Orbit

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Roger Hill, Editor

An update from last month: NOVA will be running of Wednesdays this year, as opposed to the Mondays from years past.. Please check the forum (http://hamiltonrasc.ca/forum/index.php) for the latest dates. All members are welcome.

I had a bit of a surprise about NOVA towards the end of January, when I received a number of requests for people who wanted to know more information about the course for their school age children. After the third request in less than 24 hours, including one from Richmond Hill, I asked where they had heard about the NOVA course. It turns out that someone had posted about it on a home-schooling web site. When I told them that the course was for people who had committed to amateur astronomy sufficiently to become a member of the RASC, then they offered to inform the forum. One of the other people had said that the course was for all ages when I indicated that NOVA was aimed at people in, or after, High School, and while this means that I won't turn down a really bright kid in middle school, there may be times when knowing what trigonometry or logarithms are will be helpful (but not crucial).

Needless to say, there was some discussion amongst the board about this. I suppose that the best way to have a discussion about whether we should offer an afternoon or evening course on astronomy for kids in grades 5 to 10 would be to have it on the forum. Considering that we received three requests in less than 24 hours suggests that such a thing would be popular.

So...is anyone else really annoyed by our recent weather? Time was, that January was a good observing month, with many clear, but cold, nights. Even with a "January thaw", when the temperature would rise enough to cause a backyard rink to have problems, the skies would generally be free of clouds. Well, not completely clear, of course, but certainly a lot clearer that what we have experienced of the last couple of years. There were a couple of nights in January that were usable, but I was either working, or had to get up at 4am to go to work. Hopefully, February improves, but now that NOVA is here, many evenings I'll either be working on it, or Orbit.

Being on the Board has it's perks! One of them is finding out things before the general membership. One of those was that AstroCATS will be held in Milton, this year, at the John Tonelli hockey arena. In many ways, this is an ideal spot for it (well...it certainly is for me and a number of other Milton based members), being close to the 401, making it an easy drive from London, KW, Guelph, Mississauga and Toronto, and yet still readily accessible from Hamilton. A concrete floor, and the big Zamboni doors should make set up and tear down easy, and there are plenty of places to eat within a kilometre. My schedule currently has me working the evenings of the event, but hopefully it won't be enough to stop me from spending money! I may even be able to put in a shift or two on the Saturday and Sunday mornings. I'm looking forward to attending because I had to miss the last two.

Anyway, here's hoping that February has some decent nights for observing!

I was just checking on some events for February, and realized that there will be an annular eclipse in the southern hemisphere on February 26. This reminded me of my second total eclipse of the sun on February 26, 1979 that I observed from the shore of Lake Winnipeg, in Gimli Manitoba. The other is that Les Nagy will see a 22% partial eclipse from his home just outside of San Pedro de Atacama in Chile, and then is planning to be in the path of the total eclipse in August.

See you next month,

Roger

Front Cover: IC1805, the Heart Nebula Taken by Terry Hancock of Fremont, Michigan from his backyard observatory over 3 nights during August 2012. This is a Hubble Palette version of The Heart Nebula with SII filter assigned to Red, H-Alpha filter assigned to Green and OIII filter assigned to blue channel. Total Exposure 14.5 hours.

Equipment: QHY9M monochrome CCD TMB 92SS F5.5 APO Refractor Paramount GT-1100S German Equatorial Mount (with MKS 4000)

Comet Campaign: Amateurs Wanted—By Marcus Woo

In a cosmic coincidence, three comets will soon be approaching Earth—and astronomers want you to help study them. This global campaign, which will begin at the end of January when the first comet is bright enough, will enlist amateur astronomers to help researchers continuously monitor how the comets change over time and, ultimately, learn what these ancient ice chunks reveal about the origins of the solar system.

Over the last few years, spacecraft like NASA's Deep Impact/EPOXI or ESA's Rosetta (of which NASA played a part) discovered that comets are more dynamic than anyone realized. The missions found that dust and gas burst from a comet's nucleus every few days or weeks—fleeting phenomena that would have gone unnoticed if it weren't for the constant and nearby observations. But space missions are expensive, so for three upcoming cometary visits, researchers are instead recruiting the combined efforts of telescopes from around the world.

"This is a way that we hope can get the same sorts of observations: by harnessing the power of the masses from various amateurs," says Matthew Knight, an astronomer at the University of Maryland.

By observing the gas and dust in the coma (the comet's atmosphere of gas and dust), and tracking outbursts, amateurs will help professional researchers measure the properties of the comet's nucleus, such as its composition, rotation speed, and how well it holds together.

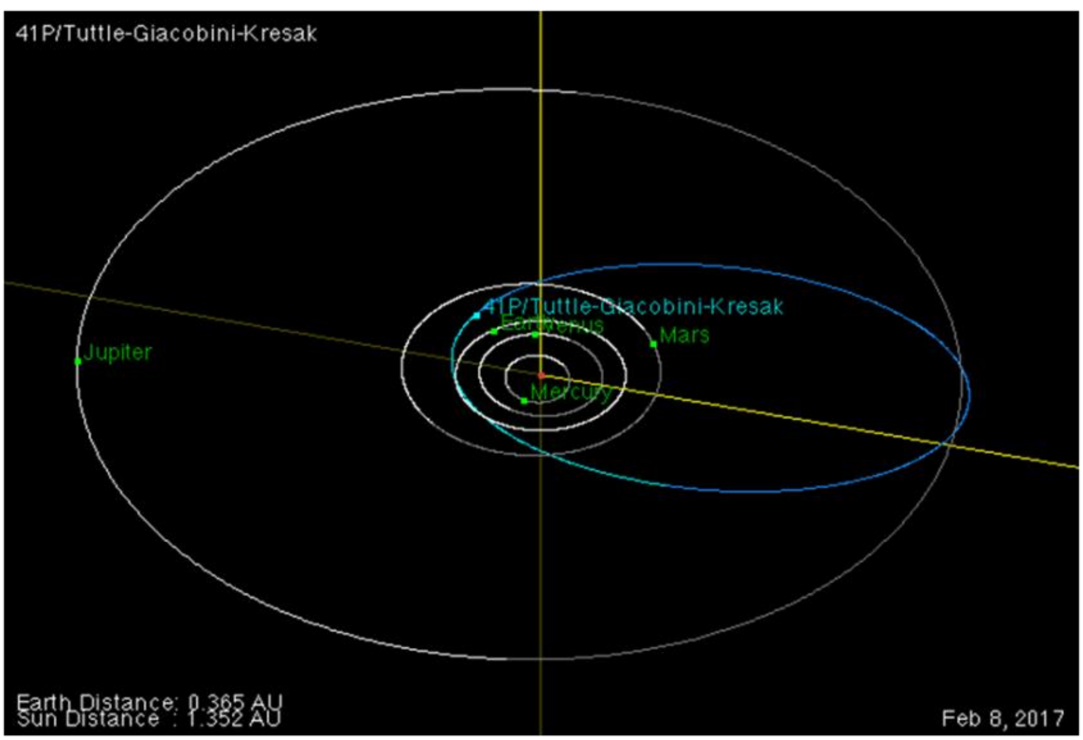
The observations may also help NASA scout out future destinations. The three targets are so-called Jupiter family comets, with relatively short periods just over five years—and orbits that are accessible to spacecraft. "The better understood a comet is," Knight says, "the better NASA can plan for a mission and figure out what the environment is going to be like, and what specifications the spacecraft will need to ensure that it will be successful."

The first comet to arrive is 41P/Tuttle-Giacobini-Kresak, whose prime window runs from the end of January to the end of July. Comet 45P/Honda-Mrkos-Pajdusakova will be most visible between mid-February and mid-March. The third target, comet 46P/Wirtanen won't arrive until 2018.

Still, the opportunity to observe three relatively bright comets within roughly 18 months is rare. "We're talking 20 or more years since we've had anything remotely resembling this," Knight says. "Telescope technology and our knowledge of comets are just totally different now than the last time any of these were good for observing."

For more information about how to participate in the campaign, visit http://www.psi.edu/41P45P46P.

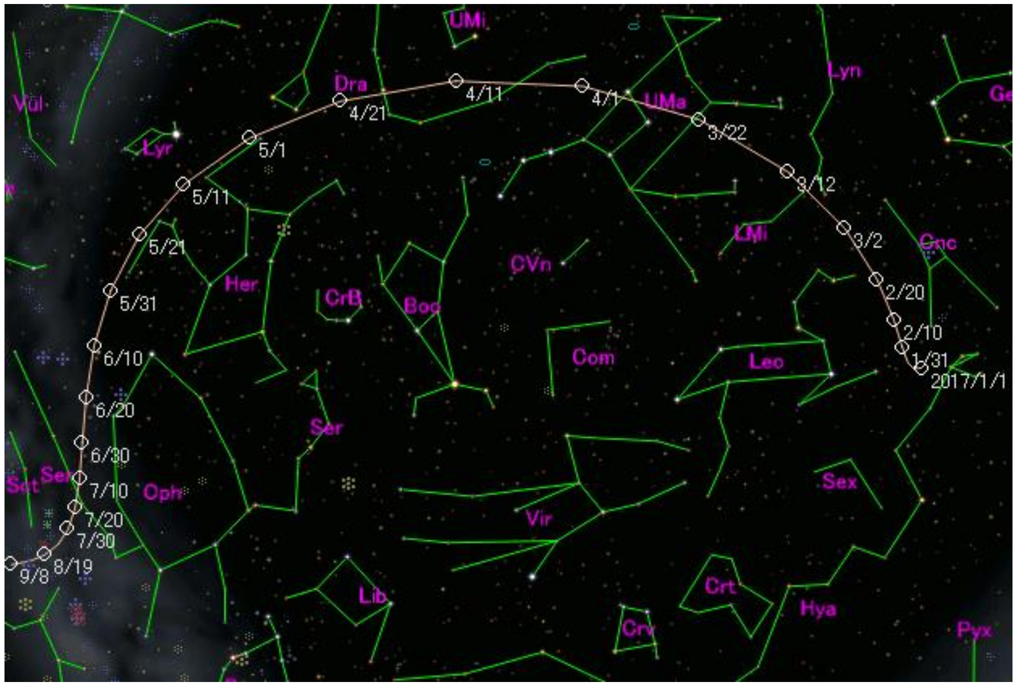
An orbit diagram of comet 41P/Tuttle-Giacobini-Kresak on February 8, 2017—a day that falls during the comet's prime visibility window. The planets orbits are white curves and the comet's orbit is a blue curve. The brighter lines indicate the portion of the orbit that is above the ecliptic plane defined by Earth's orbital plane and the darker portions are below the ecliptic plane. This image was created with the Orbit Viewer applet, provided by the Osamu Ajiki (AstroArts) and modified by Ron Baalke (Solar System Dynamics group, JPL). http://ssd.jpl.nasa.gov/sbdb.cgi?orb=1;sstr=41P



This article is provided by ***NASA Space Place.*** *With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit* ***spaceplace.nasa.gov*** *to explore space and Earth science!*

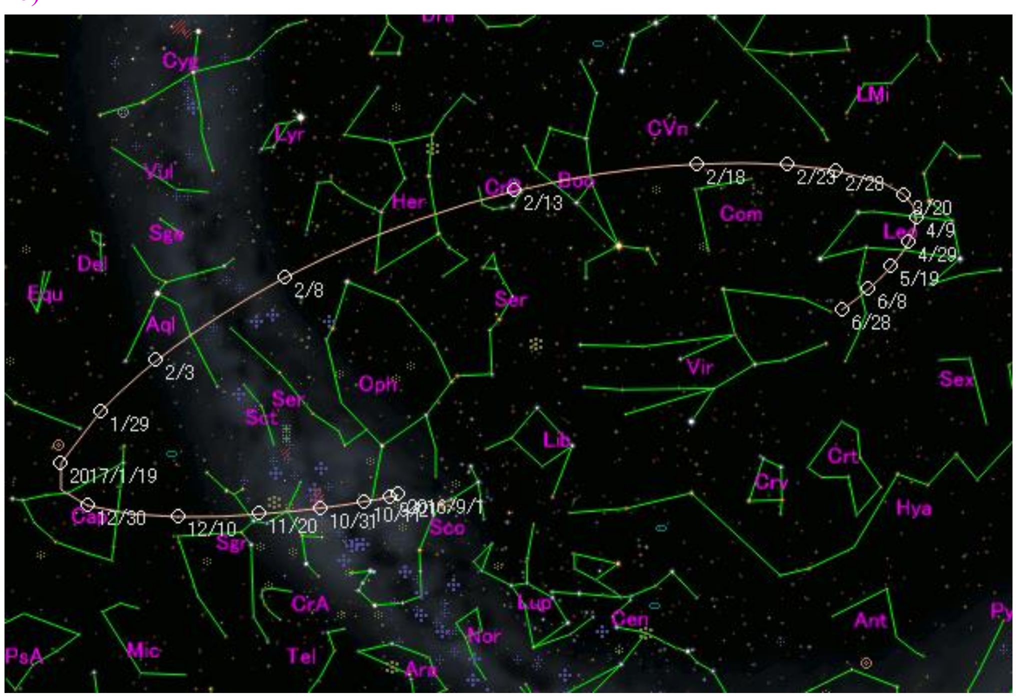
From the University of Cambridge Institute of Astronomy:

41P/Tuttle-Giacobini-Kresak (2017)



Horace Tuttle was the first discoverer of 41P/Tuttle-Giacobini-Kresak in 1858, when he found a faint comet in Leo Minor. Nearly 50 years later, Professor Michael Giacobini discovered a 13m object whilst comet hunting, which was observed for a fortnight. Andrew C D Crommelin linked the apparitions in 1928 and made predictions for future returns, but the comet wasn't recovered and it was given up as lost. In 1951, Lubor Kresak discovered a 10m comet in 25x100 binoculars whilst participating in the Skalnate Pleso Observatory's program of routine searches for comets. After further observations the comet was identified with the lost comet and a better orbit computed. At the 1973 return, which was similar to the 1907 return, it underwent a major outburst and reached 4m, before fading and then undergoing a second outburst. Alternate returns are favourable and this, its 12th, is one of them. At the last return the comet reached around 10th magnitude but it should do better this time as it passes 0.14 au from the Earth in late March. The comet should be conveniently visible from the UK in the evening sky from the beginning of the year until July. It could be a binocular object from March until June, and possibly a naked eye object around the time of its close approach. A wide-field imaging opportunity comes at the end of April when the comet passes 5° from M92.

45P/Honda-Mrkos-Pajdusakova (2016)



45P/Honda-Mrkos-Pajdusakova was at perihelion at the end of 2016 and has a brief observing window in the evening twilight at the beginning of January. It emerges from solar conjunction at the beginning of February on its way to passing 0.08 au from the Earth on February 11. It could be a binocular object as it moves rapidly across the sky during February. Though it is initially a morning object, it quickly moves into the evening sky after closest approach, but by then begins to fade fast. It passes a few degrees from M3 in mid February.

No urban legend: Our rooftops are collecting stardust—John Timmer

To some extent, scientists are professional downers, the people whose job it is to respond to outrageously improbable stories with "well, actually..." But every now and again they manage to confirm something that lots of people wanted to believe anyway.

This is one of those stories.

For years, amateur astronomers have been suggesting that microscopic, spherical particles collected from their roofs are actually tiny meteorites, the dust that formed our Solar System fallen to Earth. Scientists took the claim at face value but ended up being the downers again, at least initially. As a recent paper on this topic describes it:

A popular belief among amateur astronomers is that modern-day extraterrestrial dust can be collected on roofs in urban environments. Studies by Nininger (1941) reported large numbers of magnetic spherules collected in urban areas; however, later studies showed that the abundance of magnetic particles decreases away from urban areas, and that urban spherules are largely artificial in origin. Despite these studies, amateur collection projects in built-up areas have been common, even though most researchers in micrometeorites consider this occurrence an urban myth. (The pun on the word "urban" there is their fault, not mine.)

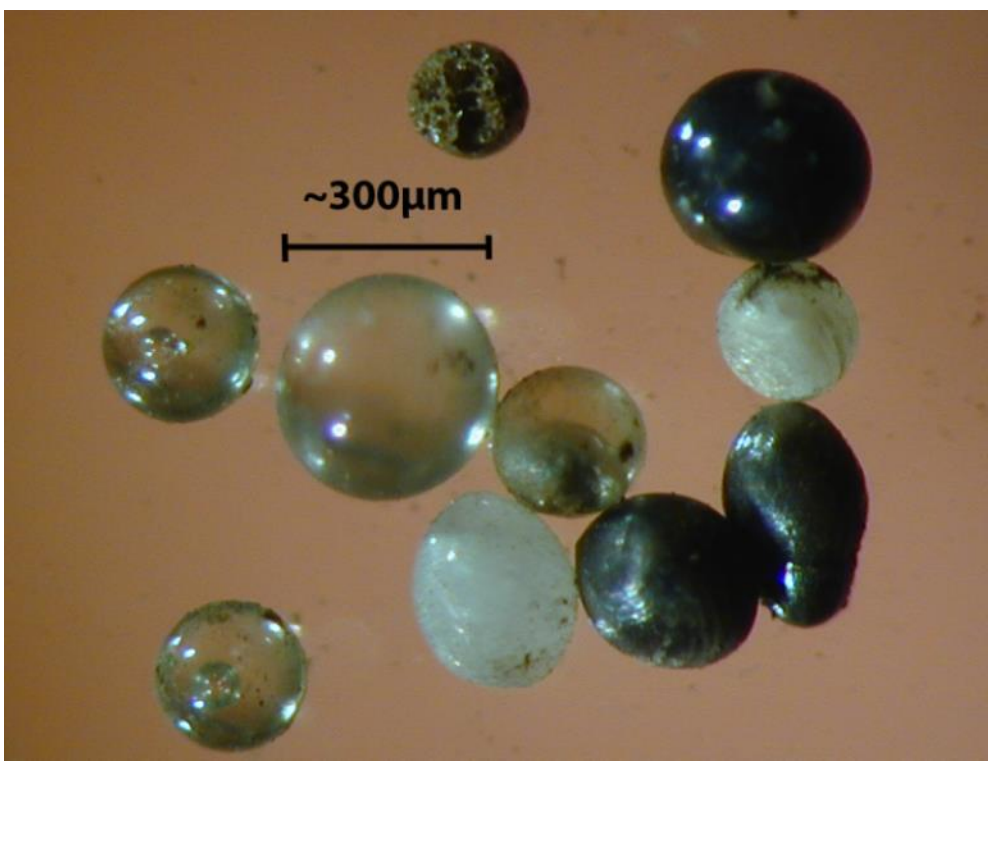
One of those amateurs is a Norwegian artist and jazz guitarist named Jon Larsen, who created a group called Project Stardust. Larsen managed two impressive feats to get the issue revisited. One, he convinced people in Oslo to gather materials from their roof gutters (although, oddly, one sample also came from Paris). And not just a few—material came in from buildings that collectively possessed 30,000 square meters of roof.

The second feat was that Larsen got a small international team of scientists (Belgian and UK) to take this seriously.

Faced with about 300kg of roof debris, the authors separated the material using a combination of magnets and physical shape—micrometeorites are spherical because they melt during atmospheric entry and are shaped by the air. From that 300kg, the researchers isolated 500 particles, all just a few hundred micrometers across, that looked like they were micrometeorites. Forty-eight of them were chosen for detailed analysis.

All 48 of them appear to be genuine micrometeorites. They have levels of seven different elements that are similar to those in chondrites, a common class of interplanetary debris. The most common mineral is olivine, which frequently occurs in micrometeorites because it's easy to form during the rapid heating/cooling of atmospheric entry. Some of them have chemicals that are rare in Earth rocks, and most lack elements like sodium, which tend to boil off as they're heated. Three of the four internal textures found in known micrometeorites appear in this collection.

And in contrast to most of the micrometeorite samples we've collected in the past, these materials have only recently fallen to Earth. Commercial buildings in Oslo apparently clean their gutters every six years on average, and the oldest building that these came from is only 50 years old. The relative precision of these dates, combined with the also precise measure of roof area, allowed the authors to estimate that the Earth is struck by about six tonnes of micrometeorites every day. Put differently, every square meter of the Earth gets hit about twice a year.



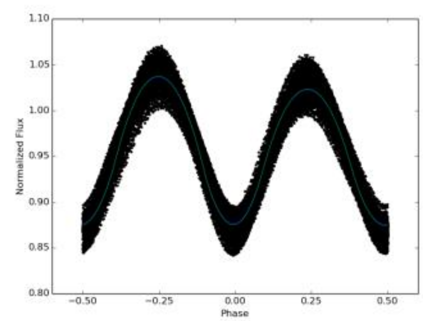
Before you look at those numbers, get excited, and head up to the roof to grab your own little bit of stardust, it's important to keep this all in perspective. The research team had to sort through an average of nearly a kilogram of roof gunk just to find one object that was, typically, 300 micrometers across. But if that's worth it for you, by all means, head for the gutters.

Star merging in KIC 9832227: a possible once-in-a-lifetime event by Gianluca Masi

Earlier this month astronomers reported that stars in KIC 9832227, a contact binary system, are going to collide in a few years, with a resulting, huge visible effect, making it a bright object in the sky. Predictions say this will happen in 2022: meantime, we can see and study the couple even with small scopes.

This amazing news was shared by Lawrence Molnar and colleagues during the 229th Meeting of the American Astronomical Society and made the astronomical community looking forward to 2022, when the two components of this contact binary system should merge, releasing such an amount of energy making the event visible as a bright star in our sky, becoming a so-called “red nova“.

KIC 9832227 is contact binary system, consisting in two very close stars, sharing the same gas envelope. Molnar and his team started studying this system in 2013, when it was unclear if it was a single pulsating star or an eclipsing binary. Its nature as a variable object was found in 2004, as part of the Northern Sky Variability Survey (NSVS). Initially, it was thought this object could be a RR Lyrae star, though there was room for other interpretations, also thanks to the data coming from the Kepler space telescope. Finally, observations provided evidence it was indeed a contact binary system.



The available data say these kissing stars are orbiting each other every 11 hours, “hiding” each other to our eyes on the Earth every half of that time, with a resulting drop of brightness of about 0.15 magnitudes.

Scientists involved in this study noticed that the speed of the orbiting stars was getting faster, meaning they were slowly approaching each other. They also suppose there is a third component, which possibly helped the two other stars to come that close, actually in contact.

Assuming all the available data, Molnar and colleagues predicted that the two stars will merge in 2022 +/- seven months.

This scenario was suggested by an event happened in 2008 and involving the star V1309 Scorpii. It showed an unexpected flare, later interpreted as the likely merging of two stars part of a contact binary system.

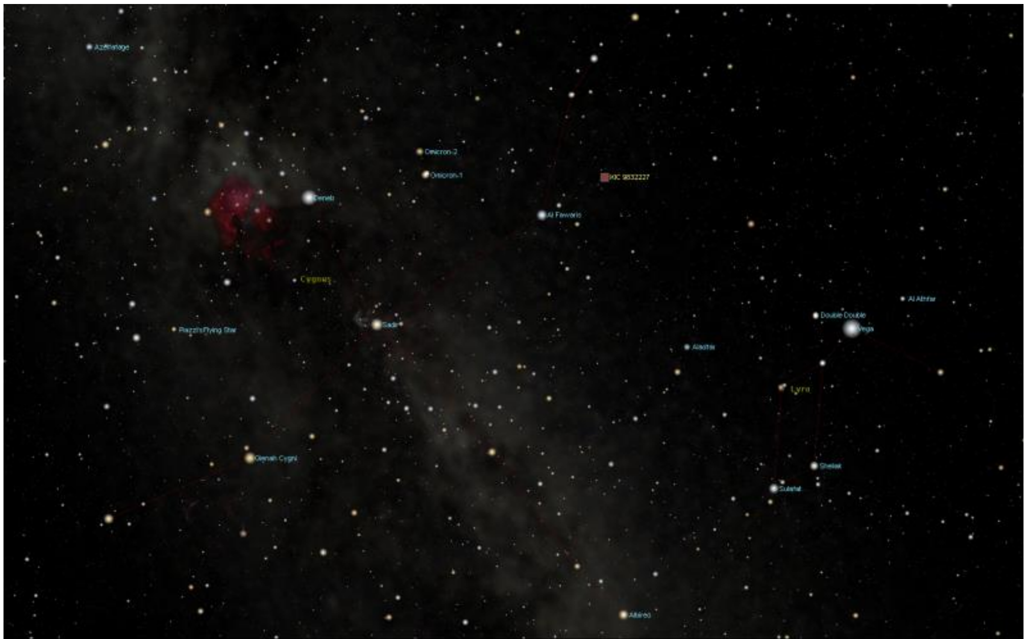
As a consequence of this kind of collision, the brightness of the system can increase of an order of magnitude of 10,000: considering KIC 9832227 is shining now around magnitude 12, at the outburst peak we could expect an object quite bright out there, easy to see by naked eye, even from light polluted cities.

Of course, at this point we are all hoping this prediction will turn to reality. We will live and see. It is not easy to imagine when the brightness of the system will start to increase, up to its climax. What we know is that this source is placed pretty well for us living in the Northern hemisphere, among the stars of Cygnus, the “Swan”, at about 1800 light years from us.

You can observe it visually with a telescope having at least a 150mm large optics. This is the position of the object: Right Ascension 19h 29m 15.948s; Declination +46° 37′ 19.89″ (J2000.0). Apparent magnitude (V) 12.27 – 12.46.

While waiting for the moment of truth, at Virtual Telescope we plan to cover KIC 9832227 during its future apparitions, to contribute to the refinements of the collision hypothesis and timing.

The top image is a general view of Cygnus, with the area that KIC 9832227 will appear to the unaided eye. The bottom one is a more detailed finder chart, produced by the Virtual Telescope Project



Position of KIC 9832227 in Cygnus. Chart plotted by Gianluca Masi - Virtual Telescope Project - using TheSkyX Pro by Software Bisque

The contact binary star system KIC 9832227. 10 January 2017.

This image comes from the average of five, 60-seconds exposures, unfiltered, remotely taken with the "Elena" (PlaneWave 17"+ Software Bisque Paramount ME + SBIG STL-6303E) robotic unit part of the Virtual Telescope Project. The binary system is in the center, marked by two white lines. The target was less than 30 deg. above the horizon at the imaging time.

Images by Gianluca Masi, Ceccano (FR), Italy - MPC code: 470 - The Virtual Telescope Project - www.virtualtelescope.eu

Why and How to Dither Your Astro Images By: Jerry Lodriguss

In astrophotography, to dither means to shift the pointing of the telescope slightly in random directions between exposures. This allows hot and cold pixels, cosmic ray artifacts, and fixed pattern noise, and even satellite or airplane trails to be removed during the stacking process. Here's how it works.

Hot pixels, which are individual pixels that look brighter than they ought to, lie in the exact same place in every exposure. By moving the pointing of the telescope, dithering shifts the stars to a slightly different place in each frame. Later, as you process your images, you'll align and stack individual frames based on the stars in each image.

This shift places the hot pixels in a different place in every frame. The Sigma rejection stacking method, available in most astronomical image-processing programs, applies a mathematical algorithm to examine every pixel and discard outliers that are very different from the average in your group of images.

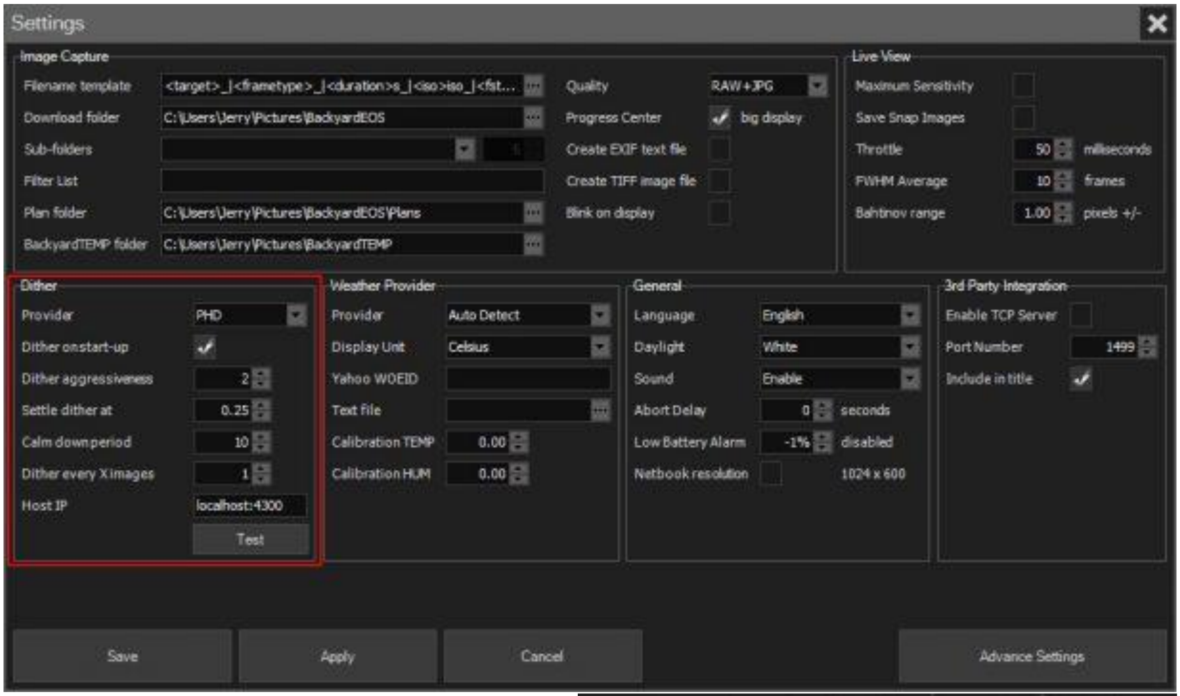
This means that if you have 10 frames and a hot pixel is only showing up in one particular location on a given frame, the algorithm replaces it with an average from the other frames. For the Sigma algorithm to work, you need a minimum of 10 frames.

Back in the days of film, I used an SBIG ST-4 autoguider, and I manually triggered a cable release for every exposure. I used to dither by turning off the autoguider, manually moving the scope a little bit with the hand controller, turning on autoguiding again, and finally starting another exposure. I did this painstakingly all night long.

Thankfully, in today's modern digital world we can automate many processes in astrophotography. We use a computer to control the telescope mount, imaging camera, and autoguider. The software that controls these different pieces of hardware enables them to communicate with each other to get the job done properly. Programs including AstroPhotography Tool, BackyardEOS, or BackyardNIKON can work with PHD2 for autoguiding. Or you could use Sequence Generator Pro with either PHD2 or MetaGuide. High-end software including MaximDL integrates all these functions.

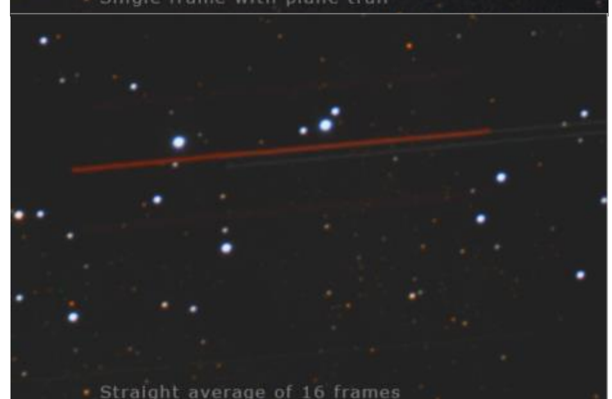
Hot pixels appearing the same place on your camera's detector, but stars shifted from frame to frame with dithering. When the image is aligned on the stars, hot pixels are in a different place from frame to frame. This allows them to be removed with Sigma stacking.

Your camera-control software does just what I did with the ST-4: it pauses the imaging sequence between exposures and sends a dither offset to the autoguider program, which then passes the command on to the mount control driver, which moves the scope. The autoguider software re-acquires the guidestar and begins guiding, and your camera-control program then starts the next exposure.



The aggressiveness setting controls how far the mount pointing will move between exposures. You may want to increase this value a bit more if you are using a DSLR or one-shot color CCD camera to compensate for the 4-pixel Bayer color filter array overlaid on the detector. The same idea applies if the optic you're guiding with has a longer focal-length than your imaging scope, which might happen if you're shooting with a telephoto camera lens on top of your normal telescope. Without a big enough shift in pointing, your pixel offset will be too small to make a difference when stacking the results.


Single frame with plane trail


Straight average of 16 frames


16 frame average with Kappa Sigma clipping

If you aren't guiding, and in some cases even if you are, you may notice your stars moving between frames from polar misalignment or flexure between your guidescope and imaging scope. You might think you can use this natural drift for dithering. Unfortunately, this generally won't work. Dithering needs to be in a random direction each time to be most effective, and drift from polar misalignment or flexure is usually in one direction, so you'll end up with smeared pattern noise appearing like dark and light streaks in your stacked result.

Also note that dithering is not the same thing as drizzling. Drizzle is a technique that improves the resolution of undersampled images. It was originally developed for the Hubble Space Telescope, where the optics resolved more detail than the size of the CCD pixels on the WFPC2 camera would allow.

Professional astronomers have a saying: "dither or die." It may not be quite that dire for amateur astrophotography, but dithering will improve your images tremendously, increasing the all-important signal-to-noise ratio and removing artifacts like hot pixels and satellite trails, as well as even compensating for temperature mismatches between darks and lights shot with an uncooled DSLR.

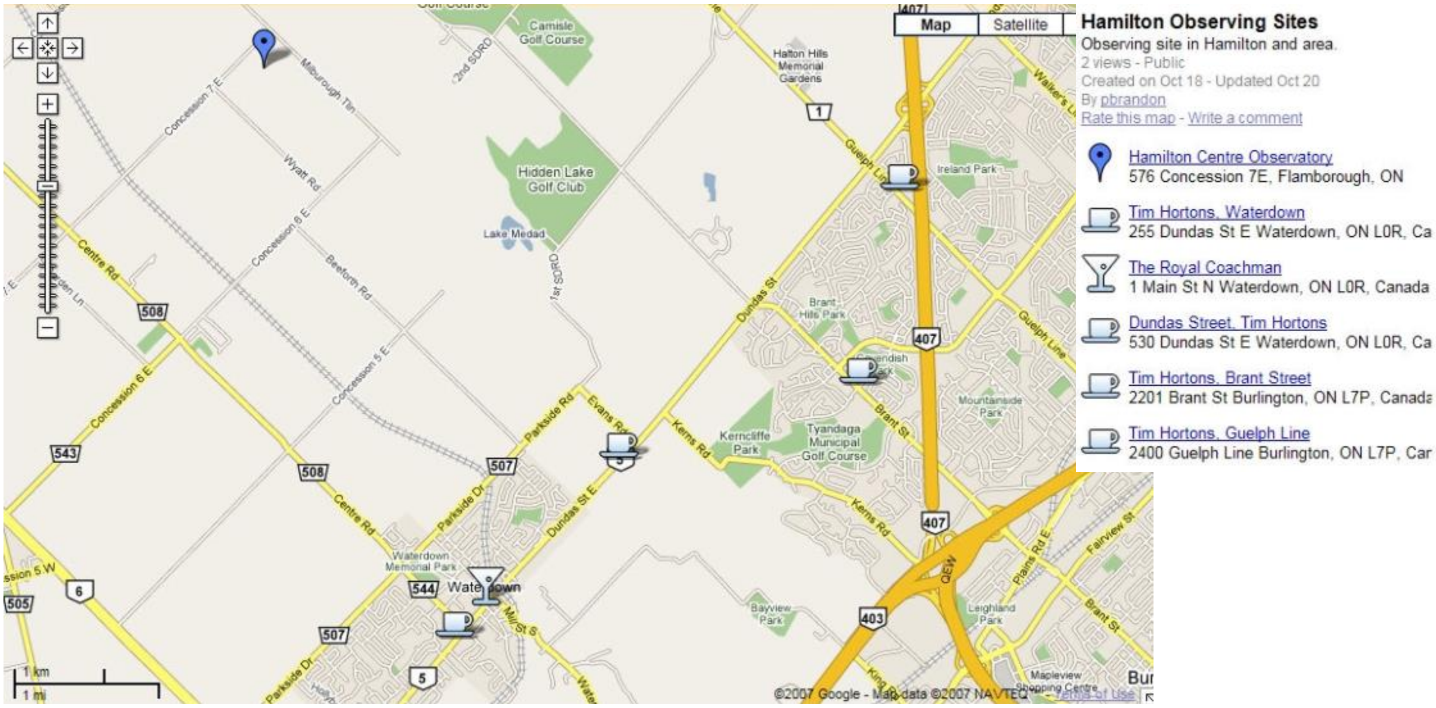
Hamilton Centre RASC, January 5, 2017: “Monthly Meeting” By Ed Mizzi

Here are the highlights of the January 5 monthly meeting.

- Gary Bennett welcomed everyone
- Bob Prociuk gave his monthly report on membership and welcomed new members in attendance
- Ed Mizzi discussed Outreach programs and how to get involved. He strongly encouraged members to join in these fun sessions, whether they are in classrooms, with adult groups or with Guides and Scouts.
- Ed Mizzi then introduced the Outreach Youth Award by explaining the criteria for choosing a winner and pointing out that it is a joint venture of our Hamilton Centre RASC club and Ontario Telescope, owned by Steve Mallia. This will hopefully become an annual event and will encourage young people to get involved in the study of astronomy and the night sky. The 2016 winner was Oliver Mao, a grade 7 student at St. Andrew elementary school in Oakville. Steve Mallia said a few words about the fascination with the universe and that he hoped this award would inspire young people to become more involved in this great hobby. Oliver was then presented with a Certificate of Recognition for being the 2016 Youth Leader in the study of astronomy in the Hamilton Centre RASC Outreach Program. Oliver also won the following: a Family membership to the Royal Astronomical Society of Canada, a RASC calendar and hat, a book (Explore the Universe Guide) and a pair of binoculars generously donated by Murray Romisher, one of our members.
- Steve Mallia was then invited to show off some new astronomy equipment that he brought with him and during the break people were able to get a close up look and ask Steve questions about these products.
- Roger Hill discussed the NOVA course he is teaching, beginning on January 30 and running for 8 sessions ending in April. He is very excited about this year’s course and encouraged members to sign up ASAP, before all the spots are taken.
- Gary Bennett introduced our guest speaker, Paul Delaney from York University who gave a talk entitled “Understanding Our Home: The Milky Way Galaxy”. Paul was not only entertaining but he described things in a way that everyone could understand, using several interesting slides and analogies. There were many questions during the Q & A session following his talk.
- Gary Bennett then invited everyone to join him at the Royal Coachman Restaurant after the meeting for refreshments and further discussion in a more informal setting.
- There were approx. 40 people in attendance and the meeting adjourned at 9:40 p.m.

The picture below might give you some idea of how much Paul Delaney gets involved in his talks. If you ever get the chance to see him in action, run, don’t walk, to wherever he is (RH)

From Top right (Clockwise) Roger Hill talks about NOVA. Steve Mallia shows some of the latest astronomy gadgets; Steve and Gary Bennett with 2016 Youth Outreach Certificate awardee Oliver Mao; Bob Prociuk wit the latest membership numbers; and Ed Mizzi talking about Outreach.



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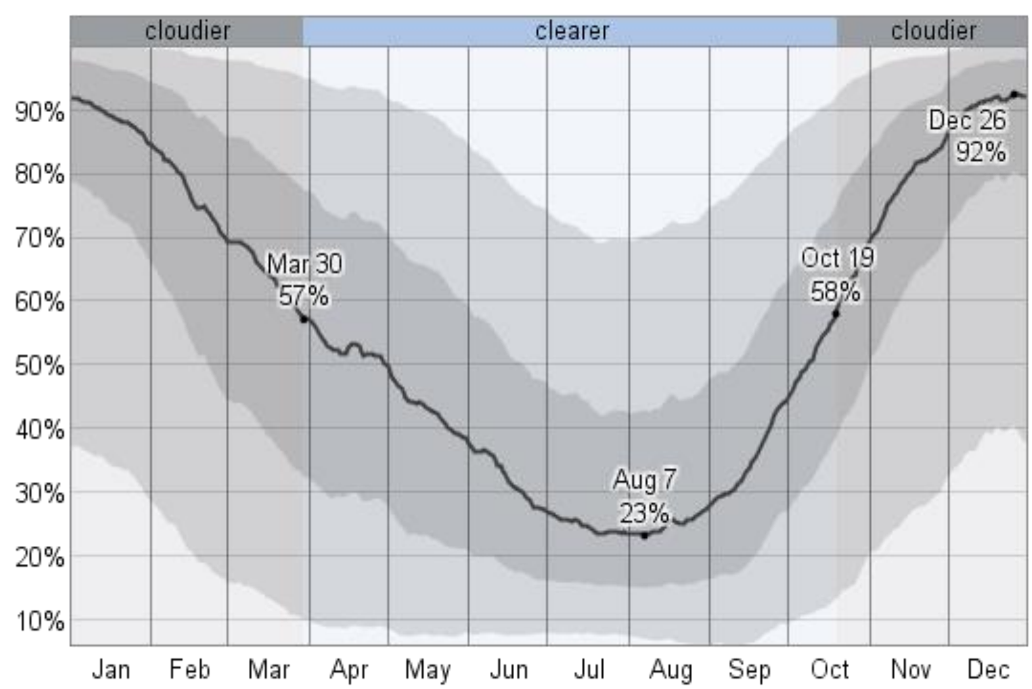
Median Cloud Cover

The median daily cloud cover (black line) with percentile bands (inner band from 40th to 60th percentile, outer band from 25th to 75th percentile). This is from a link posted on the Forum by Jeff Booth.



The median cloud cover ranges from 23% (mostly clear) to 92% (mostly cloudy). The sky is cloudiest on December 26 and clearest on August 7. The clearer part of the year begins around March 30. The cloudier part of the year begins around October 19.

On August 7, the *clearest day* of the year, the sky is *clear, mostly clear, or partly cloudy* 52% of the time, and *overcast or mostly cloudy* 28% of the time.

On December 26, the *cloudiest day* of the year, the sky is *overcast, mostly cloudy, or partly cloudy* 58% of the time, and *clear or mostly clear* 24% of the time.