Star Gazer News

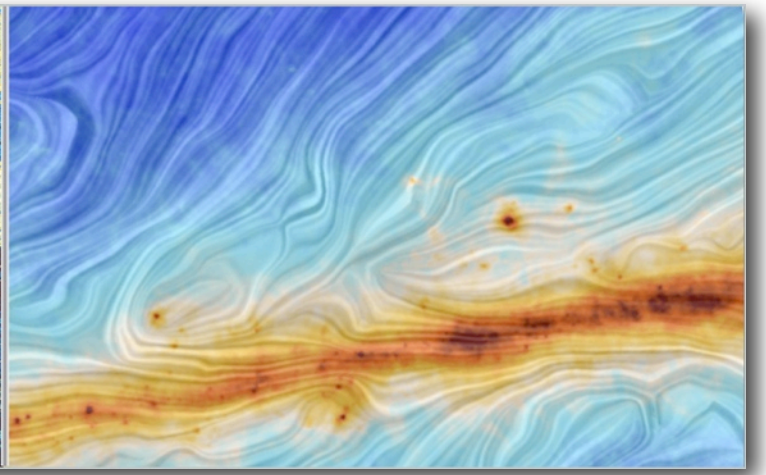
Astronomy News for Bluewater Stargazers
Vol 9 No.3 Mar 2015

This artist's impression shows a 325 m chunk of space rock called 2004 BL86 whizzing past Earth on Jan 26 at 1.2 million km. What astronomers found out about it is remarkable! See pg 3 for more.

March 2015 Contents

MW Magnetic Field Looks Like Van Gogh's Starry Night

New images returned by the Planck telescope (below right) begin to rival the complexity and beauty of the great artist Van Gogh's imagination, i.e., his Starry Night (below left). A visualization of the Planck data represents the interaction of interstellar dust with the galactic magnetic field. Color defines the intensity of dust emissions and the measurements of polarized light reveals the direction of the magnetic field lines. [Dust is greatest in the densest part of the Milky Way but also present in regions outside of the plane. The isolated brown dots are MW satellite galaxies or star-forming regions. -ed]
(Credits: Vincent Van Gogh, ESA)



From the vantage point of a window in an insane asylum, Vincent van Gogh painted one of the most noted and valued artistic works in human history. It was the summer of 1889. With his post-impressionist paint strokes, Starry Night depicts a night sky before sunrise that undulates, flows and is never settled. Scientific discoveries are revealing a Cosmos with such characteristics.

Since Vincent's time, artists and scientists have taken their respective paths to convey and understand the natural world. The latest images by the European Planck Space Telescope reveals new exquisite details of our Universe that begin to touch upon the paint strokes of the great master and at the same time looks back nearly to the beginning of time. Since Van Gogh – the passage of 125 years – scientists have constructed a progressively intricate and incredible description of the Universe.

The path from Van Gogh to the Planck Telescope imagery is indirect, an abstraction akin to the impressionism of van Gogh's era. Impressionists in the 1800s interpreted and imagined the world beyond the limitations of our five senses. Furthermore, optics since the time of Galileo had begun to extend the capability of our senses.

Read the rest of this enlightening survey of how art and science connect in this Universe Today article by Tim Reyes: http://www.universetoday.com/118640/uncovering-the-starry-night-planck-images-touch-upon-van-gogh/

More about gravitational waves can be found on pg 10 of this issue.

BAS Executive 2013-2015

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From BAS Exec: March is Election Month

Voting for BAS executive positions will start March 5, 2015 and continue to March 31, 2015. A list of candidates will be sent around after the March 4 meeting and paid up BAS members will be able to vote by return email. The new exec will be announced April 1.

Note that **you must be a current member (2015 dues paid) to vote or stand for executive position**. Membership fees are due at the March meeting and you can mail dues to the treasurer Cheryl or membership chair Dave (or pay at the March 4 meeting).

Note that the Past President, Membership Chair and Social Media are not elected positions but appointments by unanimous executive approval (or a default position as in the case of Past President). Current appointees will continue in those positions until they decide to opt out of their duties.

BAS also has a position for an individual that would like to contribute but not necessarily as an elected executive member. An executive position called Member-at-Large is also vacant and members are asked to put their name forward if they wish. Duties are light and involve tasks that are technically not done by other exec members but which need to be done from time to time. The Member-at-Large can also suggest to the BAS executive items that he/she feels might enhance the club experience. It is a chance to contribute and have a say in the direction of the club without the obligations of taking on a full exec position. We welcome volunteers for this position at any time.

BAS/Astronomical Events in March

BAS meetings resume Mar 4. See our website for details.

Mar 4 Wed	First BAS meeting of 2015, Short business meeting followed by *Jupiter, King of Planets*: John H. Grey Roots 7pm **Venus & Uranus <18 min apart** in W. evening sky (viewing if clear at the break)
Mar 5 Thu	FM
Mar 5	**Start of email voting BAS executive positions**
Mar 06 Fri	**Dawn spacecraft** captured by Ceres gravity.
Mar 13 Fri	LQ
Mar 20 NM	**Total Solar Eclipse.** Only small portion visible in NFLD at sunrise. Rest of N.America is in darkness.
Mar 21 Sat	**Messier Marathon** (prime night -backup Apr 18) **Mars 1.5° from Cres. Moon in W. evening sky**
Mar 22	**Venus 3° from Cres. Moon in W. evening sky**
Mar 24	**Moon between Hyades & Pleiades in evening sky in W.**
Mar 27 Fri	FQ
Mar 31 Tue	**Last date email voting for BAS exec positions**

The United Nations has declared 2015 the International Year of Light. Since BAS has been "celebrating" light in our pursuit of the hobby for more than 20 years now, we have no plans for a specific celebration. We continue in the normal way to bring "enLIGHTenment" to the public and our members with our regular astronomy activities.

Astronomy Day, Apr 25, 2015 at the Fox Observatory is one of those public star gazing activities and others are also listed on our website.

A video summarizing IYL can be viewed here:

http://physicsworld.com/cws/article/multimedia/2015/jan/29/a-single-light-of-science

See the events planned in Canada at: http://www.light2015.org/Home/About/Country/Canada.html

INTERNATIONAL YEAR OF LIGHT 2015

Asteroid 2004 BL86 has a moonlet!

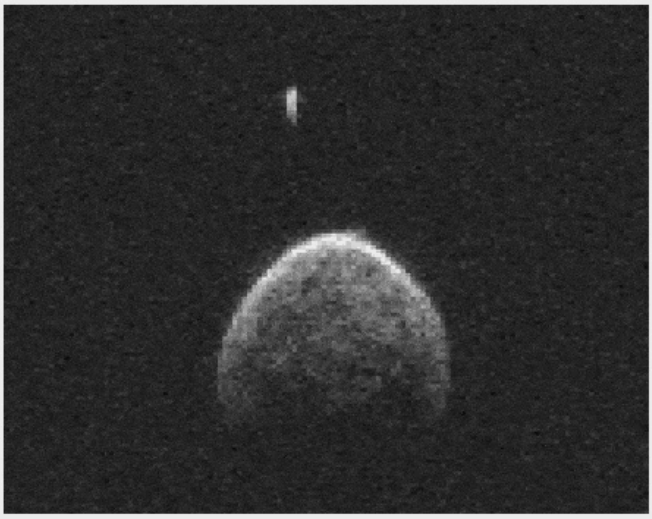
Wonderful news! Asteroid 2004 BL86, which passed closest to Earth [Jan 26] at a distance of 1.2 million km has a companion moon. Scientists working with NASA's 70-meter Deep Space Network antenna at Goldstone, California, have released the first radar images of the asteroid which show the tiny object in orbit about the main body.

While these are the first images of it, the "signature" of the satellite was seen in light curve data reported earlier by Joseph Pollock (Appalachian State University, North Carolina) and Petr Prave (Ondrejov Observatory, Czech Republic) according to **Lance Benner** who works with the radar team at Goldstone.

2004 BL86 measures about 325 metres across while its moon is approximately 70 m across. The asteroid made its closest approach Jan. 26th, 2015 at 10:19 a.m. (CST), however it peaked in brightness Jan 27 around 10 p.m. (4:00 UT) at magnitude +9.0. Unlike some flybys, 2004 BL86 remained within a few tenths of a magnitude of peak brightness [for 12 hours or so]. [Many amateur astronomers saw and imaged it through their telescopes.]

Among near-Earth asteroids, about 16% that are about 200 m or larger are either binary or triple systems. While that's not what you'd call common, it's not unusual either. To date, we know of 240 asteroids with a single moon, 10 triple systems and the sextuple system of Pluto (I realize that's stretching a bit, since Pluto's a dwarf planet) – **268 companions total**. 52 of those are near-Earth asteroids.

With a resolution of 4 m per pixel we can at least see the roughness of the main body's surface and perhaps imagine craters there. No details are visible on the moon though it does appear elongated. I'm surprised how round the main body is given its small size. An object that tiny doesn't normally have the gravity required to crush itself into a sphere. Yet another fascinating detail needing our attention.



This animation, created from 20 individual radar images, clearly show the rough outline of 2004 BL86 and its newly-discovered moon. Click for larger animation. Credit: NASA/JPL-Caltech

Of course the main asteroid will get your attention [at flypast}. This is the best view we're going to get of it for the next two centuries.

Article by Bob King **Universe Today** www.universtoday.com

NASA/JPL has more information here:
http://www.jpl.nasa.gov/news/news.php?feature=4459

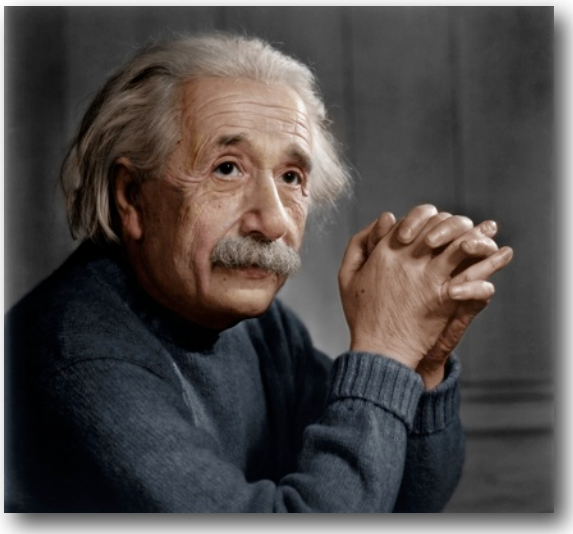
The Lighter Side of Albert Einstein

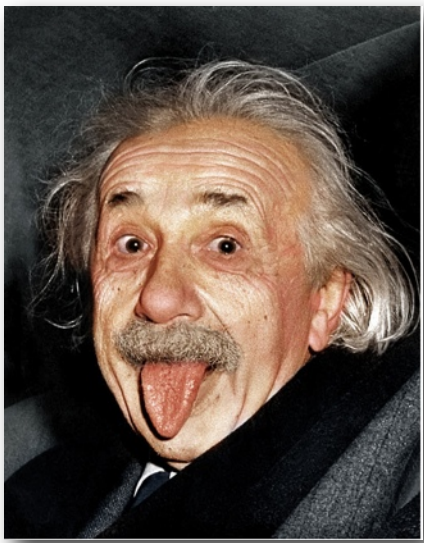
Albert Einstein, as the first "rock star" of Physics, was photographed numerous times and caught in some interesting poses. Many, like the one with his tongue stuck out below, showed Einstein's pixie-ish sense of humour. He always loved a good laugh. Originally B&W, these images and many other historic pictures have now been digitally colourized by graphic artists like Dana Keller (below) and Mads Madsen (right). The image below left taken in 1948 by Yousuf Karsh is one of the classic poses of the famous scientist. Einstein was born this month in Ulm, Germany on Mar 14, 1879.

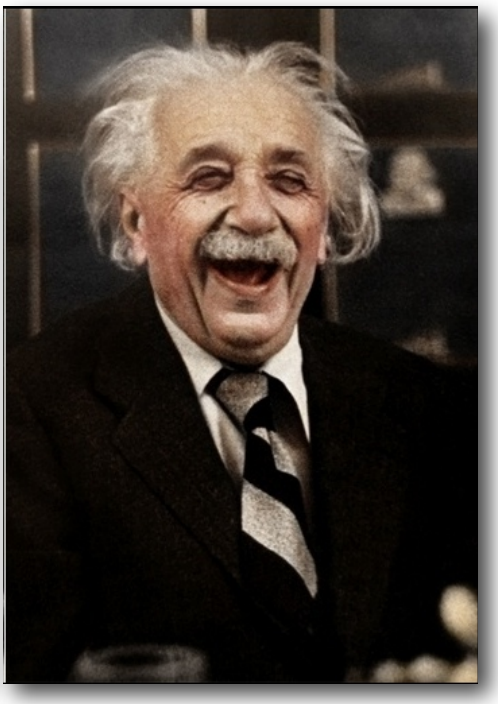
Happy 136th Dr. Albert!

It is claimed Einstein's favourite limerick was:

There was an old lady called Wright
who could travel much faster than light.
She departed one day
in a relative way
and returned on the previous night.







How Big is the Universe?

by BRIAN KOBERLEIN on AUGUST 11, 2014

The Universe is big, but how big is it? And what the heck kind of question is that? Are elephants big? Trucks? Dinosaurs? Cheese? Is cheese big? How big is cheese? How big is big?

The word “big” is tough to get clear. Are we talking about the size of the Universe we can see, or the Universe’s actual size right now? This becomes even more complicated when we are trying to work under assumptions of either the Universe is finite or the Universe is infinite.

One difficulty with talking about the size, is that the Universe is expanding. Light takes time to travel from distant galaxies, and while that light travels, the Universe continues to expand. So our problem with talking about how big it is, is that there is no single meaning to distance when it comes to the universe. For this reason, astronomers usually don’t worry about the distance to galaxies at all, and instead focus on redshift, which is measured by z. The bigger the z, the more redshift, and the more distant the galaxy.

As an example, consider one of the most distant galaxies we’ve observed, which has a redshift of 7.5. Using this, we can determine distance by calculating how long the light has traveled to reach us. With a redshift of 7.5, that comes out to be about 13 billion years. You might think that means it’s 13 billion light years away, but 13 billion years ago the universe was smaller, so it was actually closer at the time the light left that galaxy. Using this, if you calculate that distance, it was only a short 3.4 billion light years away.

Now the galaxy is much farther than that. After the light left the galaxy, the galaxy continued to move away from us. It is now about 29 billion light years away. Which is definitely more than 13, and quite a bit more than its original 3.4.

Hubble infrared image showing CL J1449+0856, the most distant mature cluster of galaxies found. Color data was added from ESO’s Very Large Telescope and the NAOJ’s Subaru Telescope. Credit: NASA, ESA, R. Gobat (Laboratoire AIM-Paris-Saclay, CEA/DSM-CNRS–)

Artist concept of the multiverse. Credit: Florida State University

Usually it is this big distance that people mean when they ask for the size of the universe. This is known as the co-moving distance. Of course, we can only see so far. So, how far can we see? The most distant light we are able to observe is from the cosmic microwave background, which has a redshift of about z = 1,000.

This means the co-moving distance of the cosmic background is about 46 billion light years. Sticking us at the center of a massive sphere, the currently observable universe has a diameter of about 92 billion light years. Even with this observed distance, we know that it extends much further than that. If what we could see was all there is, we would see galaxies tend to gravitate towards us, which we don’t observe.

In fact we don’t see any kind of galaxy clumping to a particular point at all. So as far as we know the universe could extend forever. It could be even stranger than that. Despite some media controversy, if the BICEP2 detection of early inflation is correct, it is likely the Universe undergoes a type of inflation with the intimidating moniker of “eternal inflation”. If it is the case, our observable universe is merely one bubble within an endless sea of other bubble universes. This is otherwise referred to as… the multiverse.

So, in the immortal words of Douglas Adams, “Space,” it says, “is big. Really big. You just won’t believe how vastly, hugely, mindbogglingly big it is. I mean, you may think it’s a long way down the road to the chemist’s, but that’s just peanuts to space”

About Brian Koberlein

Brian Koberlein is an astrophysicist and physics professor at Rochester Institute of Technology. He writes about astronomy and astrophysics on his blog One Universe at a Time, as well as on Google+.

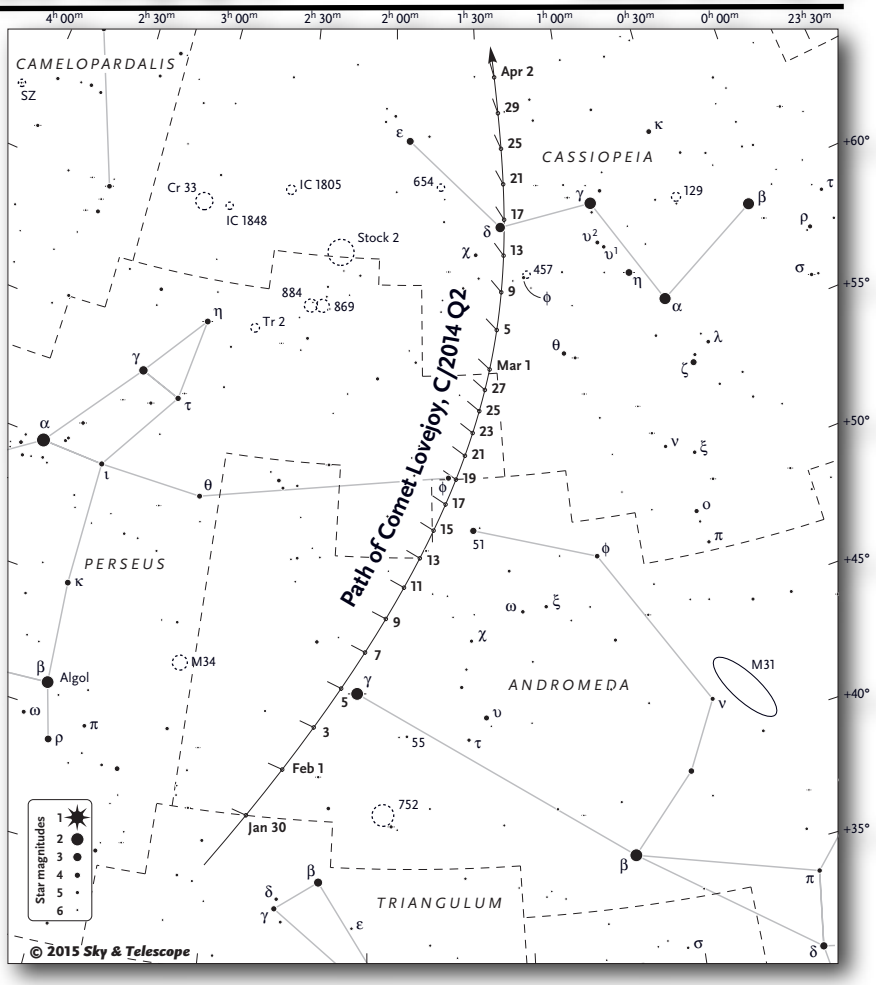
Comet Lovejoy in March 2015

After a beautiful and brighter than expected appearance in Jan and Feb, Comet Lovejoy C2014Q2, continues to grace our skies. Now circumpolar, it is above the horizon all night long. Seiichi Yoshida's http://www.aerith.net predicted light curve shows the magnitude is 6 at the start of the month dropping to 7 or so by the start of April. Sky News magazine editor Gary Seronik gives it a magnitude 5 rating in this comment on Feb 18:

Although it has lost a little of its lustre from its peak last month, it continues to shine at about magnitude 5 and is fading slower than expected. Indeed, I had little trouble viewing it in 8×40 binoculars from downtown Victoria, British Columbia, last night. The comet is noticeably smaller and fainter compared with a month ago, but remains a fine sight.

The Moon brightens the sky at the start of March (FM is Mar 5) so plan to observe in the second week of March and later, when the Moon does not rise till late in the evening. Lovejoy has been circumpolar since mid-February and will be located in Cassiopeia all month long. It's apparent motion across the sky and its brightness is dropping since it is heading away from the inner solar system and back into the cold reaches of deep space. This is your last chance to see it for about 80 centuries, at least.

On March 9, Lovejoy is less than a degree away from the Owl Cluster also known as the ET Cluster, -another photo op like its pass of the Pleiades in mid-January but this time a lot closer -about 1° from ET. Don't miss it.



Ceres Has Second Bright Spot Near First *JPL Press release Feb 25, 2015*

Dwarf planet Ceres continues to puzzle scientists as NASA's Dawn spacecraft gets closer to being captured into orbit around the object. The latest images from Dawn, taken nearly 46,000 km from Ceres, reveal that a bright spot that stands out in previous images lies close to yet another bright area.

"Ceres' bright spot can now be seen to have a companion of lesser brightness, but apparently in the same basin. This may be pointing to a volcano-like origin of the spots, but we will have to wait for better resolution before we can make such geologic interpretations," said Chris Russell, principal investigator for the Dawn mission, based at the University of California, Los Angeles.

Using its ion propulsion system, Dawn will enter orbit around Ceres on March 6. As scientists receive better and better views of the dwarf planet over the next 16 months, they hope to gain a deeper understanding of its origin and evolution by studying its surface. The intriguing bright spots and other interesting features of this captivating world will come into sharper focus.

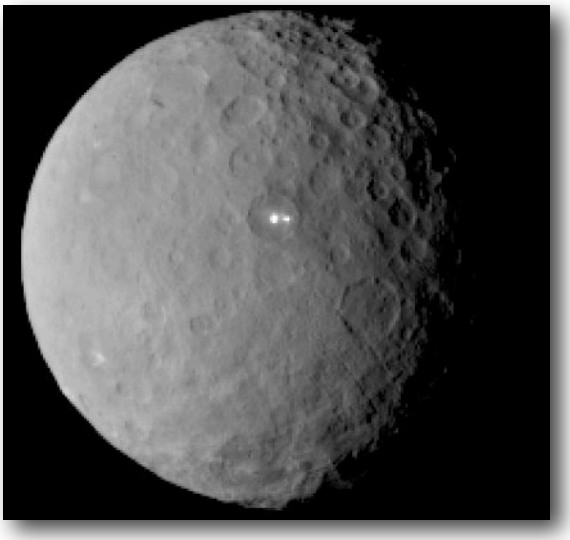
"The brightest spot continues to be too small to resolve with our camera, but despite its size it is brighter than anything else on Ceres. This is truly unexpected and still a mystery to us," said Andreas Nathues, lead investigator for the framing camera team at the Max Planck Institute for Solar System Research, Gottingen, Germany.

Dawn visited the giant asteroid Vesta from 2011 to 2012, delivering more than 30,000 images of the body along with many other measurements, and providing insights about its composition and geological history. Vesta has an average diameter of 525 km, while Ceres has an average diameter of 950 km. Vesta and Ceres are the two most massive bodies in the asteroid belt, located between Mars and Jupiter.

More at:http://dawn.jpl.nasa.gov

Dawn's mission is managed by JPL for NASA's Science Mission Directorate in Washington. Dawn is a project of the directorate's Discovery Program, managed by NASA's Marshall Space Flight Center in Huntsville, Alabama. UCLA is responsible for overall Dawn mission science. Orbital ATK, Inc., in Dulles, Virginia, designed and built the spacecraft. The German Aerospace Center, the Max Planck Institute for Solar System Research, the Italian Space Agency and the Italian National Astrophysical Institute are international partners on the mission team.

This image was taken by NASA's Dawn spacecraft of dwarf planet Ceres on Feb. 19 from a distance of nearly 46,000 km. It shows that the brightest spot on Ceres has a dimmer companion, which appears to lie in the same basin.



Credit: NASA/JPL -Caltech/UCLA/ MPS/DLR/IDA

Here's Ceres Compared to All the Other Asteroids We've Visited

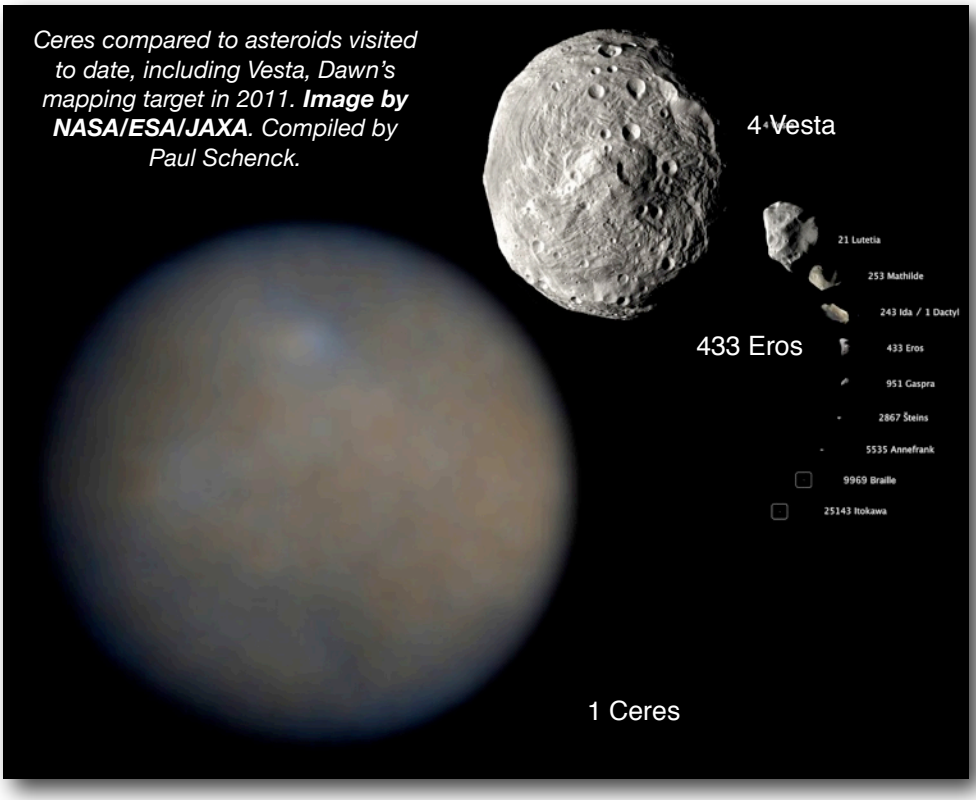
by NANCY ATKINSON *on* JANUARY 19, 2015 Universe Today www.universetoday.com

When the Dawn mission was in its planning stages, Ceres was considered an asteroid. But in 2006, a year before the mission launched, the International Astronomical Union formed a new class of solar system objects known as dwarf planets, and since by definition a dwarf planet is spherical and travels in an orbit around the Sun, Ceres fit that definition perfectly.

But since it's located in the Asteroid Belt, we still tend to think of Ceres as an asteroid. So, how does Ceres compare to other asteroids?

Dr. Paul Schenk, who is a participating scientist on the Dawn mission, recently put together some graphics on his website and the one above compares Ceres to other asteroids that we've visited with spacecraft.

Of course, Ceres is bigger (it's the biggest object in the Asteroid Belt) and more spherical than the other asteroids. When it comes right down to it, Ceres doesn't look much like an asteroid at all!



Ceres compared to asteroids visited to date, including Vesta, Dawn's mapping target in 2011. ***Image by NASA/ESA/JAXA****. Compiled by Paul Schenck.*

"Ceres is most similar in size to several of Saturn's icy moons and may be similar internally as well, being composed of 25% water ice by mass," Schenk noted on his website.And water is one of the most interesting and mysterious aspects of Ceres. A year ago, the Herschel space telescope discovered water vapor around Ceres, and the vapor could be emanating from water plumes — much like those that are on Saturn's moon Enceladus – or it could be from cryovolcanism from geysers or icy volcano.

"The water vapor question is one of the most interesting things we will look for," Schenk told Universe Today. "What is its source, what does it indicate about the interior and activity level within Ceres? Is Ceres active, very ancient, or both? Does it go back to the earliest Solar System? Those are the questions we hope to answer with Dawn."

Some scientists also think Ceres may have an ocean and possibly an atmosphere, which makes Dawn's arrival at Ceres in March one of the most exciting planetary events of 2015, in addition to New Horizon's arrival at Pluto.

"Since we don't know why the water vapor venting has happened, or even if it continues, it's hard to say much more than that," Schenk said via email, "but it is theoretically possible that some liquid water still exists within Ceres. Dawn will try to determine if that is true."

One of the possibilities that has been discussed is that if the water vapor is confirmed, Ceres could potentially host microbial life. I asked Schenk what other factors would have to be present in order for that to have occurred?

"The presence of carbon molecules is often regarded as necessary for life," he replied, "and we think we see that on the surface spectroscopically in the form of carbonates and clays. So, I think the questions will be, whether there is actually liquid water of any kind, whether the carbon compounds are just a surface coating or in the interior, and whether Ceres has ever been warm. If those are true then some sort of prebiotic or biotic activity is in play."

Since we do not know the answer to any of these questions yet, Schenk says Dawn's visit to Ceres should be interesting!

On thing of note is that Dawn is now closing in on Ceres and just today, the team released the best image we have yet of Ceres, which you can see in our article here.

Read more of Schenk's article, "Year of the 'Dwarves': Ceres and Pluto Get Their Due."

Keep tabs on the Dawn mission by following Universe Today, or see the Dawn mission website.

Ceres compared to other prominent icy objects. Dione is Ceres' closest twin in size and mass. ***Image credit: NASA/ESA.*** *Compiled by Paul Schenk.*

Don Goldman – A Landscape Photographer on a Cosmic Scale

Paula and I are now waiting out the long, and very cold, Ontario winter at Arizona Sky Village in SE Arizona. ASV is the brainchild of Jack Newton and Gene Turner and it currently has over 20 haciendas. Most of our neighbours are astro-imagers and their observatories are now finished or under construction. Actually, this year, our observing weather has not been the best, with high winds and clouds on many nights. A few days after we arrived one of our neighbours, a retired medical researcher, Roy Gravel, visited us for an afternoon of astronomy conversation. The subject was a good one! To what extent do amateur imagers reveal the reality of the objects they image? I took my iPad and showed Roy a set of images of M 27, the Dumbell nebula. No two of them were the same. The colour spaces didn't match, and, in some cases, the structural details revealed were not identical. Obviously, the pictures were more art than science. Most of my readers know some of the reasons for this state of affairs. The astro-imagers used different telescopes, different cameras, different filters, different exposure times, and they had imaged through different atmospheric conditions. Their image calibration routines employing bias frames, dark frames, and flat field frames were not the same, and more importantly, their processing techniques, such as data stretching, sharpening, contrast enhancements and combination procedures were different. Indeed, when one also considers the vagaries of personal choice for the appearance of the final image, it is really amazing that for each image of M27, there was no doubt that it was a picture of M27, the same gestalt, as it were. This brings me to the key question. Is it possible to acquire a true colour image of a celestial object?

One astro-imager who thinks this is possible is Don Goldman (astrodonimaging.com), one of the leading astro-imagers in the world today. His work sits squarely at the interface between art and science and I am a big fan of his work. He is particularly interested in planetary nebulae. His images reveal fascinating details of these enigmatic celestial objects and the final images he produces are exceptionally beautiful. Interestingly, Don has been an astro-imager for only 14 years but, in that short time, he has become a world leader in astronomical image processing. His credentials are impressive. He has earned a PhD in spectroscopy from Caltech, an MBA from the University of Washington and he even performed spectroscopic analysis on Apollo 17 moon rocks.

Don's real claim to fame with astro-imagers rests on 3 achievements. Firstly, he solved an annoying imaging problem with nebular colour depiction. In particular, significant colour variations were displayed in images of the same object taken by different astro-photographers. He realized that astrophotography is unlike terrestrial photography, due to the presence of emission lines of hydrogen, oxygen, nitrogen and sulphur. The filters of the time were not balanced for both broadband star colours and for narrow band emission lines, like O-III. He solved the problem by creating Tru-Balance filters and started marketing them with his new company which he called Astrodon. Secondly, using equipment available to high end astro-photographers, Don is creating much more than pretty pictures. He is probing the early evolution of planetary nebulae by imaging previous stellar outbursts never before revealed. Thirdly, Don Goldman was one of the founders of the Advanced Imaging Conference, North America's premier astro-photography conference, which attracts upwards of 300 high end astro-imagers each year.

Dumbell Nebula M27

Ha and OIII narrow band image of M27 with RGB image of the background stars. Total exposure 9 hr, Apogee U16M camera, f/8.9 RC 16" on Paramount ME mount
Note the radial extensions of the nebular gases in the outer halo. Courtesy of Don Goldman

The Spare Tire Nebula IC 5148

I would like to illustrate Don's work using his remarkable image of the Spare Tire Nebula. This planetary nebula, IC 5148, is 3,000 LY distant and is located in the southern constellation of Grus (the Crane). It has the reputation of being the fastest expanding planetary nebula at 50 km/s. Don's exposure was 16.5 hours (11 hours O-III, 4.5 hours Ha, 1 hour RGB) and was taken between August 4th, 2013 and October 5th 2013 using an Apogee UM 16 camera attached to a PlaneWave 20 inch CDK Telescope. This telescope is located at the Australian robotic iTelescope site (www.itelescope.net) which is located at the Siding Spring National Observatory in New South Wales. Paula and I had visited Siding Spring Observatory in 2012, after being clouded out for the total solar eclipse near Port Douglas. (The eclipse trip had been organized by Don Hladiuk and we were accompanied by our friends, Joan and Dave Skelton). We visited the empty building for the iTelescope site and spoke to the site manager. When Don Goldman sent me his image of IC 5148 I wrote back and told him we had visited the site as it was being constructed. Don does much of his southern sky imaging from this location.

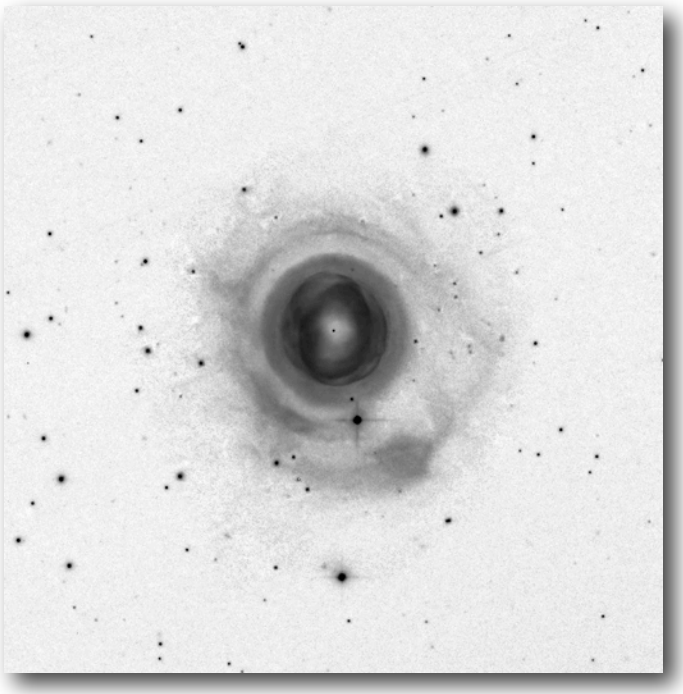
Don's narrowband images, shown above at right, have been mapped (Ha red and O-III teal) to provide a natural colour. Don's image shows interesting detail in the bright core of the planetary and, for the first time, it shows structure in IC 5148's outer halo. His inverted BW image, shown below, clearly reveals the structure in the outer envelope. It is clear that IC 5148 has undergone a number of shell ejections during its transition to a planetary nebula and central white dwarf. The cause of the outer spiral pattern and the concentration in the western lobe are mysteries for the astrophysicist. It also maps the nebular distribution of Ha and O III in both the central and halo regions.

Don describes the outer halo in his image :

"This is the first detailed image of the halo showing such structure. It is about 6' in diameter. There is an inner halo ring completely surrounding the bright core, then a gap, and then what appears to be a spiral structure expanding clockwise. There appears to be an opening or dimming in the spiral toward the west (right). There is a much fainter Ha signal in the halo, the brightest of which is located in the larger "knot" in the southwest portion of the spiral."

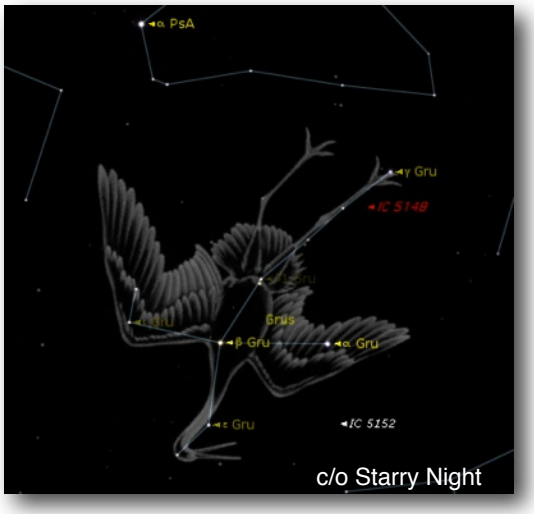
Don Goldman's feet are firmly planted at the interface between astrophotography as science and astrophotography as art. His images are revealing enigmatic aspects of planetary nebula formation that will appeal to astrophysicists. His work is an inspiration to all astro-imagers and he sets a high standard of achievement to emulate.

To see more of his work and learn more of his story, check out his website at http://www.astrodonimaging.com



The Spare Tire Nebula*: a planetary nebula in Grus IC 5148. This negative BW image shows more detail that the colour version above. (images courtesy Don Goldman)*

The Spare Tire Nebula at mag. 13 is not going to jump out of a list of planetary nebula to see. In northern skies, it only skirts the southern horizon, never getting out of the haze. The southern US is a better place and so is the southern hemi-sphere but it is a photographic target, nevertheless. Only the legs of Grus get above our SW Ont. horizon and even at best they clear it by only 5°.



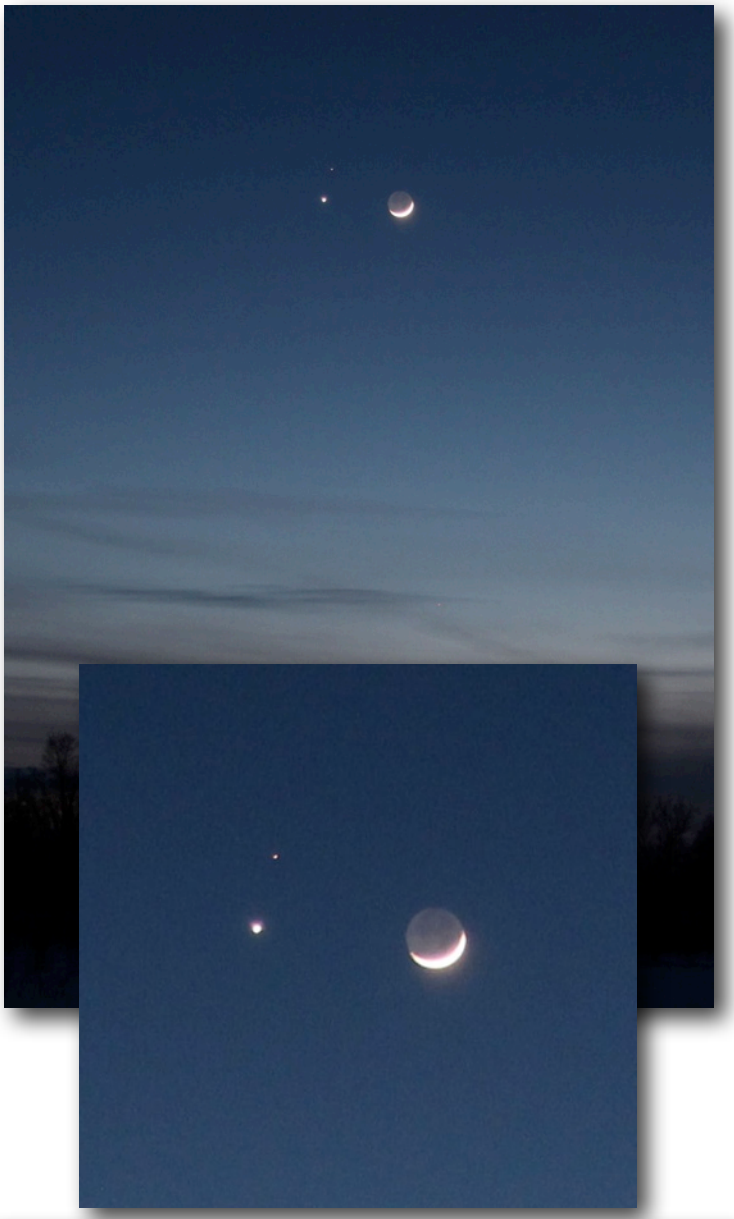
Appulse Seen From Snowy SW Ontario and Sunny Portugal

The spectacular conjunction of three objects in the evening sky on Feb 20 was eagerly anticipated by BAS stargazers in our area. From Big Bay to Port Elgin to London ON where one of our distant members resides, fingers were crossed for clear skies for that night. We wanted so much to see the close approach of Venus to Mars and the passing of the thin crescent moon along the ecliptic near the two planets. Though it was spectacularly cold, for a change the clouds parted long enough for the majority of the viewers to get a glimpse! Brett T. as well as Aaron T. and Robert A. in London successfully imaged the objects before the cold and clouds took their toll. It was cold and at least one camera lens frosted over.

On the other hand, our intrepid, wandering, vice-president was off in Portugal with his wife on a holiday and we just happened to be returning from a side trip to Tangier as the planets and Moon were setting in the west. In fact, due to the time difference of 6 hours, we got sunset before North America and were the first BAS members to see the event. This is why the Moon is farther from Venus/Mars in the Tangier image at bottom than in the images taken by Ontario observers. In the 6 hours it took for the Earth to turn into position so Canadians could see, the Moon had moved about 3 degrees (almost 6 moon widths!) along its path and appeared much closer to Venus and Mars then it was in Tangier. There was also a small effect due to the different viewing locations that would introduce some parallax into the position of the Moon if simultaneous viewing could be done. A simultaneous observation was not possible (this time) because the Moon had not risen for viewers in Ontario when it was low on the western horizon in Morocco and set in Morocco by the time it was up in North America.

This almost simultaneous viewing has never been tried before by BAS members, and as luck would have it this time, it worked.

Thanks to Steve Irvine (who was at a dinner engagement in Kemble but was clouded out), Robert Atkinson in London, ON (he of the frosted lens), and to Aaron Top and Brett Tatton who also succeeded in getting images. I am almost embarrassed to take credit for any successful images, since the weather in Morocco and Portugal was spectacularly clear during our stay. I had only to step outside the door to the top of a hill to take images like the one at right. As the real estate guys say, Location, location, location...



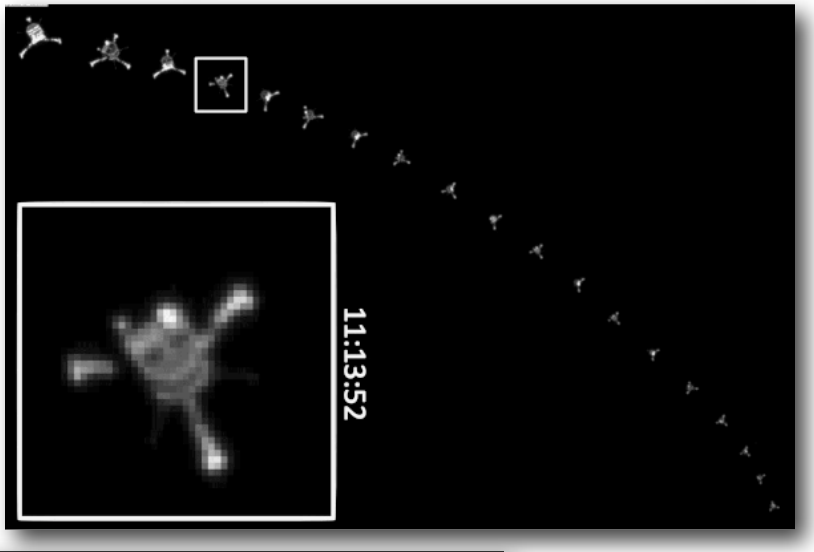
Upper image by Aaron Top. Centre is an enlargement of the central group. Canon 60Da, 56 mm focal length, exp = 0.4 s ISO 800, f/5.6. Aaron was lucky to get a clear spell just after sunset. Although both Brett and Robert spotted the group, clouds interfered with imaging and Mars was faint or invisible in the images sent to SGN. Thanks for the effort, guys.

Lower of the two is an image taken on the dock of the Tarifa, Spain ferry terminal as we boarded the bus for the trip back to Portugal after a day in Morocco. Canon 60Da, 0.2 s exp. f/5.6 85 mm focal length ISO 3200. Camera was propped on the top of an suv roof to steady the shot.

These images were taken about 6 hours apart in real time so the Moon is farther from Venus and Mars in the lower image (about 3°). A small parallax effect from the 6000 km location difference would also add to shift the Moon against the stellar background even if they had been simultaneously observed.

Absolutely awesome images of comet lander Philae

Universe Today/NASA/ESA



NASA released the animated gif above on January 30, 2015. It's a series of 19 images captured by Rosetta's OSIRIS camera as the Philae lander descended to the surface of Comet 67P/Churyumov–Gerasimenko on November 12, 2014. That was the day the Philae lander made history, becoming the first space probe to attempt a soft-landing on a comet. In the weak gravity of the 4-km-wide (2.5-mile-wide) comet, the spacecraft bounced several times from its initial touchdown point, became lost and then went silent when its battery ran out. On January 30, ESA said it would call off further searches for the lander for the time being and wait for the lander to "call home."

ESA had said in November it was likely the lander had finally touched down in the shadow of a cliff or other obstruction, somewhere it could not receive enough sunlight to re-power its battery. And yet all hope for the lander was not and is not lost. As the comet continues orbiting the sun, its seasons are subtly changing (much as Earth's are), meaning the sun is continually shifting in the comet's sky, eventually, hopefully, bringing more sunlight to the lander's location.

ESA said it will begin listening in a few more weeks with the hope that communications with the lander can be re-established by May or June.

The image left is another awesome shot of the Philae lander, making its descent to Comet 67P/C–G above the Hatmehit crater on November 12, 2014.

Here the Philae Lander is seen against black space just off the comet's surface (within the red crosshairs) during the first bounce after failing to land properly on the comet.

Philae Lander did eventually land in a still-unknown location on the comet.

Philae, call home …

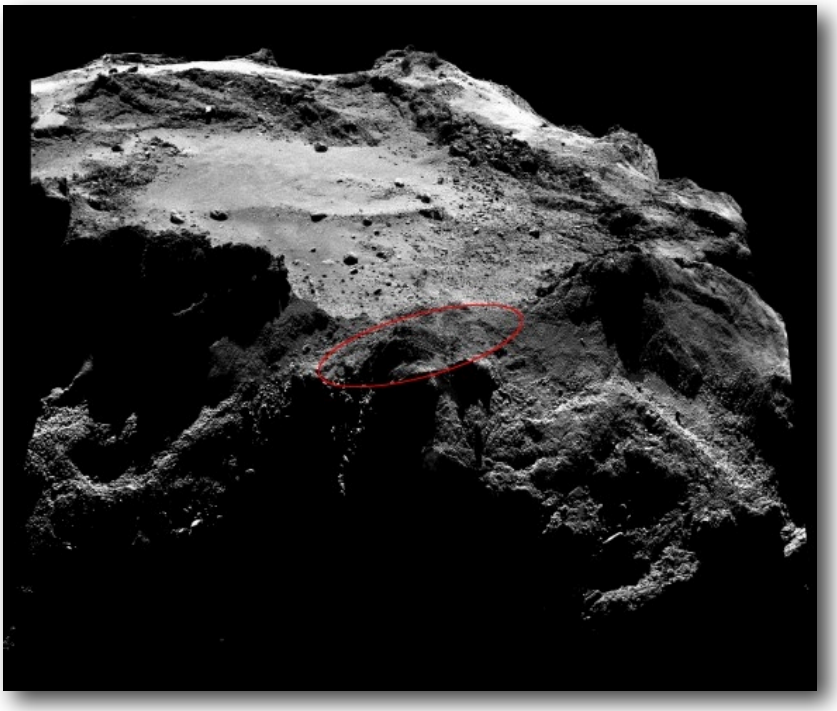


Image of the Hatmehit crater on the top of 67P's head from the OSIRIS (Optical, Spectroscopic and Infrared Remote Imaging System) Narrow Angle Camera. from December 13, 2014.

Here the Hatmehit crater is very well seen from an oblique angle with the red oval outlined area showing the search area for the washing-machine-sized Philae lander.

The nucleus of 67P/Churyumov–Gerasimenko is smaller than many mountains, is also much smaller than both of the Mars moons, Phobos and Deimos.

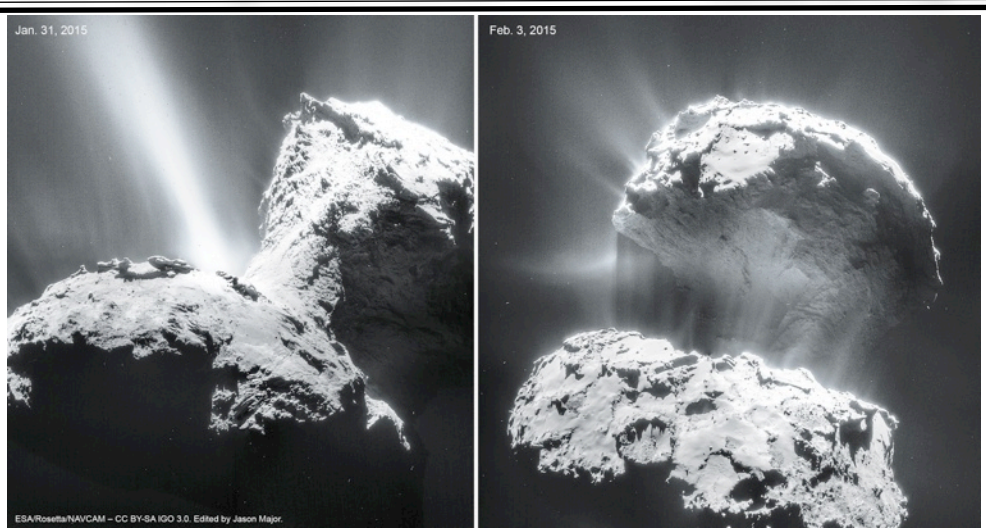
Many features look like ablation features, even though Comet 67P/Churyumov-Gerasimenko has only been in an orbit to allow sublimation only very recently, so could be impact features that have frozen.

Cliffs and boulders are also visible. Have a look at the original full-size image here:

Truly mind-boggling!

Rosetta's Comet Really "Blows Up" in Latest Images

by JASON MAJOR *on* FEBRUARY 9, 2015



The images above were captured by Rosetta's NavCam on Jan. 31 and Feb. 3 from a distance of about 28 km (17 miles). Each is a mosaic of four separate NavCam acquisitions and they have been adjusted and tinted in Photoshop by yours truly to further enhance the jets' visibility. (You can view the original image mosaics and source frames here and here.)

These dramatic views are just a hint at what's in store; 67P's activity will only be increasing in the coming weeks and months and, this weekend, Rosetta will be swooping down for an extreme close pass over its surface! On Saturday, Feb. 14, Rosetta performed a very close pass of the comet's nucleus, soaring over the Imhotep region at an altitude of only 6 km (3.7 miles) at 12:41 UTC. This will allow the spacecraft to closely image the comet's surface, as well as investigate the behavior of its jets and how they interact with its developing coma.

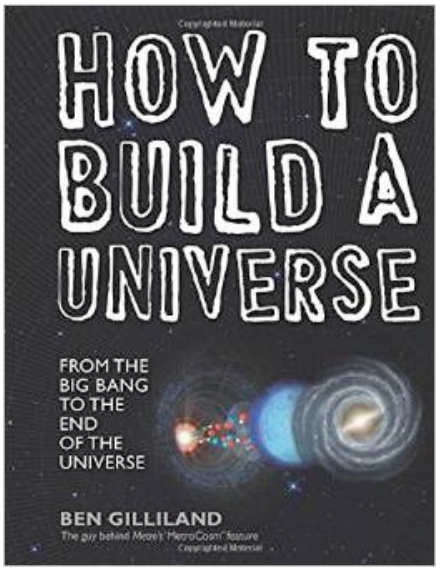
"The upcoming close flyby will allow unique scientific observations, providing us with high-resolution measurements of the surface over a range of wavelengths and giving us the opportunity to sample – taste or sniff – the very innermost parts of the comet's atmosphere," said Rosetta project scientist Matt Taylor.

Read more about Rosetta's Valentine's Day close pass here

From Universe Today www.universetoday.com

Book Review: *How To Build a Universe* by Ben Gilliland

by EVAN GOUGH *on* FEBRUARY 9, 2015 Universe Today
www.universetoday.com



We live in a wild and crazy universe. Gigantic stars explode and create the stuff of life, virtual particles pop in and out of existence so fast they can barely be measured, and light exists as particles and waves at the same time. And it all started with three simple words: The Big Bang. It's taken hundreds of years of science to begin to sort some of this out, so for one author to write one book that tells the whole story is an enormous task.

Enter Ben Gilliland, science columnist, gifted illustrator, and winner of the 2013 Sir Arthur Clarke Award for Space Achievement in Media. Gilliland tackles the task in his new book "How to Build a Universe: from The Big Bang to the End of the Universe." He uses engaging storytelling, eye-catching graphics, and a relaxed and friendly style of writing that makes reading his book an enjoyable and informative experience.

"How To Build A Universe" reads like a conversation with a knowledgeable and enthusiastic friend. Gilliland leads us through the twists and turns of the story of the universe and uses his skill as an illustrator to great narrative effect. From The Big Bang, to the discovery of the atom. From the point in time when other galaxies will become invisible to observers on Earth, to the eventual death of the universe, it's all explained with wit and detail.

If you've ever picked up a book about space science, opened the first page and then asked yourself why you didn't take cosmology and astrophysics in university, this book is for you. There's none of that with Gilliland's book. This book grabs the reader right away, and is engaging from start to finish.

You would have to take several university level courses in astronomy, astrophysics, and cosmology to cover as much ground as "How To Build A Universe" does in 224 pages. And your professors probably wouldn't be near as engaging as the author, Ben Gilliland. (You'd go to more parties if you went to university, but that's another subject.)

Don't get the wrong idea. This book is not dumbed down. It finds its audience nicely. It touches on all the important topics, and digs into the detail with clarity and humour. The writing is clear and concise at the same time that it's warm and informal. Beyond the writing, it's the wealth of thoughtful illustrations that help pull it all together.

I'm a technical writer, and I know how hard it can be to explain complicated subjects to people. ***Ben Gilliland makes it seem effortless. His explanations of quantum physics are particularly effective, and they're the clearest explanation of that challenging material that I've ever come across. I could say the same thing about how he handles Dark Matter and Dark Energy, two other difficult to explain concepts.***

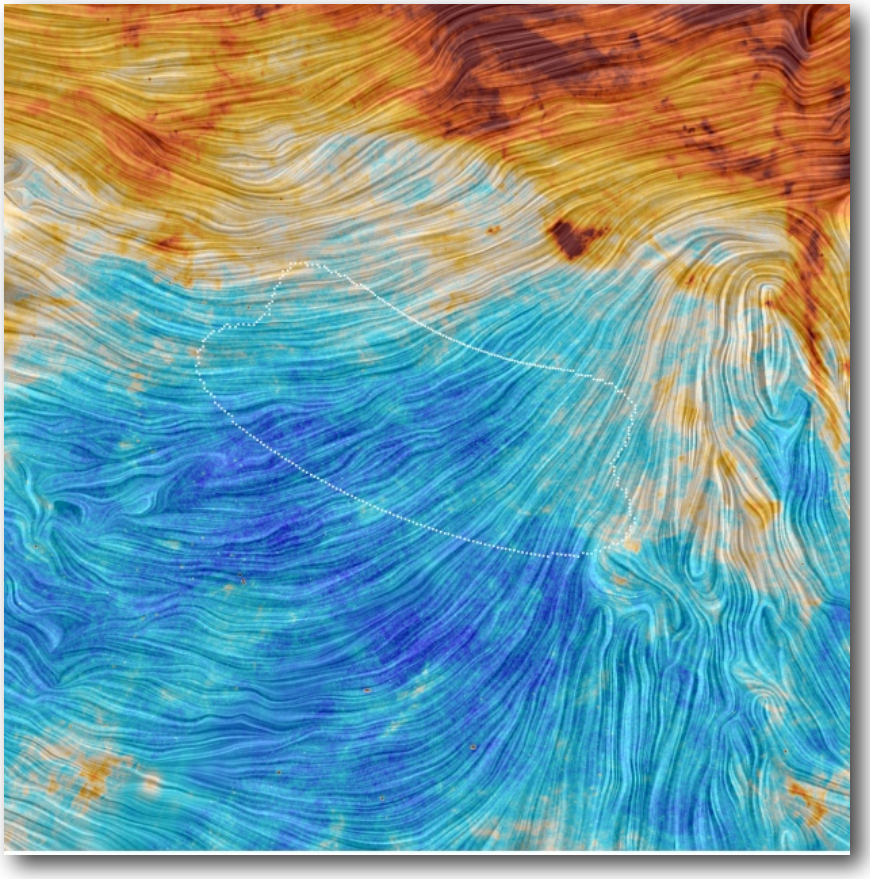
Gilliland is a gifted writer and illustrator, and I highly recommend "How To Build a Universe" to Universe Today readers.

About Evan Gough

Evan Gough lives on the West Coast of Canada with his wife and daughter, where he supervises tree planting contracts and thinks about science.

Planck: Gravitational Waves Remain Elusive

30 January 2015



This image shows a patch of the southern sky and is based on observations performed by ESA's Planck satellite at microwave and sub-millimetre wavelengths.

The colour scale represents the emission from dust, a minor but crucial component of the interstellar medium that pervades our Milky Way galaxy. The texture, instead, indicates the orientation of the Galactic magnetic field. It is based on measurements of the direction of the polarised light emitted by the dust.

The highlighted region shows the position of a small patch of the sky that was observed with two ground-based experiments at the South Pole, BICEP2 and the Keck Array, and yielding a possible detection of curly B-modes in the polarisation of the Cosmic Microwave Background (CMB), the most ancient light in the history of the Universe.

However, a joint analysis of data from BICEP2, the Keck Array, and Planck has later shown that this signal is likely not cosmological in nature, but caused by dust in our Galaxy.

The image shows that dust emission is strongest along the plane of the Galaxy, in the upper part of the image, but that it cannot be neglected even in other regions of the sky. The small cloud visible in red, to the upper right of the BICEP2 field, shows dust emission from the Small Magellanic Cloud, a satellite galaxy of the Milky Way. The image spans 60° on each side.

Despite earlier reports of a possible detection, a joint analysis of data from ESA's Planck satellite and the ground-based BICEP2 and Keck Array experiments has found no conclusive evidence of primordial gravitational waves.

The Milky Way is pervaded by a mixture of gas and dust shining at similar frequencies to those of the CMB, and this foreground emission affects the observation of the most ancient cosmic light. Very careful analysis is needed to separate the foreground emission from the cosmic background.

Critically, interstellar dust also emits polarised light, thus affecting the CMB polarisation as well.

“When we first detected this signal in our data, we relied on models for Galactic dust emission that were available at the time,” says John Kovac, a principal investigator of BICEP2 at Harvard University, in the USA.

“These seemed to indicate that the region of the sky chosen for our observations had dust polarisation much lower than the detected signal.”

The two ground-based experiments collected data at a single microwave frequency, making it difficult to separate the emissions coming from the Milky Way and the background.

On the other hand, Planck observed the sky in nine microwave and sub-millimetre frequency channels, seven of which were also equipped with polarisation-sensitive detectors. By careful analysis, these multi-frequency data can be used to separate the various contributions.

The BICEP2 team had chosen a field where they believed dust emission would be low, and thus interpreted the signal as likely to be cosmological.

However, as soon as Planck’s maps of the polarised emission from Galactic dust were released, it was clear that this foreground contribution could be much higher than previously expected.

In fact, in September 2014, Planck revealed for the first time that the polarised emission from dust is significant over the entire sky, and comparable to the signal detected by BICEP2 even in the cleanest regions.

So, the Planck and BICEP2 teams joined forces, combining the satellite’s ability to deal with foregrounds using observations at several frequencies – including those where dust emission is strongest – with the greater sensitivity of the ground-based experiments over limited areas of the sky, thanks to their more recent, improved technology. By then, the full Keck Array data from 2012 and 2013 had also become available.

“This joint work has shown that the detection of primordial B-modes is no longer robust once the emission from Galactic dust is removed,” says Jean-Loup Puget, principal investigator of the HFI instrument on Planck at the Institut d’Astrophysique Spatiale in Orsay, France.

“So, unfortunately, we have not been able to confirm that the signal is an imprint of cosmic inflation.”

See the full story at:

http://sci.esa.int/planck/55362-planck-gravitational-waves-remain-elusive/

Ursa Major (UMa)

α-Ursae Majoris - Dubhe
β-Ursae Majoris - Merak
γ-Ursae Majoris - Phad (Phecda)
δ-Ursae Majoris - Megrez
ε-Ursae Majoris - Alioth
ζ-Ursae Majoris - Mizar
η-Ursae Majoris - Benetnasch
ι-Ursae Majoris - Talita
λ-Ursae Majoris -Tania Borealis
μ-Ursae Majoris -Tania Australis
ν-Ursae Majoris - Alula Borealis
ξ-Ursae Majoris -Alula Australis
ο-Ursae Majoris - Muscida
ψ-Ursae Majoris - Ta Tsun
80-Ursae Majoris - Alcor

The Big Dipper, which actually is only a part of the constellation Ursa Major and forms the tail [and rear] of the Great Bear, is the best known and easiest group of stars in the heavens to identify. The two stars α and β-Ursae Majoris are the so-called "Pointer Stars"; the line connecting them and extended about six times their separation will locate Polaris, the Pole Star, which indicates very closely the position of the north celestial pole, the point about which the heavens seem to rotate. Mizar (ζ-Ursae Majoris) in the handle of the Big Dipper has a small companion, Alcor, of the 4th magnitude. Separation of the two stars used to be considered a test of keen eyesight; since ancient times, however, the stars have apparently become more widely separated. Mizar itself is a telescopic double.

DOUBLE STARS [Note: two digits in bold mean negative Decl.]

	Mag.	Sep (s)	Location	Remarks
α	1.9-4.8	1	110062	
ζ	2.4-4.0	14	132255	Both Greenish White
ι	3.1·10.8	7	085648	
σ2	4.9·8.1	1	090567	
ξ	4.4-8.9	2.3	111532	
57	5.3·8.0	5	112640	
65	6.5-6.8 -8.0	63 - 4	115347	Triple
Σ1415	6.6·7.2	17	101571	
Σ1495	6.0·8.3	34	105659	
Σ1520	6.3·7.9	13	111353	
Σ1561	6.3·8.4	10	113645	

MESSIER OBJECTS

	Mag	Location	Remarks
M 40	--	122058	Two faint stars probably mistaken for nebula.
M 81	7.9	095269	Spiral Galaxy. Bright, prominent center
M 82	8.8	095270	Spiral Galaxy. Long & narrow; M81 is 0.5 ° away.
M 97	12.0	111255	Planetary Nebula. Famous "Owl Nebula; large and quite round, faint resemblance to owl's head.
M 101	9.6	140155	Spiral Galaxy. large and faint.
M 108	10.0	110956	Spiral Galaxy.
M 109	11.0	115554	Spiral Galaxy.

Other Objects in Ursa Major

R Ursae Majoris - Long period (302 days) variable, maximum magnitude 7.5 Location 104169.

S Ursae Majoris - Long period (226 days) variable, maximum magnitude 7.8. Location 124261.

T Ursae Majoris - Long period (257 days) variable, maximum magnitude 7.7. Location 123560.

Ursa Minor (UMi)

α Ursae Minoris - Polaris
β Ursae Minoris - Kochab
γ Ursae Minoris - Pherkad Major
δ Ursae Minoris - Yildun
ζ Ursae Minoris - Alifa
η Ursae Minoris - Alasco

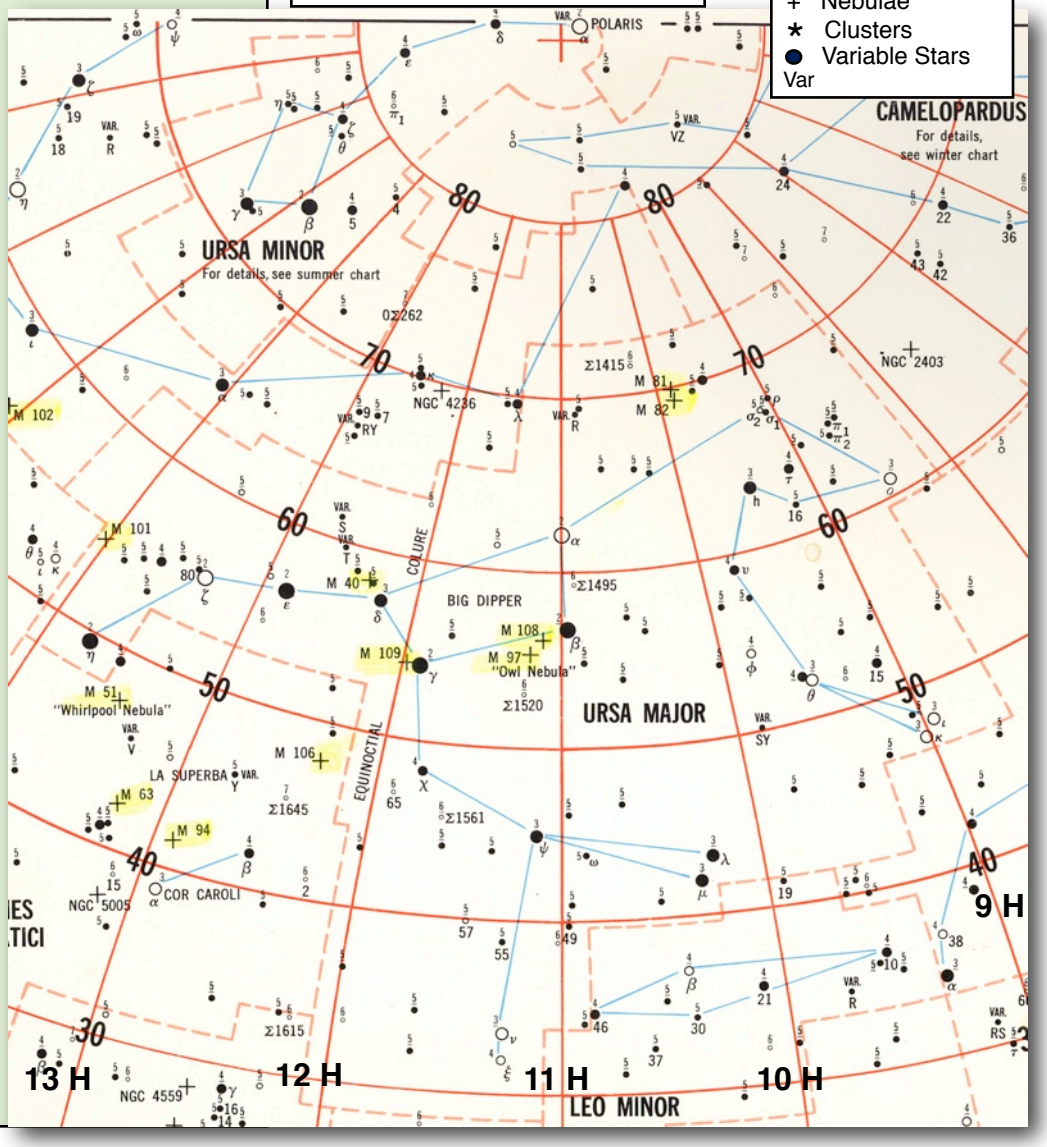
Except for Polaris, Kochab and Pherkad Major, the stars of the Little Dipper are rather faint, The last two stars named correspond in position to the "pointer stars" of the Big Dipper. Polaris is not exactly on the north celestial pole, being at present about 1° away, In AD 2000 it will be at its closest to the pole, only 27' distant. The angular distance of Polaris above the observer's horizon is a close approximation of the observer's latitude on the earth's surface; if it is 35° above the horizon, for example, then the observer's latitude will be 35°. The varying magnitudes of the stars in Ursa Minor are a good guide in estimating the magnitudes of the other stars in the sky since they range in magnitude from 2 to 5 (see chart).

DOUBLE STARS [Note: two digits in bold mean negative Decl.]

	Mag.	Sep (s)	Location	Remarks
α	2.0-8.8	18	015789	Pale Yellow-Blue
π1	6.5-8.6	31	153881	Both Yellow
OΣ262	7.3-8.2	28	130373	

Star magnitudes are labeled as numerical values above (or near) the star. Underlined values are half magnitudes. Larger star dots denote brighter stars.

Chart Legend
- Star Location
- Double Stars
- Nebulae
- Clusters
- Variable Stars



Date: Time given in EST (24 h clock) EDT after Mar 8

Mar 03 05:00 Jupiter 5°N. of Moon
04 14:00 Venus 0.1° N. of Uranus
05 02:35 Moon at Apogee: 406 386 km
13:05 **Full Moon** rises 18:29 EST (smallest of 2015)
Mar 08 Daylight Savings Time starts 02:00 EST
Zodiacal Light visible in W after sunset for next 2 weeks
11 16:00 Mars 0.3°N of Uranus
12 04:25 Saturn 2.3°S of Moon
13 13:48 **LQ** Moon rises 02:20 EDT locally
17 19:00 Mercury 1.6°S of Neptune
19 15:38 Moon at Perigee: 357 584 km (large tides)
20 05:36 **NM** rises 07:31 EDT locally
05:46 Total Solar Eclipse; vis. N.Atlantic only
18:45 Spring Equinox (6:45 pm)
21 07:00 Uranus 0.1°S of Moon: Occ'n not vis. locally
18:13 Mars 1.0°N of Moon: Occ'n not vis. locally
22 15:51 Venus 2.8°N of Moon
25 02:00 Aldebaran 0.9°S of Moon: Occ'n NW Can.&Alaska
27 03:43 **FQ Moon** rises locally at 12:38 EDT
30 06:00 Jupiter 6°N. of Moon

BAS/Astronomy Events

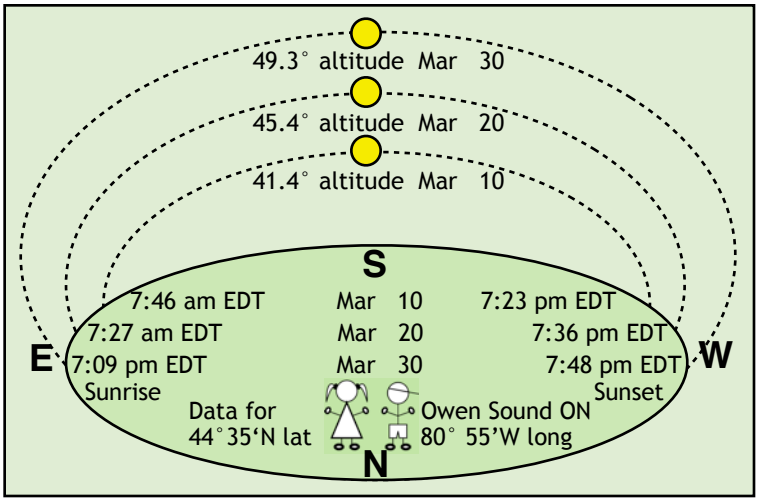
BAS meetings resume Mar 4. See our website for details.

Mar 4 Wed	First BAS meeting of 2015, AGM followed by *Jupiter, King of Planets*: John H. Grey Roots 7pm Venus & Uranus <18 min apart in W. evening sky, observing at meeting if clear.
Mar 5 Thu	FM
Mar 06 Fri	**Dawn spacecraft** captured by Ceres gravity.
Mar 13 Fri	LQ
Mar 20	**Total Solar Eclipse.** Only small portion visible in NFLD at sunrise. Rest of N.America is in darkness.
Mar 20 Fri	NM
Mar 21 Sat	**Messier Marathon** (prime night -backup Apr 18) **Mars 1.5° from Cres. Moon in W. evening sky**
Mar 22	**Venus 3° from Cres. Moon in W. evening sky**
Mar 24	**Moon between Hyades & Pleiades in evening sky in W.**
Mar 27 Fri	FQ

Planets

MERCURY, stays very low in the eastern dawn sky as it advances back towards the Sun in March. It passes the Sun in early April but will not become visible in the evening sky until later that month. **VENUS,** (-4.0) is well placed as the Evening Star and stay that way until autumn this year. It passes very close to Uranus March 4 and heads towards the Pleiades later this spring. **MARS** (mag. 1.3) also travels eastward but more slowly than Venus. It is only 21 minutes from Uranus on March 11. **JUPITER**, (-2.4) continues to be in excellent position this month for viewing. Don't pass up a view of the King of Planets and its four moons. **SATURN,** (mag. 0.4) sits near the top of the Scorpion this month and rises about 1:30 DST in the SE. It is only 3 moon-widths away from a waning gibbous moon on March 12. **URANUS,** (5.8) and **NEPTUNE,** (7.8) are evening and morning sky objects and are close to the Sun's glare for a month or so. They will become morning sky objects in summer 2015. Similarly, both **asteroid, Vesta (7.1)** and **dwarf planet**, **Ceres (8.3)** will be better summer objects. **PLUTO** (mag. 14) leads the asteroids and outer gas giants into the dawn sky and will be best placed in the summer MW in Sagittarius. Pluto 2014 charts are now found on the BAS website.

The diagram below gives the sunrise/sunset times and the Sun's altitude for March. The Sun reaches its equinox point on Mar 20 as it crosses the celestial equator heading north. Spring is on its way! 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.



Evening Planets

On Mar 4,Venus slips past Uranus at a distance of less than ¼° but the main events are Mar 21 and 22. A very thin crescent Moon is beside first Mars, then Venus -separations of 1.3° from Mars on March 21, then a bit over 3° from Venus on Mar 22. This is not the nice triangle we saw last month but this event gives you twice the chance for clear weather on one of the two evenings. Look west after sunset before 8:25 pm DST Mar 21 (Moon/Mars) and before 9:40 pm DST Mar 22 when both Moon and Venus set simultaneously.

March 2015

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5 FM	6	7
8	9	10	11	12	13 LQ	14
15	16	17	18	19	20 NM	21
22	23	24	25	26	27 FQ	28
29	30	31				

By permission Univ. of Texas McDonald Obs.

BAS Member Loaner Scopes

Solar H-alpha scope now out on loan.

Our Lunt solar scope can be borrowed by BAS members but there is a waiting list! Contact Aaron to get your name on it. We now have a suitable mount for it as well. A short training session will be provided on pickup.

One 12-inch Dob available.

Only one 12-inch loaner telescope is available for free loan by members. The other is temporarily under repair. Other scopes like **8-inch dobsonians** are available, however. 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.

SGN Classified Ads Section

(Now also on our website)

FOR SALE: Meade Lightbridge 16" Dobsonian

Azimuth bearing upgraded to Teflon and textured Formica bearing. Includes AstroZap shroud and Telrad unit finder. The truss tubes and castings were originally bright white! I recoated them in flat black header paint after a light sandblasting. I have also modified the Rocker/Base Assembly using "knock down" fasteners. This bulky assembly can be assembled or disassembled in about five minutes with one Allen key for flat storage in a car trunk. The Lower Optical Assembly will fit into the backseat of my Corolla. This is a relatively transportable "Light Bucket" priced at $1300. Make me an offer! Brett Tatton ph: (519) 389-6010 or: bretttatton@gmail.com

Note: Actual scope does not have a handle under focuser or reinforced base (near eyepiece rack) as shown in image above.

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 this item to your telescope as well (for a small fee/materials cost).

FOR SALE: Televue Pronto

2 element E.D. Refractor, 2.7" / 70mm diameter. f.l. 480mm, f/6.8. with 1-1/4" Star Diagonal, with 45 degree Prism diagonal (for terrestrial viewing), with TeleVue Red dot finder, complete with TeleVue Soft Case. Contact Anton VanDijk 519 376-9912 ravand@rogers.com

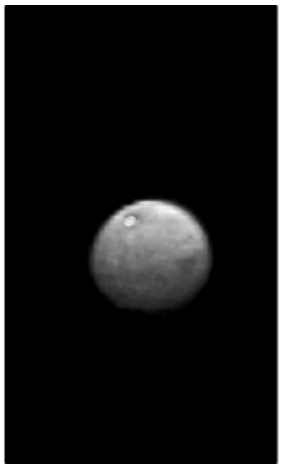
Price reduced to $600 !

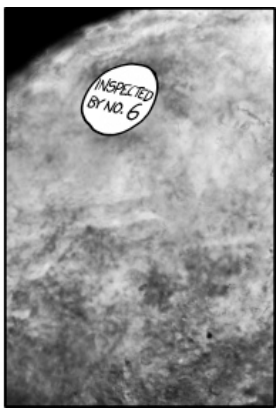
Sale Pending!

FOR SALE: Canon EF 20 mm f/2.8 USM lens

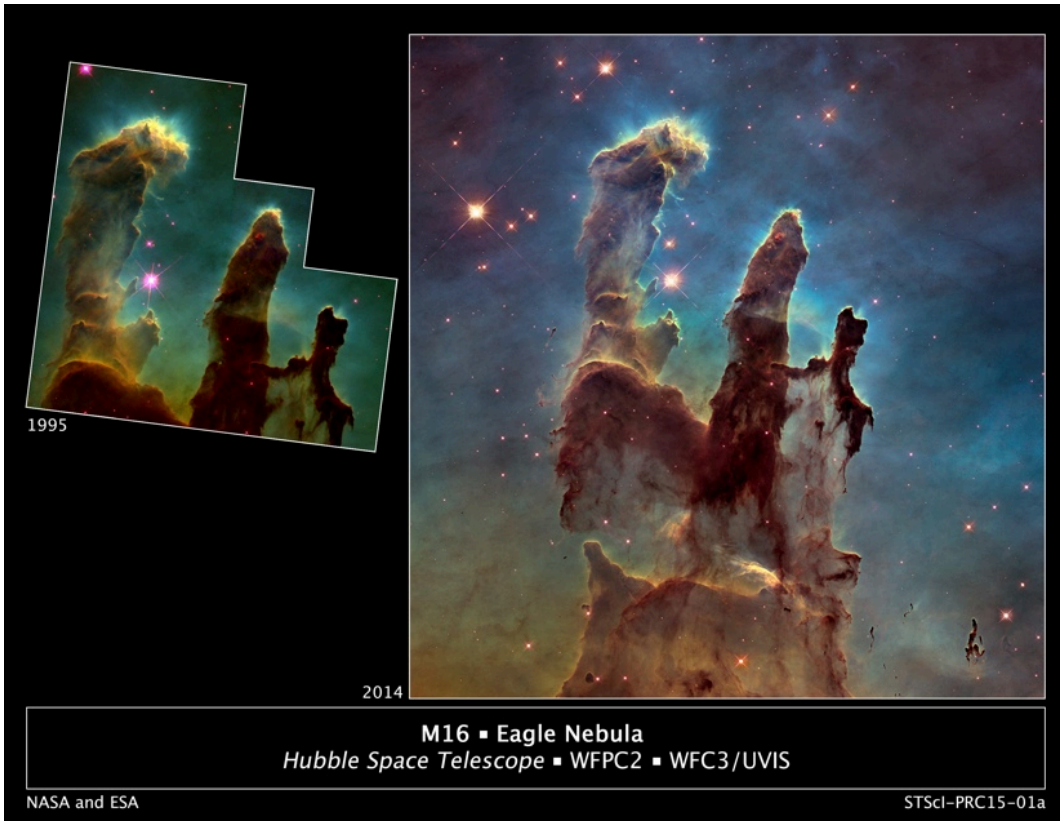
Field of view = 94° (along diagonal) filter size = 72 mm (Skylight 1B filter included) lens caps included. Asking $400. Call 519-371-0670 or contact stargazerjohn@rogers.com. Review at: http://www.photozone.de/Reviews/151-canon-ef-20mm-f28-usm-lab-test-report--review

The Cartoon Corner http://xkcd.com





Hubble: Pillars of Creation are also Pillars of Destruction



Jan. 7, 2015: The original "Pillars of Creation" image taken in 1995, revealed never-before-seen details of three giant columns of cold gas bathed in the scorching ultraviolet light from a cluster of young, massive stars in a small region of the Eagle Nebula, or M16. The new HST image (far right and on pg 16) could be called the "pillars of destruction."

"I'm impressed by how transitory these structures are," explains Paul Scowen of Arizona State University in Tempe. "They are actively being ablated away before our very eyes. The ghostly bluish haze around the dense edges of the pillars is material getting heated up and evaporating away into space. We have caught these pillars at a very unique and short-lived moment in their evolution." Scowen and astronomer Jeff Hester, formerly of Arizona State University, led the original Hubble observations of the Eagle Nebula.

The original 1995 images were taken in visible light. The new image includes near-infrared light as well. The infrared view transforms the pillars into eerie, wispy silhouettes seen against a background of myriad stars. That's because the infrared light penetrates much of the gas and dust, except for the densest regions of the pillars. Newborn stars can be seen hidden away inside the pillars.

The infrared image shows that the very ends of the pillars are dense knots of dust and gas. They shadow the gas below them, keeping the gas cool and creating the long, column-like structures. The material in between the pillars has long since been evaporated away by the ionizing radiation from the central star cluster located above the pillars.

At the top edge of the left-hand pillar, a gaseous fragment has been heated up and is flying away from the structure, underscoring the violent nature of star-forming regions. "These pillars represent a very dynamic, active process," Scowen said. "The gas is not being passively heated up and gently wafting away into space. The gaseous pillars are actually getting ionized, a process by which electrons are stripped off of atoms, and heated up by radiation from the massive stars. And then they are being eroded by the stars' strong winds and barrage of charged particles, which are literally sandblasting away the tops of these pillars."

The first features that jumped out at the team in 1995 were the streamers of gas seemingly floating away from the columns. Astronomers had previously debated what effect nearby massive stars would have on the surrounding gas in stellar nurseries. "There is the only one thing that can light up a neighborhood like this: massive stars kicking out enough horsepower in ultraviolet light to ionize the gas clouds and make them glow," Scowen said. "Nebulous star-forming regions like M16 are the interstellar neon signs that say, 'We just made a bunch of massive stars here.' This was the first time we had directly seen observational evidence that the erosion process, not only the radiation but the mechanical stripping away of the gas from the columns, was actually being seen."

By comparing the 1995 and 2014 pictures, astronomers also noticed a lengthening of a narrow jet-like feature that may have been ejected from a newly forming star. The jet looks like a stream of water from a garden hose. Over the intervening 19 years, this jet has stretched farther into space, across an additional 96 billion km, at an estimated speed of about 200 km/s.

Our sun probably formed in a similar turbulent star-forming region. There is evidence that the forming solar system was seasoned with radioactive shrapnel from a nearby supernova. That means that our sun was formed as part of a cluster that included stars massive enough to produce powerful ionizing radiation, such as is seen in the Eagle Nebula. "That's the only way the nebula from which the sun was born could have been exposed to a supernova that quickly, in the short period of time that represents, because supernovae only come from massive stars, and those stars only live a few tens of millions of years," Scowen explained. "What that means is when you look at the environment of the Eagle Nebula or other star-forming regions, you're looking at exactly the kind of nascent environment that our sun formed in."

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Compare this view to the 2014 image in a side-by-side montage

The new image is provided full page below, As you can see it is truly impressive! You can download full resolution copies from NASA.gov

M16 ▪ Eagle Nebula
Hubble Space Telescope ▪ WFPC2 ▪ WFC3/UVIS