"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

SEPTEMBER 2017

This month's Centre meeting
This will take place on **Monday 18 September** at the **Catholic Hall** starting at **19.00**. The speaker, Assistant Professor Michelle Cluver from UWC will be talking on "Hidden features: discovering space in a reluctant Universe' See below for more details.

Change of meeting venue A reminder that the Scout Hall is no longer the venue for Centre meetings. These now take place at the neighbouring **Catholic Church Hall** (the venue for U3A meetings). The Catholic Hall is in the block on the mountain side of the Scout Hall. Parking is available to the side of the building or across the road.

WHAT'S UP?

A bird of prey Low to the north-west, Vega (Alpha Lyrae) in Lyra (the lyre) can be found during this month. The fifth brightest star, it is 25 ly away. Visible only north of 51 degrees South, it always appear low to the north from the Cape south coast. Its Arabic name means 'swooping eagle' or 'vulture'. This hot blue-white star forms the right-angled corner of the northern summer triangle. The other corners are formed by Altair (Aquila) and Deneb (Cygnus). Vega's position is over particular interest to astronomers. Earth's pole 'wobbles' over time, a full precession taking around 25,000 years. This means that, over time, the position of stars, as seen from Earth, changes. Vega is important because, in around 12,000 years it will replace Polaris as the North Star. Although only visible through a telescope, Lyrae also contains the attractive Ring Nebula (M57). The smoky ring which surrounds the small core of this planetary nebula is slowly expanding is its gases dissipate into space. Unlike nearby Vega, the Ring Nebula is around 2,000 ly away.

LAST MONTH'S ACTIVITIES

Monthly centre meeting The presenter on 21 August was Dr Amanda Sickafoose, astronomer and Head of Instrumentation at the SAAO in Cape Town. Her excellent presentation, titled 'Exploring the outer solar system with stellar occultations' covered recent findings regarding the nature of several classes of the small objects which orbit beyond the asteroid belt. After outlining the overall structure of the outer solar system, Amanda looked more closely at the wide range of, often unexpected, features and characteristics which both telescopes and space probes have found on these small, distant bodies eg Pluto. Then she addressed findings from stellar occulations (the passage of a distant object in front of an even more distant star). The effects of their passing on the

light curves of the stars provide astronomers with new, information on the nature of the objects incl their size, density, presence of an atmosphere.

She focused particularly on her research into occulations by Centaurs, a group of small objects with unstable orbits found mostly between Jupiter and Neptune, which are not either asteroids or comets. Using examples of the light curves made during her, and others, occultation studies, she demonstrated how they were able to identify the presence of rings round larger Centaurs as well as the presence of jets and comas in their atmospheres. Finally, Amanda explained the importance to astronomers of the scheduled flyby by New Horizons of the very small Kuiper Belt object MU69 in 2018. Overall, she demonstrated how dynamic the outer areas of the solar system are and how, apart from slowly revealing their own characteristics via occultation studies and flybys, their behaviours enable researchers to make predictions eg the posited presence of another planet in the solar system.

Interest groups

Cosmology 22 people (14 members, 8 visitors) attended the meeting on 7 August. They watched another two episodes in the DVD series: Particle Physics for Non-Physicists: a Tour of the Microcosmos' by Prof Steven Pollock, Professor of physics at the University of Colorado at Boulder. These episodes were Lecture 13: 'Symmetry and conservation laws' and Lecture 14: 'Broken symmetry, shattered mirrors'.

Astro-photography At the meeting on 14 August, members considered nebulosity in processing their own astro-images.

Other activities

Educational outreach

Hawston Secondary School Astronomy Group Weekly meetings continued during August.

Lukhanyo Youth Club No meetings are being arranged while members are attending a series of workshops being run by SANSA staff during 2017.

THIS MONTH'S ACTIVITIES

Monthly centre meeting

This month's meeting will take place on **Monday 18 September** at the **Catholic Hall** starting at **19.00**. The speaker is Assistant Professor Michelle Cluver, Associate Director of the Inter-University Institute of Data Intensive Astronomy (IDIA), and an NRF Research Career Advancement Fellow at the University fo Western Cape. She also acts as Honorary Research Associate at the Iziko Planetarium in Cape Town. She is an active member of several international collaborations, researching the mid-infrared properties of galaxies observed by the WISE space telescope, particularly those in groups. Her first post-doctoral position was at the California Institute of Technology using the Spitzer Space Telescope to study the evolution of galaxies in compact groups. Following this she took up an ARC Super Science Fellowship at the Australian Astronomical Observatory in Sydney. Her topic is "Hidden features: discovering space in a reluctant Universe'

There is an entrance fee of R10 per person for members, R20 per person for non-members, and R10 for children, students and U3A members.

Interest group meetings

The **Cosmology** group meets on the first Monday of each month at 19.00. This month's meeting will take place on **4 September** at the **Catholic Hall**, starting at **19.00**.

Attendees will watch the next two episodes in the DVD series: Particle Physics for Non-Physicists: a Tour of the Microcosmos' by by Prof Steven Pollock, Professor of physics at the University of Colorado at Boulder. The content will be Lecture 15 'The November revolution of 1974' and Lecture 16 'A new generation'.

There is an entrance fee of R10 per person for members, R20 per person for non-members, and R10 for children, students and U3A members. For further information on these meetings, or any of the group's activities, please contact Pierre Hugo at pierre@hermanus.co.za

Astro-photography This group meets on the second Monday of each month. The next meeting is on **11 September**. Members will continue to work on processing their own astro-images.

To find out more about the group's activities and the venue for particular meetings, please contact Deon Krige at astronomy.hermanus@gmail.com

Hermanus Youth Robotic Telescope Interest Group Organisers are progressing with work towards accessing images which learners can start processing with suitable software.

For further information on both the MONET and Las Cumbres projects, please contact Deon Krige at deonk@telkomsa.net

FUTURE ACTIVITIES

Possible trips for 2017 are being planned. Details will be circulated to members when arrangements have been made.

2017 MONTHLY MEETINGS

Unless stated otherwise, meetings take place on the **third Monday** of each month at the **Catholic Church Hall**, beginning at 19.00.

18 Sept	'Hidden features: discovering space in a reluctant Universe' Presenter: Dr Michelle Cluver, UWC
16 Oct	'Jupiter: the neighbourhood bully' Presenter: Jenny Morris, Committee member
20 Nov	'The mystery of the black aurora' Presenter: Amore Nel, SANSA
11 Dec	Xmas party

ASTRONOMY EDUCATION CENTRE AND AMPHITHEATRE (AECA)

Consideration of the planning application by the Council of Overstrand Municipality is still awaited. Hopefully, the additional information requested by staff will enable this to take place within a month or two. In the meantime, the Friends of the Observatory pledge fund continues to be an important source of funds to cover associated costs.

The **Friends of the Observatory campaign** was launched several years ago when preliminary work began on plans to construct an astronomical observatory in Hermanus. Over the years, members have been very generous, for which we are deeply grateful. It may seem logical to assume that, now money has been awarded by the National Lotteries Board, pledge monies are no longer needed. Unfortunately, that is not the case. NLC funds can only be used once the plans have been formally approved by the Municipality, something which is still awaited.

We would, therefore, be very grateful if members could either continue to contribute to the campaign or start becoming a contributor. Both single donations and small, regular monthly donations, of any amount, are welcome. Contributions can take the form of cash (paid at meetings), or online transfer, The Standard Bank details are as follows:

Account name – Hermanus Astronomy Centre
Account number – 185 562 531
Branch code – 051001

If you make an online donation, please include the word 'pledge', and your name, unless you wish to remain anonymous.

ASTRONOMY NEWS

Breakthrough Starshot takes its first step toward interstellar travel 2 August: The first big step to making humans an interstellar species is underway. Breakthrough Starshot wants to accelerate small spacecraft to a good fraction of the speed of light to send probes to a nearby star in a human lifetime. Last week, the company announced that the first tests of its spacecraft had taken place when a few single-circuit board Sprite crafts hitched a ride on a satellite launch.

Breakthrough Starshot is aiming for the nearby Alpha Centauri system: Pictured here, Alpha (left), Beta (right), and Proxima (circled in red) Centauri. Skatebiker at English Wikipedia

The Sprites seemed to be functioning relatively well for an initial flight. They experienced some communications hiccups, meaning the communications equipment may need some work over time. However, this is just a small hiccup - the Sprites are just prototypes of the 'StarChips' which will eventually launch several decades from now. The goal is to strap a microweight space probe onto a star sail, then fire a laser at it repeatedly. This will accelerate it to around 20 percent the speed of light. Starshot plans on sending several at a time, increasing the odds that one or more will make it to their final destination in the Alpha Centauri system.

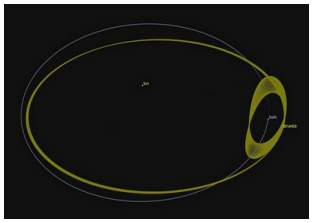
First, the small chips will need to be packed with a camera, a power source, a transmitter, and more; this process is still under development. Still, the Sprites are an important first step. The prototype has been built. Now, it is just time to scale it up so we can head to the stars. By: John Wenz

Total Eclipse of 2016 HO3? 4 August: Earth has a second moon. "Our calculations indicate 2016 HO3 has been a stable quasi-satellite of Earth for almost a century," a June 15, 2016, NASA release attests, "and it will continue to follow this pattern as Earth's companion for centuries to come." Earth's mini-moon was first spotted on 27 April 2016, by the Pan-STARRS1 asteroid survey telescope on Haleakala, Hawaii.


This artist's concept of a near-Earth object could look like our mini-moon, 2016 HO3. NASA/JPL-Caltech

2016 HO3 seems like old news now, as Earth's original Moon - the OG of asteroids - has captured all astronomy headlines here of late. On 21 August the Moon will pass between the Earth and Sun, causing what Dr. Thomas Zurbuchen, head of the NASA Science Mission Directorate, believes will be the most-viewed total solar eclipse in history. As eclipse fever sweeps the United States, some wonder when 2016 HO3 will get more love. Will eclipse chasers everywhere ever flock to see a total eclipse from Earth's mini-moon?

To quote NASA, "No." "It's far too small," explains Paul Chodas, manager of NASA's Center for Near Earth Object Studies at the Jet Propulsion Laboratory. Of course, actual size is not the only factor in an eclipse. The Moon is much smaller than the Sun, but on 21 August, that will not stop its apparent size from completely covering the other, thanks to their relative distances from Earth.


2016 HO3's orbit is a strange one. As it orbits the Sun, it also appears to orbit the Earth. While this orbit is stable for centuries, it won't remain stable indefinitely, dubbing HO3 a "quasi-satellite" rather than a permanent one, like the Moon. NASA/JPL-Caltech

So once positioning is added in the mix, how much larger would 2016 HO3 need to be? "A lot larger," Chodas says. Like the Moon, 2016 HO3 does not always orbit directly between Earth and the Sun. "2016 HO3 is actually in a heliocentric orbit rather than a geocentric orbit," says Dr. Alex King, chair of physics and astronomy at Austin Peay State University. No matter what size 2016 HO3 is or how often it comes between Earth and the Sun, King says the asteroid's orbit changes the vocabulary astronomers use: "If it were to appear to pass in front of the Sun relative to the Earth, astronomers would more properly classify it as a solar transit."

Also, this orbit is generally above or below the ecliptic plane. "Once each orbit, it overtakes Earth," King explains, "and once each orbit the reverse happens (Earth overtakes HO3). For a transit to occur, it would have to happen during the overtaking process." The next time this happens is during the years 2312 and 2313. So even if it were big enough, our favourite mini-moon still would not get a lot of chances.

When it does transit, Chodas says, "The asteroid will be about 15 million kilometres from our planet." That's 39 times the distance between Earth and the Moon, the latter of which Chodas says "is just large enough." So to cause a total solar eclipse, Earth's mini-moon would need to be 39 times larger than the real deal. He continues, "The Moon is 3,475km in diameter, which means the asteroid would have to be 39 times 3,475 or about 135,400km in diameter. That's very large, almost the diameter of Jupiter (143,000km)." In

comparison, 2016 HO3 is around 0.05km wide.

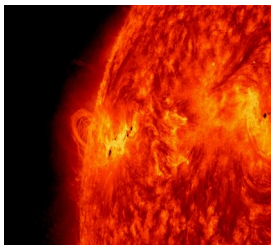
"The asteroid would have to be 2.7 million times bigger than it actually is to cause an eclipse! Or, if it stayed its original size, and just moved close enough to eclipse the Sun, it would have to be 2.7 million times closer, or only 5 kilometres above the observer," Chodas says. "In other words, it would have to be flying through our atmosphere lower than a typical jetliner." By: Teresa Bell

New Horizons may visit twice the object for the same price 4 August: New Horizons is getting the ultimate two-for-one deal. The intrepid craft, which flew through the Pluto system in 2015, is en route to 2014 MU69, an icy remnant from the solar system's formation that lives in the Kuiper Belt. While initially thought to be a chunk of ice less than a few dozen miles in size, a recent occultation event has revealed that MU69 may be even weirder.


2014 MU69 is New Horizons' next target. Now, data indicate it could be a contact binary - two objects orbiting each other so closely that they touch. NASA/JHUAPL/SwRI/Alex Parker

The object appears to have an odd shape, based on the occultation data (taken when an object passes in front of a background star). In a press release, NASA officials said that it is either football shaped or, more intriguingly, a type of object called a contact binary. A contact binary is composed of two objects close enough that they actually touch in an orbital dance around each other that leaves them relatively intact. The comet 67P explored by ESA's Rosetta probe is believed to be a contact binary. We will find out for sure in 2019, when New Horizons flies by the object - or objects. By: John Wenz

The Sun's core rotates faster than its surface 8 August: The Sun is the closest star to Earth at a mere 150 million kilometres away. Despite the fact that you can feel its heat on your skin and its disk appears as large as the Full Moon in the sky, the Sun still largely remains an enigma. For all that astronomers have learned about our planet's nearby host star, many questions and uncertainties remain. Now, though, one of those questions has been answered: the rotation rate of the Sun's core.


The Solar and Heliospheric Observatory captured this image of the Sun in 2013. After studying our star for more than 20 years, SOHO has now allowed astronomers to measure the rotation rate of its core. NASA/SDO

An international team of astronomers using the Global Oscillations at Low Frequencies (GOLF) instrument aboard the ESA/NASA Solar and Heliospheric Observatory (SOHO) satellite has< for the first time, accurately measured the speed at which the Sun's core rotates. That rotation rate is once per week.

The SOGO satellite has been studying the Sun for more than two decades. Its GOLF instrument records oscillations, which are wavelike changes in the gases of the Sun's atmosphere that reveal information about its inner structure. GOLF records these changes at the level of the Sun's surface every 10 seconds; solar astronomers then look at the signals over time to infer details about the activity deeper within the star. Studying the Sun this way is similar to studying the way waves caused by earthquakes propagate through the Earth, which tells scientists about the structure that lies beneath our feet.

To study the Sun's core, the team examined an aspect of the oscillations visible at the Sun's surface that reflects the time it takes for waves to travel through the centre of the Sun. They found that the thermonuclear core rotates once per week, which is nearly four times faster than the rotation rate of the middle and outer layers of the star. Using this new information, astronomers will be able to refine their models of the Sun's current and past behaviour, as well as determine more accurately its composition and the structure of its layers and magnetic field. By: Alison Klesman

Is this the first picture of an eclipse? 9 August: There are so many photographs of eclipses, and while they are all amazing to see, this one may be the most special. Emeritus J. McKim "Kim" Malville," professor of astrophysical and planetary sciences at the University of Colorado Boulder, said there may be a very old symbol of a total solar eclipse in New Mexico's Chaco Canyon.


The petroglyph shows a circle with loops around the edges, which may represent the Sun's corona during an eclipse. Courtesy of University of Colorado

The petroglyph, a picture carved into a rock known as Piedra del Sol in the canyon, shows a circle with looping lines coming off of it, similar to the Sun's corona. The petroglyph was first discovered during a CU Boulder school trip and is believed to have been a representation of the 11 July 1097 total solar eclipse. **"**To me it looks like a circular feature with curved tangles and structures," Malville said. "If one looks at a drawing by a German astronomer of the 1860 total solar eclipse during high solar activity, rays and loops similar to those depicted in the Chaco petroglyph are visible."

Malville worked with José Vaquero, a professor at the University of Extremadura in Cáceres, Spain, to study the petroglyph in relation to the 1097 eclipse using three different sources. The first was using ancient tree rings that were dated back to thousands of years ago. The rings also have traces of isotope carbon-14, which can be correlated back to solar activity at the time. Less carbon-14 means more sunspots, and sunspots are evidence of high solar activity. The second method the pair used was naked-eye observations of sunspots, and the third method was studying data from northern

Europeans about 'auroral nights', or the northern nights, which is another sign of high solar activity.

Piedra del Sol also has a spiral petroglyph that Malville said marks sunrises about 15 days before June solstice as well as a hollowed-out bowl on the east side where Chacoans left offerings. There are two other astronomical art pieces on rocks Chaco Canyon: what is believed to be the A.D. 1054 supernova and a comet, possibly Halley's Comet.

By: Nicole Kiefert

System of super-Earths discovered around a nearby star 14 August: If you look up at Earth's night sky and find the constellation Cetus - it looks something like a sea monster - you may also notice a rather average looking star called Tau Ceti. It is slightly smaller than our Sun and sits just 12 light years from Earth.Now, a new study suggests that the system has at least four planets, and two of them orbit on the edge of their habitable zones — the region where liquid surface water might exist. All four are likely super-Earths, and some could potentially even be as big as Neptune.

Astronomers still don't know what life might be like — or if it could exist — on planets near twice the size of our own. Would these worlds be toxic wastelands or ocean oases? NASA/JPL-Caltech/Ames

Tau Ceti's proximity to Earth has made it a prime target for planet hunters since 1988. However, the system is not easy to study. There is a vast amount of dust, and astronomers have not seen any planets pass in front of Tau Ceti, producing a telltale dip in light called a transit. So, researchers have instead relied on the radial velocity method, which can reveal minute wobbles as planets pull on their host star. In the past, astronomers have claimed to find super-Earths and even mini-Neptunes in the Tau Ceti system.

The four planets they found orbit Tau Ceti in 20, 49, 160, and 642 day orbits. All four are super-Earths, with the inner two (Tau Cetis g and h) at least roughly twice as massive as Earth. The outer two are both some four times bigger than Earth. Fabo Feng, a research fellow at the University of Hertfordshire and lead author on the study, says that Tau Ceti is a tempting target because itis more like our Sun than other nearby stars, like Proxima Centauri - Earth's nearest star. Last year, scientists made global headlines when they discovered Proxima b, an Earth-sized planet. However, Proxima Centauri is a red dwarf star, which are prone to extreme flares that might extinguish life. Tau Ceti may be more stable."If the planets are confirmed to be habitable, Tau Ceti may also be a target for manned interstellar travel, as seen in science fiction," Feng says.

The two new planets orbit in 20 and 49 days, respectively, while the others they confirmed are at 160- and 642-day orbits. Previous studies have also suggested planets at 14-, 35-, and 94-day orbits. This could mean that Tau Ceti has seven or more planets. The astronomers even spotted a potential planet in a 1,000 day orbit, but the signal was confusing and could not be confirmed or rejected. "Still, it may yet prove to be real," UC Santa Cruz astronomer Steve Vogt, a co-author on the study, says of that particular world.

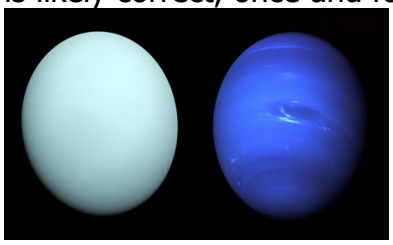
"We have certainly not ruled it out here. We merely point out its appearance, and give all appropriate caveats about its reality."

However, the study also could not detect the previously announced 14-day planet or the 35-day one, and found only weak evidence for the 94 day signal. Scientists say one of those previously suspected planets might have been caused by activity from the star itself. "There are weak signals corresponding to these three signals," Feng says. "But they either vary with time or are not significant (enough) to be confirmed as planet candidates. So we only report four planets."

There is also the issue of habitability. The 160-day planet is at the inner edge of the habitable zone - like Venus - while the 642-day planet is at the outer edge and could be a cold, Mars-temperature zone planet. Also, since the system is jam packed with debris, space rocks likely strike the planets 10 times more often than Earth gets hit.

We are thus left with a puzzle of a system. There is one world that may be too hot, another that may be too cold, but both could somehow be both just right if their orbit is slightly eccentric. In addition, those planets are likely rocky, but may not be, and if they are, may experience daily violent impacts. There are at least four but maybe seven planets there, or six and a solar storm. There may be others lurking somewhere, including ones closer to Earth in size. There's a world of possibilities in these worlds - if we can just sort through the mess of conflicting data first. By: John Wenz

Uranus and Neptune: Cloudy with a chance of diamonds 23 August: On Earth, we experience rain composed of liquid water. On Titan, it rains liquid methane, while, on Uranus and Neptune, it rains solid diamonds. For the first time, researchers have now simulated and observed this process here on Earth, proving that this long-held assumption is likely correct, once and for all.



Uranus and Neptune experience diamond rain deep within their atmospheres — and now scientists on Earth have watched this process occur in the lab. NASA/JPL-Caltech (Left, Uranus); NASA (Right, Neptune)

The work combined a high-powered optical laser with the X-ray free-electron laser at SLAC National Accelerator Laboratory, the Linac Coherent Light Source (LCLS). The LCLS creates X-ray pulses that last a million-billionths of a second, allowing for ultrafast high-precision monitoring of processes that occur all the way down to the scale of atoms. As a result, the researchers were able to watch tiny diamonds form as shock waves passed through plastic, offering a peek at processes that take place in planetary atmospheres on a much grander scale.

The experiment focused on inducing shock waves in a plastic material called polystyrene, which contains hydrogen and carbon - two elements found in abundance inside Uranus and Neptune. According to theory, methane (four hydrogen atoms and one carbon atom) inside the planets' atmospheres forms hydrocarbon chains that in turn form diamonds in response to the right temperature and pressure. This occurs more than 8,000 kilometres

beneath the planets' surface. There, the diamonds precipitate out and sink deeper into the atmosphere, a 'diamond rain'.

Though this has been assumed to be the case for decades, the exact process has never been observed in experiments on Earth before now. Some previous experiments failed because the pressures and temperatures inside the atmospheres of these planets cannot be created in the lab for long, and without the ability to record data at the speed afforded by the LCLS, any transitions were missed. Other experiments produced graphite or diamond, but were conducted at lower pressures or required the introduction of additional materials.

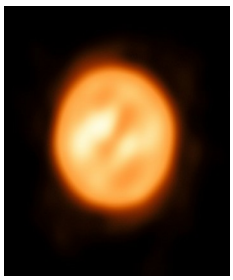
Using an optical laser, the researchers induced one, then a second shockwave in a polystyrene sample at the temperatures and pressures found within Uranus and Neptune. As they probed the material with 50-femtosecond X-ray pulses (a femtosecond is a quadrillionth of a second), they watched the carbon atoms in the plastic become part of tiny diamonds (called nanodiamonds) where the shockwaves overlapped, creating areas of higher pressure.

"For this experiment, we had LCLS, the brightest X-ray source in the world," said Siegfried Glenzer, professor of photon science at SLAC. "You need these intense, fast pulses of X-rays to unambiguously see the structure of these diamonds, because they are only formed in the laboratory for such a very short time." Dominik Kraus of Helmholtz Zentrum Dresden-Rossendorf and lead author on the paper, added, "When I saw the results of this latest experiment, it was one of the best moments of my scientific career."

This work will benefit not only planetary scientists seeking to understand the conditions inside our own local ice giants, but those studying extrasolar planets as well. Learning more about how elements combine and precipitate out of atmospheric layers allows researchers to create better models for a deeper understanding of these planets, including not only their weather, but their sources of energy as well. Diamond rain could create friction as the diamonds sink deeper within the atmosphere, generating heat and affecting atmospheric circulation and other conditions. "We can't go inside the planets and look at them," Kraus said, "so these laboratory experiments complement satellite and telescope observations."

The nanodiamonds resulting from this experiment could have other applications closer to home as well, such as use in the medical and technology industries. While such nanodiamonds can be produced in explosions, manufacturing them with lasers could be a cleaner alternative. By: Alison Klesman

Astronomers have just mapped the surface of Antares 25 August: When you look up into the night sky, you can spot thousands of stars from a dark location on a given night. Those stars only appear as pinpricks of light to the human eye and, unfortunately, they look much the same to advanced telescopes as well. While nebulae and clusters can span hundreds of light-years, a single star alone is quite small. In the past, this left astronomers with but one star whose surface could be studied in any real detail: the Sun. However, a team of astronomers has combined three telescopes to map the surface of another star: the red supergiant Antares.


Astronomers have mapped the surface of the star Antares in unprecedented detail, producing the best image of a star's surface to date other than our Sun. ESO/K. Ohnaka

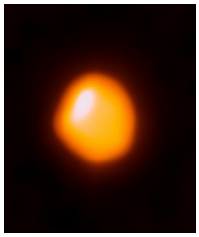
Their work, utilises the European Southern Observatory's Very Large Telescope Interferometer (VLTI) in Chile to create the best yet image of the surface of a star that is not our Sun. The data was taken in near-infrared light with the VLTI's AMBER instrument to achieve a resolution seven times smaller than the star's angular diameter and almost 12 times smaller than its full atmospheric extension. As a result, the team was able to measure the speed of gas moving across the face of the star, a feat that has only ever been achieved for our Sun before now.

The results show that Antares' atmosphere contains several clumps of gas and extends farther from the star than expected, nearly two times the star's radius. Convection alone, which is the rising of heated gas and the sinking of cooled gas, does not explain the extension of the atmosphere to such great distances. This suggests a different, as-yet-unexplained process at work in the massive star's atmosphere.

The astronomers also determined that mass loss experienced by supergiant stars, which often shed several solar masses' worth of material before they explode, is occurring farther from the star than 1.7 stellar radii. When a star goes supernova, that lost mass lights up as the shock wave from the explosion tears through it, leaving behind the stunning supernova remnants we see.

Keiichi Ohnaka, an astronomer at the Universidad Católica del Norte in Chile said, "How stars like Antares lose mass so quickly in the final phase of their evolution has been a problem for over half a century. The VLTI is the only facility that can directly measure the gas motions in the extended atmosphere of Antares - a crucial step towards clarifying this problem. The next challenge is to identify what's driving the turbulent motions."

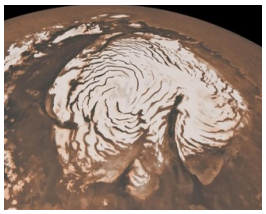
Similar activity has been seen in the atmosphere of the supergiant star Betelgeuse in the constellation Orion, but Antares' atmosphere appears even more turbulent. Betelgeuse was imaged using the Atacama Large Millimeter/submillimeter Array earlier this year


Taken in submillimeter wavelengths with ALMA, this is the highest-resolution image of Betelgeuse ever taken. ALMA (ESO/NAOJ/NRAO)/E. O'Gorman/P. Kervella

Antares is a red supergiant star located about 550 light-years away with a mass of about 12 times that of our Sun. It will someday explode as a type II supernova, and represents a 'prototypical' star of this type. It is often called the 'heart' of the constellation Scorpius,

and is visibly red to the naked eye when spotted in the sky. In fact, the name Antares itself essentially means rival of Ares (or rival of Mars) because the star is easily mistaken for the planet Mars. By: Alison Klesman

Mars has some serious snowstorms at night 25 August: With scientists trying hard to get new a mission on Mars, this recent study might give us information that could impact future travel to the Red Planet.


This new study shows Mars' weather gets more intense after the sun sets. NASA/JPL-Caltech/MSSS

A study found new information about heavy snowstorms on the Red Planet. While researchers knew snow existed there, given the ice caps at its poles and the data from NASA's Phoenix Lander back in 2008, no one predicted how severe Mars' snowstorms are. Instead of the regular weather predicting method using one type of software at a time, the research team ran three popular computer models at once to simulate the climate, calculate the air turbulence, and predict Mars' weather.

Scientists knew Mars has clouds, but they had not considered how important those clouds could be to its larger-scale weather. Using those three models at once showed how clouds absorbing sunlight stay warm during the day and keep the atmosphere stable. However, temperatures inside the clouds drop 4 degrees Celsius per hour after the Sun sets. Hot air then rises from the surface of the planet and combines with the cool air dropping from the clouds, causing wind that hits about 10 meters per second and snow-like ice particles. The simulations also showed water vapour rising inside polar clouds, but they do not know if it stays in the clouds or rises so high it gets lost to space. Researchers say this evaporation process could explain how Mars lost its water in the first place. By: Nicole Kiefert

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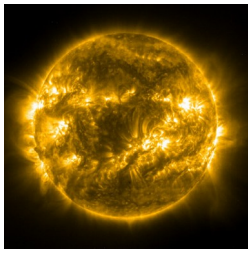
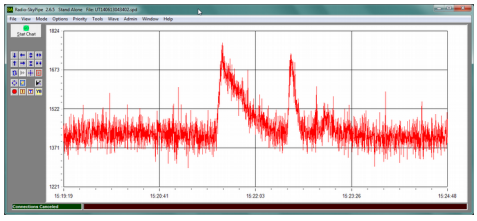
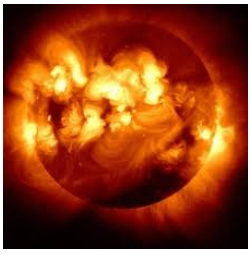
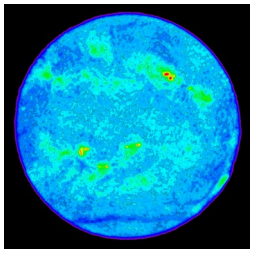
DID YOU KNOW?

The Sun Part 18: **Sunlight 2**


UV image at solar maximum


Solar radio emissions


Infrared image


Radio image

UV radiation Usually invisible to humans, but visible to birds, some fish and insects, this is a major source of energy in sunlight. The hotter a star, the proportionately more ultraviolet it emits. Ultraviolet radiation was discovered by Johann Whilhelm Ritter, in 1801,

when he noticed that invisible rays just beyond the violet end of the visible spectrum darkened silver chloride soaked paper much more quickly than violet light itself.

The Sun emits at all ultraviolet wavelengths, including extreme UV where it crosses into X-rays. Earth's atmosphere absorbs around 77% of the Sun's ultraviolet, including almost all the most dangerous shorter wavelength (UVC) emissions, while allowing UVA and some UVB rays to reach the surface. UVC from the Sun is absorbed by atmospheric oxygen, generating the ozone in the ozone layer. This layer is important in blocking much UVB and any remaining UVC radiation. At the top of the atmosphere, ultraviolet forms around 10% of sunlight, but at ground level, only about 3%.

Visible radiation The Sun is the dominant source of visible light seen by life. The solar corona can be seen in visible light, but it is so faint that it is only observable when the bright photosphere which normally overwhelms it is obscured. eg total solar eclipse, solar shield in images.

Solar visible radiation is the strongest output range of the Sun's total irradiance spectrum, the energy at all wavelengths that falls on a surface in a given time. This is perhaps surprising, because this range is so narrow. Only a very small range of the electromagnetic radiation is visible to humans and human eyes are most tuned to the radiation that the Sun most abundantly emits. This suggests a strong link between solar energy emission and the evolution of life on Earth.

Infrared radiation This was discovered in 1800 by William Herschel. While using a prism to refract light from the Sun, he detected the infrared beyond the red part of the spectrum through an increase in temperature recorded on a thermometer. He called them 'calorific rays'. The term 'infrared' was only adopted as the scientific label in the late 19th century.

Most thermal radiation emitted by objects is in infrared and over half of total energy from the Sun arrives on Earth as infrared radiation. On Earth, with its much lower surface temperatures, almost all radiation is infrared. Only a few eg fire, lightning are hot enough to produce visible energy. Infrared from the Sun accounts for 49% of heating of Earth, the rest being caused by visible light which is absorbed and re-radiated at longer wavelengths.

Microwave radiation This is often regarded as part of radio radiation. The Sun and other astronomical radio sources emit low level microwave radiation which carries information about their make-up.

Radio radiation Although radio wavelengths can be very long, like all other electromagnetic radiation, it travels at the speed of light. In 1867, the Scottish physicist James Clerk Maxwell mathematically predicted their existence as part of his discovery of the wavelike properties of light. Two decades later, in 1887, the German physicist Heinrich Hertz generated radio waves experimentally, showing that they do have the same wave properties as light.

Celestial objects, including the Sun are source of naturally occurring radio waves. This was first discovered in 1932 when American Karl Jansky detected radio waves being emitted from an astronomical object, the Milky Way galaxy. In 1938, during the first radio survey of the sky, American Grote Reber's observations included the Sun, although he did not distinguish the objects he had detected with the first purpose-built radio telescope. The first specific detection of radio waves from the Sun was made by the English physicist Stanley Hey, in 1942 while he was working with radar during World War 2.

Radio waves penetrate through outer layers of solar gas ie the atmospheric chromosphere and corona and can be observed with radio telescopes, which allow 'sight' of objects and features not detectable in visible wavelengths. Because radio frequencies are little affected by Earth's atmosphere, radio telescopes can be Earth-based, although optimally from high altitudes.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.en.wikipedia.org, www.quora.com, www.windows2universe.org, www.universetoday.com, www.solar.physics.montatn.edu, www.missionscience.nasa.gov

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