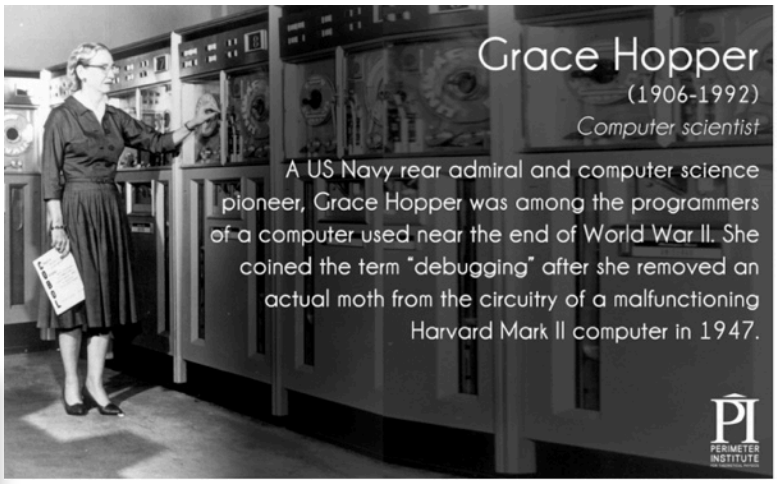
Star Gazer News

INTERNATIONAL YEAR OF LIGHT 2015

Astronomy News for Bluewater Stargazers
Vol 9 No. 11 November 2015



Perimeter Institute in Waterloo, ON, has issued a series of posters honouring Women in Physics. SGN 2015 issues will feature women who have made major contributions to astronomy and physics.

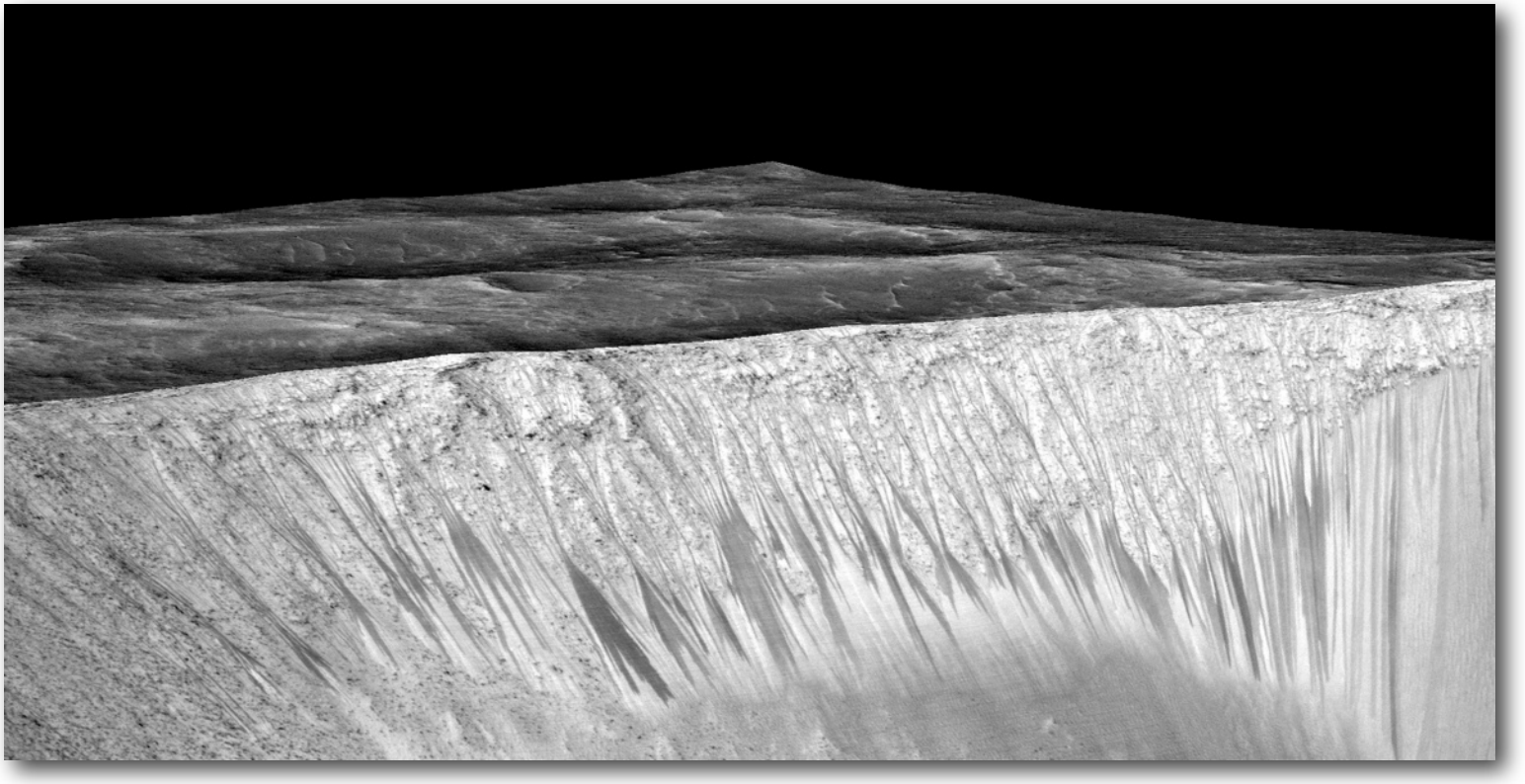
November 2015 Contents

Liquid Water on Mars

New findings from NASA's Mars Reconnaissance Orbiter (MRO) provide the strongest evidence yet that liquid water flows intermittently on present-day Mars.

Using an imaging spectrometer on MRO, researchers detected signatures of hydrated minerals on slopes where mysterious streaks are seen on the Red Planet. These darkish streaks appear to ebb and flow over time. They darken and appear to flow down steep slopes during warm seasons, and then fade in cooler seasons. They appear in several locations on Mars when temperatures are above minus 10 degrees Fahrenheit (minus 23 Celsius), and disappear at colder times.

"Our quest on Mars has been to 'follow the water,' in our search for life in the universe, and now we have convincing science that validates what we've long suspected," said John Grunsfeld, astronaut and associate administrator of NASA's Science Mission Directorate in Washington. "This is a significant development, as it appears to confirm that water -- albeit briny -- is flowing today on the surface of Mars."
(continued on page 3)



Below: *Dark narrow streaks called recurring slope lineae emanating out of the walls of Garni crater on Mars. The dark streaks here are up to few hundred meters in length. They are hypothesized to be formed by flow of briny liquid water on Mars. Vertical exaggeration is 1.5.* ***Credits: NASA/JPL/University of Arizona***

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BAS & Astronomy Events for Nov

Nov 3 Tue — LQ **Mars and Venus conjunction** in morning sky less than 1 degree apart

Nov 4 Wed — BAS meeting at Grey Roots Museum Topic: Members/ Gadget night

Nov 7 Sat — **Venus, Mars and Last Crescent Moon** in nice 2° triangle below Jupiter in morning sky

Nov 11 Wed — NM

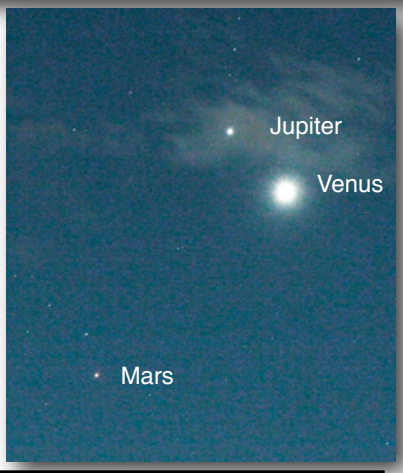
Nov 14 Sat — BAS Dark of the Moon viewing@Fox

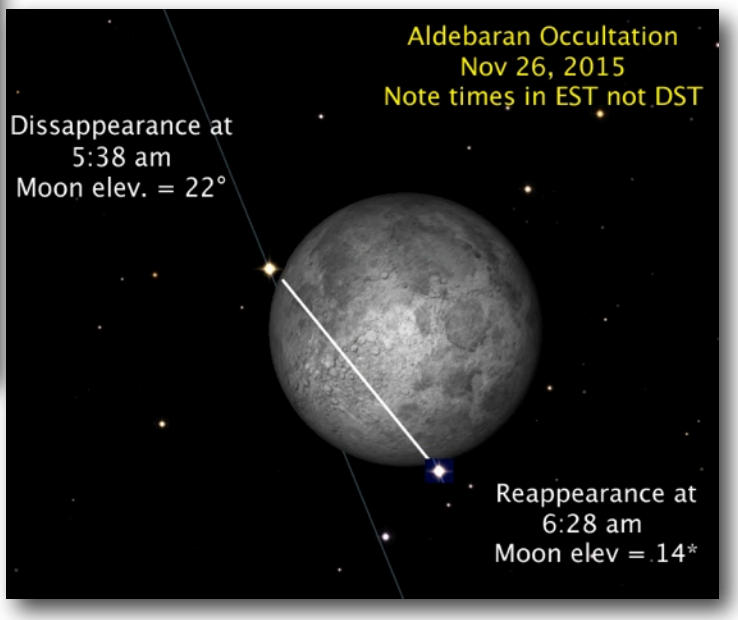
Nov 19 Thu — FQ

Nov 25 Wed — FM

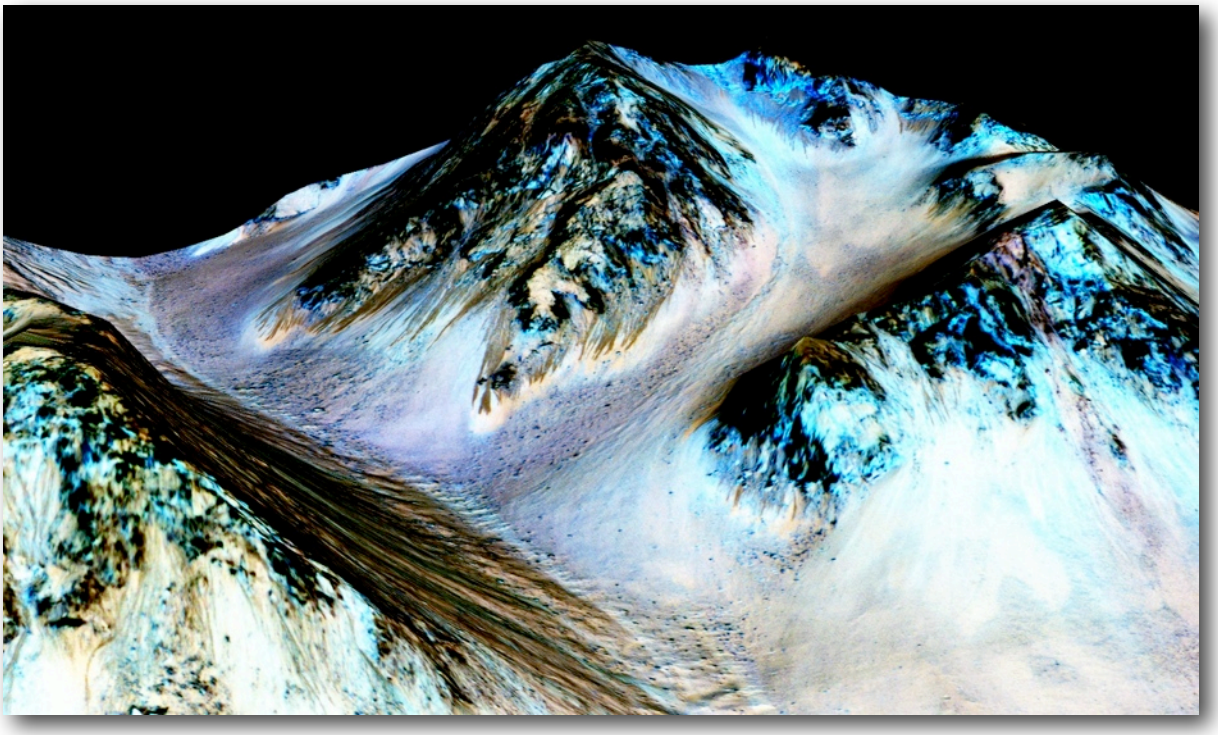
Nov 26 Thu — **Aldebaran Occultation** Disappearance at 5:38 am EST, Reappearance at 6:28 am EST Moon is Full, elevation of Moon drops from 22° to 14° during event.

Planet Trio Over the Sound:
The night of Oct 25 was crisp and clear and Clear Sky Clock showed it would last until noon the next day. Image above shows that October weather changes quickly. An hour before the trio were due to rise in the east on the morning of Oct 26, a cloud bank passed over Owen Sound and messed up the imaging. Holes in the clouds allowed for these images to be taken, however (by John H). See pg 9 and 10 for more images.





From the editor:
My apologies for not getting around to the follow-up article on **OS LED lights (July 2015)**. There have been so many interesting events like auroras and eclipses that the article keeps getting pushed back to future issues. It will appear in the Dec 2015 issue.



These dark, narrow, 100 meter-long streaks called recurring slope lineae flowing downhill on Mars are inferred to have been formed by contemporary flowing water. Recently, planetary scientists detected hydrated salts on these slopes at Hale crater, corroborating their original hypothesis that the streaks are indeed formed by liquid water. The blue color seen upslope of the dark streaks are thought not to be related to their formation, but instead are from the presence of the mineral pyroxene. Vertical exaggeration is 1.5.
Credits: NASA/JPL/University of Arizona

These downhill flows, known as recurring slope lineae (RSL), often have been described as possibly related to liquid water. The new findings of hydrated salts on the slopes point to what that relationship may be to these dark features. The hydrated salts would lower the freezing point of a liquid brine, just as salt on roads here on Earth causes ice and snow to melt more rapidly. Scientists say it's likely a shallow subsurface flow, with enough water wicking to the surface to explain the darkening.

"We found the hydrated salts only when the seasonal features were widest, which suggests that either the dark streaks themselves or a process that forms them is the source of the hydration. In either case, the detection of hydrated salts on these slopes means that water plays a vital role in the formation of these streaks," said Lujendra Ojha of the Georgia Institute of Technology (Georgia Tech) in Atlanta, lead author of a report on these findings published Sept. 28 by Nature Geoscience.

Ojha first noticed these puzzling features as a University of Arizona undergraduate student in 2010, using images from the MRO's High Resolution Imaging Science Experiment (HiRISE). HiRISE observations now have documented RSL at dozens of sites on Mars. The new study pairs HiRISE observations with mineral mapping by MRO's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM).

The spectrometer observations show signatures of hydrated salts at multiple RSL locations, but only when the dark features were relatively wide. When the researchers looked at the same locations and RSL weren't as extensive, they detected no hydrated salt.

Ojha and his co-authors interpret the spectral signatures as caused by hydrated minerals called perchlorates. The hydrated salts most consistent with the chemical signatures are likely a mixture of magnesium perchlorate, magnesium chlorate and sodium perchlorate. Some perchlorates have been shown to keep liquids from freezing even when conditions are as cold as minus 94 degrees Fahrenheit (minus 70 Celsius). On Earth, naturally produced perchlorates are concentrated in deserts, and some types of perchlorates can be used as rocket propellant.

Perchlorates have previously been seen on Mars. NASA's Phoenix lander and Curiosity rover both found them in the planet's soil, and some scientists believe that the Viking missions in the 1970s measured signatures of these salts. However, this study of RSL detected perchlorates, now in hydrated form, in different areas than those explored by the landers. This also is the first time perchlorates have been identified from orbit.

MRO has been examining Mars since 2006 with its six science instruments.

"The ability of MRO to observe for multiple Mars years with a payload able to see the fine detail of these features has enabled findings such as these: first identifying the puzzling seasonal streaks and now making a big step towards explaining what they are," said Rich Zurek, MRO project scientist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California.

For Ojha, the new findings are more proof that the mysterious lines he first saw darkening Martian slopes five years ago are, indeed, present-day water.

"When most people talk about water on Mars, they're usually talking about ancient water or frozen water," he said. "Now we know there's more to the story. This is the first spectral detection that unambiguously supports our liquid water-formation hypotheses for RSL."

The discovery is the latest breakthrough by NASA's Mars missions.

"It took multiple spacecraft over several years to solve this mystery, and now we know there is liquid water on the surface of this cold, desert planet," said Michael Meyer, lead scientist for NASA's Mars Exploration Program at the agency's headquarters in Washington. "It seems that the more we study Mars, the more we learn how life could be supported and where there are resources to support life in the future."

How Rosetta's comet got its shape


Rosetta's Comet 67P

28 September 2015 ESA Press Release

Two comets collided at low speed in the early Solar System to give rise to the distinctive 'rubber duck' shape of Comet 67P/Churyumov-Gerasimenko, say Rosetta scientists. The origin of the comet's double-lobed form has been a key question since Rosetta first revealed its surprising shape in July 2014. Two leading ideas emerged: did two comets merge or did localised erosion of a single object form the 'neck'?

Now, scientists have an unambiguous answer to the conundrum. By using high-resolution images taken between 6 August 2014 and 17 March 2015 to study the layers of material seen all over the nucleus, they have shown that the shape arose from a low-speed collision between two fully fledged, separately formed comets.

"*It is clear from the images that both lobes have an outer envelope of material organised in distinct layers, and we think these extend for several hundred metres below the surface,*" says Matteo Massironi, lead author from the University of Padova, Italy, and an associate scientist of the OSIRIS team. "*You can imagine the layering a bit like an onion, except in this case we are considering two separate onions of differing size that have grown independently before fusing together.*"

The results of the study are reported in the journal *Nature* and were presented today at the European Planetary Science Congress in Nantes, France.

To reach their conclusion, Matteo and his colleagues first used images to identify over 100 terraces seen on the surface of the comet, and parallel layers of material clearly seen in exposed cliff walls and pits. A 3D shape model was then used to determine the directions in which they were sloping and to visualise how they extend into the subsurface. It soon became clear that the features were coherently oriented all around the comet's lobes and in some places extended to a depth of about 650 m.

"*This was the first clue that the two lobes are independent, reinforced by the observation that the layers are inclined in opposite directions close to the comet's neck,*" says Matteo. "*To be sure, we also looked at the relationship between the local gravity and the orientations of the individual features all around the reconstructed comet surface.*"

Broadly speaking, layers of material should form at right angles to the gravity of an object. The team used models to compute the strength and direction of the gravity at the location of each layer. In one case, they modelled the comet as a single body with a centre of mass close to the neck. In the other, they worked with two separate comets, each with its own centre of mass.

The team found that orientation of a given layer and the direction of the local gravity are closer to perpendicular in the model with two separate objects, rather than in the one with a single combined nucleus.

"*This points to the layered envelopes in the comet's head and body forming independently before the two objects merged later,*" concludes Matteo. "*It must have been a low-speed collision in order to preserve such ordered strata to the depths our data imply.*"

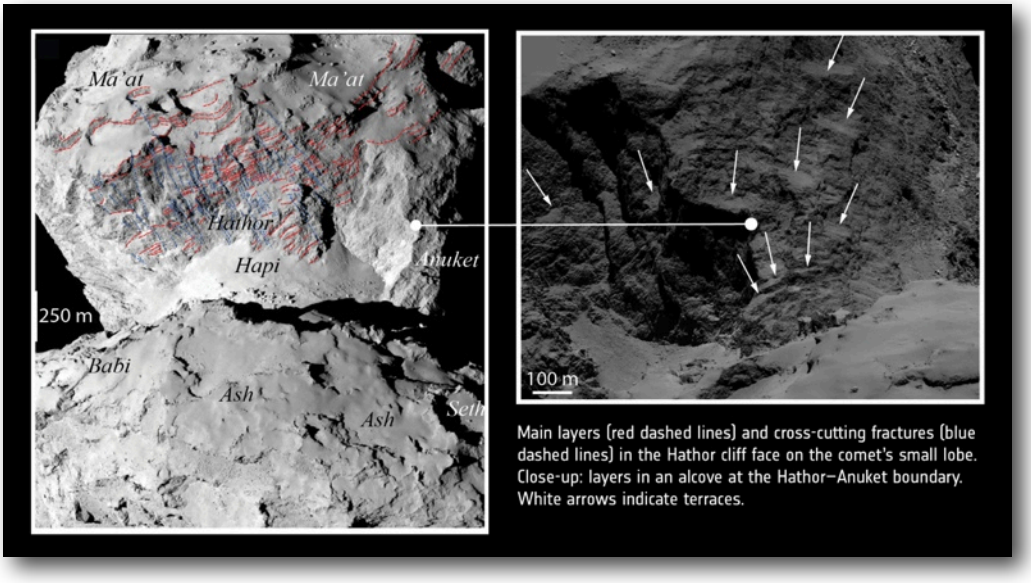
"*In addition, the striking structural similarities between the two lobes imply that despite their initially independent origins, they must have formed through a similar accretion process,*" adds co-author Bjorn Davidsson of Uppsala University, Sweden.

"*Layering has also been observed on the surface of other comets during previous flyby missions, suggesting that they also underwent a similar formation history.*"

Finally, the team note that even though erosion is not the root cause of the comet's double-lobed shape, it nevertheless does play an important role in the comet's evolution today. Local variations seen in the structure of the surface likely result from different rates of sublimation – when ice turns directly into a gas – of frozen gases embedded within the individual layers, which are not necessarily distributed evenly throughout the comet.

"*How the comet got its curious shape has been a major question since we first saw it. Now, thanks to this detailed study, we can say with certainty that it is a 'contact binary',*" says Holger Sierks, OSIRIS principal investigator at the Max Planck Institute for Solar System Research in Göttingen.

"*Rosetta will continue to observe the comet for another year, to get the maximum amount of information on this celestial body and its place in the history of our Solar System.*"



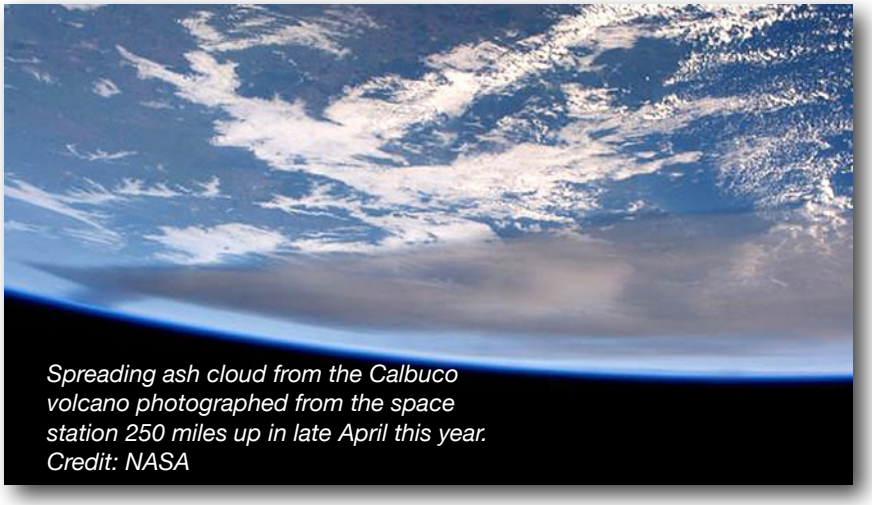
Main layers (red dashed lines) and cross-cutting fractures (blue dashed lines) in the Hathor cliff face on the comet's small lobe. Close-up: layers in an alcove at the Hathor–Anuket boundary. White arrows indicate terraces.

Why Was September's Lunar Eclipse So Dark?

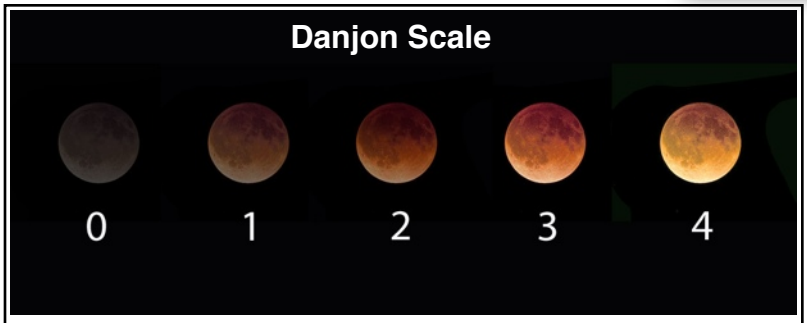
by BOB KING: Oct 5, 2015 Universe Today

First off, a huge *thank you* to everyone who made and sent their Danjon scale estimate of the totally-eclipsed Moon's brightness to Dr. Richard Keen, University of Colorado atmospheric scientist. Your data were crucial to his study of how aerosols in Earth's atmosphere and other factors influence the Moon's appearance. Keen received a total of 28 observations from 7 different countries.

Using the Danjon information and estimates of the Moon's brightness using the reverse binocular method, Keen crunched the data and concluded that the Moon was about 0.6 L (Danjon) units darker than expected and 0.4 magnitude dimmer, a brightness reduction of 33%. This agrees well with my own observation and possibly yours, too. No wonder so many stars sparkled near the Moon that night.

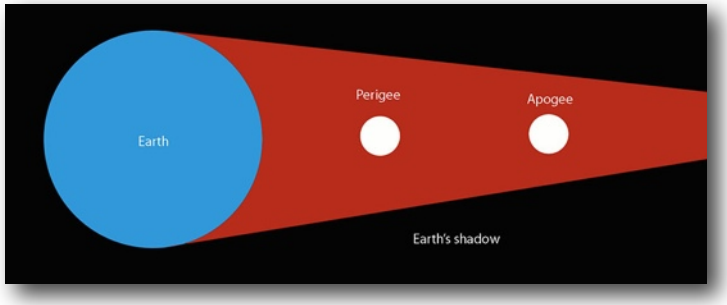


Spreading ash cloud from the Calbuco volcano photographed from the space station 250 miles up in late April this year. Credit: NASA



French astronomer Andre Danjon came up with a five-point scale back in the 1920s to characterize the appearance of the Moon during totality. The Danjon Scale couldn't be simpler with just five "L values" from 0 to 4. September's eclipse was predicted to be around 2.5 and the observations sent in to Richard Keen (28 observers in 7 countries) when plotted gave a value of 1.9 on the Danjon scale.

Below: *During a perigee eclipse, the moon passes more deeply into Earth's shadow compared to one that happens near apogee, when the moon is most distant from Earth. Moon distances not to scale and for illustration only. Credit: Bob King*



I think it's safe to say, most of us expected a normal or even bright totality. So why was it dark? Several factors were at play — one to do with the Moon's location in Earth's shadow, the other with a volcanic eruption and a third with long-term, manmade pollution.

You'll recall that the eclipse occurred during lunar perigee, when the Moon swings closest to Earth in its 27-day orbit. Being closer, it also tracked deeper into Earth's umbra or inner shadow which narrows the farther back of the planet it goes. An apogean Moon (farthest from Earth) passes through a more tapered cone of darkness closer to the penumbra, where sunlight mixes with shadow. A Moon nearer Earth would find the umbral shadow roomier with the light-leaking penumbra further off in the distance.

But there's more. Working independently, Steve Albers of NOAA and Brazilian astronomer Helio Vital suggested another reason: aerosols in the atmosphere. "Earth's stratosphere is no longer completely clean of volcanic ashes," said Vital in an e-mail communication. "In fact, lingering aerosols (ash, dust, sulfuric acid droplets) from the explosion of Calbuco five months ago may be to blame for that excessive darkening."

While much of the debris blasted into the stratosphere made for colorful sunsets in the southern hemisphere, some of that material has likely made its way to the northern hemisphere. Albers has noticed an increase in yellow and purple sunsets in his home town of Boulder in recent months, telltale signs of volcanic spew at play.

Forest fires that raged across the western states and Canadian provinces all spring and summer may also have contributed. Most of that smoke usually stays in the lower part of the atmosphere, but some may have found its way to the stratosphere, the very layer responsible for transmitting most of the sunlight that falls into Earth's shadow and colors the moon.

Sunlight has to pass through these light-absorbing minerals and chemicals on its way through the atmosphere and into Earth's shadow. Less light means a darker moon during total eclipse. Coincidentally, much of the totally eclipsed Moon passed through the *southern* half of the umbra which "increased the effectiveness of the Calbuco aerosols (which are still more concentrated in the southern hemisphere than the northern) at dimming the light within the umbra," writes Keen.

It also so happened that the darkest part of the moon coincided with two vast, dark volcanic plains called Oceanus Procellarum (Ocean of Storms) and Mare Imbrium, artificially enhancing the overall gloom over the northern half of the Moon.

Finally, the human hand may also have played a role in lunar color and brightness. The burning of coal and oil has caused a gradual increase in the amount of human-made sulfate aerosols in the atmosphere since the start of the industrial revolution. According to NASA, at current production levels, human-made sulfate aerosols are believed to outweigh the naturally produced sulfate aerosols. No surprise that the concentration of aerosols is highest in the northern hemisphere where most industrial activity is found.

Isn't it fascinating that one blood-red Moon can tell us so much about the air we breathe? Thank you again for your participation!

Solar Wind casts a Reddish Hue Over Asteroidal Space Objects

From Physics World by Ian Randall

The slow darkening of the surface of rocky objects in space may be caused by the bombardment of particles in the solar wind. This is the conclusion of a new study by researchers in the US, who have simulated the effects of the solar wind by bombarding samples of rock with hydrogen and helium ions.

Physical and chemical weathering has a profound influence on the surface of the Earth, and it turns out that weathering also occurs on the surfaces of bodies in space. Space-weathering processes may have a variety of causes, including meteorite and micrometeorite impacts, cosmic rays, ultraviolet radiation and exposure to the solar wind.

Prolonged space weathering has a curious effect. The surfaces of weathered, airless bodies – like the Moon, Mercury and asteroids – gradually become darker and redder over time. Seen in lunar samples, this colouration appears to be caused by the formation at the surface of tiny particles of iron with grain sizes less than 50 nm. Exactly how these tiny iron particles form, however, has been the subject of much debate. One popular theory is the vaporization and recondensation of solid material caused by micrometeorite impacts. However, it is unclear how such a process could operate on small bodies, which experience lower-impact speeds.

Wind worn

In a new study, Kimberly Kuhlman of the Planetary Science Institute in Arizona and colleagues at the University of Wisconsin-Madison have instead explored whether the iron particles could be created by exposure to the solar wind – charged particles that stream from the Sun at speeds of several hundred kilometres per second. The team studied the effects of such charged particles on enstatite, which is a magnesium-rich orthopyroxene mineral that is common in the solar system. It is often found in meteorites and is abundant in the Earth's mantle.

Kuhlman and colleagues began with wafers of enstatite – approximately 1 cm in diameter – that were highly polished and mounted on a larger slice of silicon. The samples were then bombarded with energetic hydrogen and helium ions using plasma-source ion implantation. This involves placing the target samples within a vacuum chamber, through which hydrogen and helium gas is allowed to flow. The gases are ionized by tungsten filaments and high-voltage pulses are used to accelerate the ions into the samples at energies comparable to the solar wind.

Following the bombardment, the researchers looked for changes to the composition of the outer 20 nm of the samples using scanning transmission electron microscopy. Sure enough, Kuhlman and colleagues found that the simulated solar wind caused the formation of iron nanoparticles.

Broken bonds

The researchers believe that the nanoparticles form because ion implantation disrupts the atomic lattice of the mineral, creating broken bonds. These are free to react with hydrogen, creating molecules of water and hydroxide. These molecules then escapethe damaged lattice, leaving behind iron in a chemically reduced state. The iron then nucleates into nanoparticles.

"This continuing work will allow us to estimate the rate at which these nanophase iron particles form as a consequence of exposure to the solar wind," says Kuhlman. She says that this information will help scientists to use remote sensing to infer the age of objects in the solar system, which in turn will inform our understanding of a wide range of physical processes that occur in space.

Simone Marchi of the Southwest Research Institute, who was not involved in this work, says that the study suggest that the solar wind is the best candidate for explaining nanophase iron formation in asteroids, outweighing the effects of micrometeorite impacts. Marchi adds, however, that other important aspects, such as the timescale involved in the formation of small iron particles, remain to be investigated in detail.

Cateline Lantz – an astrophysicist at the Observatoire de Paris – told *physicsworld.com* that the research is important because it has the potential to broaden our understanding of space weathering. "Space weathering is now well understood on the Moon and some asteroid types, but the dark primitive surfaces are still puzzling," she says.

The research is described in *Planetary and Space Science*.

Ian Randall is a science writer based in New Zealand

Hourglass Gas Flows Found Around New High Mass Stars

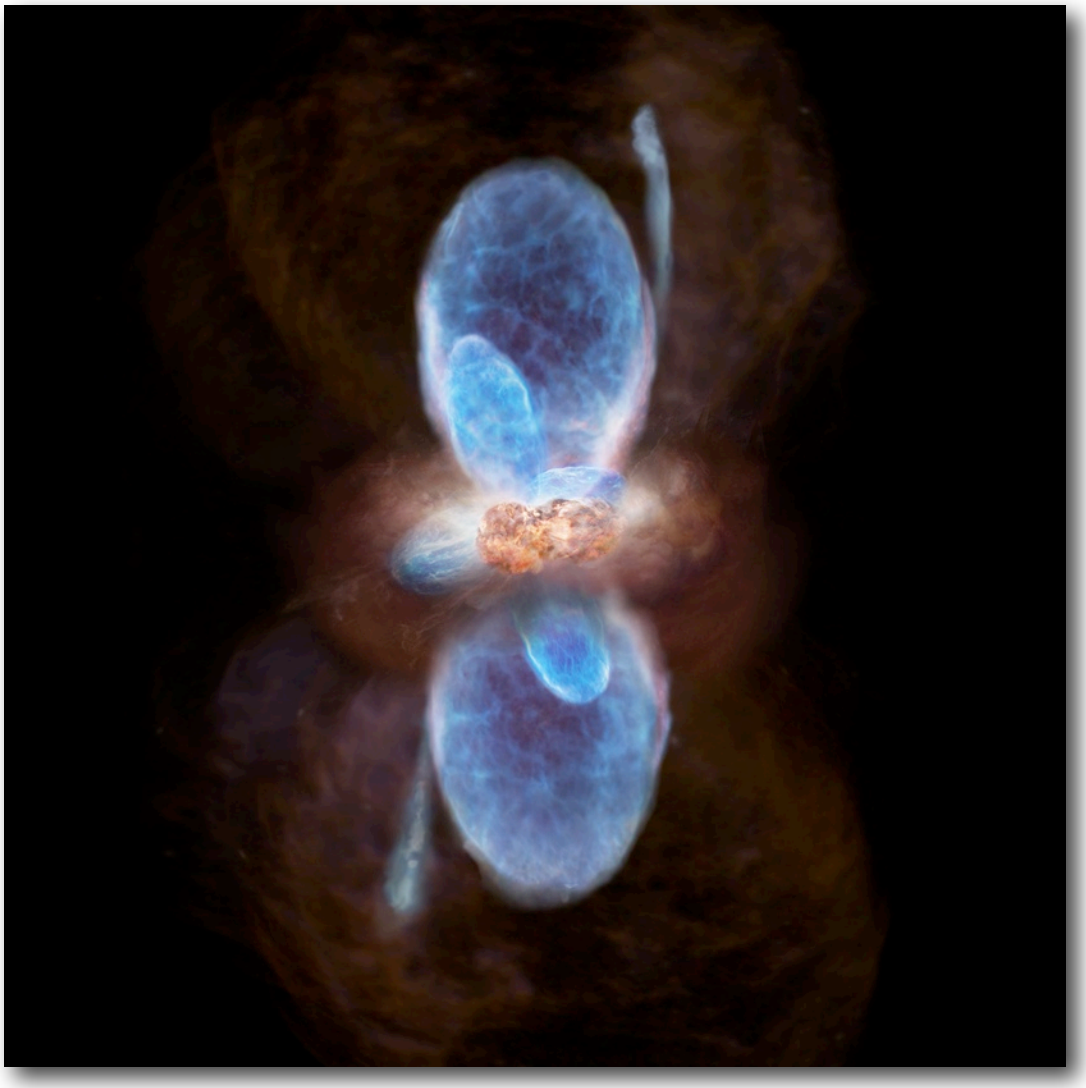
Press Release ALMA

A research group led by Aya Higuchi, a researcher at Ibaraki University in Japan, conducted observations of the massive-star forming region IRAS 16547-4247 with the Atacama Large Millimeter/submillimeter Array (ALMA). The observation results shows the presence of multiple, or at least two, gas outflows from a protostar, indicating the possible existence of two new-born stars in this region. Also, the radio observation results of molecular line emission of methanol revealed in vivid detail an hourglass structure created by gas outflows spreading outward while thrusting the ambient gas cloud away. It is the first time that such an hourglass structure was found in observations of methanol in high-mass star forming regions. Detailed observations of high-mass stars have been considered difficult so far because high-mass stars form in a complex environment with multiple protostars in clusters, and their forming regions are located farther away from the Earth compared to those of low-mass stars. However, high angular resolution observations with ALMA opened a new window to understand their formation environment in further details.

Research Background

All stars that twinkle in the night sky vary in their masses. While some stars have masses smaller than 1/10 of solar masses, others have masses larger than 100 solar masses. How such a wide variety of stars are born and what factors make the difference in their masses; these are the most fundamental and most enigmatic astronomical questions, which have yet to be answered. To solve these mysteries, it is essential to make detailed observations of various stars of different masses during formation.

The formation process of high-mass stars, which have masses larger than ten times solar mass still has much to be explored. Detailed observations of high-mass stars at an early stage of formation are difficult because the number of high-mass stars is smaller than that of one-solar-mass stars and the evolution process of high-mass stars is faster than low-mass stars [1]. Another adverse condition in the study of high-mass stars is the distance from the Earth; while the forming regions of low-mass stars are about 500 light years away from the Earth, those of high-mass stars are farther and even the closest one in the Orion Nebula is about 1500 light years away. Since it is thought that high-mass stars are born in clusters far away from the Earth, it is impossible to understand their formation process in detail without high angular resolution observations. In this regard, ALMA is the most desirable telescope for this purpose as being capable of observing gas and dust, which will be ingredients of stars at high sensitivity and high resolution.



Atacama Large Millimeter/submillimeter Array
In search of our Cosmic Origins

Observations with ALMA

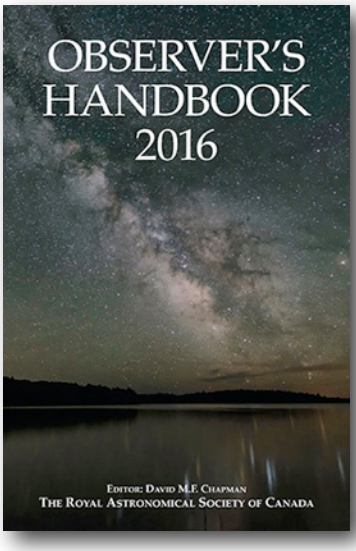
The research team led by Aya Higuchi made observations of the luminous infrared source IRAS 16547-4247 in the direction of the Scorpion. IRAS 16547-4247 is an object emitting strong radiation with about 60 times solar luminosity and being surrounded by high-density molecular cloud with a mass of 1300 times solar mass in a distance of 9500 light years away from the Earth. Past radio observations of molecular carbon monoxide (CO) in this region revealed a pair of outflows, which was thought to be emitted from a young star, and some other radio sources have been found in addition to a bright object at the center.

"*Even though many of the astronomers assumed that this would be a fertile high-mass star forming region, we couldn't probe the kinematics of gas around high-mass protostars at the level of resolution provided by existing telescopes,*" Higuchi said. "*A typical example of a high-mass star forming region is the Orion Nebula, but ALMA enabled us to see the complex formation environment of star clusters which is even 7 times farther away than the Orion Nebula with the highest imaging resolution ever achieved. ALMA will become indispensable for the future research on the high-mass star forming region.*"

The Wanderer

"Astronomy compels the soul to look upwards, and leads us from this world to another."
"The Republic", by Plato

I had just received my copy of the 2016 RASC "Observer's Handbook" and, on the front page, was a reproduction of a photo of the summer Milky Way taken by professional photographer, Chris Green, from Liverpool, Nova Scotia. He had taken it from the shores of Kejimkujik Lake, the largest lake in the Keji Dark-Sky Preserve of the Kejimkujik National Park, located in SW Nova Scotia. This 30 second exposure was taken with a 15 mm lens attached to a Nikon D600 camera and set at f/ 2.8. Quite a spectacular image ! Chris readily captured the Galactic Dark Horse, the Central region of our Galaxy, the Sagittarius and Scutum star clouds, the Great Cygnus Rift, numerous bright stars, and the wonderful reflections in the quiet waters of Keji lake! No wonder it was chosen for the front cover of the 2016 Handbook. My wife, Paula, and I have visited and camped on the shores of Kejimkujik Lake many times. We were married in 1967 and the best man at our wedding was Bob Lewis, a professional photographer and High School Chemistry teacher. Usually, when we visit Nova Scotia, Bob takes me on a nature photography expedition, mostly to Keji, and I am never disappointed by the photographic results.



On the back cover of the 2016 Observer's Handbook (above) is a reproduction of a painting by Mi'kmaw artist, Gerald Gloade. I found it riveting! Gerald calls it "The Wanderer" and he created it especially for this 2016 edition of the Observer's Handbook. In the painting, Gerald depicts a Mi'kmaw brave, illuminated by the light of a waning gibbous Moon, paddling his birch bark canoe along the Milky Way. I just had to talk with this wonderful artist. I immediately did a "Google" search and found out that he is associated with the Mi'kmawey Debert Cultural Centre, near my home town of Truro, in Nova Scotia. Within minutes, I had made contact. I told him I found his painting stunning and explained that I am an amateur astronomer, who is also a canoeist and kayaker, and that his painting had a natural resonance for me. Gerald then explained that the Moon in his painting is called "Alasuinuiguskew", or the "Wanderer's Moon". He noted that the traditional Mi'kmaw Calendar consisted of 13 months of 28 phases, with each month starting with the "New Moon", also known as the "Dark of the Moon". He went on to explain that the Mi'kmaw Calendar, much like our own, had 52 weeks in a year, except theirs had four weeks in each month for 13 months. However, once every 22 years, there was a 14th Moon, "Alasuinuiguskew", the "Wanderer's Moon". This Moon was said to paddle around the Heavens and only comes ashore once every 22 years, so every 22nd year is a year with 14 months!

Gerald explained that his ancestors lived on Kejimkujik Lake and noted that the familiar landmarks of Gloade Island and Gloade Point, within Keji, are named after his family. The Mersey River runs through Kejimkujik National Park and when he takes his sons canoeing down that river, he explains that the blood that runs through their veins has been on this river for thousands of years. It was obvious that Gerald is proud of his ancestry. He explained to me that he is currently the Program Development Officer for the Mi'kmawey Debert Project. Debert is home to the oldest archaeological site in Canada. I didn't know that! The artifacts being collected there date back more than 13,000 years, at the end of the last ice age. The current plan is to build a a cultural centre on the site to house the collected artifacts and showcase the history of the 13 First Nations communities in Nova Scotia.

I told Gerald that I was a retired Chemistry, Physics, and Outdoor Education teacher, but now, I am active in giving science-themed lectures to lifelong learners and engaging in astronomy public outreach events. He explained that for him, showcasing the Mi'kmaw culture to the young children through storytelling is his passion. In an interview for Aboriginal Affairs on June 26th, 2007, he said:
"*That's what it's all about --- the kids," They're what's left after we are gone*."
I asked Gerald if he would be able to send me a high resolution copy of his painting for our Quetican Observatory. Later that day, he sent the high resolution file. I hope that within a few weeks to have a large, framed, copy of his painting hanging in Quetican. By the way, do yourself a favour and order your copy of the 2016 Observer's Handbook. The editor is Dave Chapman and he, along with his many contributors, have produced one of the best Observer's Handbooks yet. It can be ordered separately for $27.95 CDN or can be received free with a paid membership ($75 CDN) in the Royal Astronomical Society of Canada. It contains a wealth of interesting information and, on those nights, when cloudy curtains cover the heavens, look at both Handbook covers again, and be transported above the clouds!

Left: Mi'kmaw artist, Gerald Gloade

Dawn planets thrill, surprise viewers

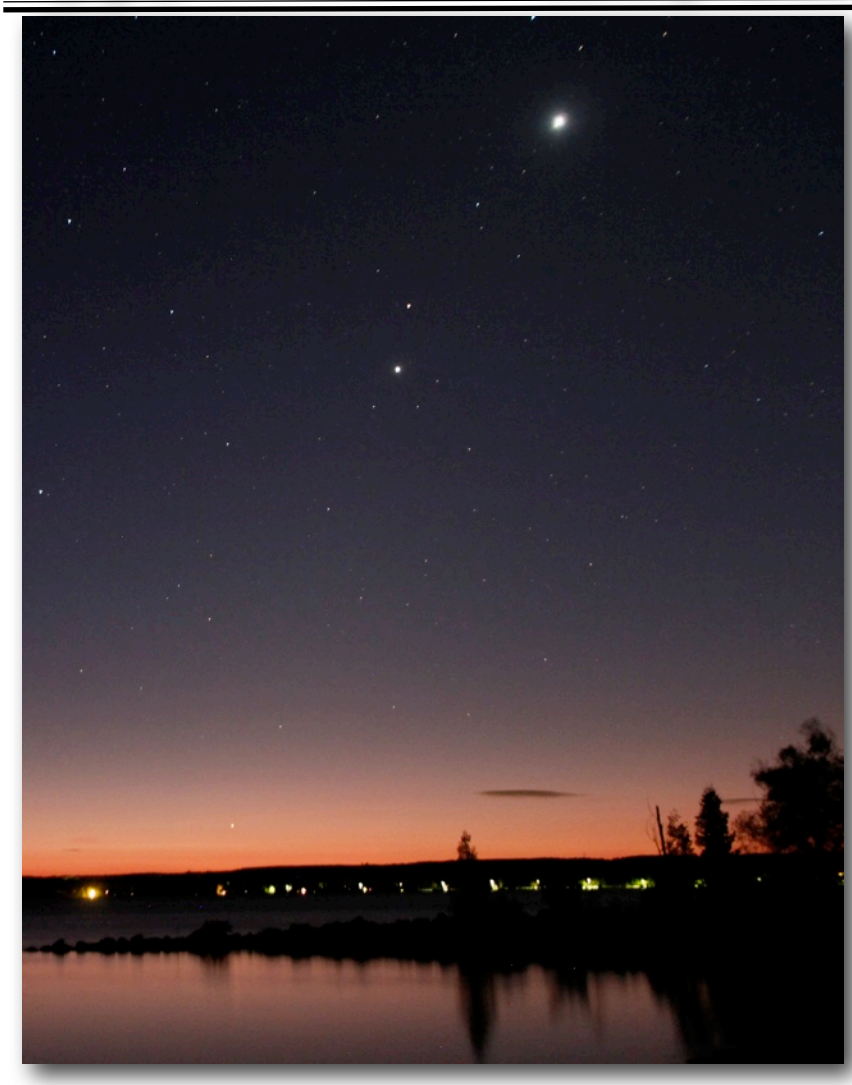
The planetary grouping of three planets (plus one) continues to draw BAS members out to view and image in spite of the ungodly hours when the planets are at their best. Lorraine R. has been the most consistent with ten morning views including two of Mercury! She reports having seen it first on Thursday morning Oct 8.

I have received images from Steve Irvine (below) and Robert Atkinson (right) who got Mercury alongside a nice thin crescent Moon! Robert shot the image (at right) on Oct 11 and Steve got Mercury on Friday morning Oct 23. I have been out several mornings doing my own imaging. See page 2 and 10.

The Oct 18 conjunction of Mars and Jupiter was rained out locally and so was the Oct 25 close approach of Venus to Jupiter. However, the following morning (Oct 26) was clear and I obtained about 500 images, enough to make two movies. For the second video I was actually pointing my camera to the right place...

Steve Irvine captured this view from a hill in Georgian Bluffs on the morning of Oct 23. I took the liberty of contrast enhancing the image to make Mercury easier to pick out. It is still not easy. Look for it near the three little clouds about 1/4 of the way from the lower left corner. Venus is the top bright planet, then Jupiter and faintest is Mars. Canon 6D, EF 24-105 L-series lens at f/4.5 and 45mm, ISO 320, 2 sec. exp., tripod mount. Image taken 7 a.m. EDT, Oct 23, 2015.

Robert A. found a photogenic cloud layer for these spectacular shots of the last crescent Moon near Mercury on Oct 11. Upper image was 1/4 s long, 85 mm lens, f/2, ISO 3200. Star above is Zavijava. Lower image taken through a 300 mm f/5.6 telephoto, 1/40 s exp at ISO 400. Both images are cropped slightly. I can't recall having visually seen a crescent Moon near Mercury let alone imaged it. Bravo, Robert!

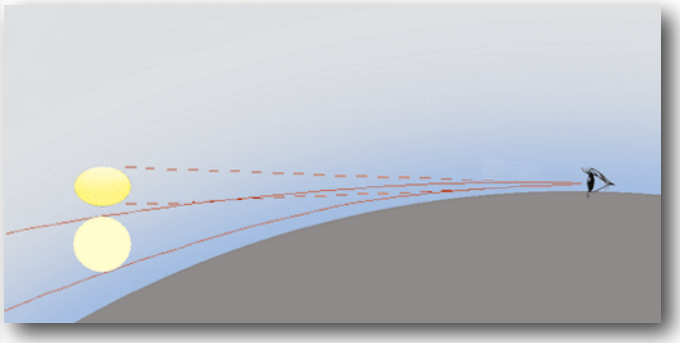


The image above, my first "Mercury included" image of the planetary group, was on Oct 12 at 6:20 am. This is one of many frames that show Mercury rising above the eastern horizon. It literally crests the dark edge of hills like a distant bulb being turned on. I have rarely seen an object do this, they always waver a bit as the atmosphere distorts the light. Not this time. No clouds! **Image details:** Canon 60Da, Canon EF 15-85 mm lens at f/4.0 set to 21 mm, ISO 2000, 10 s exp., on tripod. Sarawak Family Park Owen Sound.

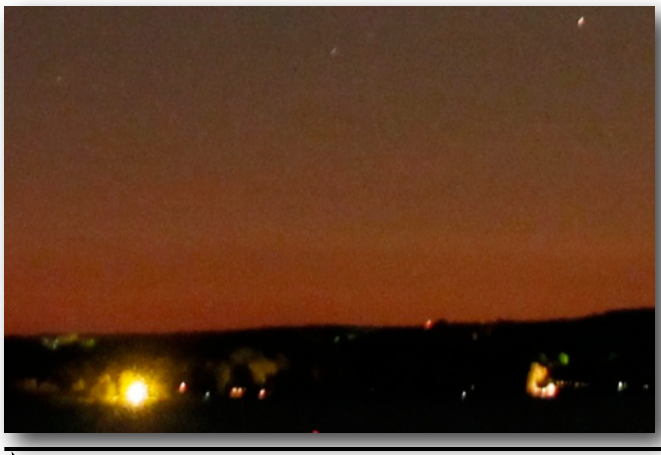
A Mars Surprise! On Oct 26, Jupiter, Venus and Mars were due to rise above the eastern horizon just one day after the close approach of Venus to Jupiter. I was hoping to see all three do what Mercury did on Oct 12. See image right. Unfortunately incompetence interfered and I did not get either of the two brightest planets peeking out above the horizon. They actually did rise in clear sky where they were supposed to, but I was aiming the camera in the wrong spot and monitoring that spot with binos. (cont'd

here...) The best I got was a visual glimpse of either Venus or Jupiter (I am not sure which) passing through the clear layer below the cloud deck. My attention was drawn (finally) to this bright light north of the red lights on the towers and so I turned the binos on it. It looked like a chinese lantern or a flare from the tank range. In retrospect, it was one of the two brightest planets clearing the horizon and sneaking through the gap! However, I did manage to capture Mars rising (image left) when I finally realized that I should shift the FOV of the camera a bit farther north! Live and learn. See the movie of this at BAS Nov 4 meeting at Grey Roots. **Image left details:** Canon 60Da, 15-85 mm lens at 85 mm, f/5.6, 3.2 s exp. ISO 2000. Time of shot 4:04 am.

We often watch the atmosphere contort the Sun and Moon as it nears the horizon (recall the green flash?) and often do not realize just how much atmospheric refraction affects the image. The layer of air that light passes through acts like a prism that changes the direction of the light rays from celestial objects and that includes the planets that we are watching this month and next. The diagram below shows that sunlight (or a light ray from a star) can deviate by about 0.5° traversing the atmosphere before getting to an observer.



This is the maximum amount since the light's path through the refractive atmosphere is the longest. Stars farther up will be distorted less and there is zero distortion at the zenith. Coincidentally, the Moon and Sun are 0.5° in size, so when we see the first glimpse of sunlight (or the light from a point source rising in the east), the Sun is still actually below the horizon! Star or planet "rise" times could be as much as 2 minutes early because of this effect. Setting times would be 2 minutes later. To see sources rise at the horizon requires a perfectly flat horizon and no clouds to block the light.
The image at left was shot about 6:20 am Oct 12 and shows Mercury close to the horizon, but one taken earlier caught it right at the dark boundary. The enlargement below from an image at 6:09:35 am shows Mercury's light just clearing the horizon. This gorgeous morning had no clouds in the way!



Research may solve lunar fire fountain mystery

August 24, 2015 Press release Brown University by Kevin Stacey

PROVIDENCE, R.I. [Brown University] — Tiny beads of volcanic glass found on the lunar surface during the Apollo missions are a sign that fire fountain eruptions took place on the Moon's surface. Now, scientists from Brown University and the Carnegie Institution for Science have identified the volatile gas that drove those eruptions.

Fire fountains, a type of eruption that occurs frequently in Hawaii, require the presence of volatiles mixed in with the erupting lava. Volatile compounds turn into gas as the lavas rise from the depths. That expansion of that gas causes lava to blast into the air once it reaches the surface, a bit like taking the lid off a shaken bottle of soda.

"The question for many years was what gas produced these sorts of eruptions on the Moon," said Alberto Saal, associate professor of earth, environmental, and planetary sciences at Brown and corresponding author of the new research. "The gas is gone, so it hasn't been easy to figure out."

The research, published in Nature Geoscience, suggests that lava associated with lunar fire fountains contained significant amounts of carbon. As it rose from the lunar depths, that carbon combined with oxygen to make substantial amounts carbon monoxide (CO) gas. That CO gas was responsible for the fire fountains that sprayed volcanic glass over parts of the lunar surface.

For many years, the Moon was thought to be devoid of volatiles like hydrogen and carbon. It wasn't until the last decade or so that volatiles were definitively detected in lunar samples. In 2008, Saal and colleagues detected water in lunar volcanic beads. They followed that discovery with detections of sulfur, chlorine and fluorine. While it became apparent that the Moon was not completely depleted of volatiles as was once thought, none of the volatiles that had been detected were consistent with fire fountain eruptions. For example, if water had been the driving force, there should be mineralogical signatures in recovered samples. There are none.

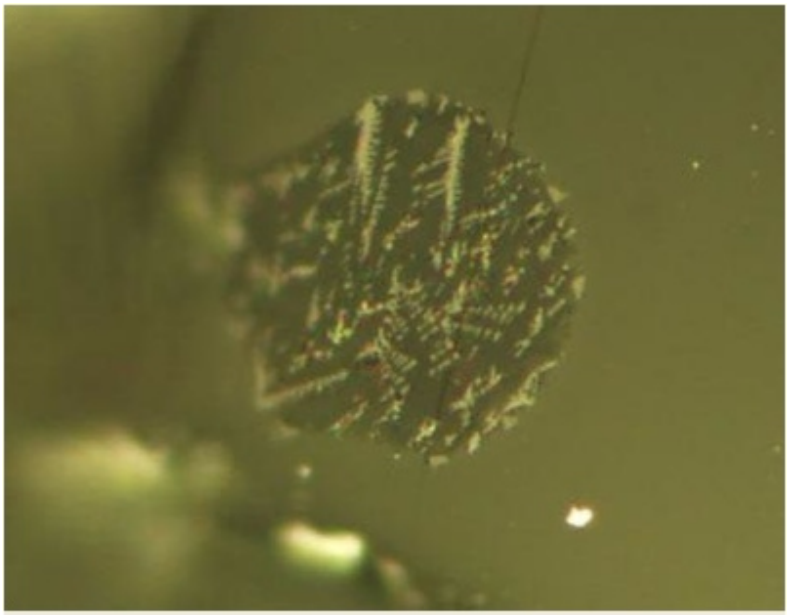
For this research, Saal and his colleagues carefully analyzed glass beads brought back to Earth from the Apollo 15 and 17 missions. In particular, they looked at samples that contained melt inclusions, tiny dots of molten magma that became trapped within crystals of olivine. The crystals trap gases present in the magma before they can escape.

Although other volatiles were previously detected in the lunar volcanic glasses and melt inclusions, the measurement of carbon remained elusive due to the high detection limits of the available analytical techniques. Erik Hauri from Carnegie Institution for Science developed a state-of-the-art ion probe technique reducing the detection limits of carbon by two orders of magnitude. That allows a measurement of as low as 0.1 part per million.

"This breakthrough depended on the ability of Carnegie's NanoSIMS ion probe to measure incredibly low levels of carbon, on objects that are the diameter of a human hair," said Hauri. "It is really a remarkable achievement both scientifically and technically."

The researchers probed the melt inclusions using secondary ion mass spectroscopy. They calculated that the samples contained initially 44 to 64 parts per million carbon. Having detected carbon, the researchers devised a theoretical model of how gases would escape from lunar magma at various depths and pressures, calibrated from the results of high-pressure lab experiments. The model had long been used for Earth. Saal and colleagues changed several parameters to match the composition and conditions affecting lunar magma.

The model showed that carbon, as it combines with oxygen to form CO gas, would have degassed before other volatiles.



Volcanic evidence
Super-tiny bits of molten magma became trapped in tiny crystals of olivine, preserving evidence of volatile gasses.
Saal lab/Brown University

"Most of the carbon would have degassed deep under the surface," Saal said. "Other volatiles like hydrogen degassed later, when the magma was much closer to the surface and after the lava began breaking up into small globules. That suggests carbon was driving the process in its early stages."

In addition to providing a potential answer to longstanding questions surrounding lunar fire fountains, the findings also serve as more evidence that some volatile reservoirs in the Moon's interior share a common origin with reservoirs in the Earth, the researchers say.

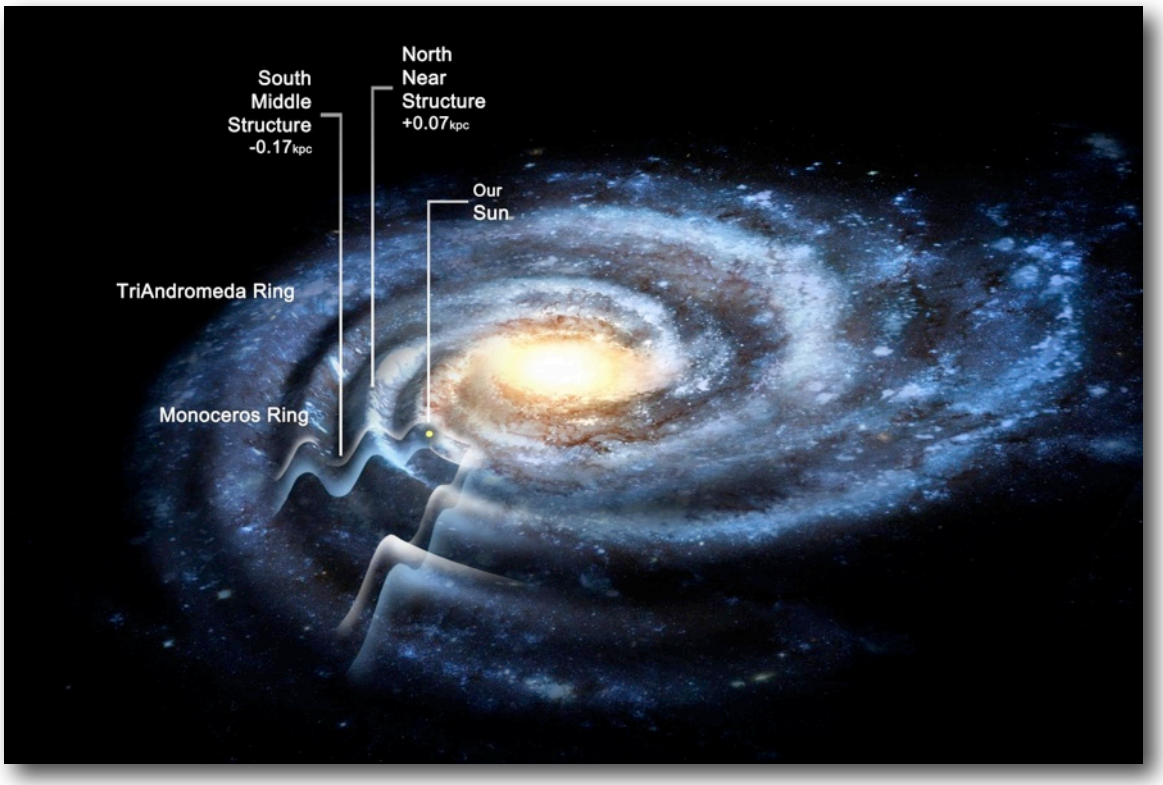
The amount of carbon detected in the melt inclusions was found to be very similar to the amount of carbon found in basalts erupted at Earth's mid-ocean ridges. Saal and his colleagues have shown previously that Earth and the Moon have similar concentrations of water and other volatiles. They have also shown that hydrogen isotope ratios from lunar samples are similar to that of Earth.

If volatile reservoirs on the Earth and Moon do indeed share a common source, it has implications for understanding the Moon's origin. Scientists believe the Moon formed when Earth was hit by a Mars-size object very early in its history. Debris from that impact accreted to form the Moon.

"The volatile evidence suggests that either some of Earth's volatiles survived that impact and were included in the accretion of the Moon or that volatiles were delivered to both the Earth and Moon at the same time from a common source — perhaps a bombardment of primitive meteorites," Saal said.

Other authors on the paper were Diane Wetzel, a graduate student at Brown, and Malcolm Rutherford, professor of geological sciences. The study was supported by NASA's LASER program (NNX08AY97G and NNX11AB27G), NASA's Cosmochemistry program (NNX12AH62G), the Deep Carbon Observatory, and the Carnegie Institution of Washington.

The corrugated galaxy: a larger Milky Way? from phys.org



The Milky Way galaxy is at least 50 percent larger than is commonly estimated, according to new findings that reveal that the galactic disk is contoured into several concentric ripples. The research, conducted by an international team led by Rensselaer Polytechnic Institute Professor Heidi Jo Newberg, revisits astronomical data from the Sloan Digital Sky Survey which, in 2002, established the presence of a bulging ring of stars beyond the known plane of the Milky Way.

"In essence, what we found is that the disk of the Milky Way isn't just a disk of stars in a flat plane—it's corrugated," said Heidi Newberg, professor of physics, applied physics, and astronomy in the Rensselaer School of Science. "As it radiates outward from the sun, we see at least four ripples in the disk of the Milky Way. While we can only look at part of the galaxy with this data, we assume that this pattern is going to be found throughout the disk."

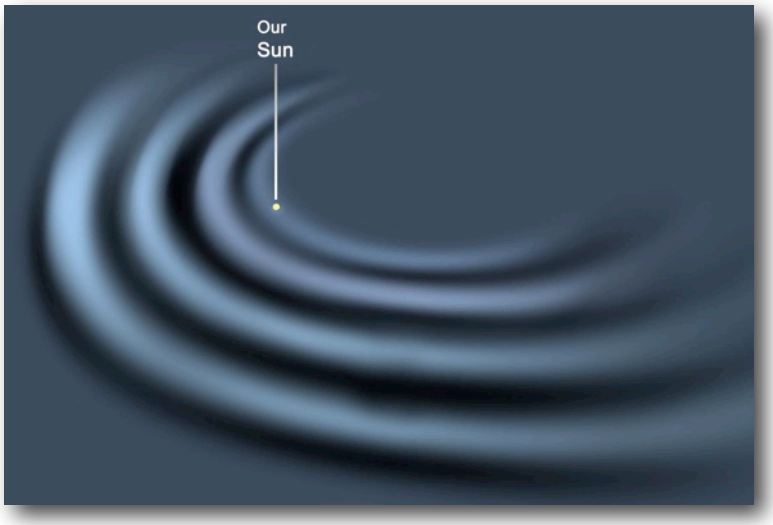
Importantly, the findings show that the features previously identified as rings are actually part of the galactic disk, extending the known width of the Milky Way from 100,000 light years across to 150,000 light years, said Yan Xu, a scientist at the National Astronomical Observatories of China (which is part of the Chinese Academy of Science in Beijing), former visiting scientist at Rensselaer, and lead author of the paper.

"Going into the research, astronomers had observed that the number of Milky Way stars diminishes rapidly about 50,000 light years from the center of the galaxy, and then a ring of stars appears at about 60,000 light years from the center," said Xu. "What we see now is that this apparent ring is actually a ripple in the disk. And it may well be that there are more ripples further out which we have not yet seen."

The new research builds upon a 2002 finding in which Newberg established the existence of the "Monoceros Ring," an "over-density" of stars at the outer edges of the galaxy that bulges above the galactic plane. At the time, Newberg noticed evidence of another over-density of stars, between the Monoceros Ring and the sun, but was unable to investigate further. With more data available from the SDSS, researchers recently returned to the mystery.

"I wanted to figure out what that other over-density was," Newberg said. "These stars had previously been considered disk stars, but the stars don't match the density distribution you would expect for disk stars, so I thought 'well, maybe this could be another ring, or a highly disrupted dwarf galaxy."

When they revisited the data, they found four anomalies: one north of the galactic plane at 2 kilo-parsecs (kpc)* from the sun, one south of the plane at 4-6 kpc, a third to the north at 8-10 kpc, and evidence of a fourth to the south 12-16 kpc from the sun. The Monoceros Ring is associated with the third ripple. The researchers further found that the oscillations appear to line up with the locations of the galaxy's spiral arms. Newberg said the findings support other recent research, including a theoretical finding that a dwarf galaxy or dark matter lump passing through the Milky Way would produce a similar rippling effect. In fact, the ripples might ultimately be used to measure the lumpiness of dark matter in our galaxy.



"It's very similar to what would happen if you throw a pebble into still water - the waves will radiate out from the point of impact," said Newberg. "If a dwarf galaxy goes through the disk, it would gravitationally pull the disk up as it comes in, and pull the disk down as it goes through, and this will set up a wave pattern that propagates outward. "[Diagram above]

Read more at: http://phys.org/news/2015-03-corrugated-galaxy-milky-larger-previously.html#jCp

* 1 kilo-parsec = 3 262 light-years. [don't worry about why...-ed]

Pegasus (Peg)

α–Pegasi - Markab
β–Pegasi - Scheat γ–Pegasi - Algenib ε-Pegasi - Enif
ζ–Pegasi - Homam η–Pegasi -Matar θ–Pegasi -Baham

The feature of this constellation is the so-called Great Square of Pegasus, formed by the four stars β, γ, α-Pegasi and α-Andromedae. The latter star [Alpheratz] actually belongs to the constellation Andromeda (see chart). The stars Polaris, Alpheratz and γ-Pegasi form a good stellar landmark; the line connecting them indicates the equinoctial colure [the 0 H RA line that runs through the N celestial pole and the First Point of Ares]. β Pegasi is one of the largest stars known; if it were in the sun's position, its size would extend beyond the orbit of Venus.

DOUBLE STARS

	Mag.	Sep'n (s)	Location	Remarks
ε	2.7-8.7-11.5	142-82	214210	Yellow-Violet; triple; good contrast
1	4.2-9.0	36	212020	
3	6.3-8.5	39	213506	
Σ2841	6.5-8.0	22		
Σ2848	7.2-7.5	11	215606	

MESSIER OBJECTS

	Mag	Location	Remarks
M 15	5.2	212812	Globular Cluster.

Other Objects of Interest (Peg)

NGC 7331 - Spiral Galaxy, magnitude 10.4. Location 223534.
R Pegasi - Long period (378 days) variable, maximum magnitude 7.8. Location 230410.
View πl and π2 with low power. This is a beautiful pair; not a double.

This atlas fails to list a companion galaxy to M31 and M32 (aka NGC 221). The third galaxy in the Andromeda group is **M110 or NGC 205**. Both M32 and M110 are magnitude 8.1 in the RASC Observer's Handbook but they are different in two ways. M110 is larger than M32 and M110 is distinctly more spherical than M32. The former is an E3 elliptical and the latter is an E5. Can you see the difference?

Several BAS photographers (including yours truly) have imaged M31, the Andromeda Galaxy. Being high in the sky right now, it is well placed for photography as well as viewing through a telescope. Since it is a magnitude 4.8, it is also a relatively easy naked eye target. It is one of the sights I do not fail to point out to elementary students at the Outdoor Ed Centre. The fact that we (i.e. the Milky Way Galaxy) are on a collision course with M31 is also an interesting factoid that never fails to raise eyebrows, at least. Imagine having two Milky Ways in the sky! NASA has provided an artist's impression as it would appear in 3.6 Billion years or so.

Andromeda (And)

α–Andromedae -Alpheratz
β-Andromedae -Mirach γ-Andromedae -Almaak

Andromeda is an attractive constellation consisting of two long curved lines of stars beginning at Alpheratz and trailing to the northeast. Alpheratz is the 2nd magnitude star at the northeast corner of the Great Square of Pegasus. Andromeda is most famous for the Great Nebula, M 31, the only spiral nebula in the heavens visible to the naked eye. In binoculars it appears as a faint elongated misty patch, slightly brighter in the center.

DOUBLE STARS

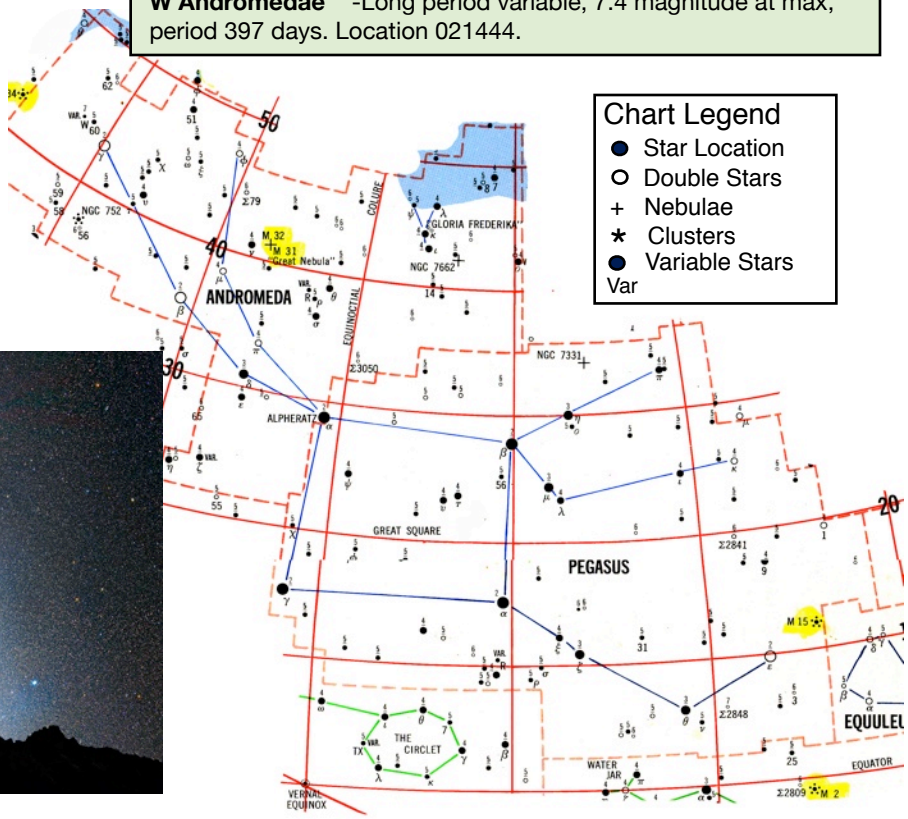
	Mag.	Sep'n (s)	Location	Remarks
γ	2.1-5.4	10	020142	Yellow-Purplish Blue; one of the most beautiful doubles -fine color contrast.
μ	4.0-11.5	34	005438	
π	4.4-8.5	36	003433	White-Blue.
56	6.0-6.0	189	015337	Test of keen naked eyesight; easily separated in binos.
59	6.0-6.7	16	020839	Yellow-Blue.
Σ79	6.0-7.0	8	005844	Very fine.
Σ3050	6.5-6.5	1.5	235734	Test for 3-inch telescope.

MESSIER OBJECTS

	Mag	Location	Remarks
M 31	4.8	004041	Spiral Galaxy. The "Great Nebula"; an impressive sight in small telescopes; beautiful in larger ones.
M 32	8.7	004041	Elliptical Galaxy.

Other Objects of Interest in Andromeda

NGC 752 -Large open cluster; lies in rich region. Location 15537.
NGC 7662 - A planetary nebula, roughly annular in shape, with a 13th magnitude star in the center. Location 232442.
R Andromedae -Long period variable, 7.0 magnitude at max, period 409 days. Location 002138.
W Andromedae -Long period variable, 7.4 magnitude at max, period 397 days. Location 021444.



Date: (Time given on 24 h clock EST unless otherwise noted).

Nov
01 02:00 EST starts, set clocks back 1 hour
03 07:24 **LQ Moon** rises locally at 11:08 pm EST Nov 2
11:00 Venus 0.7° S of Mars
04 23:19 Regulus 3.2°N of Moon
06:00 Venus still less than 1° from Mars
05 18:00 S. Taurid Meteor Shower peak 10/h Moon 26%
06 10:49 Jupiter 2.3°N of Moon
07 04:56 Mars 1.8°N of Moon
08:54 Venus 1.2°N of Moon
16:48 Moon at Apogee: 405 724 km
09 07:27 Spica 4.3°S of Moon
11 12:47 **NM** rises locally at 6:55 am EST
12 17:00 N. Taurid Meteor Shower peak 15/h Moon 1%
20:00 Saturn 3° S of Moon
18 01:00 Leonid Meteor Shower peak 20/h Moon 38%
19 01:27 **FQ Moon** rises locally at 1:22 pm EST
22 03:32 Uranus 0.9° N of Moon occ'n S. Pacific
23 15:06 Moon at Perigee: 362 818 km
25 17:44 **FM** rises locally at 5:06 pm EST
26 05:38 Aldebaran 0.7°S of Moon occ'n vis. in Canada
Disapp. 5:38 am EST, Reapp. 6:28 am EST
29 14:20 Venus 3.9°N of Spica
19:00 Saturn in conjunction with Sun (not visible)

BAS/Astronomy Events

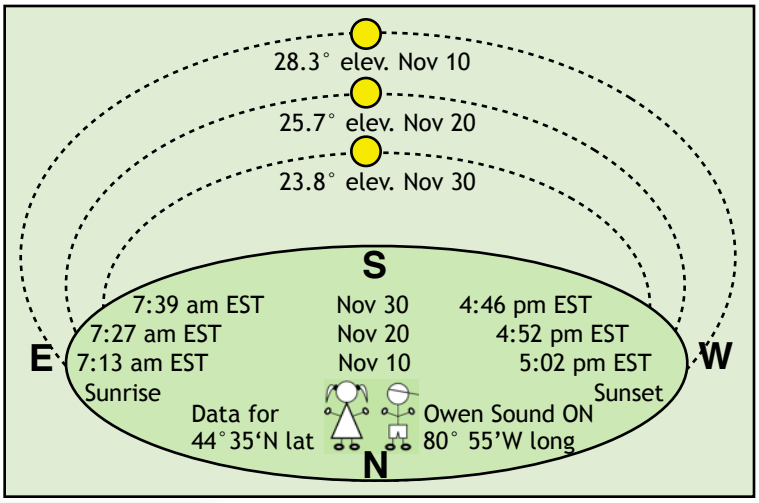
Nov 3 Tue LQ
Mars and Venus conjunction in morning sky less than 1 degree apart. Still under 1° on Nov 4.
Nov 4 Wed BAS meeting at Grey Roots Museum Topic: Members/Gadget night
Nov 7 Sat **Venus, Mars and Last Crescent Moon** in nice 2° triangle below Jupiter in morning sky
Nov 11 Wed NM
Nov 14 Sat BAS Dark of the Moon viewing@Fox
Nov 19 Thu FQ
Nov 25 Wed FM
Nov 26 Thu **Aldebaran Occultation** Disappearance at 5:38 am EST, Reappearance at 6:28 am EST
Moon is Full, elevation of Moon from 22° to 14°.

Planets

MERCURY spends all of November near the Sun enroute to an evening star appearance in December and January.

VENUS, (-4.4) is well up in the dawn sky and is in conjunction with Mars (0.7° separation) on Nov 3. There is a nice grouping of Venus, Mars and the last crescent Moon on Nov 7. **MARS,** (mag. 1.7) is also well placed in the morning sky and forms a photogenic group with Venus, the last crescent Moon and Zavijava (β-Virginis) on Nov 7. **JUPITER**, (-1.9) precedes Venus and Mars rising around midnight and is well up in the east at dawn. **SATURN,** (mag. 0.5) is only 20° from the Sun at sunset and in conjunction on Nov 29. **URANUS,** (5.8) and **NEPTUNE,** (7.8) are well-placed in the evening sky all month. Neptune sets around midnight and Uranus two hours later. **Dwarf planet**, **Ceres (8.3)** is still well up in Capricornus this month but sets by 8 pm in late Nov. **Asteroid, Vesta (6.7)** follows Ceres in the sky and sets a few hours later. Both are generally in the same part of the sky as Uranus and Neptune. **PLUTO** (mag. 14) visibility is reaching an end for this year as Sagittarius and Pluto get too near the Sun for viewing. Charts are on the BAS website.

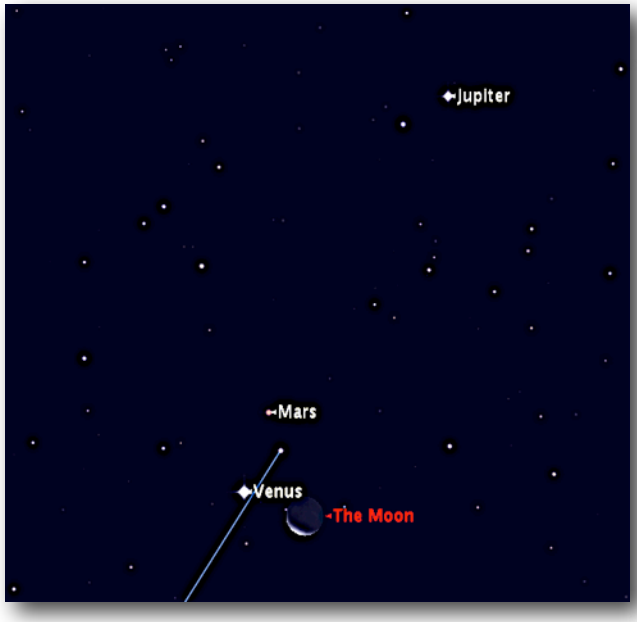
The diagram below gives the sunrise/sunset times and the Sun's altitude for November. The Sun continues to sink lower in elevation as it heads for winter solstice in December.
The moon phase graphic at the bottom of this page shows the lunar phase for each night of the month. Times of moonrise for NM, FQ, FM and LQ for Owen Sound are in the Sky Calendar listing at left. The FM occults Aldebaran again on Nov 26. See BAS events at left.



Special Events

Venus, Mars, Moon and Zavijava on Nov 7

The morning sky planets continue to please early risers with a close 40 min appulse of Venus and Mars on Nov 3&4. Then on Nov 7, the second brightest Virgo star, β-Virginis, finds itself surrounded by planetary bodies. Mars is 1° above, Venus 1.3° below and the waning crescent Moon (NM-4) is 1.4° from Zavijava. That star is the faintest at mag. 3.6, Mars is 2 magnitudes brighter at 1.6. Venus is -4.3 and the Moon outshines the bunch at mag. -10. Look 10° above the group for Jupiter, shining at -1.8. Definitely worth getting up for! Photos, please!



Nov 2015

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 LQ	4	5	6	7
8	9	10	11 NM	12	13	14
15	16	17	18	19 FQ	20	21
22	23	24	25 FM	26	27	28
29	30					

By permission Univ. of Texas McDonald Obs.

BAS Member Loaner Scopes

Solar H-alpha scope now available.

Our Lunt solar scope can be borrowed by BAS members and it is waiting at the Fox! Contact John to get your hands on it. We now have a suitable mount for it as well. A short training session will be provided on pickup.

Several Dobs available.

One 12-inch dobsonian loaner telescope is available for free loan by members. Smaller 8-inchers are also available. Contact John H. or Brett T. for availability. Scopes come in and out so keep checking with John or Brett if you are interested in a loaner.

S G N Classified Ads Section

(Now also on our website)

Dr. Steve Briggs-Dr. Liane Pitre OPTOMETRISTS

Dr. Steve Briggs gave an interesting talk on the aging eye at the last meeting of BAS. More info can be found on the topics he covered here: http://www.bpeyes.com/aging.html

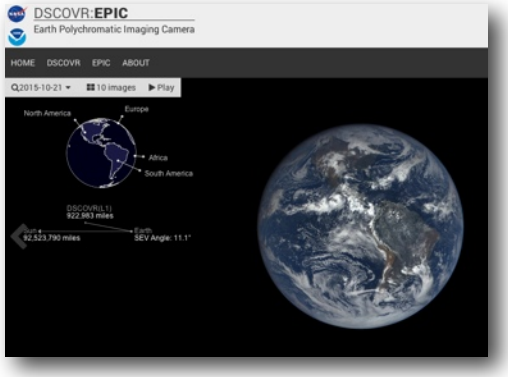
FOR SALE:

Canon EF 20 mm f/2.8 USM lens

Field of view = 94° (along diagonal) filter size = 72 mm (Skylight 1B filter included) lens caps included. Asking $400. Call 519-371-0670 or stargazerjohn@rogers.com

Review at: http://www.photozone.de/Reviews/151-canon-ef-20mm-f28-usm-lab-test-report--review

NASA has launched a new website where they will post Earth images taken by a camera called EPIC (Earth Polychromatic Imaging Camera). The 4 megapixel CCD camera is attached to a telescope aboard DSCOVR (Deep Space Climate Observatory). Once a day NASA will post at least a dozen new color images of Earth acquired from 12 to 36 hours earlier. Each daily sequence of images will show the Earth as it rotates, thus revealing the whole globe over the course of a day. The new website also features an archive of EPIC images searchable by date and continent. Check here: http://epic.gsfc.nasa.gov/



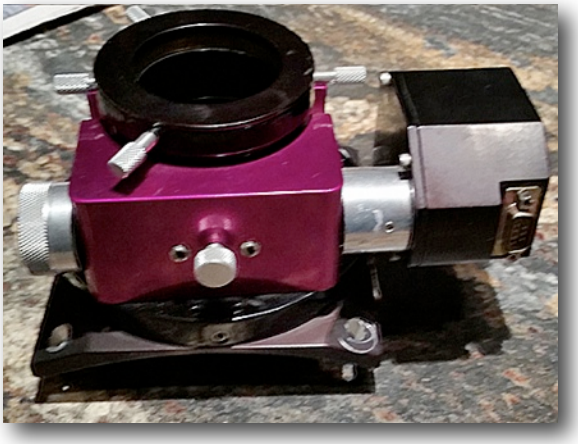
FOR SALE:

Canon EOS T-adapter

Connect your Canon camera to other components with a T-adapter. Bayonet mount connects directly to camera body. Other end has a removable threaded section that can be replaced with a 2-inch barrel for a 2-inch eyepiece holder. Contact John at 519-371-0670 or at stargazerjohn@rogers.com. I can do some machining to customize item to your telescope (for a small fee/materials cost).

FOR SALE:

Moonlite CRL 2.5 inch Large Format **Crayford Newtonian Focuser** ($592.10 new -see https://focuser.com/products.php) with Hi-Res Stepper Motor ($252.81 new). Flange for 14" tube, accepts 2" accessories (EP/camera). This is a **true Crayford focuser**, not the cheap "Crayford-style" knock-off. Not set up for manual focusing, requires hand paddle ($330 not included) for manual operation and computer control for remote focusing. This is meant for a remote imaging setup and comes from an abandoned project (12" scope). Over $850 plus taxes and shipping new. Asking $600.00. Contact **Paul Z.** at ski@bmts.com



Light Humour c/o Perimeter Institute

ES Fox Star Trails -by John H.

When an aurora alert went out Sep 9, I decided to travel to the Fox Observatory to get some possible aurora images with the Fox Observatory in the foreground.

I set up my Canon 60Da with a 15 mm wide angle lens and let my timer take images every 20 seconds or so. At about 2:30 am, and after a total of 572 shots, I stopped the sequence and decided to call it a night. A quick look at the images showed only a few brief minor flashes of northern lights, so that part of the effort was wasted. As always, whenever I take a lot of images like this, I use a time-lapse assembler to make a movie, this time it was a 3.5 hour sequence. That time-lapse showed a nice clear night and only a very faint aurora that was nothing compared to others this past year. In addition, I also stack the images onto one frame to create a star trail image. That produced a much more interesting result.

The final image above shows the rotation of the northern sky counterclockwise around Polaris which is the short trail in the middle of the circles at top. There are several aircraft and satellite trails in the image, -the most prominent one going from lower left towards Polaris is an aircraft. The red streaks at bottom are me with my red flashlight going towards the camera at various times to check its operation. The red lights also illuminate the south wall of the observatory as well as the back of the Webster telescope trailer. Unfortunately, there was no ISS pass during the interval. Not a bad result while I sipped hot chocolate and munched on two-bite brownies in the warmup room.

Technical data: images were taken every 20 s from 10:55 pm on Sep 9 to 2:26 am Sep 10, 2015. This is a stack of 572 images -each exposure at ISO 2000, f/3.5 with a 15 mm lens on a Canon 60Da camera. Processing by StarStax and Time Lapse Assembler.

New Canadian Observatory: First Light Image

What can $2.7 million by you in the way of a state-of-the-art astronomical facility? The answer is called the Trottier Observatory at Simon Fraser University in Burnaby BC. The 6-m dome houses a PlaneWave CDK700 28-inch Dall-Kirkham telescope that (like our Webster-28) can see “to infinity and beyond”. There is also an “astronomy court” with displays and interactive exhibits that will keep you entertained while you wait in line to peek through the eyepiece.

Harold Trottier, brother of Lorne Trottier, the donor, poses beside the newly installed PlaneWave 28-inch reflector.

This image of the Pinwheel Galaxy, also known as Messier 101, was shot over the course of three nights at the end of May 2015. It represents the first "deep" image taken at the Trottier Observatory, and is *true* colour! Yours truly (Mr. Starry Nights) did the image capture and processing (and image processing skill is the real secret to all good astronomical images - though it doesn't hurt to have an amazing telescope!).

The Pinwheel Galaxy is a "grand" spiral, probably somewhat larger than our Milky Way, containing several hundred billion stars, and with a diameter estimated at 170,000 light-years. At a distance of about 27 million light-years, it's one of our nearest neighbours, as galaxies go! It's a very popular target with amateur astronomers, large and bright, and is relatively easy to find, just off the end of the handle of the Big Dipper. The bright pink regions are enormous sites of active star formation, which may have been triggered by a close encounter with another galaxy, perhaps a few hundred million years ago, which would also explain how the long spiral arm on the right ended up being extended far from the rest of the galaxy.

As astronomical images go, this used relatively little telescope time: only 4 1/3 hours of exposure, divided between a luminance (clear) filter (100 minutes) and RGB filters (160 minutes). It's not unusual for amateur astronomers to image a single target for 12 hours or more: my personal record is 17 hours, on my telescope in the Okanagan. And given the light pollution that surrounds the Burnaby campus, I'm stunned at the depth of this image: for those who know star magnitudes, the limiting visual magnitude on these nights was a measly 4.4, and there was even some thin cloud!

For those interested in technical details, our telescope is the 0.7-m aperture PlaneWave CDK700, our camera is the Finger Lakes PL16803, with an external filter wheel and TrueBalance filters from Astrodon. The image capture was done using TheSkyX, PlaneWave's PWI interface, and MaxIm DL for camera control. The luminance frames were binned 2x2, the colour frames 4x4, and the image scale is about 0.8"/pixel. Image processing was done using CCDInspector, PixInsight, and Photoshop.

Howard Trottier aka Mr. Starry Nights

Images supplied by Simon Fraser University and Harold Trottier