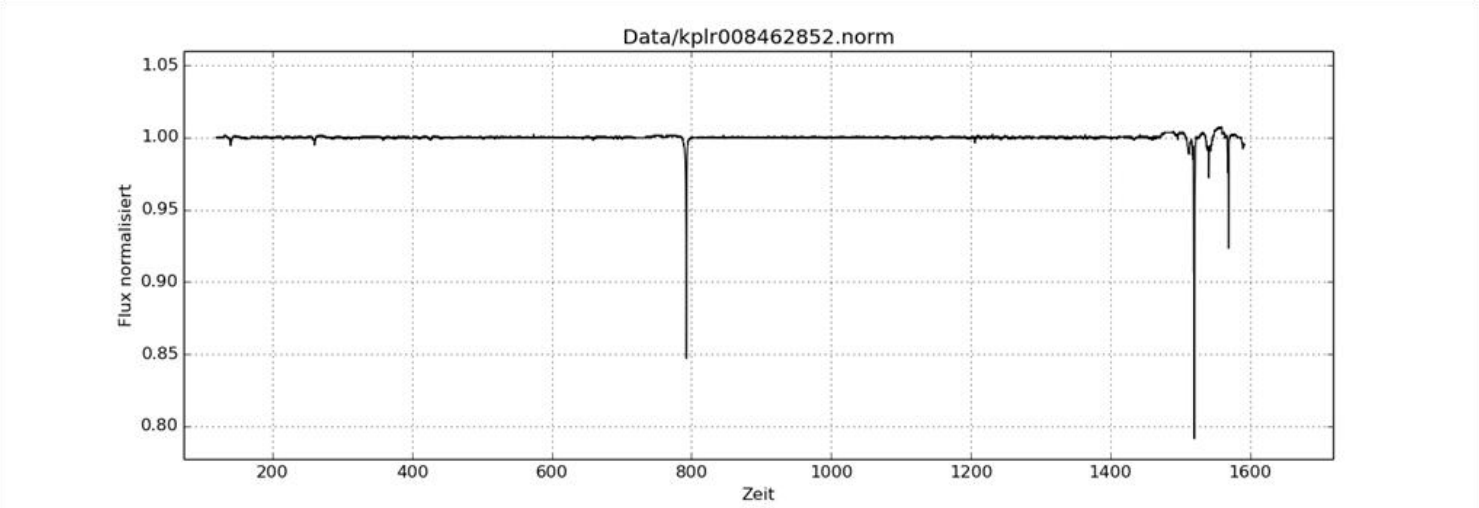
Because modern astronomers can pinpoint the date and location of that solar eclipse, the Battle of Halys is one of the oldest historical events with a precise date attached. Whether Thales predicted the eclipse or not, it did occur—and it stopped a war.

The strangest star, right now, in the sky by Chris Talpas

You may have heard of it.. colloquially known as Tabby's Star named after Tabetha Boyajian who while a postdoctoral fellow at Yale first described its odd brightening and dimming found in NASA's Kepler Space Telescope data. The star, officially known as KIC 8462852, is located at a distance of 1480 light years away in the constellation of Cygnus [see chart below] and appears to be a normal F class star which is a bit larger and hotter than our Sun which is a G class star.

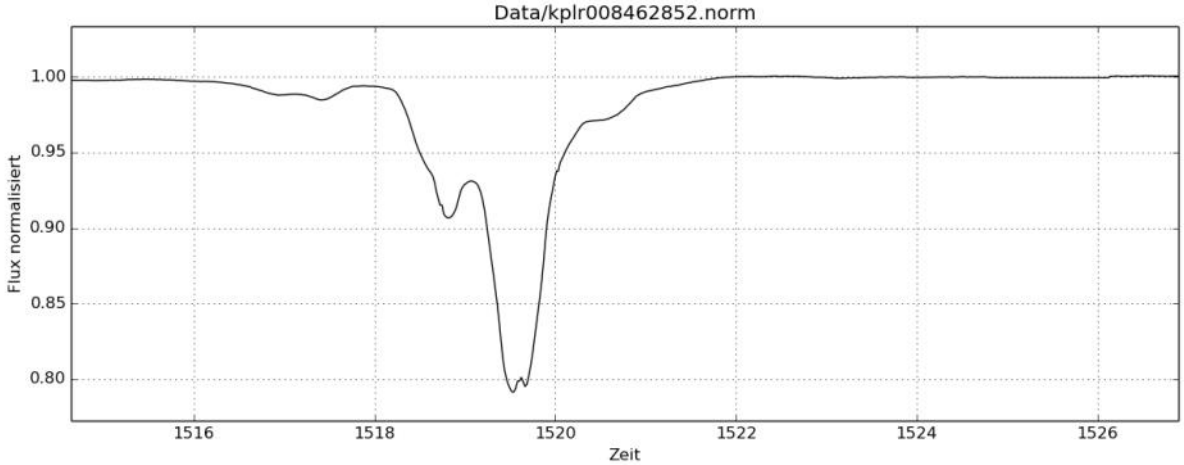
This star stands out from the 150,00 other stars that Kepler surveyed in that it displayed a light curve that has defied explanation. The anomalous light curve was first noticed by the Planet Hunters citizen science project while reviewing Kepler data and they notified Boyajian who was a member of the team overseeing the project. What set KIC (Kepler Input Catalogue) 8462852 apart was its bizarre light curve which showed transit like dips lasting for a few hours to others that persisted for days or weeks. Not only was the frequency perplexing but the intensity of the dips was even stranger. While sometimes the star dimmed by ~ 1%, which is typical of a large transiting exoplanet, other times the star dimmed by as much as 20% (see light curves below). As surprising as this behaviour was, astronomer Bradley Schaefer of Louisiana State University has presented evidence based on photographic plates that the star has dimmed by more than 15% over the past century, which is not without controversy since based on our current understanding of stellar evolution, F class stars do not undergo these types of rapid changes especially on this timescale. Steady dimming has been corroborated from an analysis of Kepler calibration data that shows the star has dimmed by 3 percent over the 4 years it was observed by Kepler. There is no evidence that it is a variable star or that it is accreting material from a companion.





Kepler Data from March 5,2011 to April 17, 2013

Kepler Data from February 28, 2013

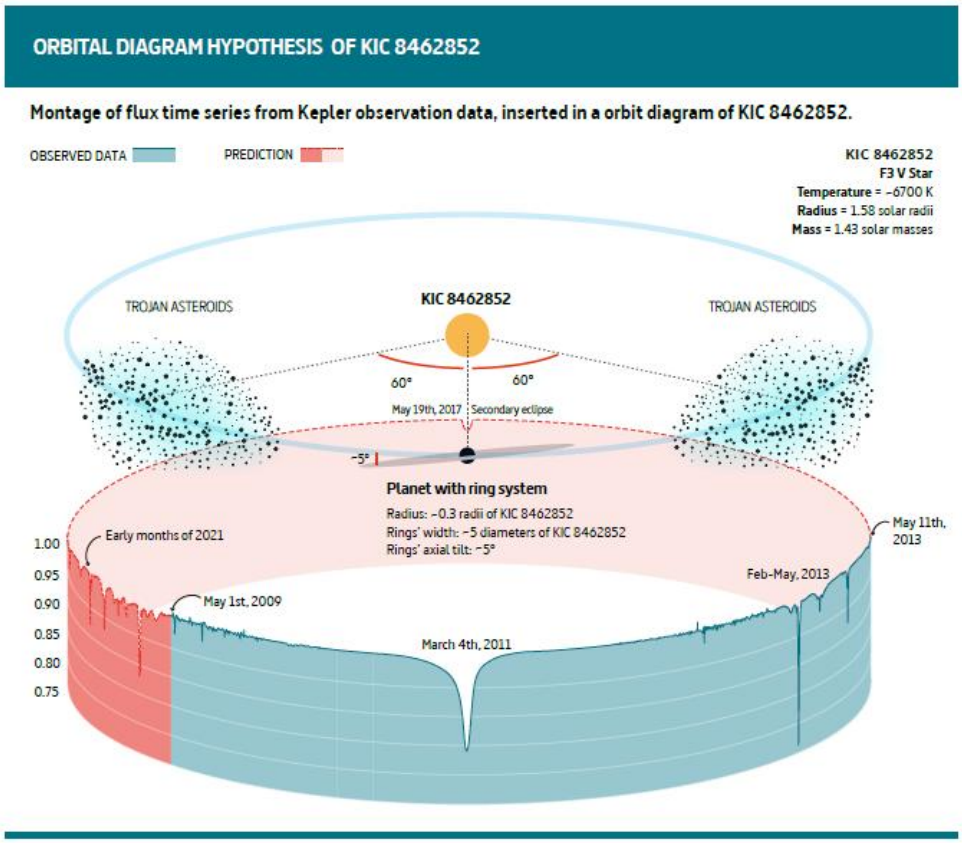


A number of theories have been put forth to explain this strange behaviour and are summarized here:
A swarm of giant comets - this was Boyajian's original hypothesis based on the fact comets have highly eccentric orbits which could possibly account for the irregularity of the dimming. However the comet hypothesis does not explain the steady dimming.

An intervening cloud in interstellar space or the solar system- since space is known to be filled with gas and dust that diminished starlight (think dark nebula), perhaps there is a cloud that blocks different amounts of light as the telescope orbits around our sun. A density gradient could explain the long term dimming while knots of material could explain the significant short term dips. The presence of this cloud within the solar system is less likely since no annual repetition of dips is observed.

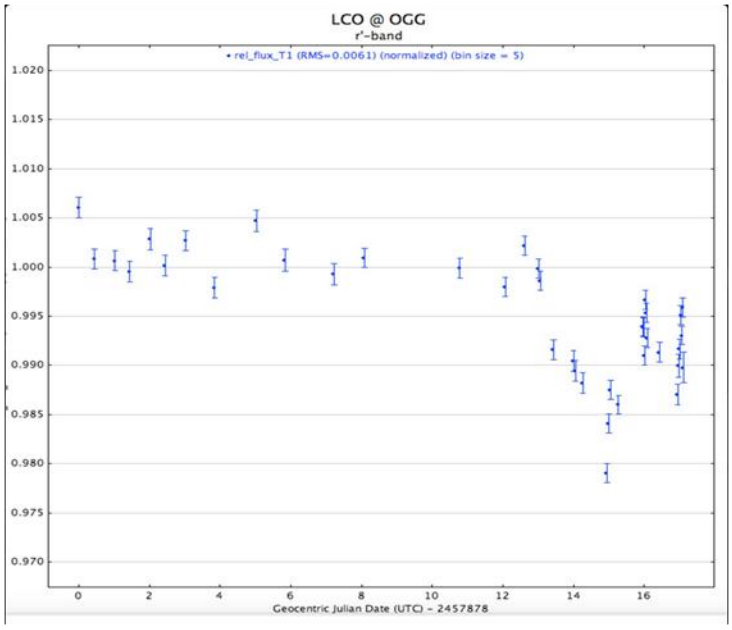
A disk of dust and gas- long term dimming and irregular dips in brightness are seen with other stars which are very young and have a protoplanetary disk. The thin ring with knots of forming planets seen edge on could produce briefly dimming light curves. However Tabby's Star is middle aged with no signs of a disk. In addition, such a disk would be expected to radiate heat as infrared radiation and no infrared excess has been observed.
Intrinsic Stellar Variations- naturally occurring events such as sunspots and flares can change the brightness of a star on a short time scale. However, this star appears to be too hot to generate the type of magnetic behaviour seen in cooler stars such as the sun. Brian Metzger of Columbia University has postulated that a brown dwarf collision with Tabby's Star could cause the star to temporarily brighten and the dimming that we are seeing is it simply returning to its normal brightness. However this fails to explain the irregular short term changes in brightness.

Large orbiting ringed body with a swarm of trojan objects- Ferdinand Ballesteros and colleagues proposed in a May 24th, 2017 paper "KIC 8462852: Will the Trojans return in 2021?" a hypothesis that a large ringed body is orbiting the star along with a swarm of Trojan bodies at the L4 and L5 Lagrange points as shown in the figure below reproduced from their paper. They have predicted that irregular transits should reappear in February of 2021 followed by the transit of the planet in the first half of 2023.



<u>Alien mega structure</u>- the most provocative explanation, which was originally proposed by Jason Wright of Penn State, proposes that the light curve could be caused by an alien civilization building a Dyson sphere or a Niven Ring World like system. This albeit remote possibility has captured the public's attention and remains a contender.
In late May of 2017, a new dimming event has started with the initial light curve shown below.

A large number of telescopes are currently observing this event and include the following: Green Bank radiotelescope, Lick Observatory's Automated Planet Finder, The twin Keck Telescopes operating in visible and near infrared, the Multiple Mirror Telescope in Arizona, the Large Binocular Telescope in Arizona, and NASA's Swift Gamma Ray Burst Mission. As can be seen from this list, astronomers are taking this event seriously. Many of the scopes will be performing spectroscopy looking to see what sort of absorption spectra is observed which hopefully will give some indication of the nature of the obscuring object(s). Stayed tuned as the results begin to come in.



There's a New Dome at Split-Rock by Gary Colwell

If you are like me (and most other amateur astronomers) funds for astronomical ventures are limited at best, and we have the misconceived idea that an observatory is priced way out of our budget. There are so many varieties of personal observatories out there…but the cost is prohibitive…ranging from a few thousand dollars to in excess of $25,000.00

In keeping with the philosophy of my good friend and fellow astronomer Glenn Kukkola, why buy one when you can MacGuiver one for a lot cheaper!

In 2005 I built a roll off observatory…not a roll off roof…but a roll off building. Back then it cost well in excess of $2000.00 by the time I purchased an 8x8 plastic shed, and poured an 8'x10' concrete pad (50 wheelbarrow loads of hand mixed concrete too!)

It served me well for the past 12 years…but the drawback was…TOO MUCH SNOW ON THE RAILS!...which made it almost impossible to use in the winter months without a lot of back breaking shovelling…and I was a lot younger 12 years ago too!

So…what to do?

Big dreams….small budget….hmmmm…

Then a "dome" came along for sale…real cheap….it was not pristine…but no leaks…and with a bit of rubberized paint on the outside and a repaint of the black interior…voila…a 7' dome for $300.00 (new they are over $1400.00).

Ok…a "dome" without a "home" isn't good…so now…price out the materials for the "base".
First thing to do was to tear out the "old" 12'x12'platform (which was made of 2x4 and 3/8 plywood). I had already installed a pier for a previous building and scope. It is a 12" poured concrete pier that goes 4' into the ground and is bolted directly to the bedrock. Rock solid.

Now came the task of building a new 8’x8’ platform with 2x6 and 1/2 “outdoor plywood.

Cost $110.00 ($410.00 so far)

Unlike the previous pier you see in the background which I did not isolate from the concrete pad (inexperience shows!...lol..) I made sure this pier was isolated!

Next came the walls. Here is where planning comes in to utilize the least amount of materials as possible….

I built the wall 44” high by 8’ long so a single sheet of plywood could be laid across the side and overlap the bottom by 4” to prevent water from seeping in under the studs. Next…put the top 4x8 sheets on so you can draw a circle around the dome for an exact fit….cost …$230.00…(total so far….$640.00)….Fast Forward….

Add door made from ¾” outdoor plywood (2 2’x4’ pieces glued together)…spare door knob….paint ($75.00)

Add vinyl roof and drip edge….($123.00) TOTAL…….. ($838.00)

Hamilton Centre RASC, May 4, 2017: "Monthly Meeting" By Ed Mizzi

On May 4 (May the 4th be with you), 2017, the Hamilton Centre met for its regular monthly meeting. Attendance was very good with about 45 people present, especially with the awful weather outside.

Gary Bennett began the proceedings with a welcome to everyone, especially new members and visitors. He named people who had recently joined the club and recognized them if they were in attendance.

Ed Mizzi gave an update about our tree culling project at the observatory and several members showed interest in volunteering to help.

Gary then introduced our guest speaker, Dr. Parshati Patel, who drove from Western University in London, to be with us and share her knowledge. She carries out her research at the Centre of Planetary Science and Exploration and her topic was "The Tale of Disks around Massive Stars". It was very intriguing and, along with several excellent slides, we were told the story of star formation and how planets follow. Dr. Patel encouraged questions from the audience and it was obvious that she is passionate about her research. I should also mention that she was a volunteer at AstroCATS 2016 and proudly wore her purple volunteer t-shirt to our meeting.

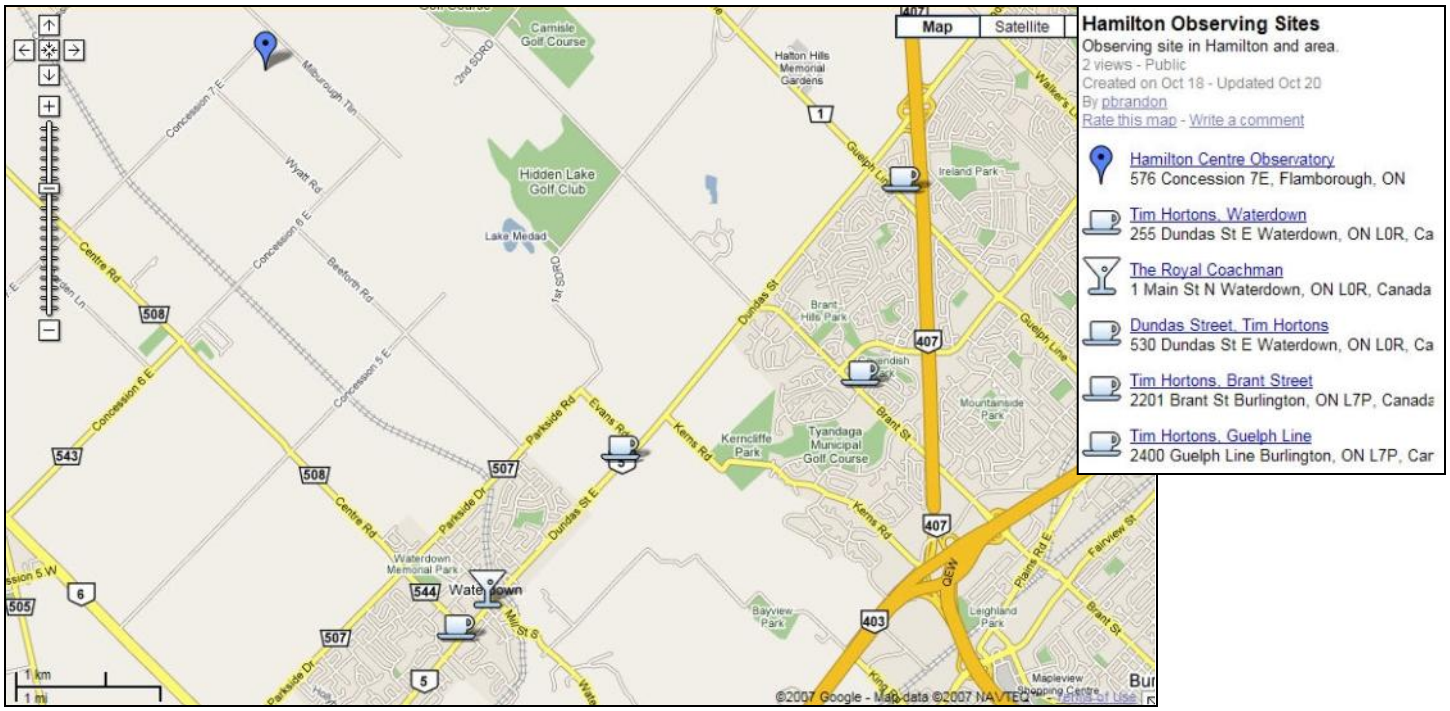
Gary then asked Andy Blanchard and Ed Mizzi to give an update on CAPS and our second annual Canadian Astro-Photography School, taking place on May 6 & 7, at Bishop Reding Secondary School in Milton, ON.

Next up was our very own member, Muhammad Basil Ahmad, who had recently travelled to Arizona. He shared his slides of the Barringer Crater and discussed its history and creation. He said it was definitely worth the visit, along with the Grand Canyon, which is not far away from this impact site.

Gary then briefly discussed his vision of having "mini" clubs set up within our RASC club, where members would gather in small groups, depending on their interests. Examples could be visual astronomers who would meet to view the night sky, astrophotographers who would gather together to image or to discuss imaging and processing, what Gary affectionately called "gear-heads", people who would work on fixing and/or modifying the club's telescopes and other equipment, and any other groups that members might be inspired to start. He told those in attendance that not everything had to be started or chaperoned by members of our Board and that all members should think about their own interests and how they would like to come together.

Gary thanked everyone for coming and invited attendees to the local pub, the Royal Coachmen, for refreshments and to continue our discussion in a more informal atmosphere.

From Top Left (Clockwise) Gary Bennett and Dr. Parshati Patel; Gary sets out the evening agenda; Gary recognizing new members; Audience, listening raptly; Muhammad Basil Ahmad and a meteorite from Barringer Meteor Crater; Muhammad with a panorama of the Barringer Meteor Crater. Previous page: Dr. Patel at the beginning of her well received talk.



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Orbit Editor	Roger Hill
Special Projects	Bob Prociuk
Youth Outreach	Ed Mizzi
Councillor	Dino diSabatino

Jeff Booth took this picture of the Aurora from May 27/28th, 2017.

It was taken with an 18mm lens and 11 seconds of exposure at ISO 3200 from the Forks of the Credit Conservation area.

Jeff has quite the tale to tell and you should head to the Forum for the full story.

Nice going, Jeff!

Head on over to https://hamiltonrasc.ca/forum/index.php and check out the “Your Images” section.