Orbit

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Roger Hill, Editor

2017 was one of the best years I've had, both personally and astronomically. For the latter, of course, the total solar eclipse in August was by far the biggest highlight. In fact, in a lifetime of observing events, it's difficult to place this one. Was it in the top 5? It certainly feels that way, despite having seen 3 other eclipses, because this is one I saw with my son and my wife. Others would be my first and second eclipse, my first trip to Chile, and the second one, come to think of it. Seeing M51 through a 36" scope at the Texas Star Party certainly ranks, as does sitting in the dark in the Atacama with Les Nagy, Scotch nearby, and a camera merrily clicking away every couple of minutes. And next year I will combine a couple of those by seeing a total eclipse of the Sun in Chile...actually, I can say, for the first time in my life, that I saw a total eclipse last year, and I'll see one next year.

Last year also saw a really nice grazing occultation of a first magnitude star in March. Aldebaran is also occulted this year, too, in July, but you'll have to go up to Kirkland Lake to see it. Still, if you have a cottage on Lake Nippissing, it could be well worth the drive to see it.

I could go on, but I'll cut my "editorial" short this month, because I think that Garry Bennett's message, below, is more important than anything I've got to say.

My thanks, along with front and back cover photographs, go with Scott Barrie for his article starting on page 4. Thanks also to Ed Mizzi, Garry Bennett and new contributor Troy McCoy for making my job easier, and increasing the variety of things that you find in these pages.

Roger

Joy of Giving – A Little Time Is All It Takes—Gary Bennett

As with most things in life, the 80-20 rule is almost like the laws of physics, although new science suggests that it has become the "90-10 rule". The people among us who "keep the wheels turning", have discovered how rewarding it can be to share the joy of astronomy with others. Most of those folks are also volunteers for other associations and have acquired the skill to balance their time, at work, with family, and still have some time to devote to others.

The members in your club that do the "heavy lifting" don't normally dive in without a little push, but once they get going, they tend to become lifelong volunteers because of how good it feels to be part of something important.

So, consider this your "gentle push". As much as we would like to do more, we can't do that without the gift of time from others. Your board of directors are the people who get asked…. "when are WE going to do……". "WE" is the problem. We don't have enough "we".

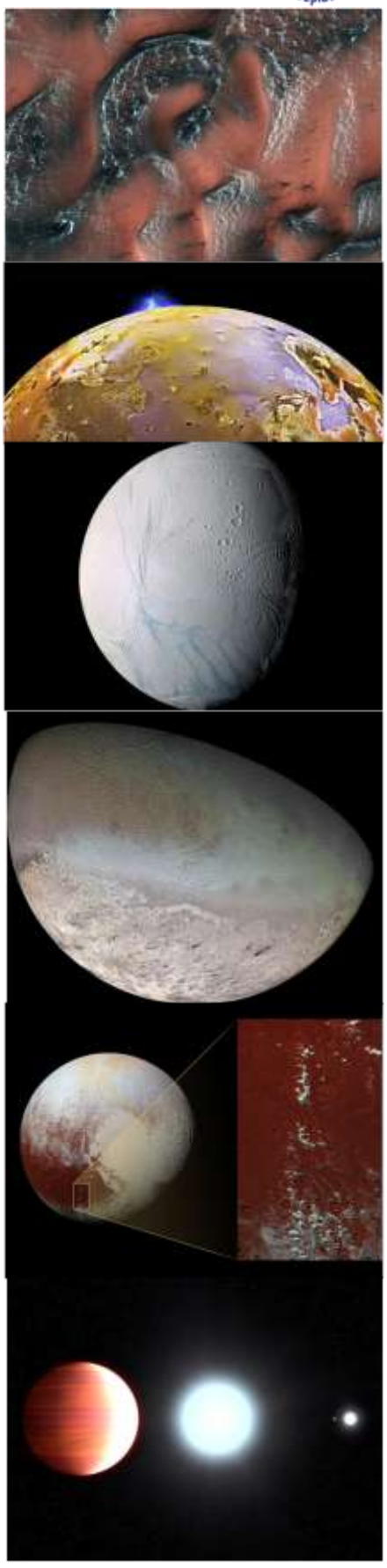
What do "we" need?

- An observing committee to organize fun get-togethers for star gazing.
- A Social Committee to organize the occasional event that includes our family. A pot-luck BBQ, annual banquet, etc.
- Group leaders for things like: telescope clinic, helping beginners, telescope making, etc. Call it "club leaders".

So, if you REALLY love to do astronomy stuff, dive in, and you will discover the fun you have been missing out on!

Snowy Worlds Beyond Earth By Linda Hermans-Killiam

There are many places on Earth where it snows, but did you know it snows on other worlds, too? Here are just a few of the places where you might find snow beyond Earth:



Mars
The north pole and south pole of Mars have ice caps that grow and shrink with the seasons. These ice caps are made mainly of water ice—the same kind of ice you'd find on Earth. However, the snow that falls there is made of carbon dioxide—the same ingredient used to make dry ice here on Earth. Carbon dioxide is in the Martian atmosphere and it freezes and falls to the surface of the planet as snow. In 2017, NASA's Mars Reconnaissance Orbiter took photos of the sand dunes around Mars' north pole. The slopes of these dunes were covered with carbon dioxide snow and ice. (*NASA's Mars Reconnaissance Orbiter captured this image of carbon dioxide snow covering dunes on Mars. Credit: NASA/JPL/University of Arizona)*

A Moon of Jupiter: Io
There are dozens of moons that orbit Jupiter and one of them, called Io, has snowflakes made out of sulfur. In 2001, NASA's Galileo spacecraft detected these sulfur snowflakes just above Io's south pole. The sulfur shoots into space from a volcano on Io's surface. In space, the sulfur quickly freezes to form snowflakes that fall back down to the surface. *(A volcano shooting molten sulfur out from the surface of Io. Credit: NASA/JPL-Caltech*)

A Moon of Saturn: Enceladus
Saturn's moon, Enceladus, has geysers that shoot water vapor out into space. There it freezes and falls back to the surface as snow. Some of the ice also escapes Enceladus to become part of Saturn's rings. The water vapor comes from a heated ocean which lies beneath the moon's icy surface. (Jupiter's moon Europa is also an icy world with a liquid ocean below the frozen surface.) All of this ice and snow make Enceladus one of the brightest objects in our solar system. *(Enceladus as viewed from NASA's Cassini spacecraft. Credit: NASA)*

A Moon of Neptune: Triton
Neptune's largest moon is Triton. It has the coldest surface known in our solar system. Triton's atmosphere is made up mainly of nitrogen. This nitrogen freezes onto its surface covering Triton with ice made of frozen nitrogen. Triton also has geysers like Enceladus, though they are smaller and made of nitrogen rather than water. (*The Voyager 2 mission captured this image of Triton. The black streaks are created by nitrogen geysers. Credit: NASA/JPL/USGs)*

Pluto
Farther out in our solar system lies the dwarf planet Pluto. In 2016, scientists on the New Horizons mission discovered a mountain chain on Pluto where the mountains were capped with methane snow and ice. *(The snowy Cthulhu (pronounced kuh-THU-lu) mountain range on Pluto. Credits: NASA/JHUAPL/SwRI)*

Beyond Our Solar System
There might even be snow far outside our solar system! Kepler-13Ab is a hot, giant planet 1,730 light years from Earth. It's nine times more massive than Jupiter and it orbits very close to its star. The Hubble Space Telescope detected evidence of titanium oxide—the mineral used in sunscreen—in this planet's upper atmosphere. On the cooler side of Kepler-13Ab that faces away from its host star, the planet's strong gravity might cause the titanium oxide to fall down as "snow." *(This is an artist's illustration of what Kepler-13Ab might look like. Credit: NASA/ESA/G. Bacon (STScI)*

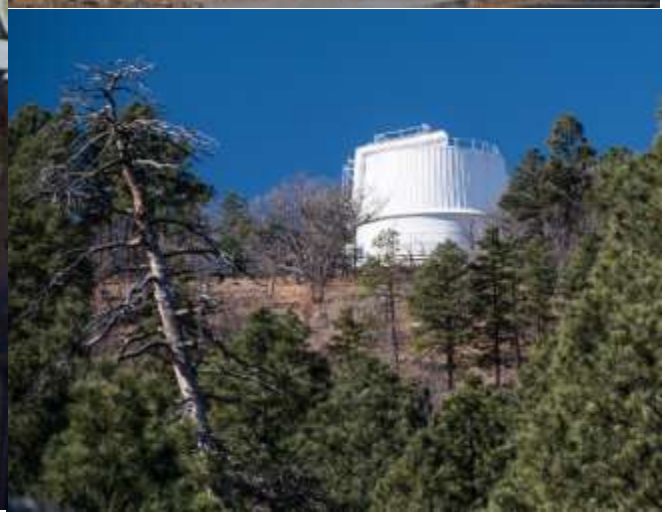
Exploring Arizona: A Couple of High Points and a Little Depression by Scott Barrie

Recently I was looking through some images from an Arizona trip my wife and I took in November of 2016, and it occurred to me that club members might have some interest in a few of the places we visited. Karen and I both love the American Southwest, and have been to the area several times, including in May, 2012 to take in the annular eclipse. But, southern Arizona was a part of the country we had not yet explored so we decided to check it out.

It seems that on any trip there is never enough time to do everything you want, and on road trips places invariably seem further apart from behind the wheel than they look on the map. Nevertheless, we managed to have quite a few adventures in the limited time available. Some of the highlights included a jeep excursion through Canyon de Chelley (pronounced Shay, and highly recommended), the requisite stop to see the flat-bed Ford at that corner in Winslow Arizona, and enjoying perhaps the best guacamole I've ever had, made right at our table in the town of Bisbee, a former mining-town-turned-hippy-colony.

But, for anyone with a particular interest in astronomy, there were a few other stops that made the trip even more memorable.

The first was a daytime drive up the West Mars Hill Road in Flagstaff to the picturesque mountaintop location of the Lowell Observatory. Founded by Percival Lowell in 1894, it is one of the oldest observatories in the United States. Over a century ago the facility was a leader in the study of "spiral nebulae", and a series of observations through the now famous 24" Clark refractor led to the first evidence that the universe is expanding. It was also from here that Lowell himself extensively studied Mars and made sketches of what he saw as an intricate system of canals on the planet – speculating that they represented signs of intelligent life. Although the public lapped it up, the astronomical community was less enthusiastic, and more detailed observations made in 1909 by the 60" telescope at Mount Wilson Observatory pretty much debunked the theory.



But the observatory continued to do valuable work. It was from here that Clyde Tombaugh discovered Pluto in 1930 and they had a mockup of it on the grounds. In 1965, Lowell was designated a National Historic Landmark, and in 2011 Time magazine named it one of the world's 100 most important places. Now, with larger, more modern and more sophisticated instruments located under darker skies elsewhere, Lowell, is perhaps no longer as important a facility as it once was. But, it still operates as an independent non-profit research institution, and its place in astronomical history is secure.

About 47 minutes down Route 66 – according to Google Maps – and about 500 meters lower in altitude, Meteor Crater has a different astronomical story to tell. Variously known as Coon Mountain, Coon Butte, and Canyon Diablo (Devil's Canyon) Crater, it was ironically officially renamed Meteor Crater to conform to an American convention whereby natural phenomena are named according to the closest post office. That said, scientists typically know it as the Barringer Crater, in honour of Daniel Barringer, early owner of the land, and the first person to become convinced it was not volcanic and had been created by a meteor impact. That hypothesis was confirmed by Eugene Shoemaker in 1960.

The crater was formed about 50,000 years ago by a 100,000 ton nickel-iron meteorite about 50 metres in diameter slamming into the ground at a rate of around 13 kilometres per second. The bulk of the meteorite was vaporized on impact, leaving a crater about 1200 meters across and approximately 170 meters deep. The rim rises about 45 meters above the surrounding landscape and, as you drive in on the lonely approach road, it seems to grow unnaturally from the desert floor.

Leaving the interpretive centre and climbing up and over the rim to one of several lookouts, one's first glimpse is awe-inspiring. The crater is an enormous, almost perfectly formed bowl. It is impossible not to make a mental comparison to the surface of the moon, and indeed, except for its comparatively modest size, Meteor Crater would comfortably fit right into the lunar landscape alongside craters like Copernicus or Tycho. This fact was not lost on NASA who sent astronauts to the bottom to train in preparation for the Apollo Missions in the 1960s and 1970s. And, there is still a flag and an astronaut mannequin planted on the crater floor to provide the visitor with a sense of scale.

One of only about 150 impact craters as yet identified globally, it is still owned by the Barringer family who claim, with some accuracy, that it is the "best preserved meteorite crater on earth".

The final astronomically themed place we visited was, for me, perhaps the highlight of our trip – the Kitt Peak National Observatory. Located in the Quinlan Mountains on the Tohono O'ogham Nation just over an hour's drive west of Tucson, it is home to more optical and radio telescopes than any other mountain on the planet.

It is actually at a slightly lower elevation than Lowell but the site is much more remote. After leaving the sparsely travelled "main" road you head towards the base of the mountain which rises steeply ahead of you and begin the twisting 11 mile long ascent to the observatory.

A number of activities are available to visitors and we had pre-registered for the nightly observing program. It was a 4 hour session beginning with an indoor component comprised of an introductory talk, video presentation, and light dinner. This was followed by a guided stroll out to the west end of the observatory to watch the sun go down over the mountains. After that, while we waited for darkness, there was another brief indoor presentation introducing the use of planispheres to find objects in the night sky.

Once the stars were out there was a comprehensive binocular tour of the sky during which we were "introduced" to numerous standard targets. For some objects this proved to be much more challenging than one might expect due to the sheer number of stars visible in the pristine sky. But really, in a situation like that, who cares about finding stuff? It was a joy just to sweep the incredible tapestry of stars overhead.

Next, smaller groups took turns going into one of the domes for some telescopic observing. The scope was about the size of the club's Ritchey-Chretien and that, combined with the wonderful sky conditions, provided some of the best views of objects like Mars, M31, The Pleiades, and others, that I've ever had. The evening was aimed at beginners, but just being in those surroundings, under that incredible sky, made it a terrific experience for any level of observer.

Now, having said that, the evening was not quite everything I had hoped.

In my overly vivid imagination, I pictured that we would attend the presentation and afterwards be given free reign to stroll the grounds to our hearts content. I pictured sitting arm-in-arm with my wife overlooking the valley far below, the valley that we wouldn't be able to see because it was so incredibly dark. I pictured us spending an hour or two scanning the dome overhead, soaking it all in. Then, Karen would curl up in the rental car to sleep while I set up my camera to shoot star fields until the sun came up.
My imaginary plan, of course, was wildly, naively optimistic. What was I thinking?!

Kitt Peak is a working observatory. Understandably, every effort is taken to keep it as dark as possible at all times. What that meant, as far as we were concerned, was that once the workshop had wrapped up, all the visitors' cars, wearing red filters over their headlights, proceeded down the mountain single-file in a convoy until safely out of range.

So, unfortunately, there was to be no leisurely astro-photo session for me. However, while the other participants shopped for T-shirts and planispheres in the gift shop, I was able to persuade one of the guides to let me to dash to the car – not an easy thing in that darkness and I had the bruises to prove it – and quickly set up my tripod to grab a few images. 10-15 minutes tops. Barely time to blast off a few exposures.

But somehow, those few pictures were enough. Now, every time I look at them they bring back some great memories, and remind me of that amazing experience under that incredible sky. Much more meaningful souvenirs than a bottle opener or keychain would ever be.

After all was said and done, it was a wonderful experience, one I would highly recommend. And, as we headed for home, I remembered that one of the other visitor programs is an in-depth astro-photography workshop. Maybe next time.

What We Learned (So Far) From 2017's Total Solar Eclipse by David W. Brown

Americans went mad for the total solar eclipse on August 21—and so did scientists. Earlier this month, researchers at the fall meeting of the American Geophysical Union in New Orleans teased out the first results of experiments performed during the eclipse. "From a NASA perspective, there is no other single event that has informed so many scientific disciplines," Lika Guhathakurta, an astrophysicist at NASA Ames Research Center, said. Among the affected fields include solar dynamics, heliophysics, Earth science, astrobiology, and planetary science. "The eclipse provided an unprecedented opportunity for cross-disciplinary studies."

To that end, NASA grants and centers supported Sun-Moon-Earth alignment research during the eclipse that involved balloons, ground measurements, telescopes, planes that chased the eclipse, and a dozen spacecraft from the agency, as well as from the National Oceanic and Atmospheric Administration, the European Space Agency, and the Japanese Space Agency. In some regions, scientists meticulously mapped responses to the total eclipse by the land and the lower atmosphere. They measured ambient temperature, humidity, winds, and changes in carbon dioxide. These data were taken to find new insights into the celestial event, which occurs somewhere on the Earth every 18 months. (Calculate here how many you could potentially see in your lifetime.)

PEERING THROUGH THE "HOLE" IN THE IONOSPHERE

Of particular interest was how the eclipse affects the ionosphere, the barrier region between the atmosphere and what we think of as outer space; it is the altitude range where auroras occur, and where the International Space Station and low Earth orbit satellites are found. The ionosphere is affected by radiation from the Sun above and by weather systems below. The eclipse gave researchers the chance to study what happens to the ionosphere when solar radiation drops suddenly, as opposed to the gradual changes of the day-night cycle.

A total eclipse essentially creates a "hole" in the ionosphere. Greg Earle of Virginia Tech led a study on how radio waves would interact with the eclipse-altered ionosphere. Current models predicted that during the brief interval of the eclipse, the hole would cause waves to travel much farther and much faster than usual. The models, it turns out, are correct, and data collected during the eclipse supported their predictions. This facilitates a better understanding of what happens on non-eclipse days, and how variances in the ionosphere can affect signals used for navigation and communication.

FINDING UNEXPECTED INTERACTIONS

"NASA's solar eclipse coverage was the agency's most watched and most followed event on social media to date," said Guhathakurta, with over 4 billion engagements. That sort of frenzied public interest for what amounted to a 90-minute celestial event over a thin strip of the United States, with around two minutes of totality for any given area, allowed scientists to engage "citizen scientists" to help with data collection. Matt Penn of the National Solar Observatory led the Citizen CATE project (Continental-America Telescopic Eclipse), which deployed 68 small, identical telescopes to amateur astronomers across the eclipse path. "At all times, at least one CATE telescope was in the shadow looking at the [Sun's] corona," Penn said. "And sometimes we had five telescopes looking at the corona simultaneously." This resulted in a lot of data. "We got 45,000 images, and to go along with that, we got 50,000 calibration images."

They're still working on the data processing, but by combining images similar to the way smartphone cameras create HDR images in certain lighting conditions, scientists are able to view the Sun's corona—the shimmering halo of plasma that surrounds it—in stunning new detail. Image-processing techniques on the high-resolution data yielded surprising results. Specifically: There are interactions between the "cold" atmosphere of the Sun—the chromosphere, which is "only" 10,000°F—and the hot corona, which is 1,000,000°F. "We're hoping to analyze these data in more detail and come up with some publications in the near future," Penn said. The project's telescopes remain in the hands of the public, and new experiments are underway.

"Most of our volunteers were going see the eclipse anyway, and what we did was try to enable them to elevate their experience by participating in research. And that goes from collecting the data to publication," Penn tells Mental Floss. "We could have had 200 sites easily with the amount of interest we had." The public's keen interest in the eclipse will spur experiments of commensurate ambition in 2024, when North America again experiences a total solar eclipse.

ATTEMPTING TO ANALYZE DATA NO ONE HAS EVER SEEN BEFORE

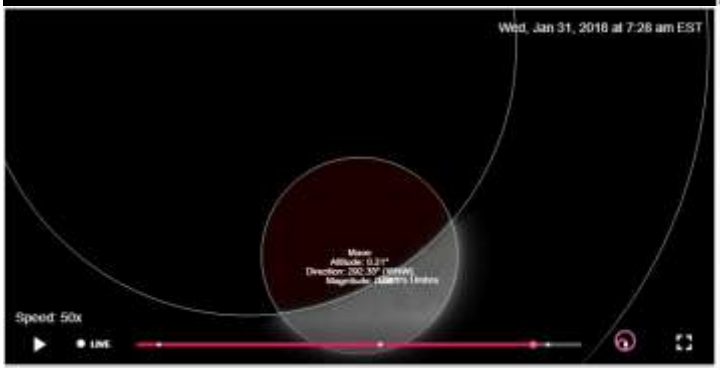
Penn's project wasn't the only science conducted with a public-engagement aspect. The Eclipse Ballooning Project, led by Angela Des Jardins of Montana State University, enabled 55 teams of college and high school students to fly weather balloons to above 100,000 feet. There, they took measurements to see how the eclipse affects the weather-influencing lower atmosphere. The balloons also live-streamed the eclipse as it occurred across the continent. To give a sense of how long the project has been in development: When it was conceived, live-streaming as we experience it today had not yet been invented.

She tells Mental Floss that the project's success has spurred ideas for future large-team, long-term projects for the 2024 eclipse. "For me, the biggest lesson is, you have to have something that is really exciting and challenging in order to get students involved, and in order for the general public to be involved," she says.

Results from the Eclipse Ballooning Project are forthcoming, a common refrain by eclipse researchers. "We're really excited about taking this new type of data that no one has ever taken before, and now we are in the phase when we realize no one has ever tried to *analyze* data like this before," Penn says. "So we're inventing the analysis as well, and it's going to take time."

More results are sure to come in 2018.

The January 31, 2018, Total Lunar Eclipse from Waterdown North



Time	Phase		Direction	Altitude
5:51 am		Penumbral Eclipse begins	277°	17.1°
6:48 am		Partial Eclipse begins	285°	7.3°
7:31 am		Maximal Eclipse visible in Waterdown North	292°	0.5°
7:35 am	Not directly visible	Moonset	293°	-0.0°
7:51 am	Not directly visible	Total Eclipse begins	296°	-2.5°
8:29 am	Not directly visible	Maximum Eclipse	302°	-9.0°
9:07 am	Not directly visible	Total Eclipse ends	309°	-14.4°
10:11 am	Not directly visible	Partial Eclipse ends	322°	-22.2°
11:08 am	Not directly visible	Penumbral Eclipse ends	335°	-27.4°

This eclipse should be similar to the one on April 4th, 2015. The photo below was taken that day, during the penumbral phase as I was waiting for the partial phases to begin. My observing site was just north of the Hamilton Centre Observatory and south of Britannia Road on Milborough Town Line.

I will probably choose the same site, if anyone cares to join me. We may have difficulty looking over the mounds of snow, though, so check on the Forum in the days leading up to this.

Roger

December 2017 Monthly Meeting by Ed Mizzi

On Dec. 7, 2017, the Hamilton Centre met for its regular monthly meeting. Attendance was very good with about 35 people present and everyone was looking forward to the lecture by Thanassis Psaltis.

Ed Mizzi began the proceedings with a welcome to everyone. He displayed a slide with the agenda on it and briefly introduced the topics for the meeting. He mentioned several club activities and advantages of membership and encouraged people to get involved. Ed then gave a special welcome to a long-time friend of Colin Haig, Dr. Dick Berg, a professional astronomer who made the trip up from New York State just to attend our meeting. Colin said a few words about him and we asked him to discuss his background and astronomy interests. Then Ed and Colin officially welcomed him with 3 gifts, a RASC cap, toque and 2018 US version of the Astronomer's Handbook. See www.brightskies.us

Ed introduced Bill Leggitt, the club's Treasurer. Bill gave an excellent financial statement presentation about the last year, 2016/2017. Bill used both a slide show and a few Excel files to describe the club's financial situation and where we are headed in the near and distant future. A motion was made to accept the financial report and was carried unanimously. Minutes of this part of the meeting were recorded by Chris Talpas, our secretary. Thanks to Bill for making everything so clear and easy to understand.

Ed introduced Bob Prociuk, Board member, whose portfolio includes vice president and memberships. Bob discussed the benefits of membership at the Hamilton Centre and the Royal Astronomical Society of Canada. He welcomed both new members and members of the public. Our newest members include John Reinsborough, Brynne Degenhardt, Emma Noel Ashworth, Anna Ashworth, Ethan Ashworth, Timothy Ashworth and Andrew K. Hughes. Our total is now 111.

Then Ed Mizzi discussed outreach and also encouraged members to participate in these fun and enjoyable activities with the public. Ed mentioned the event on Nov. 28 at Pearson High School in Burlington, where Ed did a talk during the day to 2 grade nine science classes and then those students and their teachers met at 6:30 PM for a mini star party in the back field of the school. Bob Prociuk, Erin Vassair and Ed Mizzi teamed up to show the students objects in the night sky, with the Moon being the "cool" object of the evening. Hopefully the rest of the 2017/2018 year will see similar fun events, with more members participating.

Ed Mizzi then described a program discovered by Board member Troy McCoy, called Gaia Ground based Observational Service for Asteroids (Gaia-GOSA). Members can easily get involved in assisting this program with the goal of gathering photometric light curves of a selection of asteroids. Sounds like an exciting science project.

Ed then introduced another Board member, Muhammad Basil Ahmad, to give a brief preview of the speaker he obtained for our Jan. 4 meeting. Ian Shelton will be here to discuss Super Nova 1987A and his personal connection to this incredible event. Thanks to Muhammad for securing January's speaker.

We then took a 10 minute break to give people a chance to stretch and chat with fellow members.

After the break, Bob Prociuk introduced the night's speaker, giving an excellent summary of the work that Thanassis has been involved with at the university and a brief introduction to his topic.

Thanassis Psaltis, a graduate student at McMaster University, then provided us with an entertaining and informative lecture entitled "Rust and stardust: The lives of the stars and the origin of the elements". The audience was very intrigued by what he had to say and many questions ensued, both during and after the talk. Thanassis used several cool analogies from the real world, to help describe the concepts he spoke about. A big thank you to Thanassis for taking time out of his busy schedule to visit and enlighten us with his knowledge.
Bob thanked Thanassis with a gift of appreciation for the time he spent both preparing and providing his findings.

Ed then adjourned the meeting but not before informing members of three upcoming meetings:
- December Board meeting, at the observatory, Dec. 13, 8 PM. All members are welcome.
- January Monthly meeting, at the Legion, Jan. 4, 8 PM. Members and the Public are welcome.
- January Board meeting, at the observatory, Jan. 10, 8 PM. All members are welcome.

Thanks to all who attended. Thanks to Abigail Hughes for taking photos of the proceedings.

Following the meeting, about 12 people met at the Royal Coachmen to further discuss all-things-astronomy.

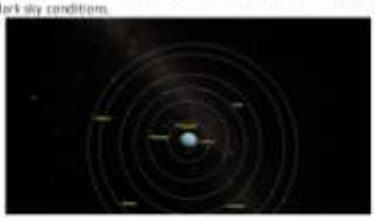

Monthly Meeting


Preview of the
Guest Speaker for
January


Dust and Stardust:
The lives of the stars and

Uranus – January 2018

- During January, Uranus is well placed in the evening sky, positioned between the 2 chains of faint stars that link the fishes of Pisces. By month end the planet will be setting about 22:30 local time. At magnitude 5.7, it is bright enough to observe in binoculars under dark sky conditions.



Neptune – January 2018

- Neptune spends January in the western evening sky in Aquarius, setting mid evening. The naked eye star Lambda Aquarii, located only 0.5 degrees north of the planet will aid you in finding it.

January 5 – Moon meets Regulus

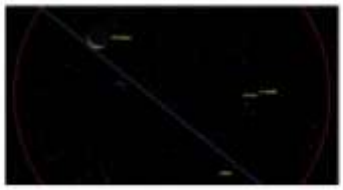
- On the morning of January 5, the waning gibbous moon will pass very close to the bright star Regulus in Leo.

January 6 – Mars close to Jupiter

- In the predawn eastern sky on January 6, Mars eastward orbital motion will cause it to pass very close to distant Jupiter. In a backyard telescope, both planets, plus Jupiter's four Galilean moon, will fit in the field of view of a low power eyepiece.

January 11 – Moon meets Mars and Jupiter

- In the eastern pre-dawn sky the waning crescent moon will sit less than 4 degrees to the upper left of dim reddish Mars and very bright Jupiter. The 2 planets will be separated by only 2 degrees and all three objects will fit in the field of view of binoculars.

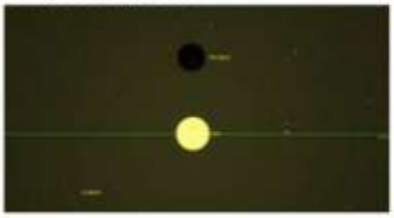


January 15 – Mercury and Saturn meet the Old Moon

- Low in the SE predawn sky, the old moon's thin crescent can be glimpsed sitting 3 degrees left of Mercury. Meanwhile Saturn will be positioned 3 degrees to the upper right of Mercury. All 3 objects will fit into field of view of binoculars.

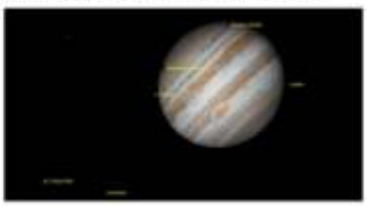
January 16 – New Moon

- When new, the moon is travelling between the Earth and the Sun. Since sunlight is only reaching the side of the moon turned away from us, and the moon is in the same region of the sky as the sun, the moon is hidden from view.



January 19 – Double shadow transit on Jupiter

- When geometry is favourable, the round black shadows of the Galilean moons can be observed as they cross the face of the giant planet. On January 19, between 04:43 – 04:55 EST the shadows of Europa and Ganymede will be visible at the same time in North America.

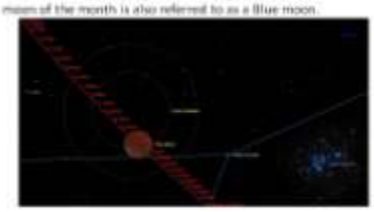


January 31 – Ceres at opposition

- The dwarf planet Ceres reaches opposition on the 31st. This is when it's at its brightest (mag 6.85) and closest to earth for the year. At opposition it will be situated near the northern boundary of Cancer. Celestial path through June 2018 is plotted in red.

January 31 – Full "supermoon", Lunar eclipse and "blue moon"

- January ends with a treat, a lunar eclipse of a full supermoon that is also a blue moon. Most of North America will see a portion of the eclipse before the moon sets. It occurs 1.2 days after perigee so the diameter will appear larger than average (super) and the second full moon of the month is also referred to as a Blue moon.



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