"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

DECEMBER 2016

2016 Christmas party

This takes place on **Monday 12 December** at the **NG Kerk, Berg St, Onrus** starting at t **19.00**. Come and enjoy a celebration of astronomy in 2016. The cost of R80 per person includes a delicious two course meal, great company, the famous quiz, a reminder of all the HAC has done this year, and stars..... Please bring your own drinks and glasses. **To book a place**, contact Karin de Bruin on 084 305 2096 or at kdb4stars@gmail.copm **by 7 December.** Payment details have been e-mailed to members.

Membership renewal for 2017

The fees for 2017 are are as follows:

Member: R150

Member's spouse/partner/child, student: R75

Six-month membership from July – December 2017:

Member: R75 Member's spouse etc, student: R40

Payment can be made in cash (at meetings directly to the Treasurer), or via online transfer. The Standard Bank details, for the latter, are as follows:

Account name – Hermanus Astronomy Centre

Account number – 185 562 531

Branch code – 051001

If you make an online donation, please reference your name and 'subs' or 'membership', or it is not possible to attribute the payment to you.

Monthly meeting dates for 2017

Dates for your diaries are: 23 January, 20 February, 20 March, 17 April, 15 May, 19 June, 17 July, 21 August, 18 September, 16 October, 20 November and 11 December.

WHAT'S UP?

Three planets The final planetary dance of the year is a trio. Low towards the west, after sunset, small **Mercury** can be found close to the horizon. Bright **Venus** forms the 'evening star' higher in the sky, and, even higher, red **Mars** is the third member of the group. Venus is the closest of the three to Earth (42 million km). It is similar to Earth in size (12,104 km (Venus) v 12,756 km in diameter), density, mass and volume (Venus is slightly smaller than Earth) and the eccentricity of their orbits round the Sun. However, in

other ways, the two planets are very different. While a day on Earth lasts 24 hours, the Venusian day lasts 243 days. In contrast, a year on Venus lasts only 224.7 days. Also, Venus' axis of rotation is the opposite of Earth's (E-W v W-E (Earth)). Almost twice as bright as Earth, Venus' high albedo is a result of the fact that its atmosphere contains a thick layer of unbroken cloud. Its atmosphere is about 95% carbon dioxide and so dense that atmospheric pressure at the surface is 92x that of Earth. Due to the runaway greenhouse effect, the average temperature on Venus' surface is 460°C. The thick, reflective cloud layer varies from 45-65 km in depth and is composed of sulphuric acid. Radar imaging has identified that the Venusian surface is composed largely of rolling plains. A few highland areas are present, as is evidence of extensive, possibly ongoing, volcanism. Internally, Venus is believed to have a similar structure to that of Earth.

LAST MONTH'S ACTIVITIES

Monthly centre meeting On 21 November, Pierre Joubert from SANSA gave an absorbing talk on 'Marion island – remote area science'. First, he summarised the history of discovery, ownership and occupation of the island. In 1947, Marion and nearby Prince Edward Island were annexed by South Africa, Then he outlined the climate and physical features of the islands. While Prince Edward Island is a pristine conservation area, Marion has long been used for meteorology by the SA Weather Service. This continues, but the researchers and support staff, who stay there for a year, now also undertake space science, botany, zoology and geology. Although the earlier buildings remain, a new base was completed in 2011. There is no passing shipping, and the new team of around 20 has to take a year's supply of everything they will need when they take over each year. There is no jetty and all personnel and equipment are flown by helicopter from the SAS Agulhas II to the land. SANSA's main project on Marion is monitoring VLF radio waves, in addition to antennae in Hermanus and Antarctica, as part of their work on Sun-Earth interactions. They also pick up 'whistlers', radiowaves emitted by lightning strikes and submit data to the global lightning research project. Pierre finished by provided fascinating answers to the many questions asked about aspects of living and working on this isolated, chilly and very wet island where the only other living company is provided by seals and penguins.

Interest groups

Cosmology Nineteen people (18 members, 1 visitor) attended the meeting on 7 November. They considered the main points of the third of five short books on quantum mechanics by Dr Robert Piccioni of Stanford University. The topic of 'Wave functions, superposition and virtual particles' again encouraged thoughtful questions and lively discussion.

Astro-photography Those who attended the meeting on 28 November discussed processing of their own images.

Other activities

Educational outreach

Hawston Secondary School Astronomy Group The final meeting for 2016 took place this month.

Lukhanyo Youth Club On 14 November a sunspot observation event took place at the school. Well over 100 learners participated. There was limited activity to observe, but the learners were still enthusiastic about observing the sun through filtered telescopes.

Southern Star Party 5 HAC members attended this event. Bennie Kotze reports on his first visit: 'It was with great anticipation that I submitted my entry forms to the SSP,

looking forward to meet and learn from the participants who shared the same interest. The weather forecast for the full period of 27 to 30 October did not look promising but it did not dampen my spirit.

On Thursday afternoon, 27 October, Peter Harvey, Pierre and I arrived at the SSP to occupy our abode which Pierre has reserved for us. It was a great honour to meet Edward and Lynnette Forster, organisers of the SSP and also to meet the stalwarts of astronomy, Auke Slotegraaf and some others, all committed and passionate about their hobby. An area was set aside for star gazing and a number of telescopes of many different makes and sizes, already decorated the area. The clouds persisted throughout the evening and, to utilise the evening productively, Pierre took Peter and I through a training session on how to approach, which factors to consider and to plan a Deep Sky Observers Challenge.

The next morning the three of us visited Bonnievale to supplement our food supplies but also decided to pop in at the Bonnievale Cellars. We just had to return with some liquid supplies. The rest of the day was spent preparing our equipment with the hope that the clouds would clear. We all gathered in the marquee at 18:00 for the official opening of the SSP.

Saturday morning started with Prof Herman Steyn (US) briefing the attendees on their involvement with a number of Space Missions, which varied from Rosetta to CubeSats". This was followed by Pierre de Villiers briefing us on his very innovative project "A novel observatory in making". A mobile observatory will utilise a specially designed trailer to accommodate his recently acquired telescope. The slides shown looked very impressive and we are looking forward to seeing the final product. During the afternoon we attended two lectures on how to clean and take care of eyepieces and the mirror of Newtonian telescopes. This was followed by the "World famous SSP Pub Quiz".

In spite of the persistence of the clouds, a large group gathered outside for the Con-Ex session (Constellation Exploration). Whenever a patch of sky would clear, Auke Slotegraaf, equipped with his green laser, lectured the group on the constellations and stars, supported by the fables and stories associated with it from days gone by. We returned to our cabin later in the evening. The three of us rigged our telescopes on the bank of the dam next to the cabin. Patches of the sky cleared with varied intervals and I could view the first object ever, through my recently acquired telescope, ie Tucanae 47.

Participants returned home on the Sunday. All in all, in spite of the evasive clear skies, the SSP was a most enjoyable experience and I will definitely consider attending future events."

THIS MONTH'S ACTIVITIES

Monthly centre meeting The Centre's Christmas party will take place on **Monday 12 December** at the **NG Kerk, Berg Street, Onrus** starting at **19.00**. Details can be found in the highlight box at the start of the newsletter. Payment is either by cash to a committee member or online EFT. Bank and account details for the later are the same as those detailed in the highlight box for membership renewal. The only difference is that the word 'party' should be included with your name in the reference.

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 **5 December** at the Scout Hall. Attendees will consider Part four of Robert Picciioni's short books on quantum mechanics: 'Spin, lasers, Pauli exclusion and barrier penetration'.

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 third Monday of each month. There is no meeting in December.

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

Stargazing The next event is scheduled for **Friday 6 January 2017.** Further details will be circulated in due course.

Hermanus Youth Robotic Telescope Interest Group Technological and communication issues continue to prevent access to the telescopes for learners. Possibilities for 2017 are under consideration.

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 considered. Details will be circulated to members when arrangements have been made.

2016 MONTHLY MEETINGS

Unless stated otherwise, meetings take place on the **third Monday** of each month at the Scout Hall beginning at 19.00. Details for 2016 and early 2017 are:

12 Dec	Xmas party Venue: NG Kerk, Berg St, Onrus
23 Jan	'SKA: a crash course' Presenter: Dr Bradley Frank, UCT
20 Feb	AGM

ASTRONOMY EDUCATION CENTRE AND AMPHITHEATRE (AECA)

Progress with the project continues to await consideration of the plans by the full Council of Overstrand Municipality. 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

Massive stars destroy their own spawning grounds 2 November: One of the most massive star systems in our galaxy is giving astronomers clues toward how stars can disrupt new stellar formation.

NASA / ESA / SSI

Newborn stars promptly start blasting away at the clouds of molecular gas that helped form them, and that destructive process has shaped the evolution of our galaxy. Stars are born in clouds of gas and dust called nebulae. Where the material gets dense enough, it collapses under its own gravity until the pressure at its core is enough to kick off the nuclear reaction that powers a star. When a new star ignites, it pours out vast amounts of radiation so powerful that it strips electrons from atoms, leaving positive ions in its wake. That radiation whittles away thinner parts of the cloud, carving the cloud into long, narrow shapes that look like pillars. The process, called photo-evaporation, is also slowly destroying the pillars themselves.

In the meantime, of course, the destructive force of newly born stars may also be helping to drive creation of other stars, by pushing gas and dust into denser clumps. Those new stars, in turn, flare to life and begin destroying the clouds that spawned them. It is a complex process of feedback, and thanks to new observations in Chile, astronomers now understand that process in greater detail. To gather the data, they pointed the four 8.2m main mirrors of European Southern Observatory's (ESO) Very Large Telescope at the Carina Nebula, a cloud of gas and dust about 6,500 light years away. Visible from the southern hemisphere, Carina is one of the largest nebulae we can see from Earth, and it is a massive hotbed of star formation. Using an instrument called the Multi-Unit Spectroscopic Explorer (MUSE), astronomers were able to map the flow of ionised gas in and around six pillars of material in Carina.

The tips of the pillars are catching the brunt of all that ionising radiation; astronomers call this area an "ionisation front," and it is where most of the action of photo-evaporation is happening. The cloud structure further back along the length of the pillar is denser and somewhat more protected from the onslaught. The researchers determined how much ionising radiation from nearby O-type and B-type stars is striking the tip of each of Carina's pillars, and how quickly each pillar is losing material to that bombardment. They combined that data, from six pillars in different regions of the nebula, with older observations of

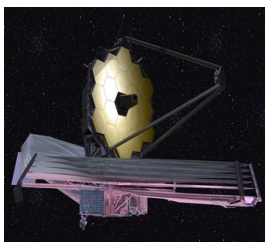
three of the Eagle Nebula's better-known "Pillars of Creation" and one pillar from NGC 3603, a nebula about 20,000 light years away.

According to Anna McLeod of the ESO, it was important to compare pillars from these different nebulae in order to get a better understanding of how photo-evaporation works in general, not just how it works in a particular set of conditions. "These regions have different numbers of ionising massive stars, different masses (in terms of gas and dust), and they are located in different environments in the Milky Way," she said. By comparing all that data, the researchers found that how quickly pillars shrink depends very closely on how much ionizing radiation is blasting their tips.

That modelling is vital to understanding why the Universe looks the way it does today. The way massive stars erode their home nebulae, clearing away the star-forming material in some regions of space and setting off new waves of star formation in others, plays a huge role in how galaxies evolve. "Galaxy evolution models can only reproduce the observed galaxy population if the effect of massive stars is included," said McLeod. Without those destructive effects to evaporate nebulae, the models end up full of unrealistically dense galaxies that produce stars much more efficiently than any galaxy we see in the real universe. That's because clearing away the molecular gas of the cloud takes away the material that might collapse and form a new star, so the destructive effects of newborn stars can, in some ways, limit star formation in their neighbourhoods."

Getting really accurate models of galaxy evolution, however, will require answering a few more questions about how young, massive stars shape, and ultimately destroy, the nebulae that spawn them. Ionising radiation is just one piece of the puzzle. "We also need to consider their strong stellar winds, supernova explosions when they exhaust their hydrogen reservoir, and bipolar jets when the massive stars are still very young and embedded in the clouds they formed from," said McLeod. "We therefore need to understand these effects separately first, so that we can then put the pieces of the puzzle together." By: K N Smith

The largest space scope ever built is finished 3 November: After two long decades from inception to construction, work on the James Webb Space Telescope (JWST) is finally completed and stored at NASA's Goddard Space Flight Centre.



Artist's image James Webb Space Telescope unfurled in space NASA

The telescope, which is the successor to the Hubble Space Telescope, will now undergo testing to make sure it can handle the conditions in deep space. Some of the tests include vibration, cryogenic, and noise tests, as well as simulated launches. After testing is complete, it will be attached to the sunshield and spacecraft bus for its scheduled launch in 2018. JWST was built using a new material made of 18 gold-plated beryllium segments that will retain its shape and can handle harsh conditions. Scientists will use the telescope to study the Universe using both red and infrared light. The first task the telescope will be

used for, though, is studying Alpha Centauri. Following its launch in October 2018 it will take about six months before it sends back any photos. By: Nicole Kiefert

The exoplanet closest to home has a new observer 7 November: The Parkes Radio Telescope in south-eastern Australia is trained on Proxima Centauri, the star closest to the Sun, and the planet recently discovered there. After two weeks of commissioning work, the Parkes telescope's giant radio dish was aimed towards the star Monday in the hopes — however scant — that the planet known as Proxima b hosts life, of the sort that can communicate using radio waves.

ESA/Hubble & NASA

"Nearby stars are naturally very interesting to us, and of course nearby planets by extension," Andrew Siemion, director of the Berkeley SETI Research Centre and member of the Breakthrough Listen team, said in an interview. "That's why knowing there's a potentially habitable planet around our nearest neighbour is such an exciting thing."

Monday's observing run marks the newest entry in the 10-year, $100 million Breakthrough Listen project to look for signs of intelligent life beyond Earth. The Green Bank Telescope in West Virginia and the Automated Planet Finder at Lick Observatory are already monitoring the skies in a targeted search. And just last month, Breakthrough Listen signed an agreement with China's brand-new FAST telescope. However, Parkes is crucial for one important reason: it can see the southern sky, which is home to Proxima Centauri but is inaccessible to Green Bank and other telescopes.

Siemion says Proxima was an ideal first target for the famed radio telescope, which played a vital role in transmitting the first messages from another world: Photos and broadcasts from Apollo 11. Australians consider it a national monument, and are much more familiar with Parkes than Americans are with comparable radio observatories, like the Very Large Array or the Green Bank Telescope, he says. While the moon landing transmissions were quite a feat, receiving messages from a civilisation just one star over would of course change everything.

Breakthrough Listen started looking for extraterrestrial signals well before anyone knew Proxima Centauri b existed. The Green Bank Telescope's dedicated Breakthrough Listen instrument has been looking to the skies for nine months, and engineers from Berkeley SETI installed a similar setup at Parkes. They spent two weeks testing and commissioning the hardware before switching it on on 7 November to look at Proxima.

Commissioning radio receivers in varying frequencies can be difficult, because local transmitters — like cell phones, microwave ovens, radios and more — can interfere with distant signals from deep space. Engineers have to write software to make sure a would-be SETI signal is not actually someone's cell phone call. To do this, the telescope looks at Proxima, then looks away, then looks at calibration sources like pulsars, which are rapidly spinning neutron stars.

Proxima itself poses some other astrophysical challenges. It is a flare star, meaning it constantly spews X-rays and other radiation into space (and toward its planet). The team is hoping to detect stellar flares using the Breakthrough setup. Those observations, as well as data management and other software tricks of the trade, will benefit not only SETI but the broader radio astronomy community, including the future Square Kilometre Array.

By opening eyes on the southern hemisphere — where observers can peer into the heart of the Milky Way, not to mention other nearby galaxies — the Parkes telescope makes Breakthrough Listen the largest coordinated SETI project ever undertaken. The Parkes programme will share data and search methods with the FAST telescope, which is the world's largest filled-aperture radio receiver, to speed up the time it takes to make follow-up observations.

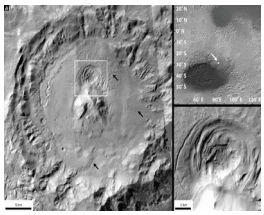
Alien-hunting has long played an outsize role in popular culture and science fiction, especially with respect to its regard among scientists, and certainly with respect to its funding in astronomy and astrophysics. However, the Breakthrough project is changing that. Now, with observatories on three continents sharing data and viewing techniques, SETI is no longer fringe — it is on the cutting edge.

Proxima Centauri itself has loomed large in pop culture since its discovery 101 years ago last month. The star closest to our own is smaller and redder than the sun and its two sunlike companions, Alpha Centauri A and B. But this has meant no diminution in its stature. And the star's dim countenance is actually good news for the small, rocky world circling it in a breakneck 11-day orbit. Because the star is dimmer, Proxima b is in the habitable zone, where conditions could be just right for liquid water to exist on its surface. It's roughly in the same position of Proxima's habitable zone as Earth is in the sun's habitable zone.

Of course, this does not mean Proxima b can host life. If it did, there is no telling whether Proximans would be intelligent. And even if they were intelligent, there is no reason to assume they would be able to transmit radio signals directly toward the middle-aged, medium-sized yellow star closest to their own. If they were, though, and they knew how to direct a beacon toward us, Parkes would be able to find them.

In the next generation, more powerful optical telescopes will scrutinize the star and try to study the planet's atmosphere. Ultimately, our first sign of life could come via another Breakthrough initiative, Breakthrough Starshot, which aims to send a fleet of thin space sails to the Alpha Centauri system. By:Rebecca Boyle

'Ice cauldrons' could tells us if there's life on Mars 15 November: Scientists are studying funnel-shaped craters similar to ones found on Earth in their search for life on Mars.



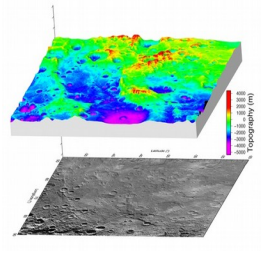
Scientists say this crater could have formed from volcano-ice interactions

Joseph Levy/UT-Austin/NASA

These craters are similar to 'ice cauldrons' on Earth, caused by volcanic eruptions under ice, can release a primordial concoction that promotes microbial life. Lead author of the study and research associate at the University of Texas Institute for Geophysics Joseph Levy said that they were "drawn to this site because it looked like it could host some of the key ingredients for habitability–water, heat, and nutrients."

After looking at the photos from NASA's Mars Reconnaissance Orbiter, Levy and his team noted cracks along the indentations that were similar to ones seen in Iceland and Greenland. Should these craters on Mars actually be ice cauldrons, they may contain necessary ingredients for human life. By: Nicole Kiefert

Scientists found a valley on Mercury 16 November: A new study on a Mercurian valley bolsters the case for Mercury as a shrinking planet.



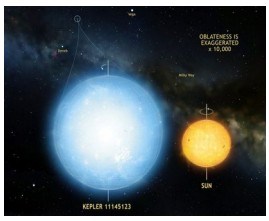
The high-resolution model created from images by NASA's MESSENGER spacecraft. NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington/DLR/Smithsonian Institution

The study's authors believe the valley likely formed in response to global contraction. Mercury's interior core cooled, which caused the one plate of its lithosphere to contract and bend. Researchers found the valley using a high-resolution topographic map of Mercury's southern hemisphere. The map was made from images taken by NASA's MESSENGER spacecraft.

The valley is 400 km wide, 1,000 km long, and about 3 km deep. It extends into the Rembrandt basin, one of the largest basins on the planet. Two large fault scarps surround the valley, and through Mercury's contraction ended up becoming large cliffs. The floor of the valley is below the terrain, which scientists believe was lowered by the same method that created the scarps.

Thomas R. Watters, senior scientist at the Centre for Earth and Planetary Studies at the Smithsonian's National Air and Space Museum and lead author of this study, said that while there are examples of lithospheric buckling on Earth, this is likely the first to occur on Mercury. Though the outcome is similar, the process between the planets is a bit different. "Unlike Earth's Great Rift Valley in East Africa, Mercury's Great Valley is not caused by the pulling apart of lithospheric plates due to plate tectonics; it is the result of the global contraction of a shrinking one-plate planet," Watters said. "Even though you might expect lithospheric buckling on a one-plate planet that is contracting, it is still a surprise when you find that it's formed a great valley that includes the largest fault scarp and one of the largest impact basins on Mercury." By: Nicole Kiefert

Kepler 11145123 attained a new status 17 November: Kepler 11145123, a star about 5,000 light-years from Earth, has been classified as the roundest natural object in the universe thus far discovered.



The Kepler 11145123 star in comparison to the Sun. Laurent Gizon et al. and the Max Planck Institute for Solar System Research, Germany. Illustration by Mark A. Garlick

Stars and planets typically are flatter in the middle because of rotation caused by centrifugal force, which is why this discovery is so interesting. Kepler 11145123 is not a perfect sphere, but it is much closer than other stars and planets. The star is only eight kilometres bigger at the equator than the poles, whereas Earth is 21 kilometres bigger at the equator than the poles while the Sun is ten kilometres bigger at the equator. Astronomers made this discovery using instruments aboard the Kepler space observatory, with a new technique determining the size with exceptional accuracy. By: Nicole Kiefert

Newest fast radio burst hints at makeup of the cosmic web 17 November: There's a long list of scientific discoveries that continue to puzzle researchers around the world, and one of the most mysterious comes in the form of something called fast radio bursts or FRBs. Scientists suspect that these extremely bright flashes of light originate from outside of the Milky Way Galaxy, but they still aren ot entirely sure where in the universe they're coming from, or what kind of event causes them.


Swinburne Astronomy Productions

Up until last year only 17 had been detected. That changed when the brightest FRB ever discovered was seen by two different telescopes at Parkes Observatory in Australia on 5 August 2015. A team of researchers from the California Institute of Technology, Curtin University, and CSIRO Astronomy and Space Science centre in Australia have announced not only that they have observed the 18th FRB, but it is also the brightest ever seen.

Until this 18th discovery, the very first FRB ever observed also held the position for the brightest. When FRB 010621 was seen in 2001 at the Parkes Radio Observatory, astronomer Duncan Lorimer had no idea what to make of the signal. The 5 millisecond burst was a new kind of cosmic phenomenon, and one that sparked more questions than the field was ready for.

Vikram Ravi of Caltech and Ryan Shannon at CSIRO and their team discovered the newest burst named FRB 150807 using the Parkes Radio telescope in New South Wales, Australia. The burst so was bright that it actually pinged two of the radio telescopes, marking the

first time an FRB showed up in more than one instrument. "By having the signal hit two telescopes it helped us narrow down a specific patch of sky that this signal could be coming from," says Shannon.

There are 13 telescopes at Parkes Observatory, each working like a 1 pixel camera. By picking up on this signal with two pixels, it allowed the team to examine that area of the sky, and what they found were six galaxies and three stars. Ultimately the team ruled out the stars since they were located in the Milky Way, and after examining the six other candidates, they decided to put their money on a sizeable galaxy 1 billion light years away called VHS7.

Scientists expect FRBs to be the product of large cosmic explosions like supernovae, colliding black holes, pulsars, magnetars or even gamma ray bursts. One reason why scientists are desperate to understand these anomalies is that the FRBs actually carry evidence about their origins and the medium in which they traveled. By understanding more about FRBs cosmologists could understand more about our universe.

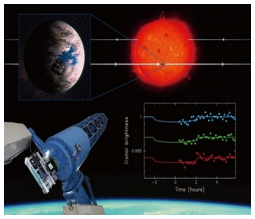
Perhaps the most interesting thing is what these FRBs can tell scientists based on their individual imprints. The data for this particular burst points to a smoother journey than maybe some others that have been discovered. "FRBs carry the imprint of the medium that they've travelled through. The radio waves from the burst interact with the ionised gas between us and it's source," explains Shannon. "With this FRB we saw an imprint of a very diffuse galaxy and a diffuse intergalactic medium." Because of the brightness of this particular burst and showing up on two telescopes, it gives the team more clues about the cosmic web — the vast space that exists between all objects in the universe.

After a radio wave travels for millions and millions of years, its shape can become altered on the journey. Often times what we've seen from FRBs is a byproduct called Faraday rotation which morphs the radio wave into a corkscrew shape. This happens when a radio wave travels through a thick intergalactic medium that's heavily magnetised. The newest FRB actually had little evidence of Faraday rotation, leading the team to believe that the area that the radio wave travelled through was not very magnetic, and that the 'space' was thinner in that region. The intergalactic medium or what we think about as 'space' is made up of plasma, an ionised gas, but it is not a uniform consistency. Shannon explains, "this burst was scintillating, so the brightness varies if you look at different wavelengths of light. Not unlike when a star twinkles in the sky, that light is travelling through diffuse gas

in the intergalactic medium. What this tells us is that there's a bit of turbulence churning around, but not that much."

By better knowing each bursts unique signature, scientists can rectify their theories on the makeup of the universe. As more telescopes are built and go online surely more FRBs will be observed and eventually scientists will begin to decipher their messages. Astronomers expect that if the technology was available and the telescopes were built to scan the sky at all times, that there would be anywhere from 2500 to 10,000 FRBs hitting Earth every single day. Luckily there are more telescopes planned to begin surveying wider swaths of sky with the hopes of picking up more bright flashes of light from any number of places in our universe. For now though the illusive fast radio burst will continue to be a source of intrigue for astronomers and cosmologists who will continue waiting to find the answers of what lies between us and everything else. By: Shannon Stirone

An Earth-like extrasolar planet could harbour extraterrestrial life 28 November: Researchers from the National Astronomical Observatory of Japan (NAOJ), the University of Tokyo, and the Astrobiology Centre have nailed down an important property of a potentially Earth-like extrasolar planet while it was in transit.



A collage that summarizes the research NAOJ

The team used the MuSCAT instrument on the Okayama Astrophysical Observatory's 188-cm telescope to study the extrasolar planet, called K2-3d, discovered by NASA's Kepler spacecraft in 2015. The extrasolar planet is about 150 light-years away, 1.5 times the size of Earth, and closely orbits its host star in about 45 days. K2-3d is particularly important to scientists because there's a chance it may foster extraterrestrial life. Calculations show that the temperature of the host star and the closeness of the orbit make for a warm Earth-like climate with the possibility of liquid water on the surface.

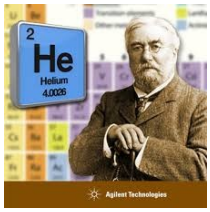
During a transit, a planet passes in front of its parent star and blocks some of its light, decreasing the star's brightness. If scientists study this transit using a future telescope such as the Thirty Meter Telescope, they will be able to check K2-3d's atmosphere for signs of important life-bringing molecules, like oxygen. To study this, the researchers will need to calculate the exact orbital period of K2-3d so they can get a closer look during future transits, and while this process has been difficult in the past, this team has successfully calculated its orbit with a precision of about 18 seconds. This success is an important step in studying the extrasolar planet, which in turn will continue the search for extraterrestrial life.

In the future, the team will use next-generation telescopes to measure how much the brightness decreases during the transit and how it varies with wavelength, which in turn will give more information about the atmosphere of the extrasolar planet. The team will continue researching K2-3d and will keep using MuSCAT for similar research in their ongoing search for extraterrestrial life. By: Nicole Kiefert

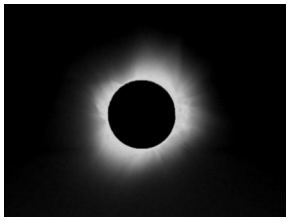
Source of these and further astronomy news items: www.astronomy.com/news

DID YOU KNOW?

The Sun Part 9: **Discovery of helium**



Norman Lockyer


Helium discovered during a solar eclipse

The name of the second element in the periodic table, helium, is derived from the Greek word for the Sun ie helios. This was in recognition of the fact that it was in the Sun's atmosphere that this gas was first detected. The discovery of the second must abundant element in the Universe involved several scientists and lasted almost 30 years.

Two astronomers are credited with the initial discovery of helium. In August 1868, the French astronomer Pierre J. C. Janssen travelled to India to measure the solar spectrum during a total eclipse. He studied the spectrum of the light energy passing through a prism. At the time, he noticed bright lines in the spectrum of the chromosphere (atmosphere) which showed this area to be gaseous. Later, he noticed that, also present in the spectrum, was a distinctive bright yellow line. He assumed that the line was of sodium.

The English scientist and astronomer Joseph Norman Lockyer also recorded the same line in the same year. In the 1860s, he became fascinated by electromagnetic spectroscopy as an analytical tool for determining the composition of celestial bodies. In October 1868, he set up a new, relativity powerful, spectroscope and, through the London smog, independently from Jannsen, also observed the emission spectrum of the chromosphere, including the same yellow line. Unlike Jannsen, Lockyer explored this new finding further. He found that the wavelength was actually slightly less than the lines of sodium and could not be explained by any known material.

During the following years, he worked with the chemist Edward Frankland on this problem. After unsuccessfully testing to see if it was a new type of hydrogen, they concluded that the line could be caused by an unknown element. They named the element helium in recognition of where it had first been detected. It was the first time a chemical element was discovered on an extraterrestrial body before being discovered on Earth. At the time, Lockyer's claim that a new element existed in the Sun was controversial and acceptance of his discovery by the scientific community had to await its discovery on Earth.

In 1882, the Italian Luigi Palmieri found the same line in the spectrum of gases emitted by Vesuvius, in retrospect, the first detection of helium on Earth. It was also found by the American William Hillebrand, in 1889, when he collected the gas given off by the mineral uraninite as it dissolves in acid. However, he attributed the lines to nitrogen.

It was Per Teodor Cleve and Nils Abraham Langer at Uppsala, Sweden, in 1895, who found helium emanating from the uranium ore cleveite. and confirmed that it was the second lightest element. They also collected enough gas to accurately measure its atomic weight.

In the same year, Earth-based helium was also discovered independently in London by the Scottish chemist William Ramsay. Like the Swedes, he treated the mineral cleveite with mineral acids. He was looking for argon, but, after separating nitrogen and oxygen from the gas liberated by sulphuric acid, he noticed a bright yellow line that matched the line previously observed in the Sun's spectrum. Lockyer's claim was vindicated when Ramsay sent him a discharge tube filled with helium gas that he had gathered from his experiment. Graciously, Hillebrand, despite being so close to being the person who discovered helium on Earth, acknowledged his scientific error and, in a congratulatory letter, formally recognised Ramsay as the discoverer of helium.

Source: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.en.wikipedia.org,, www.rsc.org, Parson, P and Dixon, G (2013) The periodic table: a field guide to the elements, Aldersey-Williams, H (2011) Periodic tales: the curious lives of the elements.

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