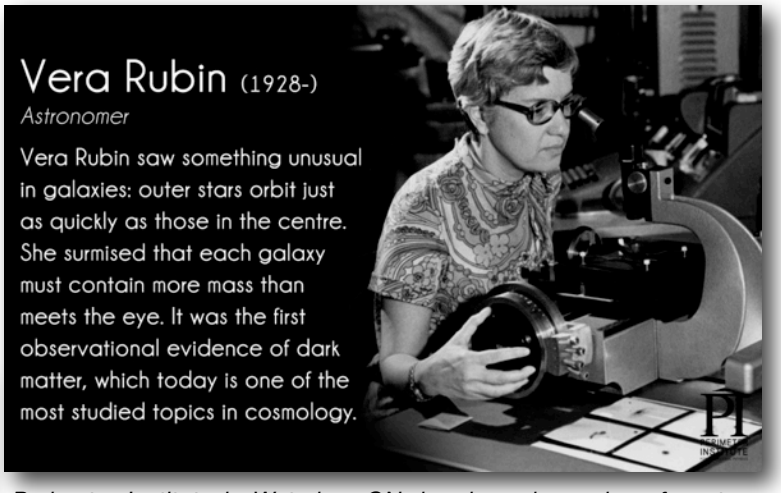
Star Gazer News

INTERNATIONAL YEAR OF LIGHT 2015

Astronomy News for Bluewater Stargazers
Vol 9 No. 9 September 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.

September 2015 Contents

Perseid 2015 Report

The Perseid meteor shower is always reliable and this year was no exception. We even got a little surprise. The prime night for maximum numbers was Aug 12/13 when 90 per hour were predicted at about 2 am Aug 13. That number was exceeded however, for 15 minutes around 10 pm EST and other bursts like this were seen in the records of experienced observers from all over the world.

Six BAS observers at the Fox Observatory watched and counted carefully for 15 minutes from 9:55 to 10:10 pm and got 48 meteors, with several fireballs that left persistent trails. If we exclude a few that were not Perseids, the hourly number works out to be more than twice the predicted figure. No. 36 was especially interesting since not only was it bright, but it appeared to break up at the end of the trail. That one unfortunately was just beyond the edge of the field of the camera that was set up to record the shower for the whole night. A composite of the night's brightest Perseids is shown below. Photo by J. Hlynialuk

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Imaging Pluto with 10-inch optics

Two BAS astrophotographers took up the challenge of imaging Pluto as a commemoration of the New Horizons flyby this past July. At the BAS Fox viewing night Aug 8, Frank W. succeeded using the club 10-inch SCT (the "Bishop" scope). Image above. The following night Aug 9, John H. confirmed the planet's motion in the image right which was taken through a Celestron 9.25 Edge SCT.

Pluto is marked in each image and clearly has shifted position with respect to the background stars. Clyde Tombaugh would have been impressed with how relatively easy our modern telescopes, electronic detectors, autoguiding and image processing software have made the job. In the image above, Frank W. went the extra step of stacking his images while the image at right is a single 30 second exposure. Both images were taken with Canon DSLR cameras and indicate how far we have come in 85 years.

BAS & Astronomy Events for September

Sep 2 Wed BAS meeting at Fox Observatory. Starfest recap

Sep 5 Sat LQ **Aldebaran Occultation** Disappearance (bright limb) at 12:07 am (just after midnight Sep 4/5), Reappearance dark limb 12:39 am Sep 5, Moon LQ and rises from 1.75° to 7° above eastern horizon during occultation.

Sep 12 Sat BAS viewing@Fox

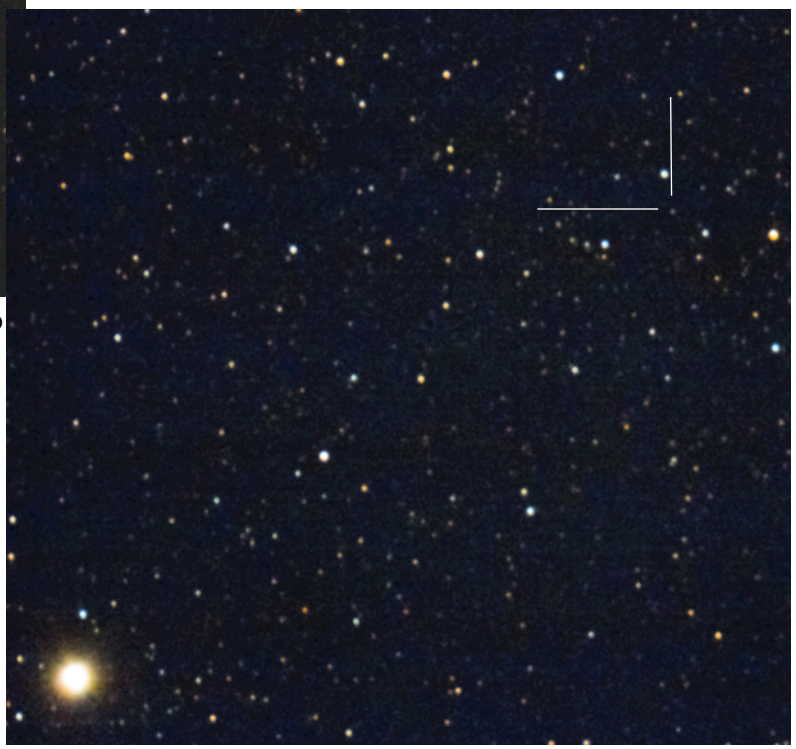
Sep 13 Sun NM **Partial Solar Eclipse** Only visible from Antarctica and S. Africa, S. Pacific

Sep 13 Sun Paisley Fall Fair Solar display (daytime event) BAS members with solar scopes welcome

Sep 20 Sun Meaford Public viewing (talk & solar viewing)

Sep 21 Mon FQ

Sep 27 Sun **Total Lunar Eclipse** Best of the year! Totality starts at 10:11 pm DST Sep 27 and continues to 11:23 pm. Moon is 35° high at mid-eclipse. A prime-time event! **Public Viewing at ES Fox.**



by **ADRIAN WEST**
2011 Universe Today
[with editing by SGN]
See also June 2011 SGN

Eyepieces are probably the most important part of your observing equipment, as they are at the heart of your setup and can make your observing experience fantastic or disastrous, or make an average telescope great or an excellent telescope bad.

The Basics

Eyepieces are responsible for magnification of the objects you see through the telescope. Depending on your telescope, they come in two sizes 1.25" or 2" and there is 0.965" which is an older size and pretty much obsolete, unless you have an old telescope. Most telescopes can be fitted with adapters so both eyepiece sizes can be used.

Magnification

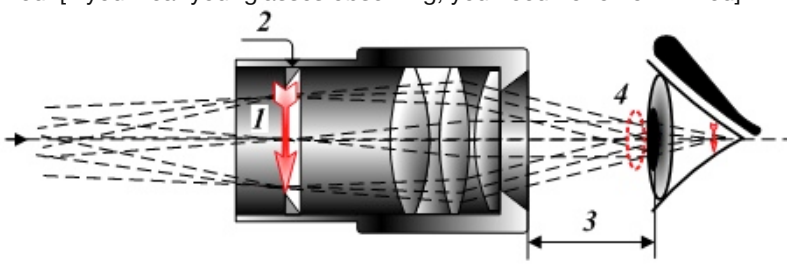
The magnifying power of any eyepiece is a simple equation expressed as a number "X" and can be found by dividing the focal length of the telescope by the focal length of the eyepiece. Use the same units -inches or millimetres. For example a typical 8-inch (200 mm) dobsonian has a focal length of 1200 mm. With a 25 mm eyepiece you would get 1200mm/25mm = 48X. Long focal length eyepieces such as 32 mm and 25 mm are lower magnification (37.5X and 48X), while lower numbers like 10 mm and 5 mm are magnifying powerhouses at 120X and 240X. Our atmosphere limits the high end to about 300X except on those rare nights when the air is absolutely steady and clear.

It is always good practice to start observing an object with a lower power eyepiece such as a 40 mm and gradually build up to higher powered eyepieces such as 10 mm or less. The reason for this is the telescope, human eye, seeing conditions and object being observed are all variable. Starting off with a high power such as 4.7 mm may be a struggle.

Fainter objects such as nebula and galaxies are usually seen better with lower powers and you can really ramp up the power with bright objects like the moon and planets.

Eye Relief

Eye relief (labelled 3 in diagram below) is the distance from the last surface of an eyepiece at which the eye can obtain the full viewing angle. The viewer's eye should be inside this distance for viewing. Generally longer eye relief is preferred. [If you wear your glasses observing, you need 16 to 20 mm -ed]



1. Image size 2. Field stop 3. Eye relief 4. Exit pupil Credit: qwiki.com

Exit Pupil

Exit pupil (labelled 4 in diagram above) is the circle of visibility and represents the opening through which all the light from the object being viewed will pass. With your eye placed right there you are seeing all there is to see and none is blocked off by either your own pupillary opening or the eyepiece structure. Obviously, the perfect match is to have your own pupil match the eyepiece exit pupil but often there is not possible. As we age, our normal 7 mm pupil gets smaller and by age 55 it is 6 mm and only 5.1 mm by age 80.

Image size

If you take your eyepiece out when looking at a bright object like the moon, and look down the barrel of the eyepiece holder, you will see an image of the Moon kind of hanging there in space. This is the "primary" image created by the telescope main optics. It will have a certain size (see 1. above) which depends only on the focal length of your telescope. There is an approximate relationship that works well enough: Image size is about 1% of the focal length. So a 1200 mm dobsonian would have a primary image of 12 mm. The full equation is here: http://www.company7.com/library/astforms.html but the 1% rule works well enough. (cont'd on pg 4)

Below are rough guides and are dependent on the telescope you use:

2mm-4.9mm Eyepieces: These are very high magnification and very difficult to use unless seeing conditions are perfect and the object observed is very bright, like the moon.

5mm – 6.9mm Eyepieces: These are good on bright objects such as the moon and bright planets, but are still very high power and work best with steady seeing conditions.

7mm – 9.9mm Eyepieces: These are very comfortable high magnification eyepieces and are excellent for observing brighter objects, a must for any eyepiece collection.

10mm – 13.9mm Eyepieces: These work well for all objects including brighter nebula and galaxies a good mid/ high range magnification.

14mm – 17.9mm Eyepieces: These are a great mid range magnification and will help resolve globular clusters, galaxy details and planetary nebulae.

18mm – 24.9mm Eyepieces: These will work nicely to show wide field and extended objects, great mid-range magnification for objects like galaxy clusters and large open clusters.

25mm – 30.9mm Eyepieces: These are wider field eyepieces for large nebula and open clusters. A good finder eyepiece for locating objects before moving to higher powers.

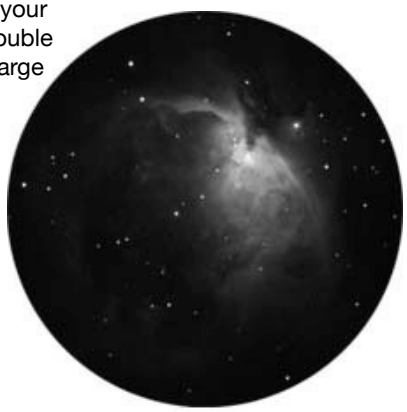
31mm – 40mm Eyepieces: These are excellent for extended views and large star fields and make excellent finder eyepieces before moving to higher powers.

[A note about **55 mm Plossl** eyepieces: This can be a useful eyepiece as a low power finder in your telescope. Objects for higher power viewing can most times be located with this eyepiece. Note that the background sky is always brighter in long focal length eyepieces and will darken i.e. increase in contrast with higher power, a useful "trick" to sometimes see more subtle detail. -ed]

Field Stop
This opaque ring (2. in diagram above) is inserted by the manufacturer with a size determined by the design of the eyepiece. It can be seen as the sharp edge of the circle of light when you look in. Its placement and size is determined by the eyepiece focal length.

Apparent Field of View
This is the apparent size of the image in the eyepiece and can range from about 35 to 100 degrees. Larger fields of view are more desired and even low-end eyepieces have 50° or more.

Apparent Field of view: Notice the larger circle of view in the image below. The object has the same magnification but more of the surrounding sky is visible. Apparent FOV is larger, say 80°, compared to the 50° FOV (lower image). Typically, large FOV makes eyepieces more expensive but note that if your primary viewing is of planets, double stars, or remote galaxies, then large FOV is not so important.



Types of Eyepiece
There are many different eyepiece types, some old and now obsolete, some simple and some advanced. The different types of eyepiece are purely governed by the configuration of the glass and lenses inside the eyepiece. Some giving exceptional eye relief, wide fields of view, colour correction etc. Some different brands of eyepiece include: Huygens, Ramsden, Kellner, Plössl, Orthoscopic and Kellner.

The most common and popular eyepiece type is the Plössl due to its good all round performance, good eye relief, approximate 50° field of view, pinpoint sharpness and good contrast. Plössl eyepieces are made by many manufacturers now, but there are excellent examples from manufacturers such as Meade and Televue.

Finally we have exotic eyepieces such as Super Wide and Ultra Wide which are usually 2" eyepieces, with higher powers up to around 4.7 mm at 1.25" and are usually in the domain of the large Dobsonian or Newtonian telescope user, but are just at home on smaller telescopes such as refractors or Cassegrains. These eyepieces sport amazing eye relief and huge "port hole" 80 – 100° views with fully loaded premium optics, which are very forgiving on telescopes with optical aberrations and other problems. They can make average or poor telescopes great, but there is a cost; an example of which is my 14 mm Ultra Wide which cost $800 just for one eyepiece! Combined, your eyepieces are probably worth as much or more than the telescopes they are used on, but it's worth it!

THE NAPERVILLE ASTRONOMICAL ASSOCIATION
"Organized Amateur Astronomy"

The Naperville Astronomical Association has an excellent Eyepiece Tool that can help you work out the useful values like magniication, FOV, etc. for any eyepiece you have or intend to purchase.
it is found here: http://www.stargazing.net/naa/scopemath.htm

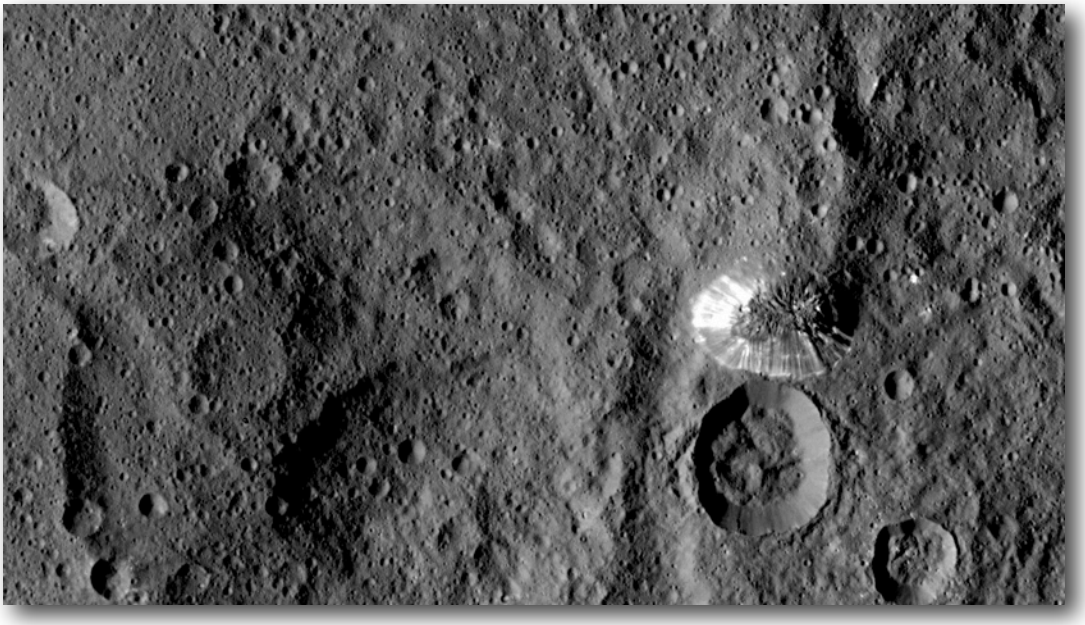
The Bottom Line: $$$.¢¢

Prices for eyepieces range from about $30 to just under $1000. And they come in a wide variety of types. At the high end are Televue and its clones with 120° FOV eyepieces that range from $500 to $900. At the lower end are 50° FOV Plossls that are excellent buys at under $100.

If you are in the market, do your research and purchase the best eyepiece you can afford for your telescope. It makes no sense to skimp with the most important single optical component of your system. And consider getting a good quality Barlow lens. You will automatically double the number of magnifications you can use!

Tele Vue Optics is a Chester, New York-based astronomical optics company known primarily for its premium brand of speciality eyepieces and apochromatic refractor telescopes. Founded in 1977 by Al Nagler, an optical engineer from The Bronx who designed simulators used in the Apollo program, the company originally made projection lenses for large projection-screen televisions, but is well known in the astronomy community for its products.

TeleVue sells Plossl, Radian, Panoptic, Delos, Nagler, Ethos and Nagler Zoom eyepieces. They made their start with a variety of Plossl eyepieces for amateur astronomers. The introduction of the original Nagler 13mm Type 1 in 1982 with its wide field of view and an equally high price soon made their mark. Using different combinations of lenses of different types of high index optical glasses, the eyepieces produce, respectively, a 50°, 60°, 68°, 72°, 82°, 100° and 50° apparent field-of-view. TeleVue calls the 82° and 100° apparent field-of-view a "spacewalk" experience. Wider apparent fields of view are helpful in viewing star clusters, galaxies and nebulae, especially large emission nebulae like the Orion Nebula, but the real reason for wide fields of view is to allow the same true field of view as is found in a lower power, narrower FOV eyepiece. This increases effective contrast and aids in visibility of certain details. Additionally, TeleVue eyepieces are well corrected for most aberrations, providing edge to edge pinpoint stars, and are well suited to use in popular "fast" telescopes. The most expensive TeleVue eyepiece is the Ethos line, which consists of eight eyepieces known for excellent image quality and ultra-wide 100 degree fields, which can retail for from $500 to $800 or more. At the North East Astronomy Forum 2010, they revealed the Ethos SX, a 3.7mm focal length eyepiece with an even greater 110° apparent field-of-view. In 2011, a new line of eyepieces was introduced called the Delos. These eyepieces are based on the Ethos but have a smaller field of view of 72°. Instead, they boast a comfortable 20mm eye relief. Some TeleVue eyepieces are over half a foot long and weigh over two pounds.



The closest-yet views of Ceres, delivered by NASA's Dawn spacecraft, show features in unprecedented detail, including Ceres' tall, conical mountain; crater formation features and narrow, braided fractures.

"Dawn is performing flawlessly in this new orbit with views now three times as sharp as in its previous mapping orbit, revealing exciting new details of this intriguing dwarf planet," said Marc Rayman, Dawn's chief engineer and mission director, based at NASA's Jet Propulsion Laboratory, Pasadena, California.

At its current orbital altitude of 1,470 km, Dawn takes 11 days to capture and return images of Ceres' whole surface. Each 11-day cycle consists of 14 orbits.

Over the next two months, the spacecraft will map the entirety of Ceres six times. The spacecraft is using its framing camera to extensively map the surface, enabling 3-D modeling. Every image from this orbit has a resolution of 140 m per pixel, and covers less than 1 percent of the surface of Ceres. At the same time, Dawn's visible and infrared mapping spectrometer is collecting data that will give scientists a better understanding of the minerals found on Ceres' surface.

Engineers and scientists will also refine their measurements of Ceres' gravity field, which will help mission planners in designing Dawn's next orbit -- its lowest -- as well as the journey to get there. In late October, Dawn will begin spiraling toward this final orbit, which will be at 375 km. More at: http://dawn.jpl.nasa.gov/mission

Comet 67P/Churyumov–Gerasimenko reaches Perihelion

13 August 2015:

ESA's Rosetta today witnessed Comet 67P/Churyumov–Gerasimenko making its closest approach to the Sun. The exact moment of perihelion occurred at 02:03 GMT this morning when the comet came within 186 million km of the Sun.

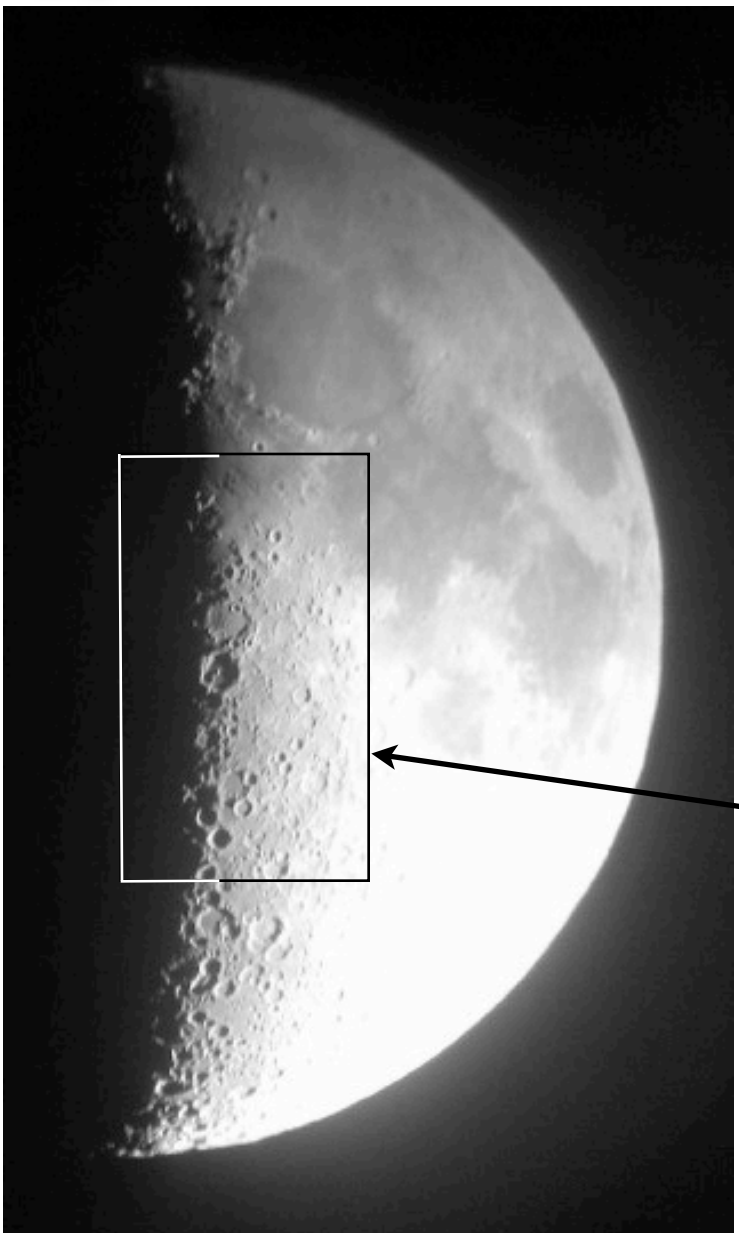
In the year that has passed since Rosetta arrived, the comet has travelled some 750 million kilometres along its orbit towards the Sun, the increasing solar radiation heating up the nucleus and causing its frozen ices to escape as gas and stream out into space at an ever greater rate. These gases, and the dust particles that they drag along, build up the comet's atmosphere – coma – and tail.

The activity reaches its peak intensity around perihelion and in the weeks that follow – and is clearly visible in the spectacular images returned by the spacecraft in the last months. One image taken by Rosetta's navigation camera was acquired at 01:04 GMT, just an hour before the moment of perihelion, from a distance of 327 km.

The scientific camera is also taking images today – the most recent available image was taken at 23:31 GMT on 12 August, just a few hours before perihelion. The comet's activity is clearly seen in the images, with a multitude of jets stemming from the nucleus, including one outburst captured in an image taken at 17:35 GMT yesterday.

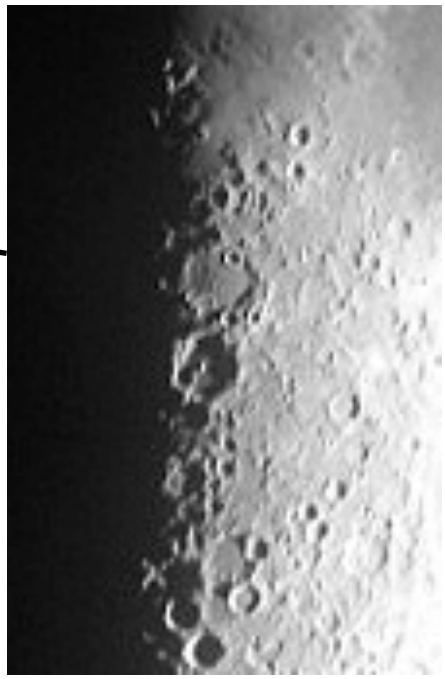
"Activity will remain high like this for many weeks, and we're certainly looking forward to seeing how many more jets and outburst events we catch in the act, as we have already witnessed in the last few weeks," says Nicolas Altobelli, acting Rosetta project scientist.

A spectacular animation is available here: http://www.esa.int/Our_Activities/Space_Science/Rosetta/Rosetta_s_big_day_in_the_Sun



Summer Moongazing The scheduled public "stargazing" event at the Fox Observatory on Aug 21 turned out to be more a "moongazing" event than anything else. With our video camera projecting a 2-m diameter Moon image through our LCD projector, who would not be amazed by the wealth of lunar features visible. The image left, taken by a Blackberry placed at the eyepiece of our 10-inch Schmidt-Cassegrain telescope (the "Bishop Scope") does not do justice to the details visible to the eye. Cameras do not show the Moon as well as actually looking at it with your eye and just before we turned the scope on other things, a feature not marked on our maps jumped out -the "Lunar X".

Look at the terminator near the bottom edge of the box for an X-shape. This is formed by low sunlight illuminating the edges of several crater rims, and it is striking, if temporary. The crater rims involved are Purbach, LaCaille and Blanchinus, in case you were curious. In 2007, David Chapman of the Halifax RASC Centre wrote an extensive article on this feature available here: http://wasociety.us/Lunar-X.pdf . See also "A B C features" at https://the-moon.wikispaces.com/A+B+C+shaped+features



The Lunar X is only visible for a few hours when the Moon phase is just a day short of FQ. And as it turns out another letter of the "lunar alphabet" is also visible at this time. Look at the feature near the top of the box and a "V" or "Y" shows up just inside the edge of Mare Vaporum.

The image left was captured by Chris Mulholland, visiting the Fox Observatory with family during our public stargazing session Aug 21. Christine and family hail from a small hamlet called Wyecombe near Langton, Ontario.

Below is Christine's email received the day after our viewing night. She also supplied the image above. It was taken with her Blackberry at the eyepiece of our Bishop Scope. [About 60x -ed]

Thank you so much for such a wonderful and informative evening last night. We so enjoyed it, and carried many happy memories away with us. I especially enjoyed being part of the Lunar X experience, and seeing how the colour is captured in celestial objects in photos.
How I wish my school was closer to you!! The most I've been able to do with my students is follow Col. Hadfield's tweets of pictures from the ISS, and then in the last 2 years participate in the NASA ISS school missions: that's been fun, requesting pictures of certain earth locales and then having the ISS send them to us. We also huddled around our huge LCD whiteboard and watched the live-stream of the landing of Philae as if it was the moon landing of '69! But it sure doesn't replace the hands-on, awe-inspiring experiences like the one we had last night. The students you have come to your facility are very lucky indeed. Keep up the wonderful work. Hope to see you again soon.
P.s. Any pictures you could send from last night would very much appreciated John; can't wait to share them with my new bunch of kidlets in a couple of weeks.
Cheers, and thank you again! -Christine

Lunar-X visibility

Aug 21 20:30 EST
Sep 20 09:01 EST
Oct 19 22:26 EST
Nov 18 12:39 EST
Dec 18 03:14 EST

The Lunar X and Y are visible on a monthly basis and appear just before first quarter phase. The dates for the next 4 opportunities are given at left. Truth be told, the Lunar X is not a "real" lunar feature but just a temporary solar illumination, and has much in common with seeing faces in clouds or imaginary rabbits, ants, or old maids on the Moon, but it is a good thing if it gets you to try for more substantial lunar features not commonly observed, like isolated mountain peaks -Mt Pico and the Straight Range, for ex. in Mare Imbrium or the domes in the Gruithuisen area.

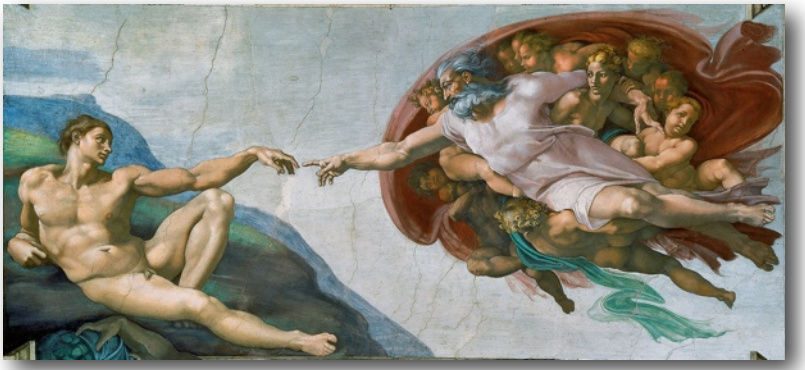
Veteran lunar observer Charles Wood has created a **Lunar 100** catalog that lists many geologic features on the Moon that are visible in amateur telescopes. Sky&Telescope provides a detailed listing of the Lunar 100 here: http://www.skyandtelescope.com/observing/celestial-objects-to-watch/the-lunar-100/ On those nights when the Moon is up, It is a great way to get some observing done, in spite of a Moonlit sky making some deep sky objects difficult. In any case, looking for faint lunar features is always good training for those dim deep sky objects.

Standing in the Presence of the Original

"*The amateur astronomer has access at all times to the original objects of his study; the masterworks of the heavens belong to him as much as to the great observatories of the world. There is no privilege like that of being allowed to stand in the presence of the original.*"

Robert Burnham, Jr

Shortly after her graduation from Medical School, our daughter, Christy, travelled with two of her classmates to Europe. She really liked Italy, and, while there, she visited the Vatican's Sistine Chapel. She later described to us her amazement at viewing Michelangelo's frescos, which he painted on the Chapel's ceiling around 1512. His composition, which took 4 years to complete, covers more than 500 square metres of the ceiling and contains over 300 figures. At its center are 9 scenes depicting events from the Book of Genesis. For me, the most famous and iconic painting shows a bearded God, wrapped in a cape, reaching out and giving both life and soul to a nude Adam. Like most people, I have seen many reproductions of this famous art work. But, and here is the point, to experience the original, to stand in the presence of the "Creation of Adam", one has to travel to Italy and visit the Sistine Chapel.



"Creation of Adam" by Michelangelo, 1512
Fresco painted on the Vatican's Sistine Chapel's Ceiling

The really neat thing about amateur astronomy is that, within the limitations of our geographical horizon and amateur equipment, we have the same access to the original celestial objects as our professional counterparts in their observatories. On a clear night we can take out our telescopes, or open our observatories, and, within minutes, visually experience the Rings of Saturn, see the Moons of Jupiter, get lost in the magnificent stellar concentration of M13, trace the ghostly wisps of a comet's tail in interplanetary space, or check out a stellar nursery like M8.

Robert Burnham, who authored the 3 volume **Burnham's Celestial Handbook**, stated in his introduction to the set, that amateur astronomy "combines the thrill of exploration, the fun of sight-seeing, and the sheer pleasure of firsthand acquaintance with incredibly wonderful and beautiful things". Well said!

I just returned from the annual Kayak and Astronomy Trip that I do for White Squall (near Parry Sound) each August. I have been doing this trip since 2001 and, except for one year, it has been sold out. We usually leave from Britt, about an hour north of Parry Sound, and explore the wonderful Georgian Bay Islands for 5 days. This year, I was joined by Dr. Gerard Courtin, an ecologist from Laurentian University, and we decided to paddle to the historic 100 year old Lorraine Lodge and use it as our base for exploring the ecology of the Bay. Gerard turned 80 this week, but he looks 60, and has a captivating story about almost any plant, lichen, or fungus you could encounter. My astronomy contribution would come after supper when I would provide an astronomy themed lecture, followed by an observing night under the stars.

Three of the celestial highlights this year were Saturn, located in Scorpius, the waxing crescent Moon, and the splendid Milky Way, beautifully detailed from our magnitude 6.5 dark sky site. Participants were introduced to the Telescope, the Constellations, our Solar System, and a sampling of Deep Sky objects. They were taught how to locate various celestial objects using their RA and Dec co-ordinates and I gave each participant a famous star, and a deep sky object to find on the celestial sphere. Later, when we went outside, they would point these out to me using my laser pointer and then I would showcase the object for them in my Celestron 8.

There is something special about seeing celestial objects with our own eyes, in real time, as opposed to just looking at a photo of them. I have observed this special observing dimension many times over the years as an amateur astronomer and astronomy educator. Robert Burnham Jr. captured this intimate personal experience that one gets when standing in the presence of the original! When darkness came, I was about to connect my kayak guests to the Universe. In preparation for our nights under the stars I showed my guests photos of Saturn, the Moon, , a few Deep Sky objects, and the Milky Way. They were grand photos, to be sure, and my guests were interested. BUT, when they actually saw Saturn in the telescope's eyepiece the Universe reached out and touched their souls. I could tell the emotional impact from their exclamations of sheer delight! (cont'd pg 8)

The Author is Anticipating a Night Filled with Stars from the Georgian Bay Islands

They were seeing, with their own eyes, the icy Rings of Saturn, the detailed image of the Ring Mountains positioned along the lunar terminator, and the striking star clouds of Sagittarius, Scutum and Cygnus .. much better than their experience with any photograph!

These days, our technology can come between us and the natural world. You just have to watch people walking along with their cell phones, oblivious to the natural world around them. We now have the same phenomenon occurring in amateur astronomy. It is becoming fashionable to showcase astronomical objects to an audience using a video camera, a telescope, and a computer screen. Certainly, there are advantages. Showcasing celestial objects to a larger audience for education purposes is one main advantage. However, here is the point. The electronic technology comes between the observer and the object. The picture on the computer screen is very nice but it is not the same as a direct observation of the original at the eyepiece. Wordsworth nicely captured the spell the natural world can cast:

"*And I have felt a Presence that disturbs me with the Joy Of Elevated Thoughts ...*
A Sense Sublime ... Of something far more deeply interfused,
Whose Dwelling Place is the Light of Setting Suns."

I hope I never lose that spell!

White Squall Paddling Centre does an annual 5-day kayak trip among the islands of Georgian Bay featuring Doug Cunningham as astronomy speaker each night. If you are interested here is their website: www.whitesquall.com

An Amateur Astronomer's Classic Reference Text

The three volume set "**Burnham's Celestial Handbook**" has a place of honour on my bookshelf and even in the age of quick fact-checking with the internet, I still refer to it often. My set came as an almost freebie through a Book Club so it cost me only $3 or so (not including the other 6 books I committed to buy.) But even a hardcover freshly printed set nowadays is under $50 and worth every penny.

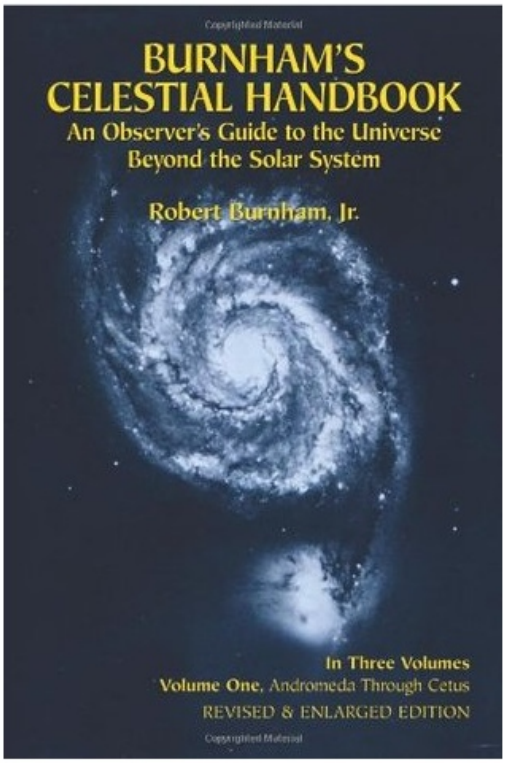
Burmham's style is very readable and his research very thorough. Before Wikipedia, this was my main source of reliable information about common and not-so-common astronomical facts. The volumes cover the constellations alphabetically and provide charts and lists of objects that can be found with modest amateur instruments in each one. On top of that, Burnham also provides extensive historical background for the constellations and the stories behind the stars, so much so that on cloudy nights, it is a pleasure to just flip a volume open randomly and start reading.

Excerpt from Wikipedia: *Full article here: https://en.wikipedia.org/wiki/Robert_Burnham,_Jr.*

In addition to his regular duties at the Lowell observatory, Burnham spent almost all of his free time working on the ***Celestial Handbook***. His writing and his book were never officially supported by Lowell Observatory. Subtitled "An Observer's Guide to the Universe Beyond the Solar System", the 2,138 page ***Burnham's Celestial Handbook*** combines a lengthy introduction to astronomy with catalog information for every constellation in the sky. Hundreds of photographic plates, tables, charts, and diagrams are included along with a vast amount of scientific and observing information, star lore, history, and even a little poetry. Thousands of stars and deep sky objects visible in small telescopes are covered in meticulous detail.

Originally self-published in a loose-leaf serial format beginning in 1966, and with a revised edition by Dover Publications in 1978, the ***Celestial Handbook*** was well reviewed in amateur astronomy magazines and became a best seller in a very specialized field. It is still in print (ISBN 0-486-23567-X, ISBN 0-486-23568-8, ISBN 0-486-23673-0) and is considered to be a classic in the literature of amateur astronomy.

Sadly, Burnham dropped out of the public eye (he was never gregarious) after he lost his job at the observatory and died in 1993 a destitute and broken man.



The full set of Burnham's books is available at the Fox Observatory. Volume 1 covers Andromeda to Cetus, Volume 2 covers Chamaeleon to Orion and Volume 3 takes on Pavo to Vulpecula. Note that this northern hemisphere observer does a great job on the constellations of the southern hemisphere. Most of the original material was from Burnham's extensive collection of 3x5 file cards on the objects he observed himself.

Is the Universe Ringing Like a Crystal Glass?

by Tara Burcham 06/18/2015 writer for University of Southern Mississippi

Many know the phrase "the big bang theory." There's even a top television comedy series with that as its title. According to scientists, the universe began with the "big bang" and expanded to the size it is today. Yet, the gravity of all of this matter, stars, gas, galaxies, and mysterious dark matter, tries to pull the universe back together, slowing down the expansion.

Now, two physicists at The University of Southern Mississippi, Lawrence Mead and Harry Ringermacher, have discovered that the universe might not only be expanding, but also oscillating or "ringing" at the same time. Their paper on the topic has been published in the April 2015 issue of the *Astronomical Journal.*

In 1978 Arno Allan Penzias and Robert Woodrow Wilson received the Nobel prize for their 1964 discovery of the key signature of this theory, the primal radiation from the early universe known as the "cosmic microwave background" (CMB).

"Then in 1998 the finding that the universe was not only expanding, but was speeding up, or accelerating in its expansion was a shock when it was discovered simultaneously by east coast and west coast teams of astronomers and physicists," said Mead. "A new form of matter, dark energy, repulsive in nature, was responsible for the speed-up. The teams led by Saul Perlmutter, Adam Riess, and Brian Schmidt won the 2011 Nobel Prize in Physics for that discovery."

According to Mead and Ringermacher, this change from slowing down to speeding up (the transition time) took place approximately 6 to 7 billion years ago. Since then, Mead and Ringermacher say a vast accumulation of high-tech data has verified the theory to extraordinary accuracy.

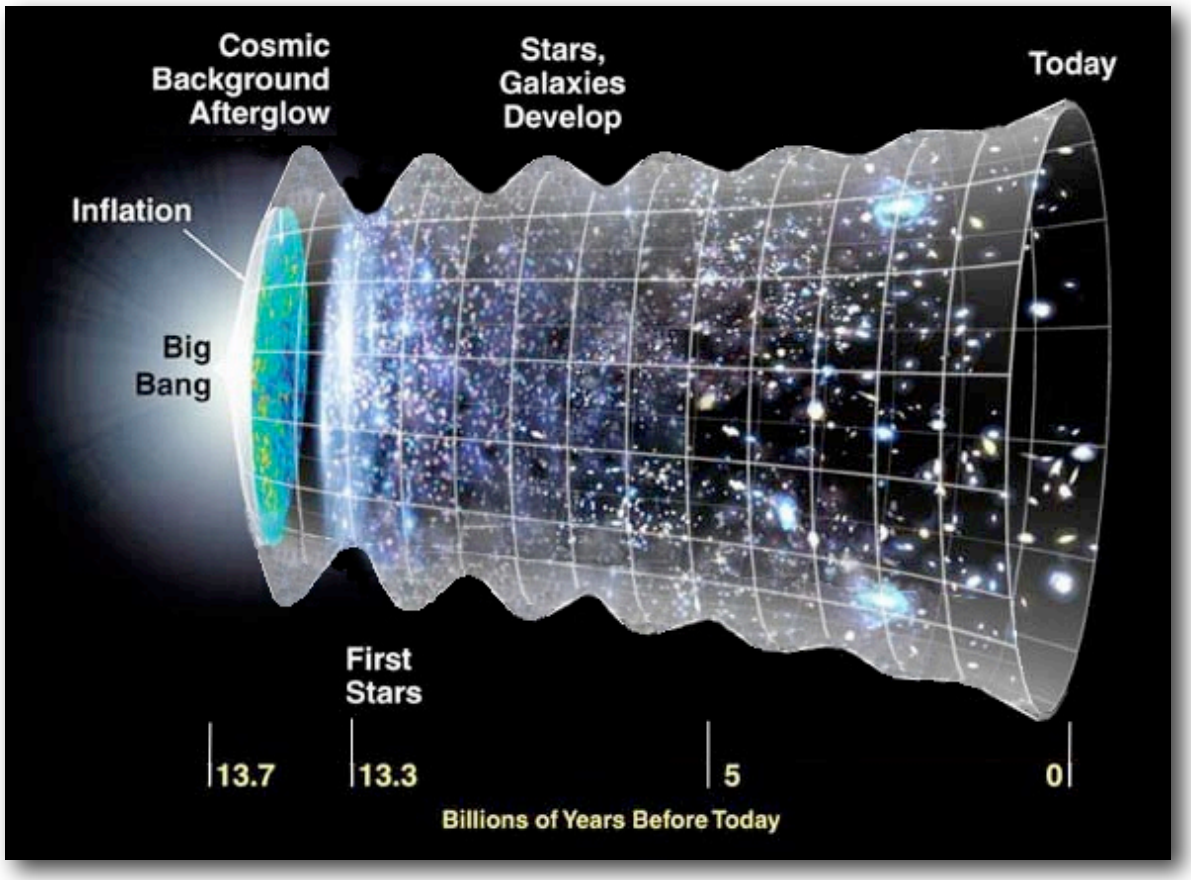


Figure 1 is a NASA diagram representing the events of the Big Bang from the beginning of time to the present day as described by the current, accepted model known as "ΛCDM" or Lambda Cold Dark Matter, where the Greek Lambda stands for Einstein's "cosmological constant". This cosmological constant is responsible for the acceleration of the universe. The outline of the "bell-shaped" universe represents its expanding size. The transition time is the point in time at which the bell shape shifts from going inward to outward from left to right.

"The new finding suggests that the universe has slowed down and speeded up, not just once, but 7 times in the last 13.8 billion years, on average emulating dark matter in the process," said Mead. "The ringing has been decaying and is now very small – much like striking a crystal glass and hearing it ring down."

Figure 2 shows the new finding superposed on the ΛCDM model of Figure 1. The oscillation amplitude is highly exaggerated, but the frequency is roughly correct. Ringermacher and Mead have determined that this oscillation is not a wave moving *through* the universe, such as a gravitational wave, but rather it is a "wave *of* the universe".

Ringermacher says the discovery was made accidentally when, through their collaboration on dark matter modeling of galaxies, they found a new way of plotting a classic textbook graph describing the scale of the universe against its age (lookback time) that did not depend on one's prior choice of models of the universe – as was traditional.

"The standard graph, the Hubble diagram, is constructed by astronomers observing the distances of Type 1A Supernovae that serve as "standard candles" for measuring the expansion of the universe," said Ringermacher. "Analyzing this new plot to locate the transition time of the universe, we found there was more than one such time – in fact multiple oscillations with a frequency of about 7 cycles over the lifetime of the universe. It is space itself that has been speeding up its expansion followed by slowing down 7 times since creation."

Mead and Ringermacher say this finding must ultimately be verified by independent analyses, preferably of new supernovae data, to confirm its reality. In the meantime, their work into the "ringing" of the universe continues.

To learn more about Ringermacher and Mead's research, visit Ringermacher's website at http://ringermacher.com/. For more information about the Department of Physics and Astronomy, visit http://www.usm.edu/physics.

The University of Southern Mississippi is located in Hattiesburg MS

Active Volcanoes on Venus

Seeing the planet's surface is extremely difficult due to its thick atmosphere, but radar observations by previous missions to Venus have revealed it as a world covered in volcanoes and ancient lava flows.

Venus is almost exactly the same size as Earth and has a similar bulk composition, so is likely to have an internal heat source, perhaps due to radioactive heating. This heat has to escape somehow, and one possibility is that it does so in the form of volcanic eruptions.

Some models of planetary evolution suggest that Venus was resurfaced in a cataclysmic flood of lava around half a billion years ago. But whether Venus is active today has remained a hot topic in planetary science.

ESA's Venus Express, which completed its eight-year study of the planet last year, conducted a range of observations at different wavelengths to address this important question.

Volcanic activity on Venus?

In a study published in 2010, scientists reported that the infrared radiation coming from three volcanic regions was different to that from the surrounding terrain. They interpreted this as coming from relatively fresh lava flows that had not yet experienced significant surface weathering. These flows were found to be less than 2.5 million years old, but the study could not establish whether there is still active volcanism on the planet.

An additional piece of evidence was reported in 2012, showing a sharp rise in the sulphur dioxide content of the upper atmosphere in 2006–2007, followed by a gradual fall over the following five years. Although changes in wind patterns could have caused this, the more intriguing possibility is that episodes of volcanic activity were injecting vast amounts of sulphur dioxide into the upper atmosphere.

Now, using a near-infrared channel of the spacecraft's Venus Monitoring Camera (VMC) to map thermal emission from the surface through a transparent spectral window in the planet's atmosphere, an international team of planetary scientists has spotted localised changes in surface brightness between images taken only a few days apart.

Brightness changes in Ganiki Chasma

"We have now seen several events where a spot on the surface suddenly gets much hotter, and then cools down again," says Eugene Shalygin from the Max Planck Institute for Solar System Research (MPS) in Germany, and lead author of the paper reporting the results in *Geophysical Research Letters* this month.

"These four 'hotspots' are located in what are known from radar imagery to be tectonic rift zones, but this is the first time we have detected that they are hot and changing in temperature from day to day. It is the most tantalising evidence yet for active volcanism."

The hotspots are found along the Ganiki Chasma rift zone close to the volcanoes Ozza Mons and Maat Mons. Rift zones are results of fracturing of the surface, which is often associated with upwelling of magma below the crust. This process can bring hot material to the surface, where it may be released through fractures as a lava flow.

"These observations are close to the limits of the spacecraft's capabilities and it was extremely difficult to make these detections with Venus' thick clouds impairing the view," says co-author Wojciech Markiewicz. "But the VMC was designed to make these systematic observations of the surface and luckily we clearly see these regions that change in temperature over time, and that are notably higher than the average surface temperature."

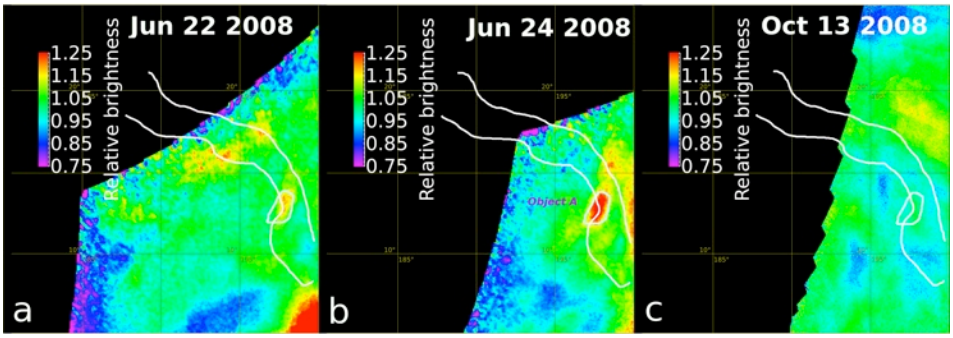
Because VMC's view is blurred by the clouds, the areas of increased emission appear spread out over large areas more than 100 km across, but the hot regions on the surface below are probably much smaller. Indeed, for the hotspot known as 'Object A', the team calculate that the feature may only be around 1 square kilometre in size, with a temperature of 830°C, much higher than the global average of 480°C.

The Ganiki Chasma rift zone was already considered to be one of the most recently geologically active regions on the planet, and as the new analysis suggests, it is still active today.

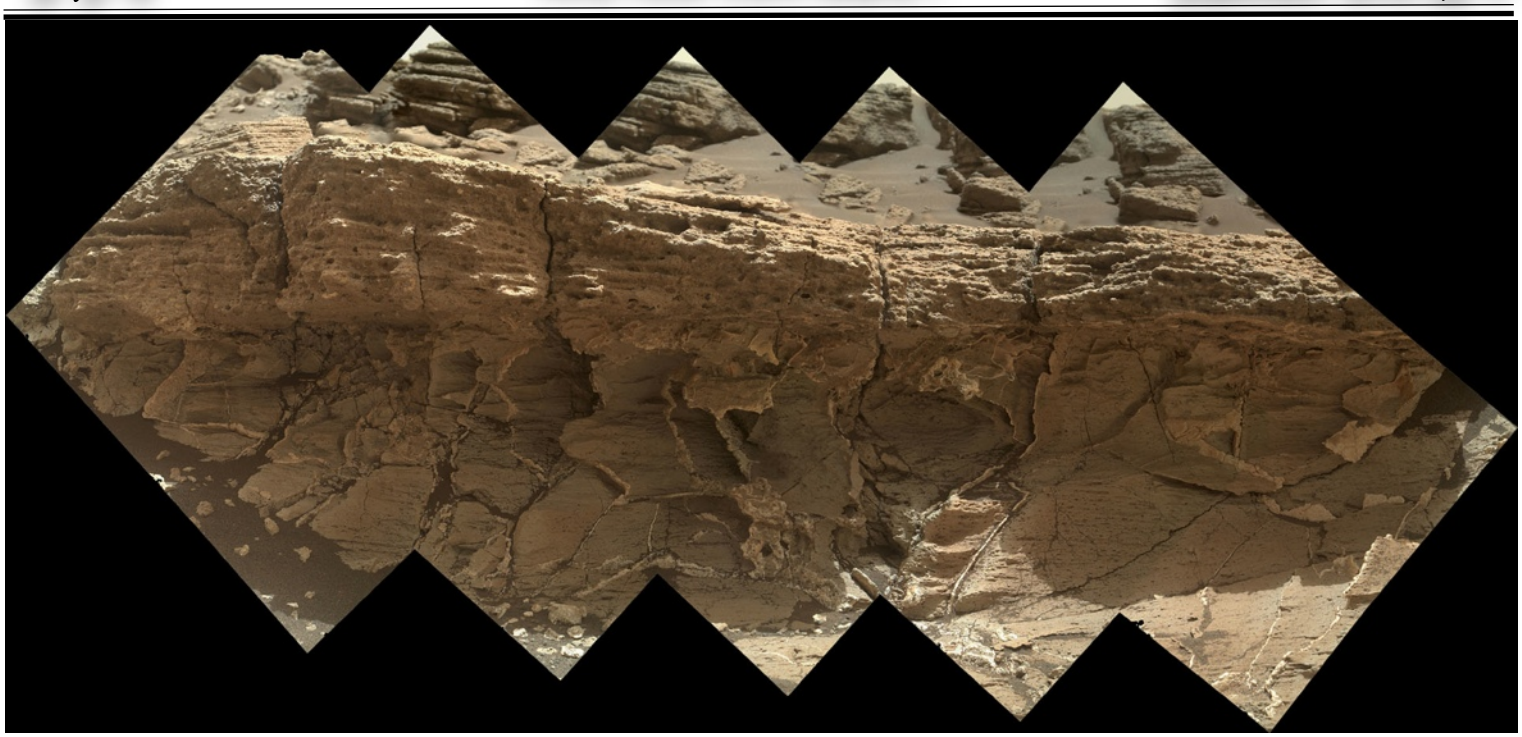
"It looks like we can finally include Venus in the small club of volcanically active Solar System bodies," says Håkan Svedhem, ESA's Venus Express project scientist.

"Our study shows that Venus, our nearest neighbour, is still active and changing in the present day – it is an important step in our quest to understand the different evolutionary histories of Earth and Venus."

"Active volcanism on Venus in the Ganiki Chasma rift zone," by E.V. Shalygin et al is published in *Geophysical Research Letters*.



The Ganiki Chasma rift zone in Atla Regio on Venus was imaged repeatedly to look for changes. The maps presented here show changes in relative brightness compared to the average background (red-orange indicates an increase, blue-purple a decrease) for a number of images acquired on each date. While some changes are due to variations in cloud brightness, one fixed surface hot spot is inferred, labelled 'Object A', which shows an increase in brightness between 22 and 24 June 2008 followed by a decrease.



A rock outcrop dubbed "Missoula," near Marias Pass on Mars, is seen in this image mosaic taken by the Mars Hand Lens Imager on NASA's Curiosity rover. Pale mudstone (bottom of outcrop) meets coarser sandstone (top) in this geological contact zone, which has piqued the interest of Mars scientists.

White mineral veins that fill fractures in the lower rock unit abruptly end when they meet the upper rock unit. Such clues help scientists understand the possible timing of geological events. First, the fine sediment that now forms the lower unit would have hardened into rock. It then would have fractured, and groundwater would have deposited calcium sulfate minerals into the fractures. Next, the coarser sediment that forms the upper unit would have been deposited.

The area pictured is about 16 inches (40 centimeters) across. The image was taken on the 1,031st Martian day, or sol, of the mission (July 1, 2015).

MAHLI was built by Malin Space Science Systems, San Diego. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Mars Science Laboratory Project for the NASA Science Mission Directorate, Washington. JPL designed and built the project's Curiosity rover.

More information about Curiosity is online at http://www.nasa.gov/msl and http://mars.jpl.nasa.gov/msl/.

Mars Silica May Contain Organics

Approaching the third anniversary of its landing on Mars, NASA's Curiosity Mars rover has found a target unlike anything it has studied before -- bedrock with surprisingly high levels of silica. Silica is a rock-forming compound containing silicon and oxygen, commonly found on Earth as quartz.

This area lies just downhill from a geological contact zone the rover has been studying near "Marias Pass" on lower Mount Sharp.

In fact, the Curiosity team decided to back up the rover 46 meters (151 feet) from the geological contact zone to investigate the high-silica target dubbed "Elk." The decision was made after they analyzed data from two instruments, the laser-firing Chemistry & Camera (ChemCam) and Dynamic Albedo of Neutrons (DAN), which show elevated amounts of silicon and hydrogen, respectively. High levels of silica in the rock could indicate ideal conditions for preserving ancient organic material, if present, so the science team wants to take a closer look.

"One never knows what to expect on Mars, but the Elk target was interesting enough to go back and investigate," said Roger Wiens, the principal investigator of the ChemCam instrument from the Los Alamos National Laboratory in New Mexico. ChemCam is coming up on its 1,000th target, having already fired its laser more than 260,000 times since Curiosity landed on Mars Aug. 6, 2012, Universal Time (evening of Aug. 5, Pacific Time).

Free Calendar from NASA

Celebrate the 12th anniversary of NASA's Spitzer Space Telescope with a new digital calendar showcasing some of the mission's most notable discoveries and popular cosmic eye candy.

http://www.jpl.nasa.gov/images/spitzer/20150820/Spitzer12thAnniversaryCalendar.pdf

The calendar follows the life of the mission, with each month highlighting top infrared images and discoveries from successive years -- everything from a dying star resembling the eye of a monster to a star-studded, swirling galaxy. The final month includes a brand new image of the glittery star-making factory known as the Monkey Head nebula.

Pisces (Psc)

α-Piscium - Al Rescha

Pisces is a zodiacal constellation of rather faint stars, consisting of two chains extending north and west from Alpha Piscium, called the Knot. The two streams of stars radiating from the knot culminate in the so-called Northern Fish, a diamond-shaped figure, and the Western Fish, also called the Circlet, an attractive oval of faint stars. [The Southern Fish is another constellation which contains Fomalhaut lying due south of the Circlet. -ed] The vernal equinox lies in Pisces; it is from this point that the right ascension co-ordinates of all heavenly bodies are measured.

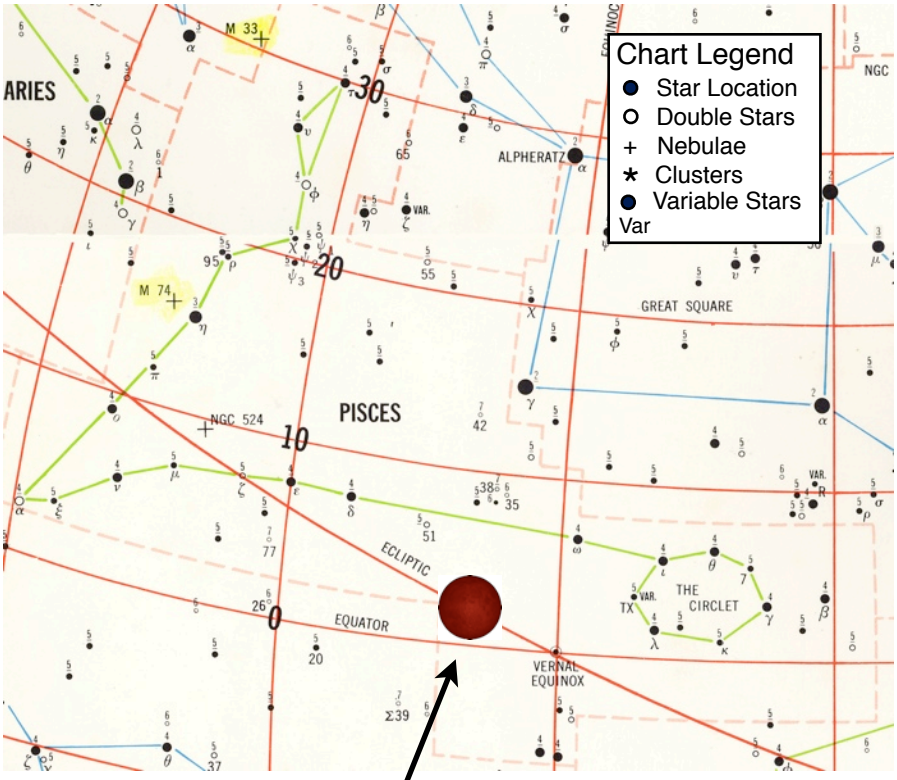
DOUBLE STARS

	Mag.	Sep (s)	Location	Remarks
α	4.3-5.3	2	015903	Green-Blue; rem. contrast.
ζ	5.6-6.5	24	011107	Beautiful.
ψ	5.6-5.8	30	010420	
35	5.9-8.1	12	001209	White-Purple
38	7.6-8.0	4	001509	Yellow-White
42	6.8-10.7	29	002013	
51	5.7-9.5	28	003007	
55	5.5-8.5	7	003721	Yellow-Blue: striking
65	6.3-6.3	4	004727	
77	6.8-7.6	33	010304	White-Blue

MESSIER OBJECTS (Psc)

	Mag	Location	Remarks
M 74	10.2	013416	Spiral Galaxy

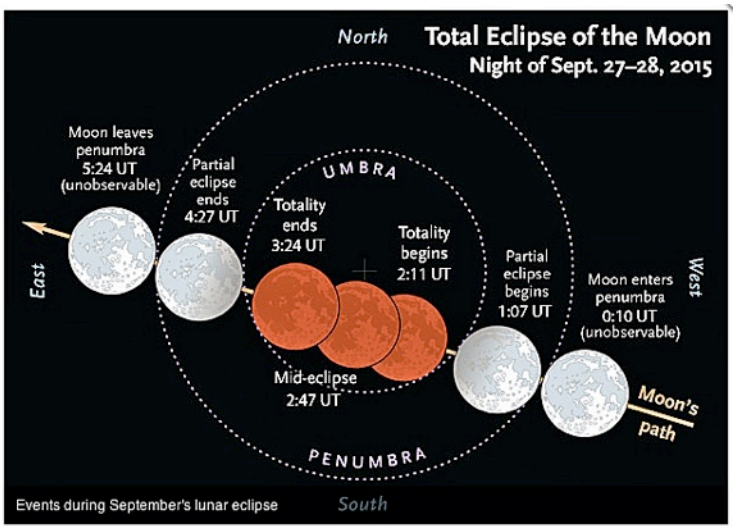
Observe the region around κ Piscium with low power; an attractive field. Also view striking pair ρ and 95 Piscium; this is not a double.



Approximate position of Moon at mid-eclipse 10:47 pm Sep 27. [They don't call it the "ecliptic" for nothing!]

Total Eclipse Sep 26/27 occurs in Pisces

What is rated as the best lunar eclipse for 2015 occurs in front of the stars of the constellation Pisces which as stated in the box at left is composed of "rather faint stars". The eclipse occurs under the "Western Fish" (aka "The Circlet") about 26° west of the brightest and only named star in Pisces, Al Rescha, a 3.8 magnitude star. Times below are given in UTC. Subtract 4 h for local DST. Mid-eclipse occurs at 10:47 pm Sunday night Sep 27.



Photographing a Lunar Eclipse

Lunar eclipses are relatively easy to photography because the target is generally stationary and you have lots of time to take photos as the eclipse slowly progresses. (It is slow. One famous astronomy author described it as the "most boring event" in astronomy.)

The single biggest mistake most beginners make is to use too short a focal length so all they get is a small orange ball in the middle of a big frame. Get the longest telephoto lens you can lay your hands on, or try shooting through the eyepiece of a telescope. I have seen many nice images made that way with simple cell phone cameras. See pg 6 for a nice example.

For all the details on eclipse imaging, start with the website below and be sure to follow the links provided to several other very comprehensive sites on eclipse photography.

http://photonaturalist.net/photograph-upcoming-lunar-eclipse/

You could even try a lunar eclipse video, but this requires some high tech gear. You need a dedicated camera (DSLR or CCD) adapted to your telescope, which needs to be polar-aligned and tracking the moon (set your tracking rate to lunar, not stellar) so the Moon will not drift off frame.

You have a long night ahead of you since the Sep 27 eclipse lasts from about 9 pm to almost 1 am. Will your battery last 4 hours? If not, get an AC adapter and run off AC power from a nearby outlet. If you take a frame once every 10 seconds or so, your 1440 frames will make a nice 2½ minute movie if you play the video back at 10 frames/second. Send in your best images to SGN for the Oct issue!

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

Sep 01 22:00 (Aug 31 actually) Neptune at Opposition magn. 7.8
04 06:00 Mercury Greatest Elong: 27.1°E but low on horizon
05 00:07 Aldebaran 0.5° S of Moon Occultation. See Special Events below.
05:54 **LQ Moon** rises locally at 11:52 pm EDT (Sep 4)
10 01:53 Venus 2.7°S of Moon, Mars 5° away
13 02:41 **NM** rises locally at 7:18 am EDT
02:55 Partial Solar Eclipse; mag=0.79 not visible locally
14 07:28 Moon at Apogee: 406 466 km
18 22:54 Saturn 2.8°S of Moon
21 04:59 **FQ Moon** rises locally at 2:53 pm EDT
Venus greatest illuminated extent magn. -4.8
23 04:20 Autumnal Equinox (One of the latest dates!)
24 15:38 Mars-Regulus: 0.7°N
27 21:46 Moon at Perigee: 356 877 km
22:48 **Total Lunar Eclipse**; mag=1.273. See p. 13 above
22:50 **FM** rises locally at 7:04 pm EDT. Harvest Moon.
28 23:00 Vesta at opposition magn. 6.2

BAS/Astronomy Events

Sep 2 Wed BAS meeting at Fox Observatory. Starfest recap

Sep 5 Sat LQ **Aldebaran Occultation** Disappearance (bright limb) at 12:07 am (just after midnight Sep 4/5), Reappearance dark limb 12:39 am Sep 5, Moon LQ and rises from 1.75° to 7° above eastern horizon during occultation.

Sep 12 Sat BAS viewing@Fox

Sep 13 Sun NM **Partial Solar Eclipse** Only visible from Antarctica and S. Africa, S. Pacific

Sep 13 Sun Paisley Fall Fair Solar display (daytime event) BAS members with solar scopes welcome

Sep 20 Sun Meaford Public viewing (talk & solar viewing)

Sep 21 Mon FQ

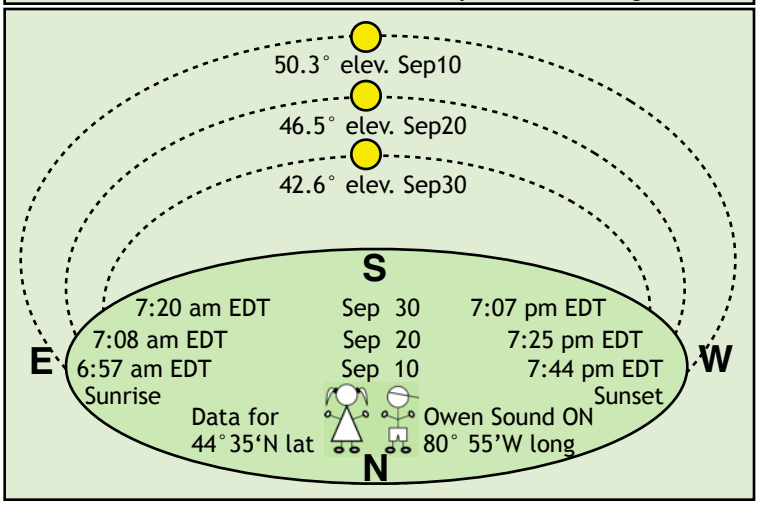
Sep 27 Sun FM **Total Lunar Eclipse** Best of the year! Totality starts at 10:11 pm DST Sep 27 and continues to 11:23 pm. Moon is 35° high at mid-eclipse. A prime-time event! **Public Viewing at ES Fox.**

Planets

MERCURY, is an evening star but very poorly placed for viewing for northern observers. It stays low on the horizon near the setting sun all month. **VENUS,** (-4.5) is climbing higher in the morning sky and passes Mars with 9° separation on Sep 7. On Sep 10, the last crescent Moon slips between Mars and Venus making for a nice photo op. **MARS (1.8)** is a morning object and now far enough from the Sun for a few dark hours of viewing before sunrise. It is less than 1° from Regulus on Sep 25. **JUPITER**, (-1.7) is low above the eastern horizon and joins Mars and Venus in the dawn sky by month end. October will be a month of several conjunctions of these three planets. **SATURN,** (mag. 0.6) is well past the meridian by sunset and sets by midnight at the start of September and by 9 pm by the end. Ring tilt is 24.0° but increases slightly later this year. **URANUS,** (5.8) and **NEPTUNE,** (7.8) rise by 9 pm in September and are visible in dark sky most of the night. **Dwarf planet**, **Ceres (8.3)** is visible in September on the border between Cap and Sgr. **Asteroid, Vesta (6.3)** follows Ceres in the sky and is located in Pisces 11° below Uranus. **PLUTO** (mag. 14) is located near the "Teaspoon" in Sagittarius. Charts are available on the BAS website.

The diagram below gives the sunrise/sunset times and the Sun's altitude for September. The Sun reaches Fall Equinox on Sep 23.

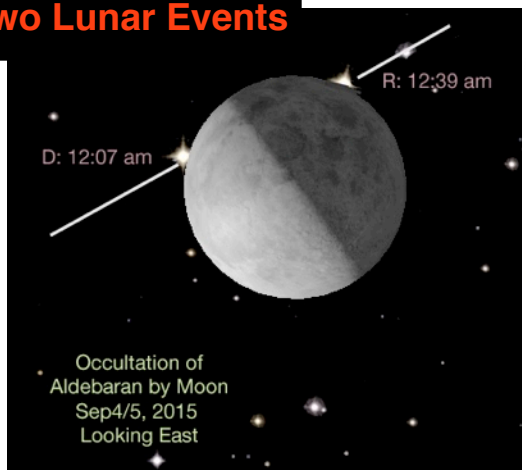
The moon phase graphic at the bottom of this page shows the lunar phase for each night of the month. Times of moonrise for NM, FQ, FM and LQ for Owen Sound are in the Sky Calendar listing at left.



Special Events

1.Aldebaran Occultation: Just after midnight Sep 4/5, (12:07 am) the LQ Moon will pass in front of the bright star Aldebaran. For the next half-hour or so, Aldebaran will be blocked by the Moon and at 12:39 am, the star should re-appear (suddenly) at the dark limb on the Moon's disk at upper right. Re-appearances of this sort are always very rapid since there is no lunar atmosphere for starlight to struggle through like our Sun does at sunrise and sunset. The Moon is quite low (under 2°) at the disappearance on the bright side and it will be difficult to see, but the re-appearance happens with the Moon much higher (7°) above the eastern horizon. A low eastern outlook is a must. Images appreciated!

Two Lunar Events



2. Best Lunar Eclipse of the Year! Sep 27, a Sunday night, may give local lunar eclipse watchers a second try this year at seeing the Moon pass through the Earth's shadow. Details pg 12. Fingers crossed for clear skies!

Sept 2015

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

FOR SALE: Meade Lightbridge 16" Dobsonian

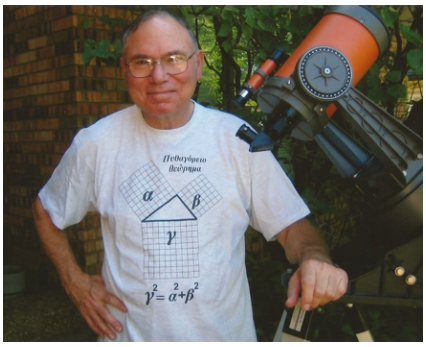
SOLD!!

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 Tower Optical Assembly will fit into the backseat of my Corolla. This is a relatively transportable "Light Bucket" priced at $1300.

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

Eli Maor Public Lecture:
The Infinite where you least expect it.
August 31, 2015 at 7:30 pm
Bruce County Museum, Southampton
www.brucemuseum.ca



Eli Maor received his PhD at the Technion - Israel Institute of Technology. His thesis was on an unusual subject: using mathematical methods to investigate problems in musical acoustics. This reflected his long interest in the relations between science and the arts, and in particular, music. His article, "What is There so Mathematical About Music?" received first award by the National Council of Teachers of Mathematics as the best article on teaching the applications of mathematics.

Maor has published over fifty articles on applied mathematics, mathematics education, and the history of mathematics. He is also an active amateur astronomer and eclipse chaser and has written articles for Sky & Telescope, Natural History, Science, and Orion. Maor is a frequent speaker on scientific and educational issues and is past member of the Mathematical Association of America's Program of Visiting Lecturers and Consultants. He is also a contributor to Encyclopedia Britannica, for which he wrote the article on the history of trigonometry. He teaches the history of mathematics at Loyola University Chicago.

Maor is the author of widely acclaimed books, all by Princeton University Press:

To Infinity and Beyond,
e: The Story of a Number,
Trigonometric Delights,
Venus in Transit,
The Pythagorean Theorem: A 4,000-Year History

and his latest **Beautiful Geometry**.

He has also written textbooks on Calculus, including an encyclopedia of calculus concepts for high school and college students. Another book about Music and Mathematics is at his publisher now.

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).

Light Humour c/o Perimeter Institute