"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

NOVEMBER 2018

Monthly meeting This month's meeting will place on **Monday 19 November** at the **Catholic Church Hall** starting at **19.00**. Centre member, Jenny Morris, will be talking on 'Table Mountains: geology and astronomy'. See below for more details.

Stargazing The next event is scheduled for **Friday 2nd or Saturday 3rd November**, weather permitting, at the NG Kerk, Onrus. Details will be circulated, in due course.

Membership renewal for 2019

There will be a small increase in the fees for 2019, following 2 years at the current rate.

The 2019 fees are as follows:

Member: R160

Member's spouse/partner/child, student: R80

New members joining after 1 October 2018 will have membership until the end of 2019.

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.

2019 monthly meeting dates For your diaries. Meeting dates will be 21 Jan 18 Feb, 18 Mar, 15 Apr, 20 May, 24 Jun, 15 Jul, 19 Aug, 16 Sept, 21 Oct, 18 Nov and 9 Dec.

'Did you know' section – new series begins this month When were the first star catalogues produced, and by which civilisation? Which characteristics of stars and other celestial objects are included in astronomical catalogues? Who compiled a list of celestial objects to avoid them being mistaken for comets? Who compiled the first catalogue of stars of the southern hemisphere? Who published the first catalogue which covered the whole sky? Why do stars have labels like α Ori or ε Cru? How can one celestial object like the Orion nebula have two designations: M42 and NGC 1976? Why are some celestial objects labelled with NGC numbers and some with IC numbers? Why is one star in the constellation Cygnus called 61 Cygni while its neighbour is labelled σ Cyg?

These questions will be answered, during the coming months, in the new series on Astronomical catalogues and charts of stars and other celestial objects.

WHAT'S UP?

Canis major One of the mid-sized constellations (43rd of the 88), the constellation of the greater dog is easy to locate as it 'follows' the distinctive hunter, Orion across the sky during the summer months. As with Orion, from the southern hemisphere, the trapezium - shaped dog, with bright Sirius at the junction of the front legs and the head, and the tail standing out from the back corner, is upside down. Apart from its central place as one of the dogs chasing the hunter Orion in Greek mythology, Canis Major has the distinction of containing the brightest star in the night sky. Sirius (Alpha Canis Majoris) is both bright and close to Earth (8.6 light years), the reasons for its ranking as brightest. Sirius has a very faint dwarf companion, Sirius B. The constellation also includes other interesting celestial objects. M41 (NGC 2287) is a large open cluster, bright enough to be seen as a hazy area within the trapezium not far from Sirius. Several of its component stars can be seen through binoculars. Sirius forms the distinctive equilateral southern summer triangle with Betelgeuse (Alpha Orionis) in Orion (and Procyon (Alpha Canis Minoris) in Canis Minor. The Greek name 'Procyon' means 'before the dog' because, in the northern hemisphere, it rises earlier than Canis Major.

LAST MONTH'S ACTIVITIES

Monthly centre meeting At the meeting held on 15 October, Centre member, Johan Retief, gave an absorbing and stimulating talk on 'Fermi's paradox' The essence of the paradox is that, while our knowledge of the Universe suggests that extraterrestrial life should exist, so far, there is no evidence of it. The question is 'Where is everybody?' After summarising the life and career or Enrico Fermi, Johan outlined various theories on the possible types and sources of life, followed by an overview of the evolution of life on Earth, from simple single cell to complex multicellular life forms. Then he explained SPONC, the elements known to be necessary for life ie sulphur, phosphorus, oxygen, nitrogen and carbon, including an overview of the origin of these elements in relation to the development of star populations as the Universe evolved.

Continuing his logical and concise presentation, Johan identified three main categories proposed to explain why extraterrestrial life has not been found on Earth: it is (or was) here, it is here, but not seen, and, it does not exist. He then outlined the several possible explanations given in each category. These ranged from UFO visitations eg aliens came, leaving evidence of their presence, like crop circles and pyramids, to possibilities based on sound science eg extraterrestrial technology is not advanced enough, yet, or the numerous factors needed for complex life occur concurrently very infrequently (the rare earth hypothesis). The number of questions and lively discussion which followed Johan's talk demonstrated how interesting the audience had found this topic to be.

Interest groups

Cosmology At the meeting on 1 October, Pierre Hugo gave the third part in the new series on 'Natural philosophy: science for non-scientists'. He presented novel ideas on particle physics, including the nature and behaviour or particles as mass and energy.

Astro-photography Those who attended the meeting on 8 October continued discussing processing of astro-images.

Other activities

Educational outreach

Hawston Secondary School Space Cadets Meetings resumed during October.

Lukhanyo Youth Club Work continues to erect an analemmatic sundial at this, and other schools in the Overstarand.

Stargazing No events took place in October.

Cederberg trip Fifteen members and partners participated in the this visit, which took place on the weekend of 12-14 October. Jenny Morris reports:"Those who travelled to the Cederberg enjoyed clear night skies, fine weather and many of the attractions which the Cederberg wilderness offers. As usual we stayed at Kromrivier. On Friday evening we visited the private observatory near Dwarsrivier, where Chris Forder led an excellent night's viewing for our group. In addition to objects with which many are familiar eg Jupiter, Saturn, Omega Centauri and 47 Tucana, we have wonderful telescopic views of the ring, lagoon and tarantula nebulae, and the intruiging orange and blue binary stars of Albireo (Beat Cygni). Naked eye constellations which we observed in addition to Crux, Scorpius and Sagittarius included Pegasus, Aquila, Cygnus and Corona Australis. Several satellites and a few meteors were also spotted.

Kromrivier view

Stadsaal cave

Site of rock paintings

On Saturday, the three residents of Breekkrans cottage visited the nearby Stadsaal and rock paintings, and Dwarsrivier vineyard. Access to the Wolfberg arch and cracks was, unfortunately, closed to the public. In the evening, after a communal braai, we, again, looked up at the star-filled skies using telescopes brought by members. These included Pierre de Villiers' fascinating new mobile observatory, which he proudly showed to us. On Sunday morning, we reluctantly left that beautiful area, again enjoying the mountain views on the trip back to Hermanus."

THIS MONTH'S ACTIVITIES

Monthly centre meeting This month's meeting, will take place on **Monday 19 November** at the **Catholic Hall** starting at **19.00**. Centre member, Jenny Morris, will be talking on 'Table Mountains: geology and astronomy'. She will address the following questions:

1. Why it Table Mountain flat, and why is this elderly mountain so high?
2. What role did this mountain play in astronomers' attempts to calculate the shape of the Earth?
3. Do other table mountains have similar origins?
4. How many Table Mountains are there in the sky?
5. What role does another Table Mountain play in modern astronomy?

There is an entrance fee of R10 per person for members, R25 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. The next meeting will take place on **Monday 5 November** at the **Catholic Hall**, starting at

19.00. Information and discussion on the nature of space will continue in the fourth meeting in the series on 'Natural philosophy: science for the non-scientist'

There is an entrance fee of R10 per person for members, R25 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 **Monday 12 November.** Members will continue work on astro-image processing.

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 Developmental work on this will resume in 2019.

For further information, please contact Deon Krige at deonk@telkomsa.net

Other activities

Stargazing The next event is scheduled for **Friday 2nd or Saturday 3rd November,** weather permitting, at the NG Kerk, Onrus. Details will be circulated closer to the time.

FUTURE TRIPS

No events are being planned, at present.

2018 MONTHLY MEETINGS

Unless stated otherwise, meetings take place on the **third Monday** of each month at the **Catholic Church Hall**, beginning at **19.00**. Details for the first few months are:

10 December Xmas party

ASTRONOMY EDUCATION CENTRE AND AMPHITHEATRE (AECA)

A decision by the Council of Overstrand Municipality on the planning application continues to be awaited. 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.

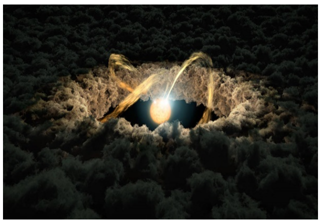
We would, therefore, be very grateful if members could either continue to contribute to the campaign or start becoming a contributor. Both single donations and small, regular monthly donations, of any amount, are welcome. Contributions can take the form of cash (paid at meetings), or online transfer,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

How do planetary systems outweigh the disks they formed in? 2 October: It has long thought that planets formed solely from the dust and gas that surrounds their young host stars, but that theory is now being challenged. A new study has found that, more often than not, planetary systems actually outweigh the protoplanetary disks that they formed in - suggesting a severe lack of dust and gas around infant stars. The findings are causing researchers to question how planets accumulate so much mass, and wonder if there are serious flaws in our understanding of planet formation.


Artist's image of a protoplanetary disk around a star. NASA/JPL-Caltech

Many details of planet formation remain a mystery, but there are some things we are pretty certain about. Stars form when huge clouds of dust and gas collapse in on themselves and condense into hot cores that absorb the material around it. In the years following a star's formation, a colossal disk of leftover material looms around it - creating a protoplanetary disk. These tiny particles start colliding with one another and cementing together, and if they grow large enough, they will evolve into the terrestrial and gaseous planets we see today. Furthermore, since planets are composed of dust and gas from the protoplanetary disk, it would only make sense that a disk's mass would align with or exceed the total mass of its planetary system, right?

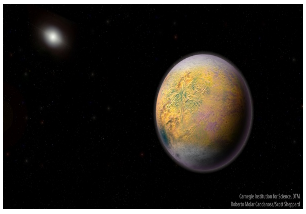
Well, that's the logic that ESO astronomer Carlo Manara was following when he set out to study protoplanetary disks and the planets that form within them. His data, though, showed quite the opposite. Manara and his team of researchers used data from the Atacama Large Millimetre/Submillimetre Array (ALMA) in Chile to probe over 100 stars between the ages of 1 and 3 million years old - around the age that stars begin giving rise to planets. By measuring the radio waves that emit from the disks at millimetre wavelengths, they were able to estimate the total mass of each disk.

They then gathered data from older stars that had similar masses, and compared the weight of their planetary systems to the weight of the young stars' protoplanetary disks. To their surprise, they found that the vast majority of disks came up far lighter than expected, with a median mass of just about 20-30 percent that of their planets. That leaves about 75 percent of the material making up the planets unexplained.

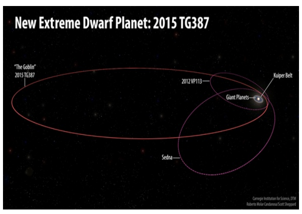
There are some theories that could explain the dust shortage. The team observed stars that are between one and three million years old, but it is possible that disks are much heavier in the first million years of a star's life, and that planets start forming during this period. This theory is supported by recent research that suggests that Jupiter's core formed within the first million years of the sun's existence. The researchers note, though, that planet formation is not very efficient, and that cores usually do not form that quickly. Plus, the theory implies that some disks were nearly 100 times more massive during their first million years than they were in the two million years that followed, a fairly drastic drop in weight.

It is also possible that disks are continuously drawing in material from the interstellar medium giving planets more to feed on during their formations, but keeping the disk's mass consistent over time. There is also a chance that the missing material does exist within the protoplanetary disks, but that our technology simply is not advanced enough to see it. Since ALMA's speciality is detecting material at millimetre wavelengths, it has a tough time identifying anything larger than about a centimetre. That is a little big for a dust grain, sure, but it is not an unfathomable measurement. By: Amber Jorgenson

Introducing 'The Goblin': a new, distant dwarf planet bolsters evidence for Planet X 2 October: Far beyond the orbits of the solar system's eight planets, astronomers have found another object they have nicknamed 'The Goblin'. It is a small world travelling a lonely path through the outer reaches of our cosmic neighbourhood, and it joins a small club of dwarf planets and other planet-like objects out beyond Neptune. Most excitingly, the object's movements fit into previous theories regarding a possible 'Planet X' hiding far away in our solar system, and could help astronomers to find it.


Artist's conception of a distant Solar System Planet X, Illustration by Roberto Molar Candanosa and Scott Sheppard, courtesy of Carnegie Institution for Science

The dwarf planet's official name is 2015 TG387, and it was discovered three years ago by a team of researchers using the Subaru telescope atop Mauna Kea in Hawaii. Led by Scott Sheppard of the Carnegie Institution for Science, the astronomers were scanning broad swathes of the sky in search of faint glimmers that might betray new objects in the solar system. Sheppard, who found another similar object just four years ago, spent the next three years confirming the original sighting with his team. 2015 TG378's nickname comes from the letters TG in its official name, as well as a recognition of the fact that it was found around Halloween, the researchers say.



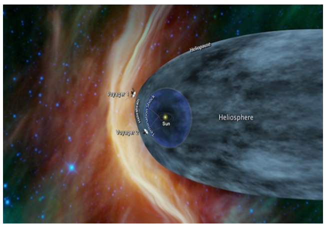
The orbits of the new extreme dwarf planet 2015 TG387 and its fellow Inner Oort Cloud objects 2012 VP113 and Sedna as compared with the rest of the Solar System. Illustration by Roberto Molar Candanosa and Scott Sheppard, courtesy of Carnegie Institution for Science

The dwarf planet is about 300km in diameter based on preliminary measurements. Pluto, for example, is about 2,400km in diameter. The Goblin is one of just a few objects whose elliptical orbits never take them closer to the Sun than Neptune. Just two, 2012 VP113 and 90377 Sedna have a perihelion (the point of an object's orbit closest to the sun) farther out than The Goblin, and its orbit actually takes it far beyond them at its most distant point. The dwarf planet is estimated to reach some 2,300 Astronomical Units (AU) from the sun at maximum, putting it more than twice as far out as Sedna. Earth is one AU from the Sun, so the new object, at maximum, is 2,300 times further from the Sun than we are.

The vast distances the object must travel to complete an orbit means that it only travels around the Sun once every 40,000 years. "We were lucky we caught The Goblin when we did," says Sheppard, "because it's only visible to use with current technology less than one percent of the time." The find reinforces the idea that there are likely many more objects like it in our solar system orbiting out of sight. "For over 99 percent of TG387's orbit, it would be too faint for us to detect it," Sheppard says. "This suggests we are only seeing the tip of the iceberg of these kinds of objects and that there are thousands of them that are too far away for us to see."

By: Nathaniel Scharping

Voyager 2 spacecraft approaches interstellar space 8 October: When it comes to space exploration, no one has the Voyager missions beat. On 5 October, NASA reported that their Voyager 2 spacecraft is nearing our heliosphere's outer borders, and could soon enter interstellar space. Data shows that the probe is detecting more and more cosmic rays from outer space - indicating a slow escape from the Sun's stellar bubble. If all goes as planned, the craft will follow in the footsteps of Voyager 1 and become the second human-made object to ever visit the interstellar medium.



The image shows the heliosphere that wraps around the Sun, its planets and far beyond. The heliosheath is the outermost later of the heliosphere, . NASA/JPL-Caltech

Voyager 2's mission has been long and strenuous, to say the least. It's travelled about 17.7 billion km from Earth since it launched in 1977, and spent three decades cruising through space before finally reaching the outermost layer of our heliosphere - the massive bubble, created by the sun's solar wind, that encompasses the Sun, its planets and regions far beyond their orbits. Since it reached this remote region, called the heliosheath, in 2007, researchers have been patiently waiting for it to pass through the heliopause - the threshold that separates the heliosphere and interstellar space. And based on recent data, Voyager 2 is starting to make some headway.

In August, researchers noted that there was a 5% increase in the cosmic rays detected by the craft's Cosmic Ray Subsystem, as well as its Low-Energy Particle instrument. Made up of mainly protons, electrons and atomic nuclei, cosmic rays blast through space at nearly the speed of light, and are thought to be ejected during powerful supernova explosions. It is believed that the heliosphere blocks a lot of these rays from reaching our solar system, but as you travel closer to the edge and the barrier starts to thin out, more cosmic rays become detectable. Voyager 2's increased measurements suggest that it' is inching closer to the heliopause, and could soon enter the interstellar medium.

In 2012, Voyager 1 experienced a similar spike in cosmic rays about three months before it passed through the heliopause, becoming the first craft to invade interstellar space. It is worth noting, though, that Voyager 1 entered the heliopause at a different location, which could cause discrepancies in cosmic ray measurements and time of entry. Voyager 2 is also lagging about six years behind its counterpart, so it will likely cross at a different point in the sun's 11 year cycle. This cycle causes variations in solar flares, eruptions and winds, which makes the heliopause expand and contract. By: Amber Jorgenson

MASCOT mission accomplished at Ryugu 9 October: In yet another historic feat, Hayabusa2's MASCOT rover has completed its mission to explore, probe and photograph the surface of asteroid Ryugu. It spent three asteroid-days, or 17 Earth-hours, hopping across the asteroid and conducting research with an array of high-powered instruments. Before its battery life ran out, MASCOT successfully transmitted the first-of-its-kind data to Hayabusa2. Once it is sent back to Earth, scientists will use the stats to track the asteroid's journey through space and decode the elements that made up our ancient solar system. Still to come is another rover scheduled for next summer and Hayabusa2's long-awaited 'punch' into the asteroid to gather up samples for a return to Earth.

MASCOT used its wide-angle camera to photograph the asteroid's physical characteristics and take measurements of geological features, giving researchers an idea of the environment it formed in and the wear and tear it's experienced over the years. The rover also used a magnetometer to test the strength of the asteroid's magnetic field, and recorded its surface temperature with a high-powered radiometer, which will help determine how well Ryugu holds onto heat.


MASCOT snaps an image of Ryugu's treacherous landscape as it floats to the surface. MASCOT/DLR/JAXA

Finally, and arguably most importantly, the rover used its infrared spectrometer to probe the asteroid and determine its composition. Asteroids, unlike planets and moons, are believed to have the same structure and chemical make-up that they did when they first formed in the early days of our solar systems. Some hypothesise that asteroids were responsible for transporting organic molecules, such as water, throughout our ancient neighborhood. By searching for hydrated material in Ryugu's composition, researchers might find evidence that corroborates this theory. By: Amber Jorgenson

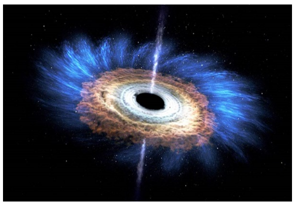
Hubble Space Telescope in safe mode after gyro failure 9 October: On Friday, NASA's iconic Hubble Space Telescope, our window into the universe since 1990, went into a protective safe mode after one of its gyroscopes failed. Hubble was built with six gyroscopes designed to keep the telescope pointed the same way for long periods of time. They were replaced during a 2009 repair mission to the telescope. However,, over the years, some of these gyroscopes have failed and stopped functioning properly. Before Friday, Hubble had four working gyroscopes, also called 'gyros'. After the failure last week, Hubble is now left with only two fully-operational gyros.

The space agency says that at least three gyros are required for "optimal operations." Still, the telescope can function with just two gyros, and it could even continue observing the universe with just one. "The plan has always been to drop to 1-gyro mode when two remain," Rachel Osten, deputy head of the Hubble mission, said. "There isn't much difference between 2- and 1, and it buys lots of extra observing time, which the astronomy community wants desperately." The official Hubble Twitter account echoed this sentiment, tweeting that the telescope was "built with multiple redundancies," and that even though it is left with just two gyros, it can work with just one.


NASA's Hubble Space Telescope, photographed during the first astronaut servicing mission in 1993. NASA

While this setback is certainly not positive news, it ss not a death sentence for Hubble. Officials have stated that they expect the telescope to last at least through 2020. The James Webb Space Telescope, Hubble's successor (at least, in the infrared regime), is currently set to launch in 2021. So, even if Hubble does continue to lose functionality or have expected issues like this gyro failure over the next couple of years, the James Webb should eventually be able to pick up where Hubble leaves off. By: Chelsea Gohd

Black holes cannot explain dark matter 11 October: The hunt for a dark matter explanation seems endless, but now we can mostly rule out one often mentioned potential culprit: black holes.


Gravitational Lensing

"The idea of primordial black holes as dark matter is quite old, with some papers already in the '70s when Stephen Hawking and others proposed it," said lead study author Miguel Zumalacárregui of the Berkeley Centre for Cosmological Physics. Scientists could not find any proof for the idea in the '90s, and it started to fade away as an explanation. However, the 2015 detection of gravitational waves re-ignited consideration for black holes as an explanation for dark matter. Now, after analysing 740 of the brightest supernovae, or exploding massive stars, discovered since 2014, scientists have found none that appear to be magnified or brightened by black hole 'gravitational lenses'. Gravitational lenses are an effect where black holes magnify bright objects behind them. "Our statistical analysis showed that the majority of the dark matter (at least 60 percent) is not made of black holes," Zumalacárregui said.

One of the common explanations for dark matter is a group of cosmic objects called MACHOs, or massive astrophysical compact halo objects. Rather than attempting to explain dark matter with widespread tiny objects, like some unknown particles, MACHOs would be large objects like black holes, dead stars and rogue planets – all large objects that are hard to see. This research team based their analysis off of the understanding that unseen primordial black holes - hypothetical black holes created soon after the big bang — or any other MACHOs, would gravitationally bend light from distant objects. So, in searching for any gravitational lensing from these bright, distant objects, the team was looking to detect lensing from black holes.

They found that none of these supernovae appeared to be magnified or brightened by 'hidden' black hole gravitational lenses. They concluded that primordial black holes could make up no more than 40 percent of dark matter, and none of the universe's dark matter could be made up of heavy black holes or similar objects. A currently unpublished reanalysis by the same team using data from 1,048 sypernovas brings that percentage down even further, to 23 percent, according to a statement.

"We computed that, if black holes were all of the dark matter, we would have seen about 8 significantly magnified supernovae," Zumalacárregui said. "In addition, if all of the dark matter was in the form of black holes, then most of the space would be empty and this makes the vast majority of the supernovae (excluding the magnified ones) be slightly dimmer than they would if dark matter was evenly distributed."

According to this work, we cannot entirely exclude black holes from dark matter yet, but it shows that there must be much more to the explanation. "Our work reinforces models of light dark matter (including elementary particles) and tells us that they have to be distributed relatively smoothly, not forming heavy compact objects," Zumalacárregui said. "It's not as exciting as if we had found evidence for black holes (as dark matter), but it's a step in the right direction." By: Chelsea Gohd

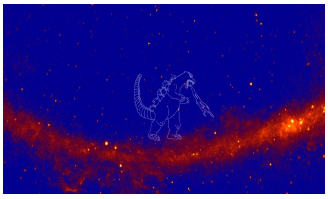
Chandra X-ray Observatory back online after failure 15 October: NASA's Chandra X-ray Observatory will soon be observing the cosmos once again, the space agency said Monday. A scare last week left the spacecraft in safe mode. Chandra is a space observatory that observes extreme objects that emit X-rays, like black holes. The problems with Chandra surfaced on 10 October.


NASA's Chandra X-ray Observatory went into Safe Mode on October 10. An investigation is underway to find the reason why. NASA/CXC

While in Safe Mode, Chandra's instruments move into a safe configuration, where important hardware is protected, the spacecraft orients so that its solar panels get the optimal amount of sunlight, and the craft's mirrors point away from the sun. According to an official NASA statement, Chandra transitioned into safe mode in a manner consistent with "normal" or expected behavior. The space agency has not announced why Chandra entered Safe Mode, but all systems aboard the craft functioned successfully in the transition and all of Chandra's instruments are safe and unharmed. NASA said last week it was still investigating the reason for this sudden shift.

"Chandra is 19 years old, which is well beyond the original design lifetime of 5 years," NASA said in the statement. "In 2001, NASA extended its lifetime to 10 years. It is now well into its extended mission." The space agency adds that Chandra "is expected to continue carrying out forefront science for many years to come." By: Chelsea Gohd

Using gamma rays, scientists map out 21 new constellations 19 October: For countless years, humans have gazed up at the sky and made sense of the stars by finding shapes in them Now, to celebrate the 10th mission year of NASA's Fermi Gamma-ray Space Telescope, scientists have used the telescope to develop a new set of constellations that correspond with gamma-ray emissions.

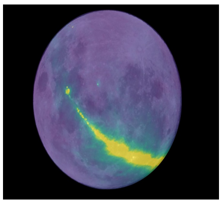

The Godzilla constellation in the gamma-ray sky — a new set of constellations based off of gamma-ray emissions.

Gamma rays are the most powerful in the electromagnetic spectrum, and they are typically only produced by very powerful objects. Supermassive black holes at the centre of galaxies emit gamma rays, and gamma rays can also spring from explosive gamma-ray bursts, pulsars, the debris of supernova explosions, and more. The Fermi telescope has spent the last decade scanning the sky to compile list of gamma ray sources in the observable universe. That has given them an array of points, similar to the stars we see shining in the visible spectrum. In what is known as the 'gamma-ray sky', scientists have devised constellations inspired by many of the same things that inspired the starlight constellations our ancestors gazed at.

The 'original' constellations primarily fall into three categories: myths and legends, meaningful topics and common creatures and items, NASA Goddard's Elizabeth Ferrara, who led the constellation project, explained in a teleconference. The Fermi constellations from the gamma-ray sky are also derived from three categories: modern legends, team partners, and Fermi science. To make sure they did not look too much like stars, the team behind these constellations used artificial colour to distinguish them.

There are 21 Fermi constellations, including the Hulk (created from a gamma-ray mishap), Godzilla, the Starship Enterprise from "Star Trek: The Next Generation", the TARDIS from "Doctor Who", gamma-ray bursts, dark lightning, spider pulsars. Important landmarks from partner nations show up as well: Mt. Fuji for Japan, the Colosseum to represent Italy and more. The constellations even include a Saturn V rocket to represent Huntsville, Alabama where the gamma-ray burst monitor team is centred.   By: Chelsea Gohd\

Astronomers catch Milky Way radio waves bouncing off the Moon 24 October: Radio waves from our home galaxy, the Milky Way, reflect off the surface of the Moon in this intriguing image created by a research team working with the The Murchison Widefield Array (MWA) radio telescopes in the Australian desert. The remote location was chosen for its extremely low levels of interference from earthly radio stations.


Dr. Ben McKinley. Moon Image Courtesy of NASA/GSFC/Arizona State University

The team, led by Benjamin McKinley of the Curtin Institute of Radio Astronomy, is hoping to detect remote signals from the very early universe. "Before there were stars and galaxies, the universe was pretty much just hydrogen, floating around in space," McKinley said. "Since there are no sources of the optical light visible to our eyes, this early stage of the universe is known as the 'cosmic dark ages'."

Shedding light on these dark ages is particularly challenging because of the weak nature of radio signals given off by these ancient hydrogen atoms. And there's significant interference from brighter objects in the foreground. "If we can detect this radio signal, it will tell us whether our theories about the evolution of the Universe are correct," McKinley said. By using the Moon as a point of reference, astronomers hope to come up with an accurate average sky brightness, which is key to unlocking this particular space mystery. As the team observed the Moon to collect its base brightness, they also picked up radio waves from the Milky Way bouncing off our satellite. The team used that to create the composite image above. By: Alison Mackey

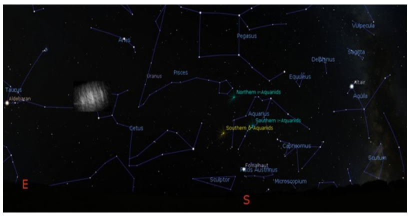
Explore Phaethon, the weird blue rock that turns metal into goo 24 October: A weird, blue rock known as 3200 Phaethon, or more commonly Phaethon, got pretty close to Earth last year. That gave scientists a unique opportunity to study it up close - and they found that this blue asteroid (that acts like a comet) is even stranger than they expected. "It's a weird blue asteroid that created the Geminids and gets so hot that metals on the surface turn to goo," Theodore Kareta, a researcher at the University of Arizona, said.

Before this flyby, scientists knew that Phaethon was blue and had a strange orbit that brings the asteroid close to the sun and then flings it out past Mars. It's a "very eccentric, inclined orbit," Kareta said. Scientists have also suspected for some time that the object might be the 'parent' of the Geminids meteor shower. This recent close encounter showed that Phaethon is actually much darker than had previously thought - only a little brighter than charcoal - and its surface is homogeneous and uniformly 'scorched' by the Sun.


3200 Phaethon, a blue rocky object, continues to puzzle scientists, . Heather Roper/University of Arizona

There are a number of mysterious that still remain about this strange asteroid. While the object's blue colour is a sign that it has travelled close to the Sun (which is clearly true, given its strange orbit), scientists are still working to fully explain its blue hue. The verdict is also out on whether the strangely-coloured object is even an asteroid. While this flyby provided scientists with amazing new data, they are still working to figure out Phaethon's true nature. "Is it a dormant comet? Is it an object that made the Geminid shower in a normal way? Or is it something different?" Kareta said. The surface of the object, while it appears blue, is also extremely hot. "(Phaethon) can reach 1,500 degrees Fahrenheit," Kareta said. By: Chelsea Gohd

Interplanetary dust clouds orbit Earth, Hungarian scientists confirm 30 October: A team of Hungarian astronomers and physicists may have finally confirmed two clouds of interplanetary dust orbiting Earth that were first reported in 1961.


Artist's impression of the Kordylewski cloud in the night sky (with its brightness greatly enhanced) at the time of the observations. Gábor Horváth

There are five points of stability in the Earth-Moon system where gravitational forces keep objects in position. Scientists call these 'Lagrange points' , and they are numbered as L1 to L5. In 1961, Polish astronomer Kazimierz Kordylewski claimed to have taken pictures of dust that formed two cloud patches at L4 and L5. Astronomers now call these Kordylewski clouds. Because the dust clouds are so faint, however, some scientists still debate if they really exist. A team of Hungarian scientists say they are now confident that they have confirmed the existence of these clouds with new observations.

"We are sure that the Kordylewski dust cloud exists at the Lagrange point L5 of the Earth-moon system,"lead author Gábor Horváth of Eötvös Loránd University said in an email. "The detected polarization characteristics cannot be explained by any other optical phenomena." Earlier this year, the team, which includes Judit Slíz-Balogh of Eötvös Loránd University and András Barta, modelled these clouds to assess how they might form and how they might be best identified. The team then used linearly polarising filters attached to a camera lens and a sensitive photon detector at Slíz-Balogh's private observatory to take exposures of the expected location of the L5 cloud. The cloud is not very bright, but it is measurably polarised, according to Slíz-Balogh, and that is how the research team says it was able to capture it.

"Many astronomers assume that these dust clouds do not exist," Horváth said. They assume that sun, solar wind and other planets may disrupt the dust cloud's orbit. However, Horváth continued, with these new observations, "the only explanation remains the polarized scattering of sunlight on the particles collected around the L5 point."

By: Chelsea Gohd

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

DID YOU KNOW?

Astronomical catalogues Part 1: Recording stellar observations is an old tradition

Introduction If any objects favour cataloguing, it is the millions of celestial objects. Many astronomical catalogues have been published, for different purposes, from antiquity to the present, by different civilisations/cultures and in many different languages. The completeness and accuracy of catalogues are defined by the weakest apparent magnitude included, and the accuracy of positions listed. Many celestial objects are commonly referred to by their catalogue numbers eg α Centauri, M44, NGC 3372.

Full-sky catalogues are based on broad-scale sky surveys (land and space based). Specialised ones include stars (different characteristics),objects found at different electromagnetic frequencies (X-ray, gamma ray, radio etc), double and variable stars, open and globular clusters, galaxies, photographic, bright and dark nebulae, exoplanets, and minor planets. There are at least 224 catalogues of astronomical objects in English.

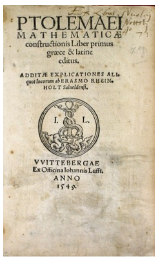
This series will provide an overview of the landmark catalogues which underpin modern astronomy, and the, mostly, men who compiled them.

Early history The ancient Sumerians were the first known to record star positions. Also recorded on clay tablets, the ancient Babylonians compiled the earliest known star catalogues..These date to the period c 1531- c 1155 BCE. Their constellation patterns show similarities to those of the later Greek civilisation.

Known records show that ancient Egyptians recorded only a few identifiable constellations and a list of 36 decans, which was used as a star clock. The circumpolar star called 'the star that cannot perish'.Although they made no known star catalogues, they did create extensive star charts of the night sky. Examples of the latter adorn the ceilings and coffins of tomb chambers. In ancient Greece, around 370 BCE. Eudoxus compiled a full set of the classical constellations. His catalogue, *Phaenomena*, became one of the most widely used astronomical tests during antiquity and later. It contained descriptions of star positions and constellation shapes, including information on their relative times of rising and setting. In 129 BCE, Hipparchus (c190–c120 BCE) completed his star catalogue. It contained 650 stars, including their co-ordinates, with brightness being divided into 6 magnitude classes.

In the 2nd century CE, the Roman astronomer and geographer Claudius Ptolemy (c100-c170) published a star catalogue within the A*lmagest.* This compendium is the most complete surviving treatise on ancient astronomy. It drew on the work of others whose works were housed in the library in Alexandria. The star catalogue is believed to be an adaptation and extension of Hipparchus' earlier catalogue. It contained 1,028 entries of stars visible from Alexandria. It includes not only the stars' ecliptic co-ordinates, but also descriptions of their positions with respect to the original 48 Greek 'Ptolemaic' constellations. This catalogue was *the* reference work on astronomy in the Western and Arab worlds for around 1,500 years. It was not fully superseded until 1598 with the appearance of Tycho Brahe's thousand star catalogue (see Part 2).


Ptolemy



Almagest

Almagest

The earliest known inscriptions of Chinese star names, written on oracle bones, date from the Shang dynasty (c1600–c1050 BCE). The first Chinese star catalogue dates to the Warring States period (403-221 BCE). It included the names of the 28 mansions ie asterisms across the ecliptic belt of the celestial sphere. Astronomical records were used for constructing the Chinese calendar. During the Han dynasty (202 BCE – 220 CE) astronomers began to observe and record names for all the stars apparent to the naked eye in the night sky, not just those around the ecliptic. This increased the number of identified constellations to at least 124.

Astronomy in India dates back to the Indus Valley Civilisation during 3rd millenium BCE. Observations were used to create calendars. However, no written records survive. First records date from the later Vedic period (c1100- c500 BCE). The style and content of records grouped into 27 'naktras' suggests influence by Babylonian astronomy. These early Indian lists contained limited detail and cannot usefully be compared with Western or Chinese constellations. They suggest that early Indian astronomy was derivative and not based on independent Indian observations.

Several star catalogues were published by Islamic astronomers between the 9th and 15th centuries. An early one corrected errors in the *Almagest*. Many stars are still known by their Arabic names eg Altair, Aldebaran, Alnitak. In the New World, the *Motul Dictionary* was published anonymously in the 16th century, possibly by a Spanish monk. It contained a list of stars originally observed by the ancient Mayas. The Mayan *Paris Codex* also contains symbols for different constellations, represented by mythological beings.

Sources: Ridpath, I (Ed) (2012) Oxford dictionary of astronomy 2nd ed rev, www.absabs.harvard.edu, www.pbarbier.com, www.en.wikipedia.org

For more information on the Hermanus Astronomy Centre and its activities, visit our website at www.hermanusastronomy.co.za