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1. Greetings!

Welcome to the Cowichan Valley StarFinders Astronomy club's "Clear Skies" monthly newsletter.

Well another year is quickly coming to an end and another one is on it's way. 2011 is the chinese calendar "Year of the Rabbit". People born in the year of the rabbit are the luckiest among "the twelve animals." Whoo hoo that's me, I am so needing this year! It is also the "International year of chemistry (IYC)" and of course here in BC, it is still the year of science (school calendar). I don't know how many of you know this but Dr. Falk really brought home a point that this is the first time in ALL of HISTORY that all scientists in multiple displines around the world have come together to try and stop or slow down global warming. That ought to tell you how serious this problem really is. Here is the BC website if you would like more information on the year of science <http://www.yearofsciencebc.ca/>

But before we get to 2011, I just want to thank you all for you're comments on the newsletter. We always try to add something for everyone inside. And speaking of inside this edition; we have a 3-D video tour of the known universe, a peak at our own "dust tail" and a cosmic snowstorm. Don't forget about the twins, yes, they are acting up in the Geminid meteor shower this month.

Also, don't forget our ""**Winter Dinner Social**" is happeining @ Good Company Steakhouse in Duncan starting at **6:00pm** on **WEDNESDAY December 15th**. It is always a good time with lots of laughter and comroderie, so come and have some good cheer.

Many thanks to this month's contributors Moe R and Bryon T.

By Freda Eckstein

"Astronomers, like burglars and jazz musicians, operate best at night"- Miles Kington

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2. Socials

Socials are held on the 4th Wednesday of each month at the home of Bryon and Freda. Click on the [Map](#) or follow these directions.

Island Hwy, Mill Bay

Turn on Frayne Rd towards ocean (Serious Coffee is on the corner)

Turn right on Huckleberry Rd

3rd house on the left across from Springbank road and Mail boxes.

Look for the STAR sign

Please park on Huckleberry or Springbank Rd's.

Call Brian 743-6633 if you need directions

Our next Social will be held at **6:00pm** on **WEDNESDAY December 15th**

Feature: ""Winter Dinner Social" @ Good Company Steakhouse in Duncan. Please RVSP newsletter@starfinders.ca to let us know you are coming.

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3. Social Highlights – November 24th, 2010

By Bryon Thompson

We were very fortunate at last month's social to have as a guest lecturer Dr. Falk Herwig. A more impassioned and knowledgeable speaker would be hard to find. Dr. Herwig explained how certain elements are formed in the last dying convulsions of super novae. From gold to the carbon we are made of, he helped us to see how these elements and others are made as the star runs out of fuel, collapses in on itself, crushing atoms together to create new and sometimes exotic isotopes. Some of these rare isotopes 'live' or exist for mere fractions of seconds before great pressures and temperatures cause 'isotope transformation' to occur and new elements are born. A great thanks goes out to Dr. Herwig for enlightening us through his complex modelling systems that show how we are all truly made of "Stardust". We hope to see him again in the future. By the way here is a link to the new telescope at UVIC that Dr Herwig kindly sent us. Public viewing is available every Wednesday night. Check it out!
<http://astrowww.phys.uvic.ca/~robb/newtelescope/index.html>

Please come out to our socials. The lectures are insightful, informative, fun and the cookies are great! The next lecture series starts in January with "The Theory of Chaos" by Dr. Florin Diacu. The mathematical theory of chaos can be explained to anybody willing to understand it. This lecture is based on the presenter's book, [Celestial Encounters](#), 'the Origins of Chaos and Stability'. Don't miss it! Also, don't forget to come out to the December Dinner Social at the Good Company Steakhouse in Duncan. Till next time.

Bryon Thompson,
Editor.

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4. Upcoming Events



Every Wednesday from 8-10 In The Sky Above, at UVic (until April 2011)

The University of Victoria's newest stellar acquisition is the largest telescope on a university campus in Canada; members of the public are invited to take in the view every Wed. night at UVic. The telescope is on the roof of UVic's new science building and is the country's fifth largest overall. Visitors can expect to observe visible planets, double stars, open clusters, nebulae and even the Andromeda Galaxy.

Weekly viewings continue through April 2011, except last two Wed. in Dec.

Bob Wright Centre, fifth floor (use main lobby elevator on east side of building)

Admission is free. All ages and levels of cosmological knowledge are welcome.

Evening parking is \$2.

Campus maps are available at www.uvic.ca/visitors/explore/maps.

For event info, contact the astronomy department at the numbers below.

Contacts: Russell Robb (Senior Lab Instructor, Department of Physics & Astronomy) at 250-721-7750
 250-721-7750 or robb@uvic.ca

NASA Launches credit NASA.Com:

Date: Dec. 7 *

Mission: Commercial Orbital Transportation Services-1 (COTS-1)

Launch Vehicle: SpaceX Falcon 9

Launch Site: Launch Complex 40

Launch Window: 9:03 a.m. to 12:22 p.m. EST

Description: The first COTS test flight of the Falcon 9 rocket with the Dragon capsule atop will demonstrate key launch capabilities including on-orbit operation, entry, descent and splashdown of the capsule.

Date: Dec. 17 *

Mission: STS-133

Launch Vehicle: Space Shuttle Discovery

Launch Site: Kennedy Space Center - Launch Pad 39A

Launch Time: 8:51 p.m. EST

STS-133 Description: Space shuttle Discovery will deliver the Express Logistics Carrier-4 (ELC-4), a Permanent Multipurpose Module (PMM) and critical spare components to the International Space Station.

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5. This Month In History

Courtesy of: Windowstotheuniverse.com

December 5

1901 - Birthday of Werner Heisenberg

Werner Heisenberg was a German physicist who lived between 1901-1976. He developed new theories in quantum mechanics about the behavior of electrons. Heisenberg is most famous for his "uncertainty principle".

December 7

1905 - Gerard Kuiper's birthday

Gerard Kuiper was an American astronomer who lived between 1905-1973. He is considered the father of modern planetary science for his brilliant study of our solar system.

December 12

1921 - Death of Henrietta Swan Leavitt

Henrietta Swan Leavitt is an American astronomer who was born in Massachusetts in 1868. She is known for her discovery of a type of variable stars named cepheid variables.

December 14

1546 - Birthday of Tycho Brahe

Tycho Brahe was a Danish astronomer who lived between 1546-1601. For over twenty years, he made very accurate observations of the night sky. Tycho also built the world's first observatory.

December 15

1970 - Venera 7 becomes first to land softly on the surface of Venus.

The Soviet space program to Venus in the late 1960's, 70's, and early 80's was very successful, with 13 of 16 Venera missions safely reaching the planet. Venera 7 was the first one to land and the first man-made probe to transmit data from the surface of another planet.

December 20

1996 - Death of Carl Sagan

Carl Sagan is an American astronomer who was born in 1934. He is famous for his research on the origins of life and his belief that life exists elsewhere in the universe.

December 23

1973 - Death of Gerard Kuiper

Gerard Kuiper was an American astronomer who lived between 1905-1973. He is considered the father of modern planetary science for his brilliant study of our solar system.

December 25

1758 - Johann Palitzsch observed Halley's comet

Edmond Halley suggested that a certain comet was a regular visitor, returning every 76 years. In 1758, Johann Palitzsch observed this comet as predicted by Halley in 1705. Today it is called Halley's comet.

December 26

1624 - Death of Simon Marius

Simon Marius was a German astronomer who lived between 1573-1624. He made observations of the heavens using a telescope and published yearly astronomical tables.

December 27

1571 - Birthday of Johan Kepler

Johan Kepler was a German astronomer who lived between 1571-1630. He introduced three important laws of planetary motion and helped the Copernican model of the solar system gain general acceptance.

December 29

1720 - Death of Maria Kirch

Maria Winkelmann Kirch was a German astronomer who lived between 1670-1720. She discovered the comet of 1702. She also published a paper in 1712 on the conjunction of Jupiter and Saturn.

1989 - Death of Hermann Oberth

Hermann Oberth, born in Transylvania, Romania, was a physicist who lived between 1894-1989. Oberth

studied rockets and wrote books on how they could be used to launch objects into space. He originated the idea of rocket stages.

December 30

1924 - Hubble shows that galaxies exist outside the Milky Way galaxy.

Edwin Hubble announced his discovery that the fuzzy "nebulae" were not a part of the Milky Way galaxy, as had been thought, but were separate galaxies.

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6. Cool Pics/Videos

Want to show off your latest pics? Well here's your chance; email the editor at [My Cool Pics](#) and we will try to post them in the next edition of "Clear Skies".

Video: A 3-D Tour of All the Known Galaxies

This little video, brought to us by NASA Goddard, shows off all of the galaxies we're currently aware of, in one swirling, fluid shot. The video was created by taking images from the Hubble telescope and several other sources and placing them in a virtual 3-D space, corresponding to our viewing vantage point. Basically, it's a 3-D video tour of the universe as we know it at the moment.

http://www.youtube.com/watch?v=NJD8QqaJyws&feature=player_embedded

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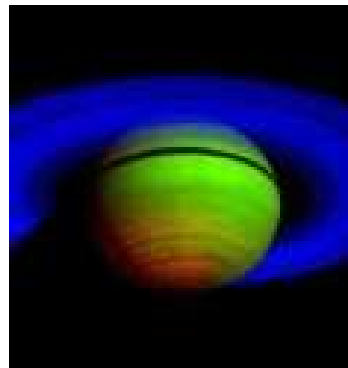
7. Featured Articles

Articles

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Cassini Reveals Saturn is on a Cosmic Dimmer Switch— Nov 11/10 credit Goddard Space Flight Center



Like a cosmic light bulb on a dimmer switch, Saturn emitted gradually less energy each year from 2005 to 2009, according to observations by NASA's Cassini spacecraft. But unlike an ordinary bulb, Saturn's southern hemisphere consistently emitted more energy than its northern one. On top of that, energy levels changed with the seasons and differed from the last time a spacecraft visited in the early 1980s.

These never-before-seen trends came from an analysis of comprehensive data from the Composite Infrared Spectrometer (CIRS), an instrument built by NASA's Goddard Space Flight Center in Greenbelt, Maryland, as well as a comparison with earlier data from NASA's Voyager spacecraft. When combined with information about the energy coming to Saturn from the Sun, the results could help scientists understand the nature of Saturn's internal heat source.

The findings were reported November 9 in the *Journal of Geophysical Research-Planets* by Liming Li, then of Cornell University, and colleagues from several institutions, including Goddard and NASA's Jet Propulsion Laboratory in Pasadena California, which manages the Cassini mission. "The Cassini CIRS data are very valuable because they give us a nearly complete picture of Saturn," says Li. "This is the only single data set that provides so much information about this planet, and it's the first time that anybody has been able to study the power emitted by one of the giant planets in such detail."

The planets in our solar system lose energy in the form of heat radiation in wavelengths that are invisible to the human eye. The CIRS instrument picks up wavelengths in the thermal infrared region, which is beyond red light, where the wavelengths correspond to heat emission. "In planetary science, we tend to think of planets as losing power evenly in all directions and at a steady rate," says Li. "Now

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we know Saturn is not doing that." Instead, Saturn's flow of outgoing energy was lopsided, with its southern hemisphere giving off about one-sixth more energy than the northern one, Li explains. This effect matched Saturn's seasons: During those 5 Earth years, it was summer in the southern hemisphere and winter in the northern one. (A season on Saturn lasts about 7 Earth years.) Like Earth, Saturn has these seasons because the planet is tilted on its axis, so one hemisphere receives more energy from the Sun and experiences summer while the other receives less energy and is shrouded in winter. Saturn's equinox, when the Sun was directly over the equator, occurred in August 2009.

In the study, Saturn's seasons looked earthlike in another way: In each hemisphere, its effective temperature, which characterizes its thermal emission to space, started to warm up or cool down as a change of season approached. Because Saturn's weather is variable and the atmosphere tends to retain heat (called heat inertia), the temperature changes in complicated ways throughout the atmosphere. "The effective temperature provides us a simple way to track the response of Saturn's atmosphere, as a system, to the seasonal changes," says Li. Cassini's observations in the northern hemisphere revealed that the effective temperature gradually dropped from 2005 to 2008 and then started to warm up again by 2009. In Saturn's southern hemisphere, the effective temperature cooled from 2005 to 2009, as the equinox started to approach. The emitted energy for each hemisphere rose and fell along with the effective temperature. Even so, during this 5-year period, the planet as a whole seemed to be slowly cooling down and emitting less energy. To find out if similar changes were happening 1 Saturn year ago, the researchers looked at data collected by Voyager in 1980 and 1981. Like Cassini CIRS, Voyager recorded fluctuations in the energy emitted by the planet and in the effective temperature. But Voyager did not see the imbalance between the southern and northern hemispheres; instead, the two regions were much more consistent with each other.

Why wouldn't Voyager have seen the same summer-versus-winter difference between the two hemispheres? The amount of energy coming from the Sun (called solar radiance), which drives weather and atmospheric temperatures, could have fluctuated from one Saturn year to the next. The patterns in Saturn's cloud cover and haze could have, too. "It's reasonable to think that the changes in Saturn's emitted power are related to cloud cover," says Amy Simon-Miller, who heads the Planetary Systems Laboratory at Goddard and is a co-author on the paper. "As the amount of cloud cover changes, the amount of radiation escaping into space also changes. This might vary during a single season and from one Saturn year to another. But to fully understand what is happening on Saturn, we will need the other half of the picture: the amount of power being absorbed by the planet."

Li is finishing an analysis of the solar energy that came to Saturn, based on data sets collected by two other Cassini instruments, the imaging science subsystem and the visual and infrared mapping spectrometer. He agrees that this information is crucial because Saturn, like its fellow giant planets Jupiter and Neptune, is thought to have its own source of internal energy. (The fourth giant planet, Uranus, does not seem to have an internal source.) By studying the changes in Saturn's outgoing energy along with the changes in incoming solar energy, scientists can learn about the nature of the planet's internal energy source and whether it, too, changes over time. "The differences between Saturn's northern and southern hemisphere and that fact that Voyager did not see the same asymmetry raise a very important question: Does Saturn's internal heat vary with time?" says Li. "The answer will significantly deepen our understanding of the weather, internal structure and evolution of Saturn and the other giant planets."

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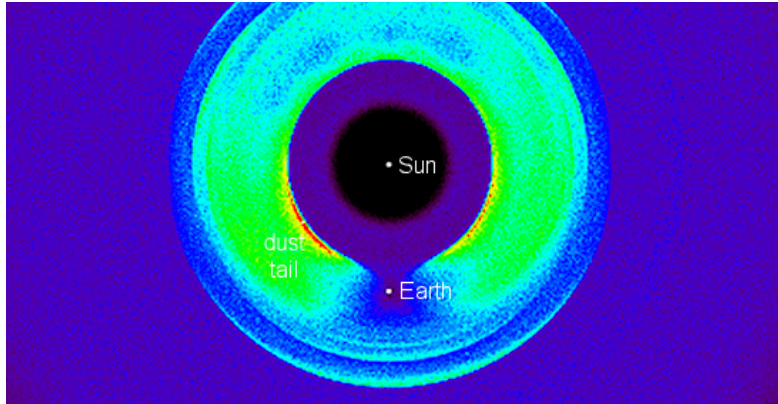
Earth's Dust Tail Points to Alien Planets – Nov 12/10 credit NASA Science

Did you know that the Earth has a dust tail? The Spitzer Space Telescope sailed right through it a few months ago, giving researchers a clear idea of what it looks like. That could be a big help to planet hunters trying to track down alien worlds. "Planets in distant solar systems probably have similar dust tails," says Spitzer project scientist Mike Werner. "And in some circumstances these dust features may be easier to see than the planets themselves. So we need to know how to recognize them."

It's extremely challenging – and usually impossible – to directly image exoplanets. They're relatively small and faint, hiding in the glare of the stars they orbit. "A dust tail like Earth's could produce a bigger signal than a planet does. And it could alert researchers to a planet too small to see otherwise."

Earth has a dust tail not because the planet itself is particularly dusty, but rather because the whole solar system is. Interplanetary space is littered with dusty fragments of comets and colliding asteroids. When Earth orbits through this dusty environment, a tail forms in the rear, akin to swaths of fallen leaves swirling up behind a streetsweeper. "As Earth orbits the sun, it creates a sort of shell or depression that dust particles fall into, creating a thickening of dust – the tail – that Earth pulls along via gravity,"

explains Werner. "In fact, the tail trails our planet all the way around the sun, forming a large dusty ring."

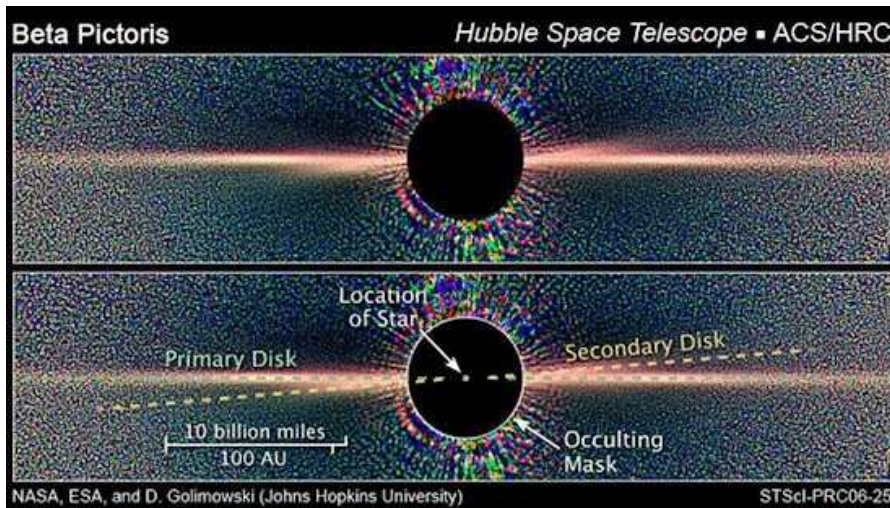


A computer simulation of Earth's dust tail/ring seen from a vantage point outside our solar system. Colors indicate density; purple is lowest, red is highest.

Spitzer's recent observations have helped astronomers map the structure of Earth's dust tail and figure out what similar "tell-tale tails" attached to alien planets might look like.

Like our own solar system, other planetary systems are infused with dust that forms a dusty disk encircling the central star. And like Earth, exoplanets interact with their dust disk gravitationally, channeling and drawing strange features into it. "In some stars' dust disks there are bumps, warps, rings, and offsets telling us that planets are interacting with the dust," explains Mark Clampin of NASA's Goddard Space Flight Center. "So we can 'follow the dust' to the planets. So far, we've seen about 20 dust disks in other solar systems. And in some of those cases, following the dust has already paid off." Clampin, Paul Kalas, and colleagues were looking for a planet around the bright southern star Fomalhaut when they unexpectedly found a dust ring. The shape of that ring led them to their goal. "We suspected that the ring's sharp inner edge was formed by a planet gravitationally clearing out the surrounding debris," says Clampin. "We tracked the planet by this 'footprint' in the dust." ([See the footprint here.](#))

Another Hubble image shows a dusty disk around Beta Pictoris, a star in the constellation Pictor, or "Painter's Easel," pictured below: A Hubble image of dusty material circling the star Beta Pictoris.



"Note the smaller dust ring that's filled with respect to the larger dust disk," says Clampin. "Like Earth, this planet is shepherding the dust into its orbital plane." Clampin and Werner say Spitzer's observation of Earth's dust tail and these initial observations of dust structures in distant solar systems set the stage for the planet hunting debut of the James Webb Space Telescope. They fully

expect the huge and powerful new telescope to spot many tell-tale tails ... of the alien variety.

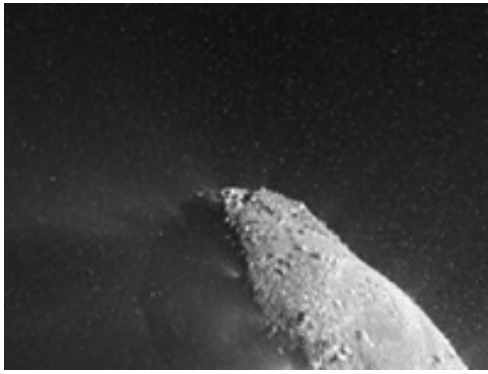
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Spacecraft Sees Cosmic Snowstorm During Comet Encounter— Nov 19/10 Credit NASA Headquarters

The EPOXI mission's recent encounter with Comet 103P/Hartley 2 provided the first images clear enough for scientists to link jets of dust and gas with specific surface features. NASA and other scientists have begun to analyze the images.

The EPOXI spacecraft revealed a cometary snowstorm created by carbon dioxide jets spewing out tons of golf ball to basketball-sized fluffy ice particles from the peanut-shaped comet's rocky ends. At the same time, a different process was causing water vapor to escape from the comet's smooth midsection. This information sheds new light on the nature of comets and even planets.

This image from the High-Resolution Instrument on NASA's EPOXI mission spacecraft shows part of the nucleus of Comet 103P/Hartley 2.



Scientists compared the new data to data from a comet the spacecraft previously visited that was somewhat different from Hartley 2. In 2005, the spacecraft successfully released an impactor into the path of Comet Tempel 1, while observing it during a flyby. "This is the first time we've ever seen individual chunks of ice in the cloud around a comet or jets definitively powered by carbon dioxide gas," said Michael A'Hearn from the University of Maryland in College Park. "We looked for, but didn't see, such ice particles around Comet Tempel 1." The new findings show Hartley 2 acts differently than Tempel 1 or the three other comets with nuclei imaged by spacecraft. Carbon dioxide appears to be a key to

understanding Hartley 2 and explains why the smooth and rough areas scientists saw respond differently to solar heating, and have different mechanisms by which water escapes from the comet's interior.

"When we first saw all the specks surrounding the nucleus, our mouths dropped," said Pete Schultz of Brown University in Providence, Rhode Island. "Stereo images reveal there are snowballs in front and behind the nucleus, making it look like a scene in one of those crystal snow globes." Data show the smooth area of Comet Hartley 2 looks and behaves like most of the surface of Comet Tempel 1, with water evaporating below the surface and percolating out through the dust. However, the rough areas of Hartley 2, with carbon dioxide jets spraying out ice particles, are very different. "The carbon dioxide jets blast out water ice from specific locations in the rough areas resulting in a cloud of ice and snow," said Jessica Sunshine from the University of Maryland. "Underneath the smooth middle area, water ice turns into water vapor that flows through the porous material, with the result that close to the comet in this area we see a lot of water vapor."

Engineers at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, have been looking for signs that ice particles peppered the spacecraft. So far they found nine times when particles, estimated to weigh slightly less than the mass of a snowflake, might have hit the spacecraft but did not damage it. "The EPOXI mission spacecraft sailed through the Hartley 2's ice flurries in fine working order and continues to take images as planned of this amazing comet," said Tim Larson from JPL. Scientists will need more detailed analysis to determine how long this snowstorm has been active, and whether the differences in activity between the middle and ends of the comet are the result of how it formed some 4.5 billion years ago or are because of more recent evolutionary effects.

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Pulsating Star Mystery Solved –Nov 24/10 credit NASA ESO

The new results, from a team led by Grzegorz Pietrzyński (Universidad de Concepción, Chile, Obserwatorium Astronomiczne Uniwersytetu Warszawskiego, Poland), appear in the 25 November 2010 edition of the journal *Nature*. Grzegorz Pietrzyński introduces this remarkable result: "By using the HARPS instrument on the 3.6-metre telescope at ESO's La Silla Observatory in Chile, along with other telescopes, we have measured the mass of a Cepheid with an accuracy far greater than any earlier estimates. This new result allows us to immediately see which of the two competing theories predicting the masses of Cepheids is correct."

Classical Cepheid Variables, usually called just Cepheids, are unstable stars that are larger and much brighter than the Sun. They expand and contract in a regular way, taking anything from a few days to months to complete the cycle. The time taken to brighten and grow fainter again is longer for stars that are more luminous and shorter for the dimmer ones. This remarkably precise relationship makes the study of Cepheids one of the most effective ways to measure the distances to nearby galaxies and from there to map out the scale of the whole Universe.



Unfortunately, despite their importance, Cepheids are not fully understood. Predictions of their masses derived from the theory of pulsating stars are 20% less than predictions from the theory of the evolution of stars. This embarrassing discrepancy has been known since the 1960s. To resolve this

mystery, astronomers needed to find a double star containing a Cepheid where the orbit happened to be seen edge-on from Earth. In these cases, known as eclipsing binaries, the brightness of the two stars dims as one component passes in front of the other, and again when it passes behind the other star. In such pairs astronomers can determine the masses of the stars to high accuracy. Unfortunately neither Cepheids nor eclipsing binaries are common, so the chance of finding such an unusual pair seemed very low. None are known in the Milky Way. Wolfgang Gieren, another member of the team, takes up the story: "Very recently we actually found the double star system we had hoped for among the stars of the Large Magellanic Cloud. It contains a Cepheid variable star pulsating every 3.8 days. The other star is slightly bigger and cooler, and the two stars orbit each other in 310 days. The true binary nature of the object was immediately confirmed when we observed it with the HARPS spectrograph on La Silla."

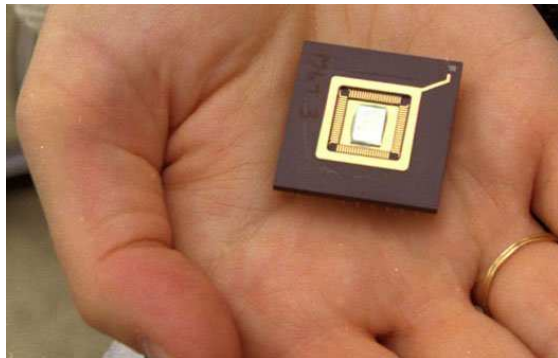
The observers carefully measured the brightness variations of this rare object, known as OGLE-LMC-CEP0227, as the two stars orbited and passed in front of one another. They also used HARPS and other spectrographs to measure the motions of the stars towards and away from the Earth — both the orbital motion of both stars and the in-and-out motion of the surface of the Cepheid as it swelled and contracted. This very complete and detailed data allowed the observers to determine the orbital motion, sizes and masses of the two stars with very high accuracy — far surpassing what had been done before for a Cepheid. The mass of the Cepheid is now known to about 1% and agrees exactly with predictions from the theory of stellar pulsation. However, the larger mass predicted by stellar evolution theory was shown to be significantly in error.

The much-improved mass estimate is only one outcome of this work, and the team hopes to find other examples of these remarkably useful pairs of stars to exploit the method further. They also believe that from such binary systems they will eventually be able to pin down the distance to the Large Magellanic Cloud to 1%, which would mean an extremely important improvement of the cosmic distance scale.

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IBM Unveils Nanophotonic Chips that Could Lead the Exascale Computing Revolution —Dec 1/10 credit POPSCI

A Conventional CMOS Chip The CMOS chips of the very near future will communicate via pulses of light rather than electricity, increasing speed by three orders of magnitude. NASA IBM is prepped to lead the way into the next era of exascale computing, at least if the technology they showed off at a convention today in Chiba, Japan can live up to expectations. Today IBM lifted the veil on its CMOS Integrated Silicon Nanophotonics (CISN) technology at Semicon Japan, saying its next-gen silicon chips that communicate via pulses of light, rather than electrical signals, will be commercially available starting next year.



In the chip sector, nanophotonics are thought to be the inevitable future of CMOS chip tech, and nearly every major player in the field – Intel, Hewlett-Packard, Samsung, Freescale, etc. – has dabbled in the technology. CISN promises to unlock exascale computing power, removing the roadblocks between today's chip technology and processors that are 1,000 times faster than today's petascale computers.

How does one create a chip that executes one million trillion operations per second? Switch from copper to light. Chips that communicate over optical interconnects rather than electron swapping connections can perform much faster. And the more optical connections you have, the better. That's why IBM is currently expanding its manufacturing capacity (some of which is licensed to other companies) in order to produce the nanophotonic chips in large quantities. The company predicts CISN technology will ship next year, but in the next five years it's due for an evolution: It'll go from simply connecting systems to connecting boards in the same system and eventually to connecting cores on the same microprocessor.

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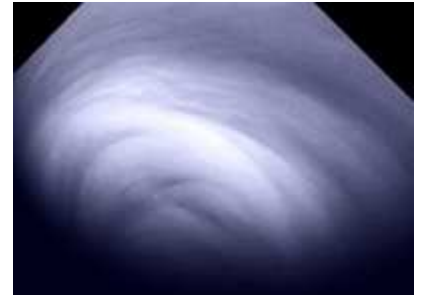
Venus Holds Warning for Earth —Dec 1/10 credit ESA, Noordwijk, Netherlands

Scientists have finally explained mysterious high-altitude layer of sulfur dioxide discovered by the

European Space Agency's (ESA) Venus Express. As well as telling us more about Venus, it could be a warning against injecting our atmosphere with sulfur droplets to mitigate climate change.

Close-up on venusian cloud structures at the south pole

Venus is blanketed in sulfuric acid clouds that block our view of the surface. The clouds form at altitudes of 30–45 miles (50–70 kilometers) when sulfur dioxide from volcanoes combines with water vapor to make sulfuric acid droplets. Any remaining sulfur dioxide should be destroyed rapidly by the intense solar radiation above 45 miles (70 km). So the detection of a sulfur dioxide layer at 55–70 miles (90–110 km) by ESA's Venus Express orbiter in 2008 posed a complete mystery. Where did that sulfur dioxide come from? Now, computer simulations by Xi Zhang from the California Institute of Technology in Pasadena and colleagues from America, France, and Taiwan show that some sulfuric acid droplets may evaporate at high altitudes, freeing gaseous sulfuric acid that is then broken apart by sunlight, releasing sulfur dioxide gas. "We had not expected the high-altitude sulfur layer, but now we can explain our measurements," said Hakan Svedhem from ESA. "However, the new findings also mean that the atmospheric sulfur cycle is more complicated than we thought." As well as adding to our knowledge of Venus, this new understanding may be warning us that proposed ways of mitigating climate change on Earth may not be as effective as originally thought.



Nobel prize winner Paul Crutzen has recently advocated injecting artificially large quantities of sulfur dioxide into Earth's atmosphere at around 12 miles (20 km) to counteract global warming resulting from increased greenhouse gases. The proposal stems from observations of powerful volcanic eruptions, in particular the 1991 eruption of Mount Pinatubo in the Philippines that shot sulfur dioxide up into Earth's atmosphere. Reaching 12 miles (20 km) in altitude, the gas formed small droplets of concentrated sulfuric acid, like those found in Venus' clouds, which then spread around Earth. The droplets created a

haze layer that reflected some of the Sun's rays back into space, cooling the whole planet by about 1° Fahrenheit (0.5° Celsius).

However, the new work on the evaporation of sulfuric acid on Venus suggests that such attempts at cooling our planet may not be as successful as first thought. We do not know how quickly the initially protective haze will be converted back into gaseous sulfuric acid — this is transparent and so allows all the Sun's rays through.

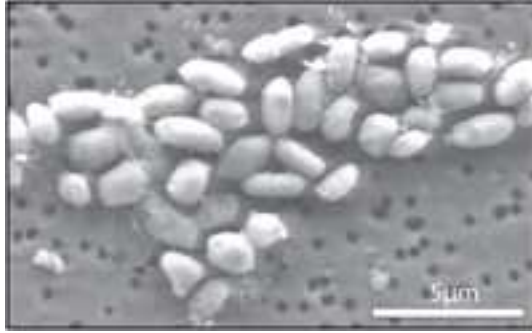
"We must study in great detail the potential consequences of such an artificial sulfur layer in the atmosphere of Earth," said Jean-Loup Bertaux from the University of Versailles-Saint-Quentin, France. "Venus has an enormous layer of such droplets, so anything that we learn about those clouds is likely to be relevant to any geo-engineering of our own planet." In effect, nature is doing the experiment for us, and Venus Express allows us to learn the lessons before experimenting with our own world.

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Deadly Arsenic Breathes Life into Organisms—Dec 2/10 credit NASA Headquarters

NASA-funded astrobiology research has changed the fundamental knowledge about what comprises all known life on Earth. Researchers conducting tests in the harsh environment of Mono Lake in California have discovered the first known microorganism on Earth able to thrive and reproduce using the toxic chemical arsenic. The microorganism substitutes arsenic for phosphorus in its cell components. "The definition of life has just expanded," said Ed Weiler, NASA's associate administrator for the Science Mission Directorate at the agency's headquarters in Washington, D.C. "As we pursue our efforts to seek signs of life in the solar system, we have to think more broadly, more diversely and consider life as we do not know it." This finding of an alternative biochemistry makeup will alter biology textbooks and expand the scope of the search for life beyond Earth.

Image of GFAJ-1 grown on arsenic



Carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur are the six basic building blocks of all known forms of life on Earth. Phosphorus is part of the chemical backbone of DNA and RNA, the structures that carry genetic instructions for life, and is considered an essential element for all living cells. Phosphorus is a central component of the energy-carrying molecule in all cells (adenosine triphosphate) and also the phospholipids that form all cell membranes. Arsenic, which is chemically similar to phosphorus, is poisonous for most life on Earth. Arsenic disrupts metabolic pathways because

chemically it behaves similarly to phosphate. "We know that some microbes can breathe arsenic, but what we've found is a microbe doing something new — building parts of itself out of arsenic," said Felisa Wolfe-Simon, a NASA Astrobiology Research Fellow in residence at the U.S. Geological Survey in Menlo Park, California, and the research team's lead scientist. "If something here on Earth can do something so unexpected, what else can life do that we haven't seen yet?"

The newly discovered microbe, strain GFAJ-1, is a member of a common group of bacteria, the Gammaproteobacteria. In the laboratory, the researchers successfully grew microbes from the lake on a diet that was very lean on phosphorus, but included generous helpings of arsenic. When researchers removed the phosphorus and replaced it with arsenic, the microbes continued to grow. Subsequent analyses indicated that the arsenic was being used to produce the building blocks of new GFAJ-1 cells.

The key issue the researchers investigated was when the microbe was grown on arsenic, did the arsenic actually become incorporated into the organisms' vital biochemical machinery, such as DNA, proteins, and the cell membranes. The group used a variety of sophisticated laboratory techniques to determine where the arsenic was incorporated. The team chose to explore Mono Lake because of its unusual chemistry, especially its high salinity, high alkalinity, and high levels of arsenic. This chemistry is in part a result of Mono Lake's isolation from its sources of fresh water for 50 years. The results of this study will inform ongoing research in many areas, including the study of Earth's evolution, organic chemistry, biogeochemical cycles, disease mitigation and Earth system research. These findings also will open up new frontiers in microbiology and other areas of research. "The idea of alternative biochemistries for life is common in science fiction," said Carl Pilcher, director of the NASA Astrobiology Institute at the agency's Ames Research Center in Moffett Field, California. "Until now, a life-form using arsenic as a building block was only theoretical, but now we know such life exists in Mono Lake."

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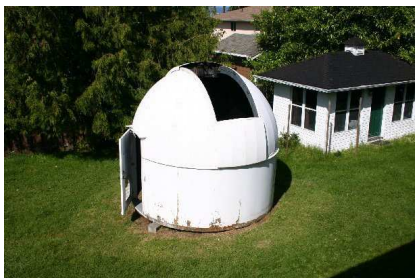
7. Buy and Sell

Here's your chance to clean out the closet and find a home for your slightly used treasures. Post your buy and sell items by emailing the [Editor](#) with your details.

We also want to bring your attention to a FREE Telescope! You read it right; Alex Haddad at the Science Department at the Cowichan Secondary has this to offer. **FREE TO A GOOD HOME** If you are interested in owning this scope, contact Alex at ahaddad@sd79.bc.ca



DEAL PENDING



Quenneville at (250) 477-2257

George Ball Observatory is looking for a new home
The RASC Society is offering this astronomical observatory at NO COST to a good home.

The building will require a proper concrete foundation and slab. Due to its size and weight a commercial crane and trailer assembly will be required to lift and deliver it to a new site at the new owner's expense. Crane costs and construction work are estimated to be in the \$2,500 to \$3,000 range. Serious inquiries are welcomed. For an appointment to view please contact : Bruno

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8. Ask an Expert

Have you been thumbing through the Astronomy or Sky and Telescope magazine and have some questions on the latest and greatest in astronomy gear? Or maybe you're narrowing down your search for just the right telescope and want to know the difference between Dobsonians, Schmidt-Cassegrains, Reflector and Refractors. Well wonder no more, email [Brian Robilliard](#) our resident expert to get the "inside scoop" on what's hot or not in astronomy gear.

Are you new to astronomy? Want to know the how to find objects in the sky? Or just wondering what that bright object in the evening sky is? Well wonder no more; email [Byron Thompson](#) our Editor and master of Astronomy 101 basics.

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9. Kids Korner

For the younger astronomers. We want your input on what you would like to see happening at the club. Tell us a bit about yourself and why you love astronomy. Email the [Editor](#) with your submissions. For the older folks, if you have any ideas that might spark the interest of a young upcoming astronomer, please send your submissions to the editor.

Astronomy Anagram

New from Enchanted Learning; an astronomy Anagram.

What to do: Draw a line from each word to its anagram. Enjoy

Earth	toaster
planet	heart
rotates	comics
space	platen
star	paces
cosmic	rats
nebula	unstops
lunar	unable
solar	ulnar
sunspots	orals

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10. The Sky This Month

By Bryon Thompson

Observing Site: Duncan, **48.783°N, 123.700°W**

When the skies clear and the winter precipitation allows, December promises to be a special month with some very cool (please excuse the pun) viewing to end the year. Our month opens with little Mercury at greatest elongation of 21° on the **1st**. You'll need an unobstructed view to the southwest to see this little planet 30 minutes after sunset as it is only 6° or about a fists width above the horizon. By the time the month is half over the little innermost planet has all but disappeared. Mercury appears again in the last week of December but in the morning sky. On the last day of the year Mercury can be seen 30 minutes before sunrise 10° above the south eastern horizon.

The incredibly bright Venus rises shortly before 4:00am all month in the south east. It reaches it's brightest in December at magnitude -4.9 and is now 25 times brighter than any star in the winter sky. Both Venus and the moon share the morning spot on the **2nd** and again on the **31st** and create a nice photo opportunity at these times.

Another bright performer is Jupiter. The big gas giant can be seen all month high in the southern sky shining at magnitude -2.5 . A telescope reveals some of the spectacular details this planet has to offer. Watch for the possible return of the South Equatorial Belt. Scientists believe that it may reappear at any time and are eager to have amateurs keep a close eye on the planet to hopefully get some images of the great return. Along with some great views of the four big moons of Jupiter; Io, Europa, Ganymede and Callisto another viewing opportunity presents itself this month. Jupiter reaches Quadrature on the **15th**. This is when the big planet and the Earth and the sun form a 90° angle relative to each other. During this time the planet appears slightly softer on the eastern side. The reason for this anomaly is that during Quadrature we can almost see the shadowed side of the planet and the result is the faded eastern limb.

Jupiter can be used to help locate Uranus. The two planets start the month barely 3° apart and by the end of the month Jupiter's easterly motion has brought it to a little more than 1° away from the distant gas giant. You'll have to look for a faint blue-green dot almost 2000 times dimmer than bright Jupiter but start your search with a pair of binoculars as Uranus glows at magnitude 5.8, well within the range of a decent pair of binos. Once you spot the planet you can switch to a telescope to see its 3.5" disc or if you are in an area with dark skies, you should be able to see it with the naked eye.

Neptune is a little harder to spot. Our outermost planet lies in the background stars of Capricornus. Find Delta Capricornii which is brightest star in Capricornus and then look 3° or about 6 moon widths to the north east to see 5th magnitude Mu Capricornii. Neptune is found 0.2° north of this star. Because Neptune's magnitude is just below naked eye visual range you'll need binoculars or a telescope to spot its magnitude 7.8 blue grey disc.

Saturn is also a good performer this month for those with telescopes. The ringed giant rises in the east and by the time Jupiter is too low in the west for a good look Saturn takes center stage. The planet shines at magnitude 0.8 with a warm yellowish glow. The rings are tilted 9° to our line of site and continue to open another degree by month's end. A clear night and a telescope will easily reveal the Cassini division; the dark space between the outer A ring and the bright B ring.

The night of the **13/14th** should bring a good look at the Geminid meteor shower if the weather co-operates. This shower usually produces 100-120 meteors per hour. The radiant is found just south of the bright twin star Castor in the in the constellation Gemini, hence the name. Although the peak is in the early hours of the **14th** there are usually a fair number of meteors to see on the day before and the day after the Geminid peak. Good luck!

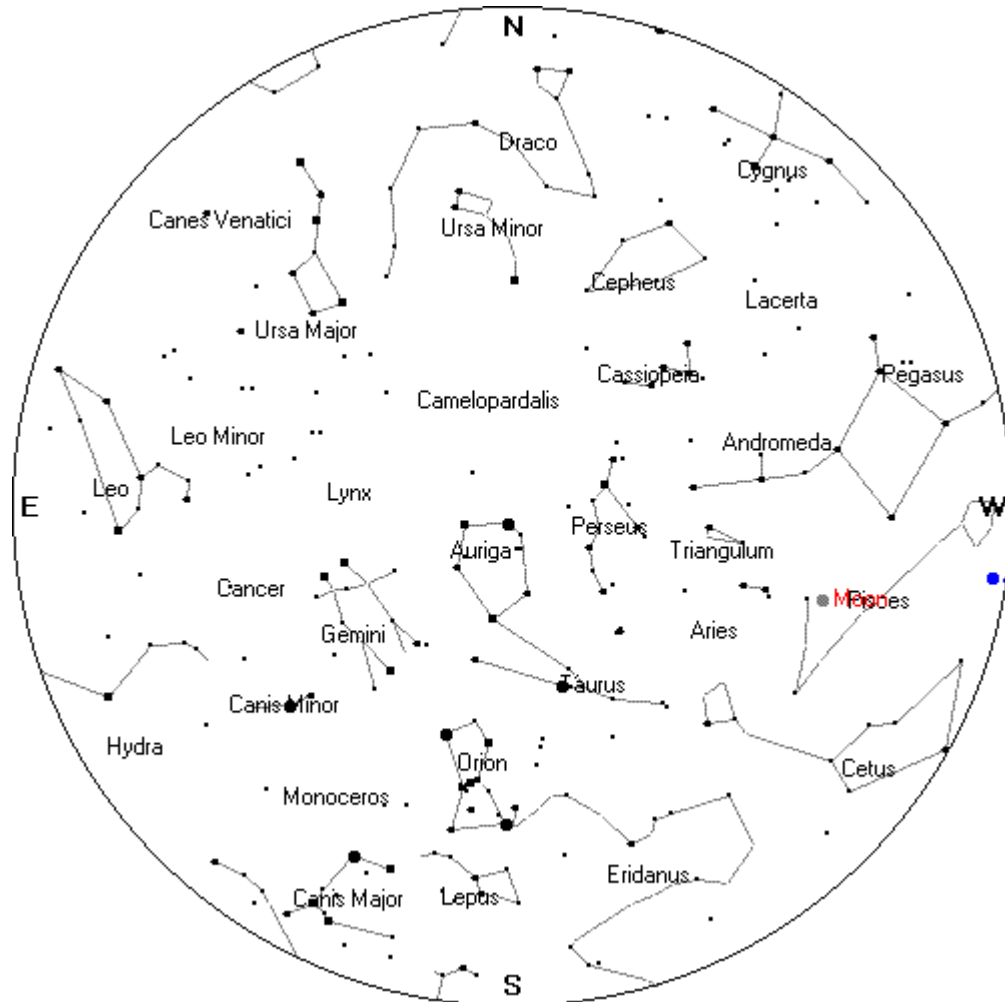
The winter solstice occurs on the **21st**. If the longest night of the year is clear it should also be the darkest night as well, at least for a few hours. The full moon will treat us to a full lunar eclipse on the evening of the 20th and the early hours of the **21st**. The eclipse starts at **10:33pm PST** on the **20th** reaching totality a couple hours later at **11:41pm PST**. The moon will be in the Umbra or the darkest part of the earth's shadow for the next 72 minutes. Will you be attempting to keep the sun going during this time? It is interesting to note that past cultures around the globe had various ceremonies to keep a small piece of the sun burning during this longest night. The burning of the Yule log is one tradition that has its roots in this belief. The hope was that the effort of holding on to the light during the longest winter night would help the sun to return once again, making the days longer. I wonder what

our past stargazers would have thought if on such a night of all encompassing darkness the moon too went dark and turned the colour of old blood. If you want to see what that was like, this month is your chance. If you miss this rare eclipse paired with the solstice you'll have a chance to see another lunar eclipse again next December. But it will not occur on the solstice. So get out there and take a friend or a neighbour and share something truly extraordinary. All the best this holiday season everyone.

Until next time remember ... Astronomy is looking up!

Dec 1	08:00 AM PST	Mercury at greatest elongation (21°)
Dec 2	Early AM	Moon and Venus Share Morning Sky
Dec 5	09:36 AM PST	New Moon
Dec 13	12:34 AM PST	First Quarter Moon
Dec 14	01:30 AM PST	Geminid Meteor Shower Peaks
Dec 15	Evening	Jupiter Reaches Quadrature
Dec 20	10:33 PM PST	Lunar Eclipse Starts
Dec 21	12:13 AM PST	Full Moon
Dec 21	03:38 PM PST	Winter Solstice
Dec 27	08:18 PM PST	Last Quarter Moon
Dec 31	Early AM PST	Moon and Venus Share Morning Sky

Sky Chart —Here's your mid-December midnight sky chart. In order to use the sky chart properly remember the centre of the chart is the sky directly above your head (or the Zenith). Turn the chart so that the direction you are facing is at the bottom of the chart (or pointed toward your toes). The star field directly in front of you will be between the bottom of the chart and the centre.



SkyChart Courtesy of Heavens-Above