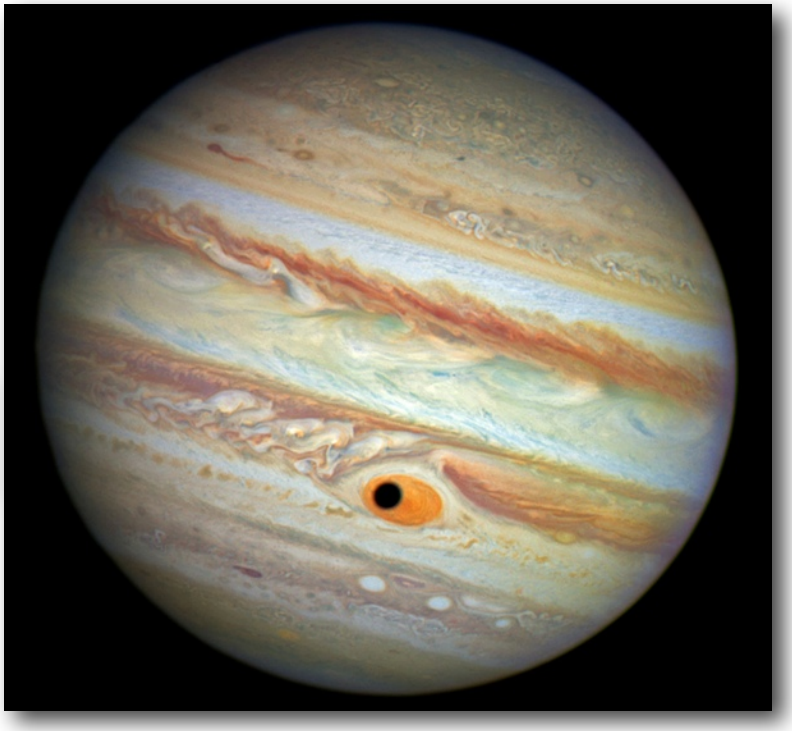
Astronomy News for Bluewater Stargazers
Vol 8 No.12 Dec 2014

Dec 2014 Contents



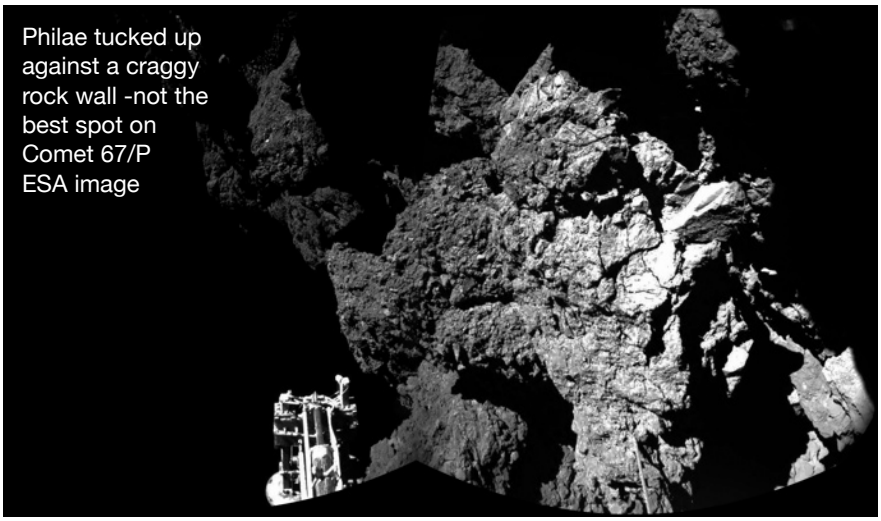
This unusual image of Jupiter and its most conspicuous feature was captured on April 21, 2014, when the Hubble Space Telescope was being used to monitor changes in the GRS. During the exposures, the shadow of Ganymede – the largest of Jupiter's moons and also the largest moon in the Solar System – swept across the storm's center. "This gave Jupiter the uncanny appearance of having a pupil in the center of a 16,000-km-diameter eye," the astronomers said. "Momentarily, Jupiter took on the appearance of a Cyclops planet!"
Image credit: NASA / ESA / A. Simon, Goddard Space Flight Center / C. Go / Hubble Heritage Team / STScI / AURA.

Philae: Between a Rock and Hard Place

by John H. (from EarthSky.org and ESA blog)

On Nov 12 at 10:34 am EST, the comet lander Philae touched the surface of Comet 67/P. Then it went on a wild ride and bounced THREE times. On the last touchdown over two hours later at 12:32 am, it came up against a bit of a rock wall with one leg apparently up off the ground and pointing skyward. That's the bad news.

The good news is that by the time the battery ran out 57 hours later, Philae had completed 100% of its First Sequence Science experiments and sent the data back to Earth via the Rosetta relay. It's battery gave out because the solar panels only got about 1.5 hours of sunshine vs the 6 they had hoped for. The landing location was apparently up against a rock wall and Philae was in its shadow.


Philae tucked up against a craggy rock wall -not the best spot on Comet 67/P ESA image

Controllers tried to bring the craft to a more horizontal position to bring up the solar power and while a hop was successfully performed, Philae is still in deep shadow and the maneuver did not improve the solar power output.

Before the power drained out, all experiments were deployed, even the drilling into the surface went ahead on the last few ergs of energy.

Then Philae went to "sleep" as it was programmed to do when the energy was insufficient to continue operations.

The hope now is that as the comet approaches the Sun and energy levels increase, Philae will wake up and re-establish contact with Rosetta and the ground. Controllers indicate that further contact with the lander would be a wonderful plus on an already successful mission.

On the first hop, Philae traveled over a kilometre and took just over 2 hours to come back down. This is some indication of how weak the pull of gravity is from this comet. On the last bounce the craft was airborne only a few minutes. The first touchdown occurred right in the middle of the target zone -an achievement that is of some pride to the flight dynamics engineers. Images of the location (available on the ESA website here: http://rosetta.esa.int/) show the disturbed surface after the touchdown. What a roller-coaster ride! Well done, Team Rosetta!

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BAS executive to March 2015 is:

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From the BAS Exec:

BAS/Astronomical Events in Dec

Dec 3 Wed **BAS meeting** Grey Roots Museum 7 pm Topic: Recap of 2014 in images/Xmas meeting

Dec 6 Sat (FM) Night of the **Full Moon** "Moon before Yule"

Dec 9 Tue (FM+3) **Double Shadow Transit** on Jupiter 11:18 am to 11:27 am EST (both shadows near limb - difficult event)

Dec 13/14 Sat/Sun (LQ) **Geminid Meteor Shower**, viewing from ES Fox, 120/h at peak 7 am Sun , LQ Moon rises at midnight Dec 13

Dec 16 Tue (LQ+2) **Double Shadow Transit** on Jupiter 1:13 am to 2:00 am (farther in than last time -should be easier)

Dec 20 Sat (NM-1) **BAS viewing @Fox**@dark. Members and guests welcome! **Winter Solstice** 6:03 pm EST.

Dec 21 Sun **(NM)**

Note: three double shadow transits occur on Jupiter in December, only two when Jupiter is up in local skies and only one is easy to see. The easiest event is Dec 16 from 1:13 am to 2:00 am. The two shadows will be farther in on the disc of the planet than the Dec 9 event which lasts only 9 minutes. The third is a daytime event.

What was the Christmas Star?

A question always asked this time of year is whether astronomers have figured out what the Christmas Star was -a comet? supernova? a miracle? Assuming it was a real event, here is the answer accepted by most astronomers at present.

The Christmas Star was a real event, but a prolonged one that involved a triple conjunction of Jupiter and Venus that happened at the time that Jesus was considered to have been born, between 3 BC and 1 AD. On 12 August, 3 BC, Jupiter and Venus appeared very close together just before sunrise, appearing as bright morning 'stars.' It would have been visible in the dawn sky of the Middle East from 3:45 to 5:20 a.m.

But it didn't stop there. The crowning touch came ten months later, on 17 June 2 BC, as Venus and Jupiter joined up again in the constellation Leo. This time the two planets were so close that, without the use of our modern optical aids, they would have looked like one single, brilliant star. Jupiter was known as the "planet of Kings" and Saturn as the "Protector of the Jews". This could easily have been interpreted as a sign that the Jewish Messiah had been, or was about to be, born. Also, Leo was thought to denote royalty and power. In an era where astronomy and astrology were not separate, an event like this would have been a great omen and something to write about. In fact, it still resonates even after 2000 years. Enjoy the season, everyone!

Successful BAS events in 2014 included the Oct 23 partial Solar Eclipse (2 images below), a cloudy but enjoyable Dark Sky Weekend July 25/26 (image right) and a Webster visit to Starfest (lower left).

Image right: Rock Mallin shows off his new truss tube telescopes at AstroCATS in Hamilton May 3/4 and is attended by two (former) BAS members.

Below that image, at Starfest, Brian from K-W Telescopes tries to decipher his handwriting on a note while BAS members watch.

Also at Starfest, the two images left show Webster and an admirer, (not the only one that weekend). Lower left, the traditional Starfest group-shot (missing are two long-time and valued BAS members.)
Right: Paula C. shows off her Vesta meteorite in her office at Quetican.

Image left: A solar halo helped usher in summer in 2014 at the annual celebration of summer solstice June 21 at Keppel Henge.

Image right: Sad events marked 2014 as well when BAS lost an original BCAS member and long-time supporter of our public astronomy programs. John Lash passed away Mar 20. Sadly missed by all.

John W. Lash (1945 - 2014)

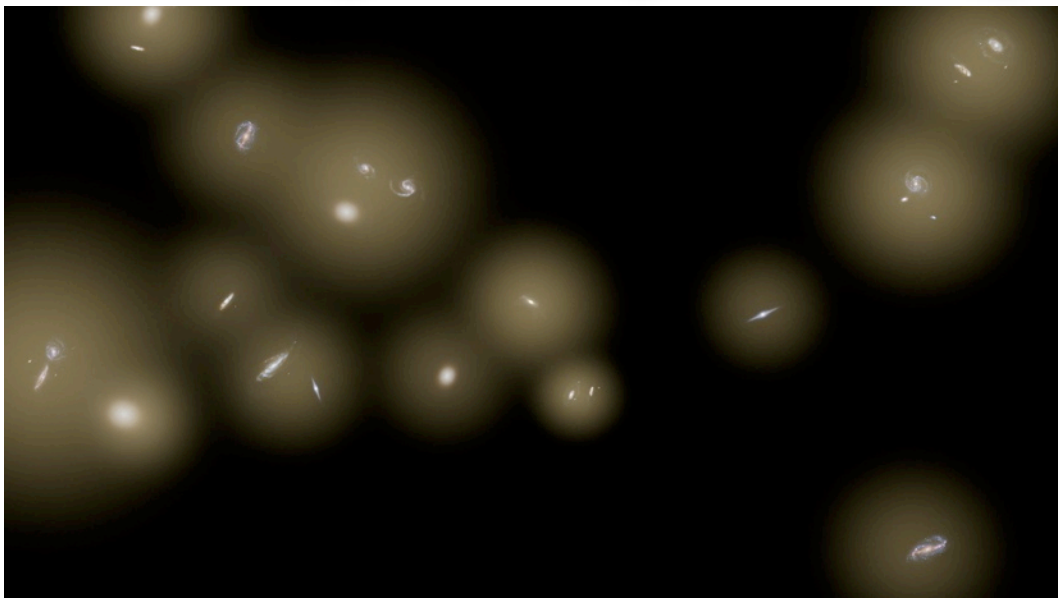
Image centre right: Bluewater Astronomy events were regularly publicized on Rogers TV on Grey County Life. Shown here is John H. and host Linda VanAlst talking astronomy on air Sep 3, 2014.

Image above shows some of our regulars at the Summer Solstice celebration taking a lunch break.

Image below: Deb "Atlas" Diebel, site manager at BOEC doesn't even break a sweat holding up the world. She does a great job of supporting ecology as well as astronomy programs at the Fox Observatory, too.

Image right: Looking a lot like a Christmas ball, Aaron T.'s all-sky image takes in the winter atmosphere with the moon and Jupiter above his house in an early morning image in mid-Dec, 2013. ISO 800, exp = 25 s, fish-eye lens on Canon 50D.
Happy Holidays from BAS!

NASA Rocket Redefines What Astronomers Think of as Galaxies



This artist's concept shows a view of a number of galaxies sitting in huge halos of stars. The stars are too distant to be seen individually and instead are seen as a diffuse glow, colored yellow in this illustration. The CIBER rocket experiment detected this diffuse infrared background glow in the sky -- and, to the astronomers' surprise, found that ***the glow between galaxies equals the total amount of infrared light coming from known galaxies. This means a large number of stars may be flung out as galaxies collide and merge in the process of galaxy assembly. [Is this the "missing mass" from our Universe? -ed]***

This process of flinging out stars is thought to be more common today than in our universe's distant past. Our own Milky Way galaxy will collide with the Andromeda galaxy in about 5 billion years, tossing stars out into space. Though the process is gravitationally chaotic, the stars are far away from each other and will not directly collide. IMAGE CREDIT: NASA/JPL

Nov 6, 2014: A NASA sounding rocket experiment has detected a surprising surplus of infrared light in the dark space between galaxies, a diffuse cosmic glow as bright as all known galaxies combined. The glow is thought to be from orphaned stars flung out of galaxies.

The findings redefine what scientists think of as galaxies. Galaxies may not have a set boundary of stars, but instead stretch out to great distances, forming a vast, interconnected sea of stars.
Observations from the Cosmic Infrared Background Experiment, or CIBER, are helping settle a debate on whether this background infrared light in the universe, previously detected by NASA's Spitzer Space Telescope, comes from these streams of stripped stars too distant to be seen individually, or alternatively from the first galaxies to form in the universe.

"We think stars are being scattered out into space during galaxy collisions," said Michael Zemcov, lead author of a new paper describing the results from the rocket project and an astronomer at the Calif. Institute of Technology (Caltech) and NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. "While we have previously observed cases where stars are flung from galaxies in a tidal stream, our new measurement implies this process is widespread."

Using suborbital sounding rockets, which are smaller than those that carry satellites to space and are ideal for short experiments, CIBER captured wide-field pictures of the cosmic infrared background at two infrared wavelengths shorter than those seen by Spitzer. Because our atmosphere itself glows brightly at these particular wavelengths of light, the measurements can only be done from space.

"It is wonderfully exciting for such a small NASA rocket to make such a huge discovery," said Mike Garcia, program scientist from NASA Headquarters. "Sounding rockets are an important element in our balanced toolbox of missions from small to large."

During the CIBER flights, the cameras launch into space, then snap pictures for about seven minutes before transmitting the data back to Earth. Scientists masked out bright stars and galaxies from the pictures and carefully ruled out any light coming from more local sources, such as our own Milky Way galaxy. What's left is a map showing fluctuations in the remaining infrared background light, with splotches that are much bigger than individual galaxies. The brightness of these fluctuations allows scientists to measure the total amount of background light.

To the surprise of the CIBER team, the maps revealed a dramatic excess of light beyond what comes from the galaxies. The data showed that this infrared background light has a blue spectrum, which means it increases in brightness at shorter wavelengths. This is evidence the light comes from a previously undetected population of stars between galaxies. Light from the first galaxies would give a spectrum of colors that is redder than what was seen.

"The light looks too bright and too blue to be coming from the first generation of galaxies," said James Bock, principal investigator of the CIBER project from Caltech and JPL. "The simplest explanation, which best explains the measurements, is that many stars have been ripped from their galactic birthplace, and that the stripped stars emit on average about as much light as the galaxies themselves."

Future experiments can test whether stray stars are indeed the source of the infrared cosmic glow. If the stars were tossed out from their parent galaxies, they should still be located in the same vicinity. The CIBER team is working on better measurements using more infrared colors to learn how stripping of stars happened over cosmic history.

Results from two of four CIBER flights, both of which launched from White Sands Missile Range in New Mexico in 2010 and 2012, appear Friday, Nov. 7 in the journal *Science*.
Credits: Production editor: **Dr. Tony Phillips** | **Credit: Science@NASA**
More information:
http://www.nasa.gov/mission_pages/sounding-rockets/
More about CIBER: http://ciber.caltech.edu/rocket.html

The CIBER sounding rocket was launched from Wallops Island Virginia

SNOLAB - Searching for Dark Matter Two Kilometres Underground at Vale's Creighton Mine near Sudbury

"***When everything impossible has been eliminated, whatever remains, however improbable, is the truth***."
Sherlock Homes speaking to Dr Watson
"The Sign of Four" by Sir Arthur Conan Doyle

"***... we run into ... difficulties. .. the Coma cluster of galaxies will ultimately fly apart unless sufficiently large amounts of inter-nebular matter change our estimate of the average value of nebular masses.*** "
"On the Masses of Nebulae and of the Clusters of Nebulae"
Fritz Zwicky, Astrophysical Journal, October 1937

Paula grabbed onto my hand as the high speed elevator at the Creighton mine, near Sudbury, began its 2 kilometre descent beneath the surface. We were part of a small group invited this fall to participate in a rare tour of Sudbury Neutrino Observatory's Laboratory (SNOLAB).

SNOLAB Admin Building (above) Dressed for the mine (below)

Readers might recall that Sudbury's Neutrino Observatory was instrumental in solving the Solar Neutrino Problem. We were joined by miners going down to work their shifts and everyone was crammed like sardines into the elevator. Each person was dressed in miner's clothes, boots, helmets, and lamps. The crowded conditions felt like wearing a full-body seatbelt. I could see the rock face of the elevator shaft moving quickly past, and, in spite of chewing gum, my ears still popped a few times during the descent. Then, in just minutes, we were at the bottom of the shaft. Paula wore a big grin because the ride down wasn't as bad as she had expected. Our small group still had a 2 kilometre walk along the mine drift to gain access to the showers and clean rooms of SNOLAB. The mine drift was warm and damp, with some standing water, and a chemical odour. And, it was a long walk!

The Cunninghams all cleaned up.

SNOLAB is straight out of James Bond. It is a world class facility whose location, 2 km deep within the earth, shields its experiments from interfering cosmic rays. It is the ideal location to conduct experiments at the cutting edge of particle physics; experiments as diverse as searching for Dark Matter particles, detecting distant supernovae as far out as 60,000 ly, and searching for the neutrinos resulting from an extremely rare, double beta decay, which if detected, would prove that the neutrino is its own anti-particle. Amazingly, up to 120 scientists and engineers can work there at a time.

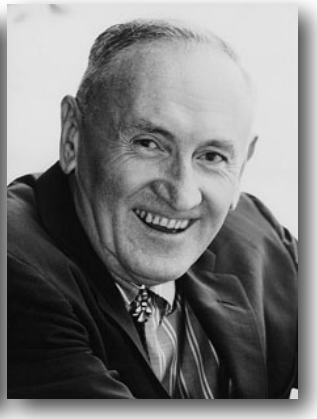
SNOLAB is as spotless as an operating room, and every piece of equipment has to be thoroughly cleaned to remove any traces of radioactive contamination. We were no exception. We had to surrender our cameras to be cleaned, and then everyone had to undress, shower, and put on SNOLAB issued clothing. We all looked like we were part of an operating room team. The rules were quite strict ... even to the point of not touching the walls since isotopes of potassium in our sweat could invalidate some sensitive experiments.

Our tour lasted for more than 5 hours and our tour guide, Samantha, was an excellent communicator. She kept our group on schedule, and had a thorough grasp of the technical and scientific aspects of the various experiments, and she explained each one in considerable detail.

I found all the experiments fascinating but the space limitations for my monthly column prevent me from discussing them all. However, one experiment that greatly interested us was the DEAP-3600 experiment (***D***ark matter ***E***xperiment ***A***rgon ***P***ulse) which should come on line in the next few months. DEAP-3600 will be the most sensitive dark matter experiment in the world! (cont'd on pg. 7)

More about the science going on at SNOLAB can be found here:
https://www.snolab.ca/science

Coma Cluster



Fritz Zwicky

In 1933, Fritz Zwicky, a Caltech astronomer, studied a large cluster of galaxies in the constellation of Coma Berenices. This huge cluster is over 300 million ly distant and contains over 1000 individual galaxies. He compared the estimated total mass of the cluster's galaxies to the orbital motions of the outermost galaxies in the cluster. What he found amazed him. To prevent the cluster from dispersing, there had to be 1000 times as much matter within the cluster than could be accounted for by the estimated luminous mass. Clearly, there was additional mass in the cluster that wasn't luminous, and Zwicky called it "dark matter". We now know that dark matter, which makes up 23% of the mass of the Universe, is dark because it doesn't emit or absorb light. It only reveals itself by its gravitational influence on the motions of normal matter or on its warping of space-time. In the Coma Cluster, studied by Zwicky, it is the additional gravity of the Zwicky's Dark Matter that keeps the galaxy cluster gravitationally bound.

The evidence for the presence of dark matter in the Universe is quite strong. But, even though modern science can measure the presence of dark matter through its gravitational effects on normal matter we still don't know its real nature. In the early Universe, dark matter provided the scaffolding on which normal matter later condensed to make the earliest stars, galaxies, and galaxy clusters. In fact, without the influence of dark matter in the early Universe, our current cosmology would be decidedly different.

We do know our Milky Way is embedded within a halo of dark matter that extends well past the outer globular clusters and dwarf galaxies. At one time, it was thought that dark matter was composed of faint gas, or stars, that we couldn't detect with our existing technology. Then our technology got better, but the theorized faint gas/stars weren't observed in the required amount. It was then theorized that neutrinos, present in massive numbers and possessed with a minuscule mass, could collectively make up dark matter's missing mass. Alas, the neutrino's mass is so tiny it can't account for the missing mass in the galaxy cluster, or significantly affect the motions of the cluster's individual galaxies.

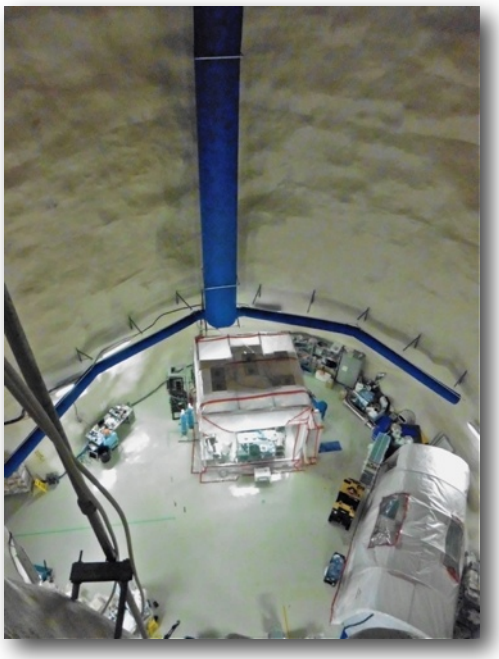
One current favourite theory is that dark matter is composed of Weakly Interacting Massive Particles, known as WIMPS. In the Standard Model of Particle Physics, the leading contender for a WIMP is the neutrino; but, because of its minuscule mass, it doesn't rate as a massive particle. The favoured current WIMP contender is a more massive supersymmetry particle called a neutralino. If neutralinos exist then SNOLAB's DEAP-3600 experiment should be sensitive enough to detect them. This experiment is 500 times more sensitive than the most sensitive WIMP experiment running today. The experiment uses an acrylic sphere filled with 3600 kg of liquid argon. If a WIMP dark matter particle strikes an argon nucleus it will cause a nuclear recoil, which initiates a brief pulse of radiation that can be detected and amplified by photomultiplier tubes. The whole experiment will be submerged in a cylinder of ultra-pure water and located in a special excavated cavity. DEAP-3600 is designed to run continuously for 3 years without any contaminating background radiation that would mask the dark matter signal. If this dark matter detection experiment is successful, a visit to Stockholm and a certain Nobel Prize awaits the SNOLAB's DEAP-3600 scientists. That would be wonderful!

It was now 12:00 noon and we had been at SNOLAB since 7:00 AM. We returned to the foyer of the shower rooms, changed back into our mining clothes, and walked, mostly single file, 2 km back to the elevator for our return trip to the surface. SNOLAB is an impressive facility to have in our province. It is a world class facility, with international consortiums of scientists involved in the planning and execution of the experiments. It was hard not to experience a sense of pride and wonder at the technology we saw.

Our small group was the second last to ever be allowed to visit SNOLAB. The last tour is already booked for a group of graduate students and, after that, SNOLAB will be closed to visitors. We were pleased to be invited and enjoyed every minute of the tour.

DEAP-3600 Stainless Steel Spherical Detector

DEAP-3600 Acrylic Sphere Detector



DEAP-3600 Experimental Cavity

ABBREVIATIONS Used Herein:

DEAP **=**
Dark matter
Experiment
Argon
Pulse

WIMP =
Weakly
Interacting
Massive
Particles

SNO =
Sudbury
Neutrino
Observatory

ly = **l**ight **y**ear

The Heart Nebula

NGC 1805, also known as the Heart Nebula, lies in Cassiopeia very near the Double Cluster (which is in Perseus). The Heart Nebula is about 2.5° across or 5 moon diameters!

Frank W. sent this image and it is a worthy addition to our astrophotography page. Frank took the data over 2 nights through a TV 85 mm refractor in 35 x 5 minute exposures.

Aaron Top's wider angle image below shows the Double Cluster just below centre and the Heart and adjacent Soul Nebula (Sharpless2-199) above centre and left. Star upper right is ε-Cas, the star in the "fallen leg" of the Cassiopeia "W".

From Wikipedia: The Heart Nebula, IC 1805, Sh2-190, lies some 7 500 light years away from Earth and is located in the Perseus Arm of the Galaxy in the constellation Cassiopeia. This is an emission nebula showing glowing gas and darker dust lanes. The nebula is formed by plasma of ionized hydrogen and free electrons.

The very brightest part of this nebula (the knot at the right) is separately classified as NGC 896, because it was the first part of this nebula to be discovered.

The nebula's intense red output and its configuration are driven by the radiation emanating from a small group of stars near the nebula's center. This open cluster of stars known as Melotte 15 contains a few bright stars nearly 50 times the mass of our Sun, and many more dim stars that are only a fraction of our Sun's mass. The cluster used to contain a microquasar that was expelled millions of years ago.

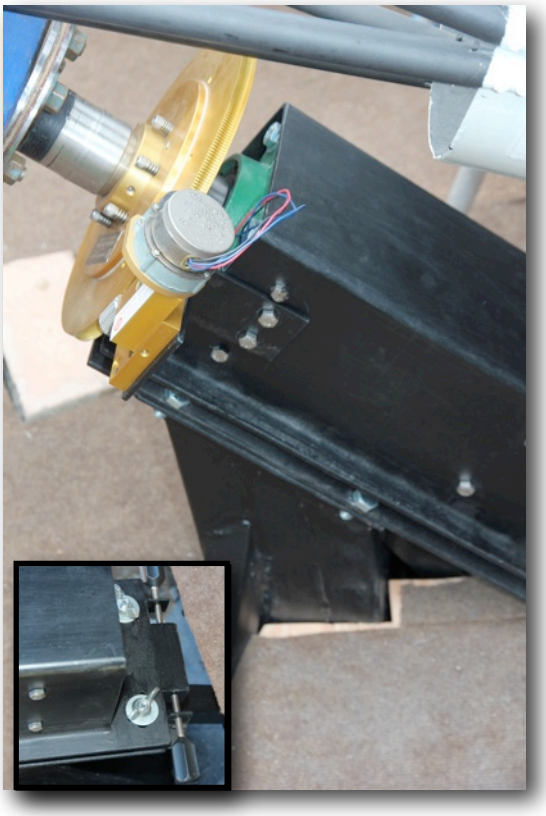
[The APOD for Feb 11, 2014 was the Heart and Soul Nebula and is a spectacular image. Have a look here: http://apod.nasa.gov/apod/ap140211.html -ed]

NGC 1805, the Heart Nebula, was featured at one of the fall dinners on a wine label made up especially for the occasion by the kind folks at Pelee Island Wineries. It was appropriately served at the Oct 2010 Cupid's Cosmic Caper. Also featured on our specialty wines at other dinners were astronomical objects like the N. America Nebula, the Hercules Cluster M13 (the two empty bottles image right) and the Andromeda Nebula. The last three mentioned labels displayed images taken by our 2009 IYA Cosmic Images photographers.

The major construction of the mount is now over and the paint has dried. Image below shows the new mount with its square column to which is attached the mounting plate for the polar axis assembly that holds the polar axis and the clock drive. (Box-like structure in image right).

The clock drive is the heart of any telescope since this drives the gear to keep objects centered once you place them in the field of view of the eyepiece. The drive I currently have installed is a true clock drive in that it uses the same type of motor (called a synchronous motor) that was used to run a clock hand around at a steady pace. These motors are synchronized to the 60 Hz fluctuation of the voltage in power lines in most of North America since the 1950's (when it was upgraded from 25 cycles per second). However, synchronous motors are bulkier and require more power than those used in clocks nowadays. And the synchronous types run on 120 V AC rather than the 1.5 V DC that you find in most electronic clocks. Stepper motors are a third type that have replaced the 120 V synchronous motors partly because they can be run on lower voltages and can be controlled over a larger range of speeds (good for slewing to targets) than synchronous motors. Needless to say an upgrade to stepper motors is in the works for Cyclops-2.1.

Many mounts that support fork mounted telescopes have a flat top and an adjustable wedge is attached to allow for setting the latitude. My mount (left) has a permanent 45° top plate that is part of the structure. Since I have no plans to move to another location at this point, it made sense to build in the approximate 45° local latitude and use another plate to do the final fine-tuning of the polar axis.

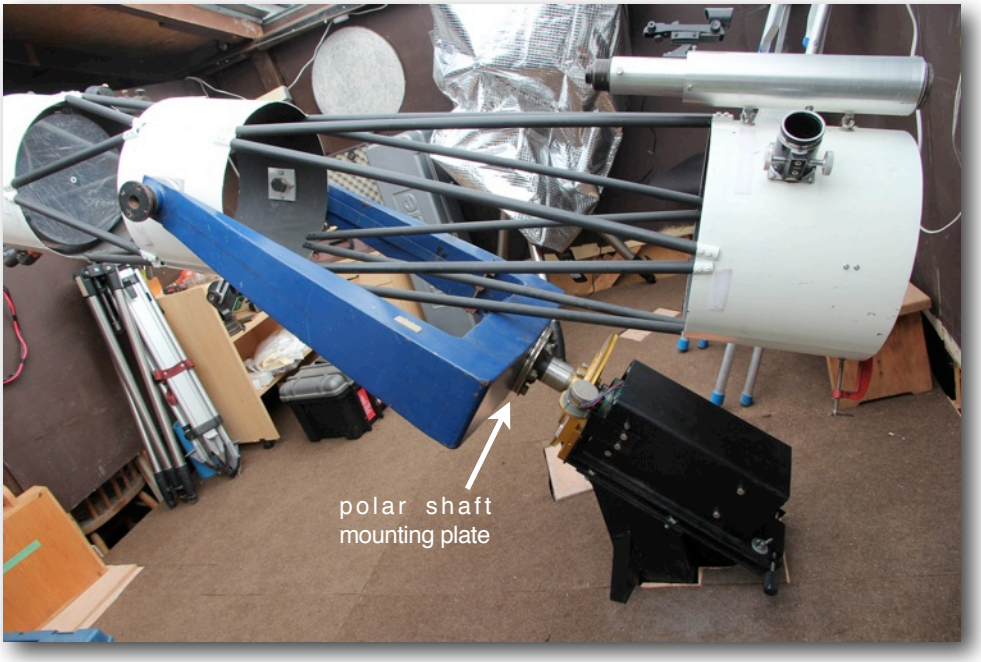


The box structure in the image right, holds the square flange bearings (green bearing just behind silver clock motor), and the polar shaft (silver) and Byers Gear (gold anodized). The whole polar assembly is adjustable in altitude (up and down) and azimuth (left and right) using screws and locking bolts. Azimuth adjustment is done at the back and uses two screws acting against each other to lock the axis in position. (See inset right.)

Encoders are pretty much essential nowadays, and even Cyclops-1 had a set installed. This was a unit from Lumicon -a Sky Vector II which I customized to use on the two axes of the telescope.

I installed a toothed spool (from an old printer) on both the polar and declination axes and connected them to the encoders with toothed belts from the same printer. The belt engages another section of printer belt that is glued in place in a groove in the circular endplate of the polar shaft mounting plate and the dec bearing. (See labels in images). In order to program the encoders with the correct number of teeth, I had to count the fine teeth on each belt - a magnifying glass helped. The belt was glued with epoxy into a groove machined in the edge.

Cyclops-2 below (minus encoders and light shroud) is now installed and the floor boards replaced around the pier. Pardon the mess but the facility is (always) "under construction."



Make a Deal for Land on the Moon (or Mars or Venus or ....)

by MATT WILLIAMS on OCT. 27, 2014
www.universetoday.com

Whether its asteroid prospecting, mining interests, or space tourism, a lot of industries are taking aim at space exploration. Some pioneering spirits – such as Elon Musk – even believe humanity's survival depends on our colonizing onto other planets – such as the Moon and Mars. It's little surprise then that lunar land peddlers have begun making deals for land on the Moon.

Currently, a company known as Moon Estates is offering single acre plots for just £16.75 (that's about $27 US). More importantly, large corporations, entrepreneurs, and even some politicians are eying property on the Moon, hoping to get at its rich resources before long. Read the rest of Matt Williams' very informative article on space property rights here:

http://www.universetoday.com/115682/make-a-deal-for-land-on-the-moon/

"*Ambition*": Mission to a Comet

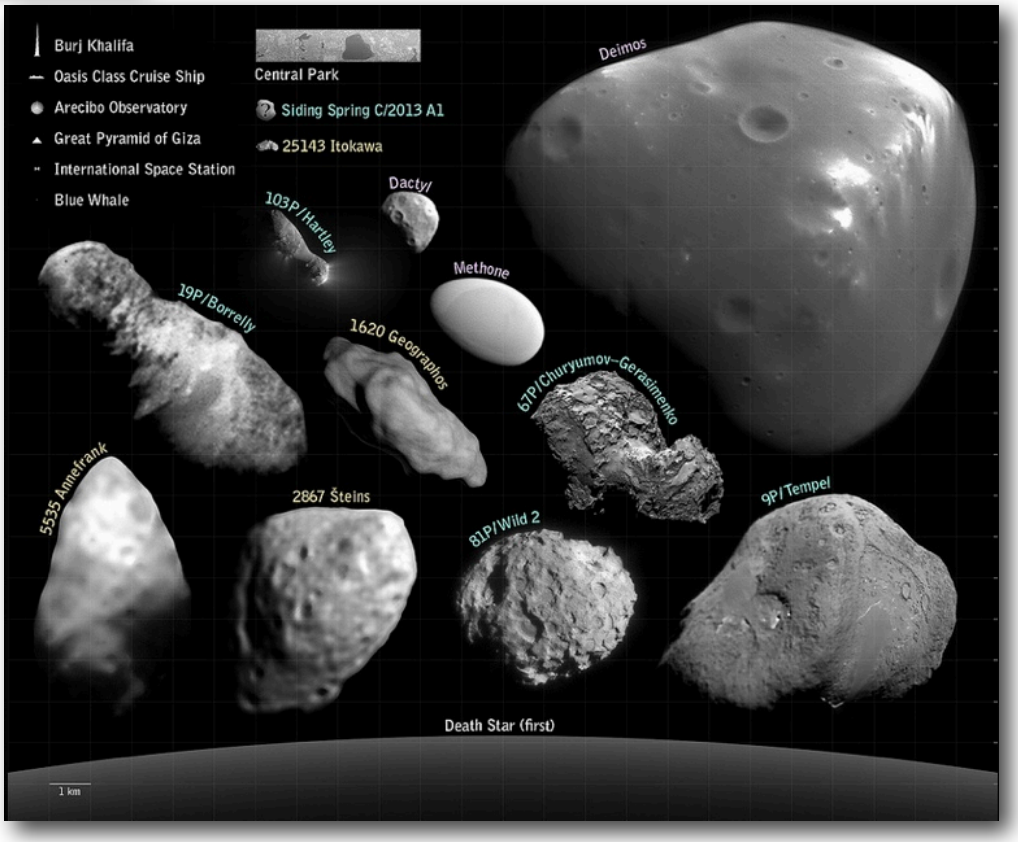
'Ambition' is a 7 minute movie created for ESA and Rosetta, shot on location in Iceland, directed by Oscar-winning Tomek Baginski, and stars Aidan Gillen—Littlefinger of 'Game of Thrones.' It is an abstraction of the near future where humans have become demigods. An apprentice is working to merge her understanding of existence with her powers to create. And her master steps in to assure she is truly ready to take the next step.

See it here: http://www.universetoday.com/115699/why-watch-esa-rosettas-movie-ambition-because-we-want-to-know-what-is-possible/

How BIG is Comet 67/P ?

How big is 67P/Churyumov–Gerasimenko compared to the Death Star?!? Judy Schmidt @SpaceGeck took it upon herself to clear this all up. She created this wonderful infographic that shows 67/P surrounded by a bunch of other objects in the Solar System with a similar size. There's Siding Spring, the Mars moon Deimos, 19P/Borrelly, 103P/Hartley, and others. And then they're compared to the Burj Khalifa, a blue whale, the Great Pyramid of Giza, and much more. But most importantly, at the bottom of the image, you can see the slight curvature of a fully operational Death Star. Yeah… those things are pretty big.

Source: Judy Schmidt's Flickr Page



Mars Atmosphere Significantly Changed by Comet Siding Spring

Two NASA and one European spacecraft that obtained the first up-close observations of a comet flyby of Mars on Oct. 19, have gathered new information about the basic properties of the comet's nucleus and directly detected the effects on the Martian atmosphere.

Data from observations carried out by NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission, NASA's Mars Reconnaissance Orbiter (MRO), and a radar instrument on the European Space Agency's (ESA's) Mars Express spacecraft have revealed that debris from the comet added a temporary and very strong layer of ions to the ionosphere, the electrically charged layer high above Mars. In these observations, scientists were able to make a direct connection from the input of debris from a specific meteor shower to the formation of this kind of transient layer in response; that is a first on any planet, including Earth.

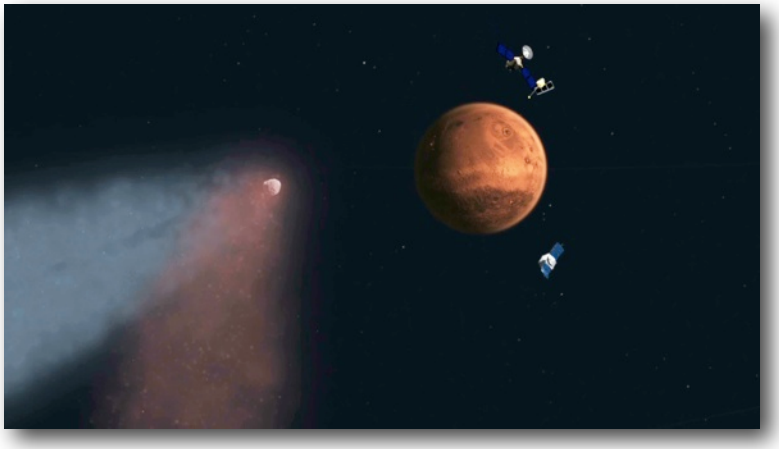
Comet C/2013 A1 Siding Spring traveled from the most distant region of our solar system, called the Oort Cloud, and made a close approach around 2:27 p.m. EDT within about 87,000 miles (139,500 kilometers) of the Red Planet. This is less than half the distance between Earth and our moon and less than one-tenth the distance of any known comet flyby of Earth.

Dust from the comet impacted Mars and was vaporized high in the atmosphere, producing what was likely an impressive meteor shower. This debris resulted in significant temporary changes to the planet's upper atmosphere and possible longer-term perturbations. Earth-based and a host of space telescopes also observed the unique celestial object.

"This historic event allowed us to observe the details of this fast-moving Oort Cloud comet in a way never before possible using our existing Mars missions," said Jim Green, director of NASA's Planetary Science Division at the agency's Headquarters in Washington. "Observing the effects on Mars of the comet's dust slamming into the upper atmosphere makes me very happy that we decided to put our spacecraft on the other side of Mars at the peak of the dust tail passage and out of harm's way."

The MAVEN spacecraft, recently arrived at Mars, detected the comet encounter in two ways. The remote-sensing Imaging Ultraviolet Spectrograph observed intense ultraviolet emission from magnesium and iron ions high in the atmosphere in the aftermath of the meteor shower. Not even the most intense meteor storms on Earth have produced as strong a response as this one. The emission dominated Mars' ultraviolet spectrum for several hours after the encounter and then dissipated over the next two days.

MAVEN also was able to directly sample and determine the composition of some of the comet dust in Mars' atmosphere. Analysis of these samples by the spacecraft's Neutral Gas and Ion Mass Spectrometer detected eight different types of metal ions, including sodium, magnesium and iron. These are the first direct measurements of the composition of dust from an Oort Cloud comet. The Oort Cloud, well beyond the outer-most planets that surround our sun, is a spherical region of icy objects believed to be material left over from the formation of the solar system.



Elsewhere above Mars, a joint U.S. and Italian instrument on Mars Express observed a huge increase in the density of electrons following the comet's close approach. This instrument, the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS), saw a huge jump in the electron density in the ionosphere a few hours after the comet rendezvous. This spike occurred at a substantially lower altitude than the normal density peak in the Martian ionosphere. The increased ionization, like the effects observed by MAVEN, appears to be the result of fine particles from the comet burning up in the atmosphere.

MRO's Shallow Subsurface Radar (SHARAD) also detected the enhanced ionosphere. Images from the instrument were smeared by the passage of the radar signals through the temporary ion layer created by the comet's dust. SHARAD scientists used this smearing to determine that the electron density of the ionosphere on the planet's night side, where the observations were made, was five to 10 times higher than usual.

Studies of the comet itself, made with MRO's High Resolution Imaging Science Experiment (HiRISE) camera, revealed the nucleus is smaller than the expected 1.2 miles (2 kilometers). The HiRISE images also indicate a rotation period for the nucleus of eight hours, which is consistent with recent preliminary observations by NASA's Hubble Space Telescope.

MRO's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) also observed the comet to see whether signs of any particular chemical constituents stood out in its spectrum. Team members said the spectrum appears to show a dusty comet with no strong emission lines at their instrument's sensitivity.

In addition to these immediate effects, MAVEN and the other missions will continue to look for long-term perturbations to Mars' atmosphere.

MAVEN's principal investigator is based at the University of Colorado's Laboratory for Atmospheric and Space Physics in Boulder, and NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the mission. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, manages the Mars Reconnaissance Orbiter. Mars Express is a project of the European Space Agency; NASA and the Italian Space Agency jointly funded the MARSIS instrument.

For more information about NASA's Mars missions, visit:
http://www.nasa.gov/mars

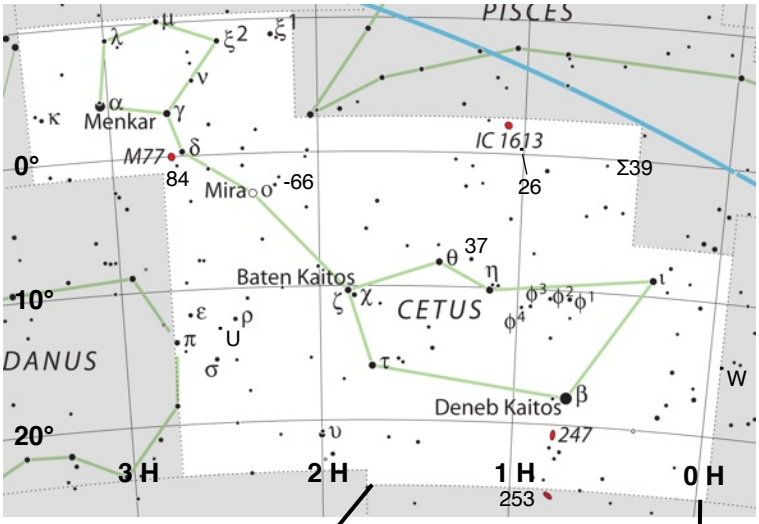
Cetus (Cet)

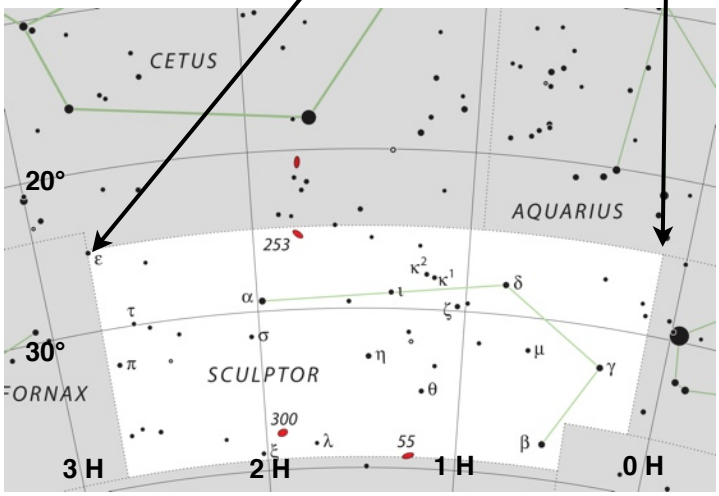
α-Ceti - Menkar β–Ceti - Deneb Kaitos
γ–Ceti - Alkaffaljidhina ζ-Ceti - Baten Kaitos o–Ceti - Mira

A rather flattened and clearly defined pentagon of stars on a line with and directly south of Triangulum and Aries marks the head of the whale. It is the largest of all the constellations. One of its most interesting features is Mira, the prototype of the long period variable stars. It varies in magnitude from 2.0 at maximum to 10.1 at minimum, when it becomes invisible to the naked eye. Its period is approximately 11 months, the period and range being quite irregular. It was first observed in 1596; Mira means "Wonderful Star." τ Ceti is one of the closest stars to the sun, being but 11.8 light years distant. [Mira's maximum occurred last summer so it is below naked eye visibility right now. Next max. is in May 2015 -ed]

DOUBLE STARS

	Mag	Sep(s)	Location	Remarks
γ	3.6-6.2	3	024003	Yellow-Pale Blue; beautiful.
26	6.1-9.0	16	010101	Topaz-Lilac.
37	5.2-8.7	49	011**208**	
66	5.7-7.8	16	021**003**	Yellow-Blue
84	5.8-9.0	4	023**901**	
Σ39	7.0-8.5	20	003**204**	Yellow-Pale Blue





A target well worth pursuing is NGC 253 in Sculptor -an edge-on galaxy that many say is better than M31 in Andromeda since the dust lanes are much more prominent in NGC 253 than M31. I agree, and the larger the scope the better the view! -ed

MESSIER OBJECTS

	Mag	Location	Remarks
M 77	8.9	024**00**	Spiral Galaxy.

Other Objects of Interest in Cetus

α-Ceti- Has a 5.5 magnitude companion with good contrasting color; not a double. Use low power when observing.
o-Ceti(Mira) - See note in box at left. Location 021**703**.
U-Ceti- Long period (235 days) variable, maximum magnitude 7.5. Location 023**113**.
W-Ceti- Long period (351 days) variable, maximum magnitude 7.6. Location 000**015**.
NGC 247 - Elliptical Galaxy. Location 004**421**.

Bonus Constellation: Sculptor (Scl)

Sculptor is a constellation of rather faint stars; the three brightest, α, β and γ-Sculptoris, have magnitudes of about 4.5 . This area and the constellation to the east, Fornax, are very poor in stars as these areas lies in a direction perpendicular to the galactic plane. The constellation contains one object well worth viewing; it is the spiral nebula NGC 253, a very large nebula [galaxy actually -ed] seen almost edge-on. After M31, the Great Nebula of Andromeda, it is the brightest of the spiral nebula. [Scupltor is best viewed this time of year -it only gets high in our northern skies in winter.-ed]

Objects of Interest in Sculptor

NGC 253 - spiral galaxy , mag. 7.6, 30' x 7' in size. Loc'n: 004**525**.

NGC 253 *Paul Zelichowski image above shows the Sculptor Galaxy through a 10 inch f/4.5 Newtonian, SXVH9C camera taken in October, 2006, about 60 minutes of exposure.*

From Wikipedia: As one of the brightest galaxies in the sky, the Sculptor Galaxy is viewable through binoculars. It is considered to be one of the most easily viewed galaxies in the sky after the Andromeda Galaxy. NGC 253 is highest in northern hemisphere skies in December but still visible in the SW in January.

The Sculptor Galaxy is a good target for 12-inch (300 mm) or larger telescopes, but even a 6-inch scope will show details. It appears as a galaxy with a long, oval bulge and a mottled disk. Although the bulge appears only slightly brighter than the rest of the galaxy, it is fairly extended compared to the disk. In 16-inch (400 mm) scopes and larger, a dark dust lane northwest of the nucleus is visible, and over a dozen faint stars may be seen superimposed on the bulge.

Dec 01 19:00 Uranus 1.2° S of Moon, occultation W. Canada
05 23:35 Aldebaran 1.5°S of Moon
06 07:27 **FM** rises 5:21 pm EST "Moon Before Yule"
08 05:00 Mercury at Superior Conjunction (behind Sun)
14:29 Jupiter 2.7°N of Regulus
11 22:36 Jupiter 5.1°N of Moon
12 13:06 Regulus 4.4°N of Moon
18:02 Moon at Apogee: 404 584 km
14 07:00 **Geminid Meteor Shower 120/h Moon LQ**
07:51 **LQ Moon** rises locally at 12:56 am EST
16 20:05 Spica 2.8°S of Moon
19 15:55 Saturn 1.6°S of Moon
21 18:03 Winter Solstice
20:36 **New Moon** rises locally at 7:09 am EST
22 15:00 Ursid Meteor Shower 10/h Moon is New
24 11:43 Moon at Perigee: 364 791 km
25 02:32 Mars 5.7°S of Moon
28 13:31 **FQ Moon** rises locally at 12:04 pm EST
29 19:00 Uranus 1.0° S of Moon, occultation N. Canada
Note: three double shadow transits occur on Jupiter in December, only one is easy to see. Look from 1:13 am to 2:00 am Dec 16.

BAS/Astronomy Events

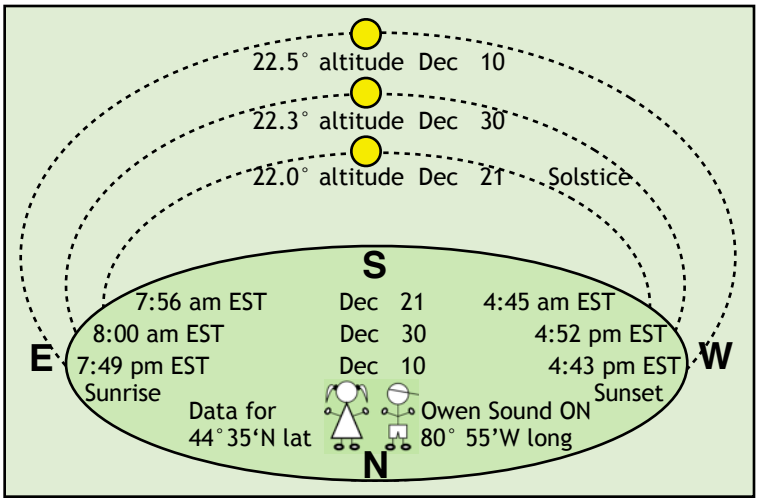
Dec 3 Wed **BAS meeting** Grey Roots Museum 7 pm
Topic: 2014 in images/Xmas meeting
Dec 6 Sat (FM) Night of the **Full Moon** "Moon before Yule"
Dec 9 Tue (FM+3) **Double Shadow Transit** on Jupiter 11:18 am to 11:27 am EST (both shadows near limb)
Dec 13/14 Sat/Sun (LQ) **Geminid Meteor Shower**, viewing from ES Fox, 120/h at peak 7 am Sun , LQ Moon rises at midnight Dec 13. View Fri, Sat and Sun nights
Dec 16 Tue (LQ+2) **Double Shadow Transit** Jupiter from 1:13 am to 2:00 am EST (both shadows near limb but farther in than last time)
Dec 20 Sat (NM-1) **Winter Solstice** 6:03 pm EST. **BAS viewing** @Fox @dark. Members and guests welcome!
Dec 21 Sun (NM)
Dec 25 Thu **Christmas Day**
Dec 31 Wed **New Year's Eve** -last day of 2014!

Planets

MERCURY, is lost in solar glare until the end of Dec when it appears near Venus in the SW evening twilight. It climbs higher in Jan 2015. **VENUS,** also reappears near the setting Sun in evening twilight. Mercury is nearby in the latter part of Dec and both get higher and higher as January progresses. **MARS** (mag. 1.0) continues its eastward trek across Capricornus in December. Look for it near the crescent Moon on Dec 24. **JUPITER**, (-2.3) rises in the east at 10:20 pm at the start of Dec and 2 hours earlier at the end of the month. Jupiter viewing is excellent this month. **SATURN,** (mag. 0.5) passes behind the sun in Nov and re-appears as a morning object in the new year. **URANUS,** (5.8) and **NEPTUNE,** (7.8) are evening sky objects and set by 9 pm and midnight respectively in Dec. Both **asteroid, Vesta (7.1)** and dwarf planet, **Ceres (8.3)** are too close to the Sun for viewing this month. **PLUTO** (mag. 14) is in Sagittarius and sets an hour after sunset in December. Pluto 2014 charts are now found on the BAS website. There will be lots of planetary activity in the western sky in January. Stay tuned!

The diagram below gives the sunrise/sunset times and the Sun's altitude for Nov. The Sun reaches its lowest elevation on Dec 21 when it reaches Winter Solstice and starts to rise again in elevation.

The December moon phase graphic in the lower corner shows lunar phases for each night of the month. Times of moonrise for NM, FQ, FM and LQ are given in the Sky Calendar listing at upper left.



Special Events

Geminid Meteors

Stargazing in December is a pretty hit and miss affair because of weather but with 120 meteors per hour possible, the annual Geminid meteor shower is always one to plan for. It is safe to say the shower WILL happen (in our upper atmosphere) regardless of what is going on in the lower weather zone. And over the years of study, the Geminids have revealed a remarkable profile. There is a slow rise to peak activity taking 2 or 3 days and a fairly quick drop-off to normal numbers afterwards. Contrast this to the Perseids (which were "mooned-out" this year) which may take several weeks to reach a peak.

Also, there appear to be more bright Geminids a few hours after the peak since the particles appear to have experienced some sorting by mass. The smaller particles appear early and the larger particles seem to come late in the shower.

In my observations on the few times that weather allowed local observers to see Geminids, I recall some nice bright, yellow fireballs but never connected it to the end of the shower. In the days "BD" (Before Digital) it was a waste of film to try to record meteors, but now, I regularly take a few 1000 digital images over the course of a few nights. For example, in Aug 2013, I recorded more meteors in two nights than in all my previous attempts with film. (All were Perseids.) I will be shooting for Geminids this time!

The LQ Moon rises around 11 pm EST Dec 12, (an hour later each subsequent night) so there are 5 or 6 evening hours to spot some fainter Geminids before the "onslaught" of fireballs late in the shower. Should be a fun "shooting star weekend"!

Dec 2014

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

Price reduced to $600 !

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

We have lenses!

FOR SALE: Sigma 17-70mm f/2.8-4 Lens

DC Macro OS HSM image stabilized.Asking $360 For Canon APS-C sensor sized cameras. Only 1 year old, includes 72mm MC UV filter ($70 value) Lens new ~$650 See link for details/review http://m.dpreview.com/lensreviews/sigma-17-70mm-f2-8-4-os-hsm Contact robotbo@gmail.com if interested.

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