canopus

Monthly Newsletter of the Johannesburg Centre of ASSA

The crew of Apollo 17 took this photograph of Earth in December 1972 while the spacecraft was traveling between the Earth and the Moon

Next meeting at Johannesburg Observatory, 18a Gill St, Observatory

***Wednesday,* February 8 2017**
Speaker : Brian Fraser
Topic: Significant Discovery in Meteoritics

Upcoming Events:

Friday FEBRUARY 2017: TBA

- **Public Viewing :** Weather permitting
- **Venue:** Johannesburg Observatory, 18a Gill St, Observatory
- **Time: 19h00 - 22h30**
- **Binocular observing is encouraged. Please bring your pair.**

Contact :

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Notifications are posted on Facebook (https://www.facebook.com/assajhb), assajhb@yahoo.com and Twitter @JoosteJerome on the viewing day.

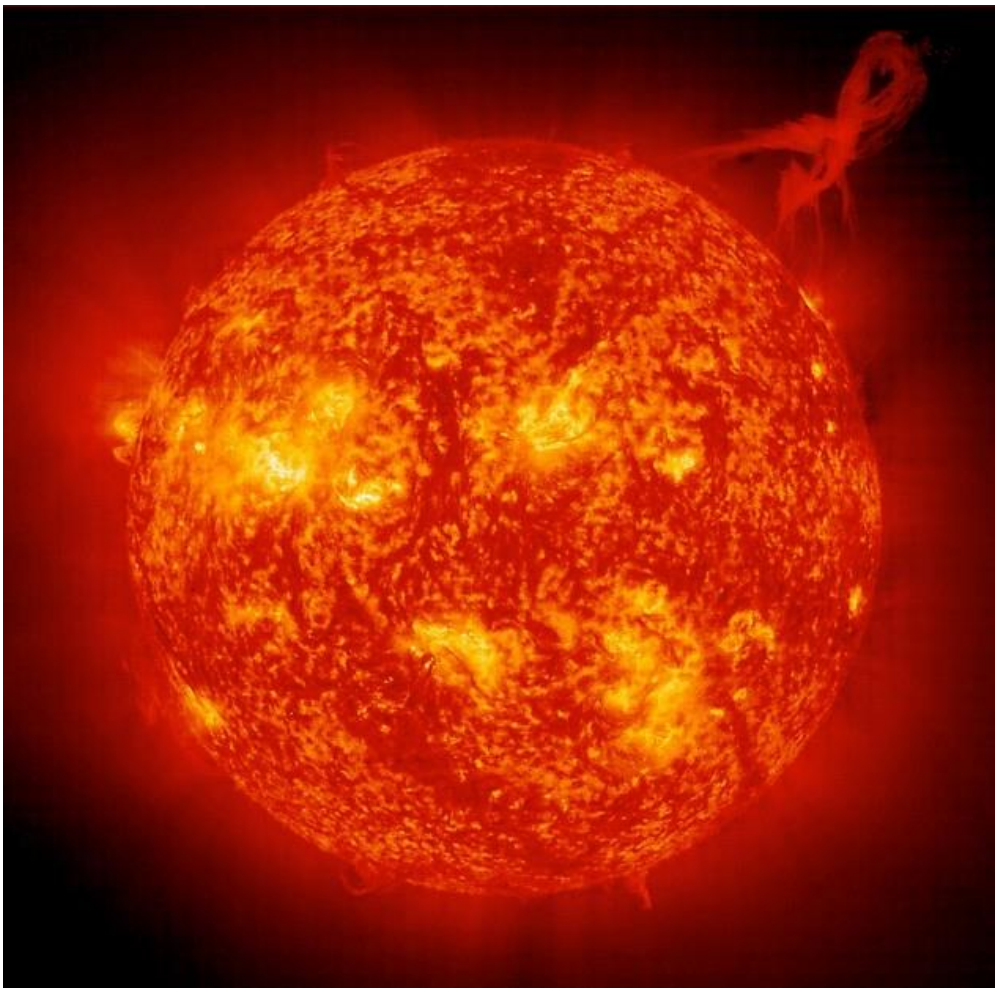
Our next monthly Braai and Sky takes place on:

- **Date:** Sunday 26 FEBRUARY 2017
- **Time:** 16h30
- **Location:** Jhb. Observatory, Top of the hill at the Herbert Baker Library. Map.
- **Topic:** Whats Up – a detailed overview of some objects.
- **Donation**: R20 pp for the fire wood. Children under 15 free.

THE SUN IN FEBRUARY:

Date	Sunrise	Sunset	Length of day
05/02/2017	5:43	19:03	13:20:48
11/02/2017	5:50`	18:57	13:07:00
15/02/2017	5.53	18:54	13:01:00
21/02/2017	5:57	18:57	13:00:00
28/02/2017	6:01	18:43	12:44:00

There is a partial solar eclipse happening: 26 February 2017. Unfortunately not visible in Gauteng.



https://www.timeanddate.com/sun/south-africa/johannesburg

THE MYSTERY OF CORONAL HEATING:

Imagine standing around a roaring campfire, roasting s'mores. You feel the warmth of the flames as the marshmallows crackle. Now back away. You get cooler, right?

That's not how it works on the sun. The visible surface of the sun has a temperature of 10,000° F. Backing away from the inferno should cool things down, but it doesn't. Instead, the sun's upper atmosphere, or corona, sizzles at millions of degrees - a temperature 200 to 500 times higher than that of the roaring furnace below.

For more than a half-century, astronomers have tried to figure out what causes the corona to be so hot. It is one of the most vexing problems in astrophysics.

Solar physicist Bart De Pontieu of the Lockheed Martin Solar & Astrophysics Laboratory says, "The problem of coronal heating was first discovered in the 1940s. The problem involves a variety of complex physical processes that are difficult to directly measure or capture in theoretical models."

On June 27, 2013, with campfires blazing around the USA, NASA launched the Interface Region Imaging Spectrograph (IRIS) - a space-based solar observatory designed to get to the bottom of how the solar atmosphere is heated.

"IRIS studies the transition region between the sun's surface and the corona," explains De Pontieu, who is the science lead of the observatory. "It can track the temperature and motions of hot gas at unprecedented spatial (0.33 arcsec), temporal (2 s) and spectral (2 mi/s) resolution."

Most researchers agree that the corona is probably heated in several different ways. For instance, plasma waves from the sun can rise into the corona and crash, depositing their energy there. At the same time, "heat bombs" could be going off. These explosions happen when magnetic fields in the corona criss-cross and realign, exploding like a miniature solar flare.

One of the big questions of coronal heating has been: *Is the corona heated everywhere at once, or is heat delivered in discrete, bomb-like events?*

De Pontieu says, "These two possibilities are very different, but the distinction can be difficult to observe."

The problem is the corona is a great thermal conductor. If a heat bomb goes off, the resulting heat rapidly spreads out over a large region. Blink, and it looks much the same as uniform heating.

Fortunately, IRIS never blinks. A recent observation by the observatory's spectrographs has found evidence for these discrete, explosive events.

Paola Testa of the Harvard-Smithonian Center for Astrophysics, lead author of the paper reporting the results says, "Because IRIS can resolve the transition region ten times better than previous instruments, we were able to see hot material rushing up and down magnetic fields in the low corona. This is compatible with models from the University of Oslo, in which magnetic reconnection sets off heat bombs in the corona."

Testa emphasizes that other heating mechanisms may be at work, too. Even so, these new observations could help tease out how much of the heating comes from discrete heating events, helping researchers sort out a decades-old puzzle of great complexity.

For more news about big mysteries, stay tuned to science.nasa.gov.

https://science.nasa.gov/news-articles/the-mystery-of-coronal-heating

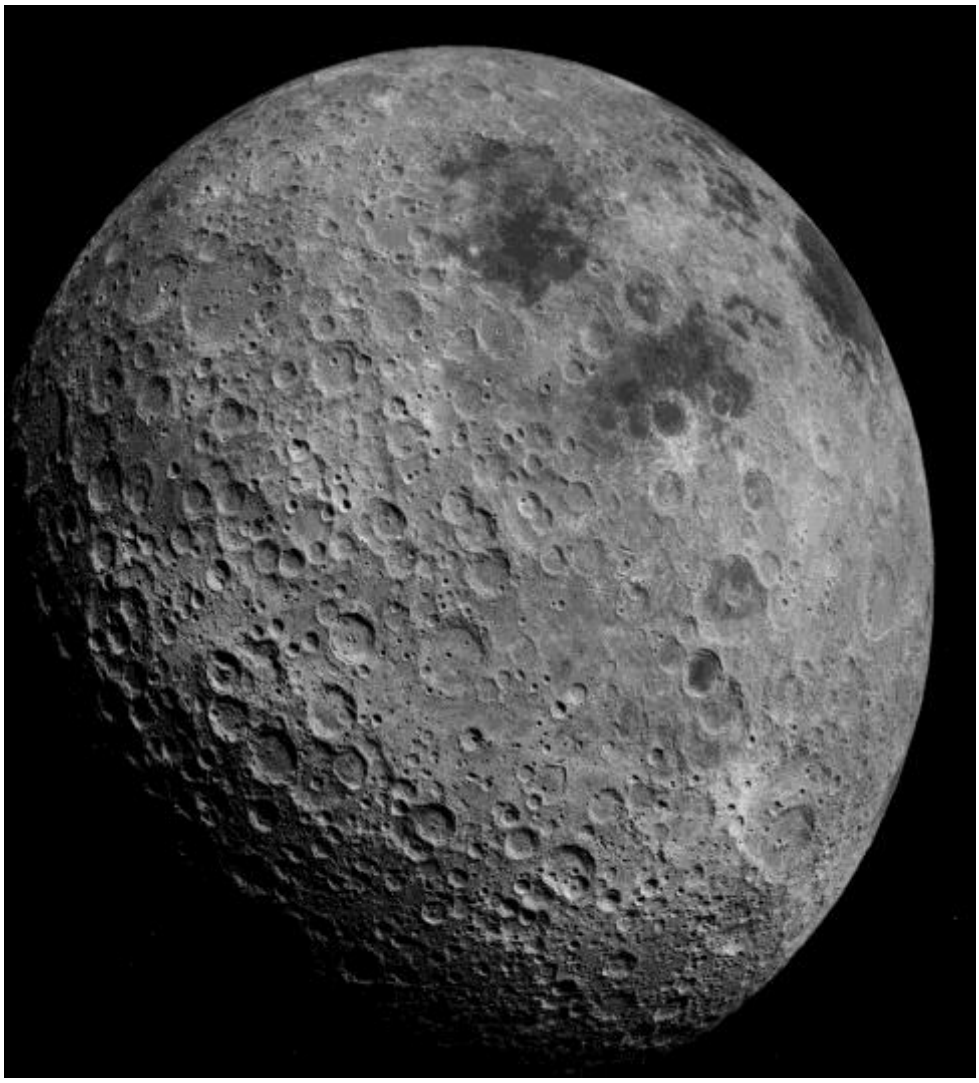
THE MOON IN FEBRUARY:

Date	Moonrise	Moonset
01/02/2017	09:47 `	22:06
5/02/2017	13:51	00:18
12/02/2017	19:58	07:00
15/02/2017	21:50	09:45
20/02/2017	00:24	14:00
28/02/2017	07:38	20:04

https://www.timeanddate.com/moon/phases/south-africa/johannesburg

Lunar Eclipse Saturday 11 February

A lunar eclipse occurs when the Moon passes directly behind the Earth into its shadow. This occurs when the sun, Earth, and moon are aligned exactly, or very closely, with the Earth in the middle. Hence, a lunar eclipse can occur only the night of a full moon. The refracted light makes the moon look a reddish colour and the reddish light comes from rayleigh scattering so sometimes the reddish moon is called a blood moon.



https://cdn0.vox-cdn.com/uploads/chorus_asset/file/3943328/Back_side_of_the_Moon_AS16-3021.jpg

ALL ABOUT BLUE MOONS

"Once in a blue moon," a term we usually use to define a happening or something that is rare. However, we use this term today, meaning, the second of two full moons occurring in a single calendar month, so from something rare, we have made Blue Moons quite common.

There is a definition that indicates that a Blue Moon is the third of four full moons within a single season. This is perhaps more commonly known amongst the older

generations because, life was lived at a much slower rate than what appears to be happening today. People then, had a more relaxed idea of time.

The time between one full moon and the next is close to the length of a calendar month. So the only time one month can have two full moons is when the first full moon happens in the first few days of the month and the second full moon at the month end. This happens every 2-3 years, so Blue Moons come about that often. Seven times in 19 years there were, and still are, 13 full moons in a year. This gives 11 months with one full moon each and one with two. This second full moon in a month, is called Blue Moon.

The reality is that Blue Moons are not really blue, moons cannot be blue in colour. Perhaps some might have considered that the colouring that one sees, the "Man in the Moon," on the face of a full moon is bluish in colour.

There is a very rare occasion when one could see a kind of a blue-ish/grey coloured moon. This would be under most unusual sky conditions, when particles of dust or smoke could create the bluish colour. Generally blue moons are not really blue it is just a myth.

PLANETS IN FEBRUARY:

Mercury is visible in the eastern eastern sky in the early morning, try to observis this planet in the early hours before the glow of light at dawn.

Venus and Mars still remain visible in the Western sky after sunset. Venus is low in the western sky and will disappear around 8:30 pm. Followed by Mars as well, in the early evening.

Jupiter and Saturn both planets are clearly visible in the Eastern skies from after 1:00 am. Jupiter is fairly high up and is followed by Saturn.

Uranus and Neptune are no longer visible from Gauteng but Neptune is spending its time in Aquarius, now quite low in the west and barely visible below Venus.

INTERPLANETARY SEASONS:

Every planet in the solar system has seasons. Most have four like the Earth -- called Winter, Spring, Summer and Autumn -- but that's where the similarities end. Extra-

terrestrial seasons are hardly noticeable on some planets as in Venus, mindbogglingly extreme on others Uranus and in some cases simply impossible to define as in Mercury.

The table below gives the dates of the seasons for 8 of the 9 planets in the solar system. Only Pluto is missing. It's so far away that we don't know much about seasons on that distant world.

In the table the equinoxes and solstices are named after the corresponding season in the northern hemisphere. This is the convention that astronomers often use to discuss planetary seasons. When the north pole of a planet is tilted toward the sun, astronomers call it the Summer Solstice; when the south pole is tilted toward the sun it is called the Winter Solstice. Nevertheless, the seasons are always opposite in the two hemispheres. On Earth, for example, when it is summer in New York, it is winter in Sydney. On a spring day in Paris, autumn leaves are falling in Argentina, and so on...

When the Vernal Equinox takes place on March 20, Earth will join Venus and Jupiter as the only planets in the solar system where it is now northern Spring.

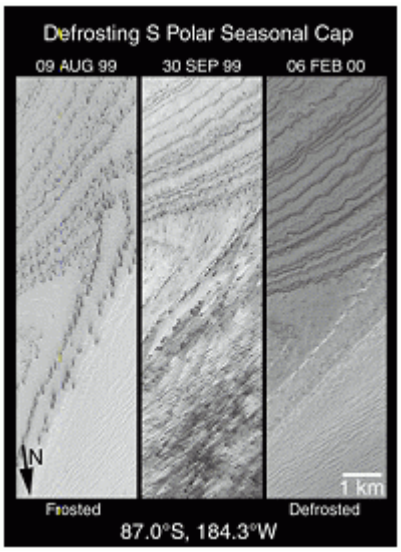
Seasons on Other Planets

			vernal equinox	**summer solstice**	**autumnal equinox**	**winter solstice**
PLANET	*e* orbital eccentricity	spin axis tilt (deg)	Spring begins	Summer begins	Autumn begins	Winter begins
Mercury	0.21	< 28	n/a	n/a	n/a	n/a
Venus	0.01	3	Feb 24, '00 1930 UT	Apr 1, '00 1600 UT	May 28, '00 0400 UT	Jul 22, '00 1800 UT
Earth	0.02	23.5	Mar 20, '00 0735 UT	Jun 21, '00 0148 UT	Sep 23, '00 1727 UT	Dec 21, '00 1337 UT
Mars	0.09	24	May 31 '00	Dec 16 '00	Jun 12 '01	Nov 2 '01
Jupiter	0.05	3	August 1997	May 2000	March 2003	March 2006
Saturn	0.06	26.75	1980	1987	1995	2002
Uranus	0.05	82	1922	1943	1964	1985
Neptune	0.01	28.5	1880	1921	1962	2003

(Table note: seasonal names refer to the northern hemisphere of each planet.)

Planetary seasons are caused by two factors: axial tilt and variable distance from the sun (orbital eccentricity). Earth's orbit is nearly circular and so has little effect on climate. It's our planet's axial tilt that causes almost all seasonal changes. When the north pole is tilted toward the Sun, it's northern summer. Six months later the north pole tilts away from the Sun and we experience northern winter.

The other two planets where it is northern spring, Jupiter and Venus, have very small axial tilts -- just 3 degrees compared to Earth's 23.5 degree, tilt. Seasonal changes on those planets are correspondingly small. Spring on Venus isn't much different from autumn. The planet's dense, acidic atmosphere produces a runaway greenhouse effect that keeps the surface at 750 K year-round -- that's hot enough to melt lead. Spring fever on Venus is really hot!



Our second-nearest planetary neighbour Mars has the highest orbital eccentricity of any world except Pluto. Its distance from the Sun varies between 1.64 and 1.36 AU over the Martian year. This large variation, combined with an axial tilt greater than Earth's gives rise to seasonal changes far greater than we experience even in Antarctica.

Right: Over the past six months, the southern hemisphere of Mars has passed through spring and into summer. Spring started in early August 1999 and summer arrived toward the end of December 1999. Mars Global Surveyor is in a polar orbit, thus the spacecraft's camera has had an excellent view of seasonal changes. Shown here are three views of the same portion the layered terrain near the Martian south pole. They show how the landscape thaws and defrosts as summer approaches.

From the point of view of an Earth-dweller, one of the strangest effects of seasons on Mars is the change in atmospheric pressure. During winter the global atmospheric pressure on Mars is 25% lower than during summer. This happens because of the eccentricity of Mars's orbit and a complex exchange of carbon dioxide between Mars's dry-ice polar caps and its CO2 atmosphere. Around the summer solstice when the Martian north pole is tilted away from the sun, the northern polar cap expands as carbon dioxide in the polar atmosphere freezes. At the other end of the planet the southern polar cap melts, giving CO_2 back to the atmosphere. This process reverses half a year later at the winter solstice.

At first it might seem that these events occurring at opposite ends of Mars would simply balance out over the course of the Martian year, having no net effect on climate. But they don't. That's because Mars is 10% closer to the Sun in winter than it is in summer. At the time of the winter solstice the northern polar cap absorbs more CO_2 than the southern polar cap absorbs half a year later. The difference is so great that Mars's atmosphere is noticeably thinner during winter.

Seasons on Mars vs. Seasons on Earth

Season (Northern Hemisphere)	**Length of Season on Earth** (Earth Days)	**Length of Season on Mars** (Martian Days)
Spring	93	194
Summer	93	178
Autumn	90	142
Winter	89	154

Above: The orbit of Mars is very eccentric, unlike Earth's which is more nearly circular. Its orbital motion is slowest when it is at aphelion (the farthest point from the Sun) and fastest at perihelion (the closest point to the Sun). This effect, combined with the planet's axial tilt, makes Martian seasons vary in duration more than those on Earth. The length of the seasons in this table are given in Earth days and Martian days. The two are almost of exactly the same duration. An Earth day is 24 hours long, a Martian day is 24.6 hours long.]

Martian seasons are peculiar by Earth standards, but they probably pale in comparison to seasons on Uranus. Like Earth, the orbit of Uranus is nearly circular so it keeps the same distance from the Sun throughout its long year. But, Uranus's spin axis is tilted by a whopping 82 degrees! This gives rise to extreme 20-year-long seasons and unusual weather. For nearly a quarter of the Uranian year (equal to 84

Earth years), the sun shines directly over each pole, leaving the other half of the planet plunged into a long, dark, frigid winter.

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The Northern Hemisphere of Uranus is just now coming out of the grip of its decades-long winter. As the sunlight reaches some latitudes for the first time in years, it warms the atmosphere and triggers gigantic springtime storms comparable in size to North America with temperatures of 300 degrees below zero. In the animation pictured left the bright clouds are probably made of crystals of methane, which condense as warm bubbles of gas well up from deep in the atmosphere of Uranus.

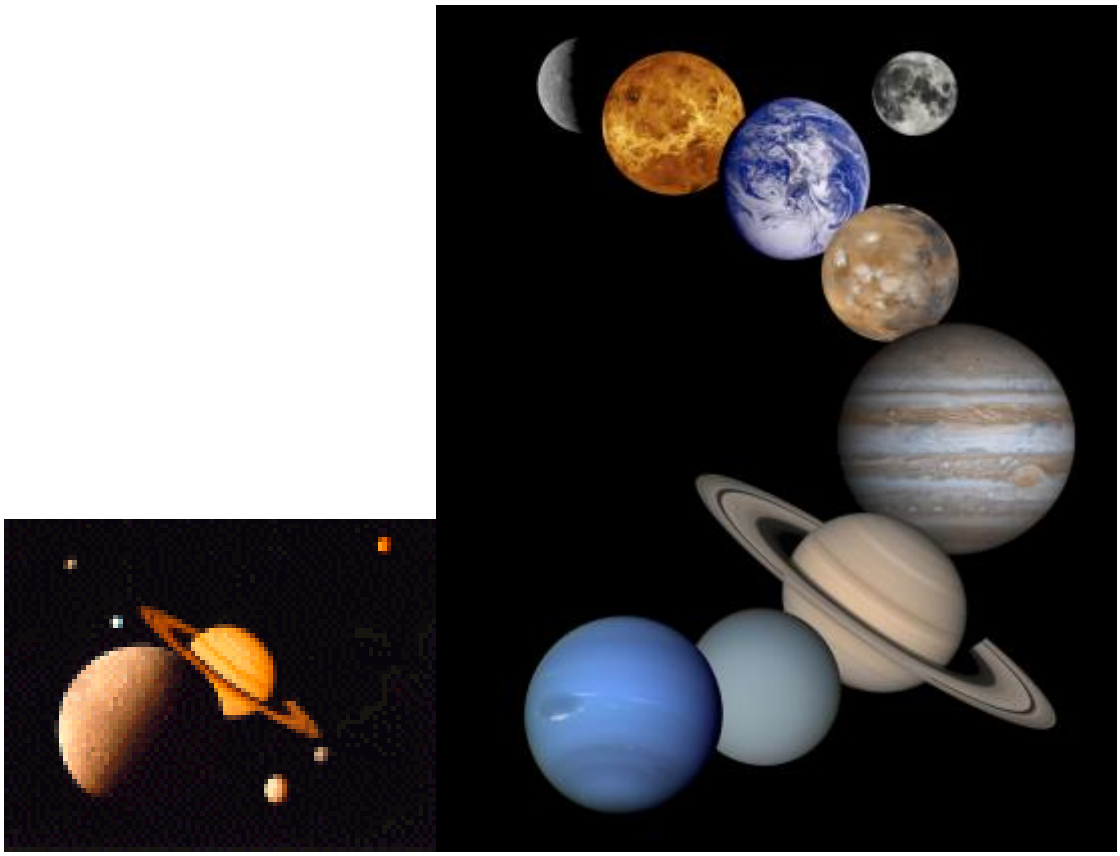
Uranus does not have a solid surface, but is instead a ball of mostly hydrogen and helium. Absorption of red light by methane in the atmosphere gives the planet its cyan color. Uranus was discovered March 13, 1781, by William Herschel. Early visual observers reported Jupiter-like cloud belts on the planet, but when NASA's Voyager 2 flew by in 1986, Uranus appeared as featureless as a cue ball. In the past 13 years, the planet has moved far enough along its orbit for the sun to shine at mid-latitudes in the Northern Hemisphere. By the year 2007, the sun will be shining directly over Uranus' equator.

Mercury's seasons -- if they can be called that -- are also remarkable. Until the 1960's it was thought that Mercury's "day" was the same length as its "year" keeping the same face to the Sun much as the Moon does to the Earth. This was shown to be incorrect by Doppler radar observations. We now known that Mercury rotates three times during two of its years. Mercury is the only body in the solar system tidally locked into an orbital-to-rotational resonance with a ratio other than 1:1.

This fact and the high eccentricity of Mercury's orbit would produce very strange effects for an observer on Mercury's surface. At some longitudes the observer would see the Sun rise and then gradually increase in apparent size as it slowly moved toward the zenith. At that point the Sun would stop, briefly reverse course, and stop again before resuming its path toward the horizon and decreasing in apparent size. All the while the stars would be moving three times faster across the sky. Observers at other points on Mercury's surface would see different but equally bizarre motions.

Temperature variations on Mercury are the most extreme in the solar system ranging from 90 K at night to 700 K during the day

https://science.nasa.gov/science-news/science-at-nasa/2000/interplanetaryseasons



http://www.space.com/22872-rigel.html

CONSTELLATIONS:

Our summer constellations are well up in the sky right now.
These are some of the constellations that it is possible to view in our summer months.
The southern Cross.
Centaurus
Orion
Canis Major
Gemini
Taurus and the Pleiades

Star maps are easily available on the Internet, for example: **www.skymaps.com**

A SUMMER TOUR IN THE SOUTH:

During our summer months our skies are enhanced by the Constellation Orion. For summer magic and wonderment little else will overtake the awe inspiring Orion Constellation.
Now is the time when we sadly begin to notice that summer is passing rapidly. Just step out at about 9pm. On a clear evening and you will see how far Orion has travelled the sky and now lies almost vertically above us. Soon, in the wee hours before dawn we will be seeing the start of Scorpious rising, reminding one of the approaching winter for the Southern Hemisphere.
Yet another constellation that inspires one with the mystery and beauty of the night, is the imposing sight of the constellation Taurus. At first glance one sees the typical v-shape of a large pair of horns but those horns are filled with so much to see, keeping one engrossed for many a dark night hour.
At the end of January, Taurus held the star of the week, Elnath, also known as Alnath. After Aldebaran, Elnath is the second brightest star in Taurus and is the closest bright star to the opposite end of the Milky Way centre, known as the anti centre.
To find Elnath: Aldebaran stands on the one horn of Taurus. Elnath is at the open end of the other horn.
Elnath actually goes by three names: Alnath, Beta Tauri, abbreviated to Beta Tau and Elnath. It has an apparent magnification of 1.68 and an absolute magnification of -1.34 which is the same size magnification as the star Maia, in the close by Pleiades cluster. However, Maia is 360 light years away while Elnath, by comparison, is only 130 light years away, thus ranking the B-class giant Elnath as the second brightest star in the constellation.
Interestingly, Ptolemy in his day, considered El Nath to be shared by Auriga so, under the Johan Bayer designation, it was called Beta Tauri and gamma Aurigae. In 1930, the modern constellation boundaries were fixed and the name Gamma Aurigae was dropped.
In February,Pleiades and Taurus are moving, slightly ahead of Orion also going westward; while Gemini, Cancer and Leo, are the Zodiac signs following Orion from the East.
From the southern aspect and Westward of Crux, we have a very bright star, Formalhaut. This star acts as a guide to the location of four bird constellations, Grus, Pavo,Tucana and Phoenix. To the East of Crux and almost in line with Agena lies Corvus the crow, the fifth bird constellation.
Above Corvus lies below Hydra the water snake who until everlasting, separates Corvus from the Cup, preventing the crow from taking the cup to drink from. There is this myth that Zeus asked the crow to take the cup and fetch water for him but the crow being lazy, told a lie and said he lost the cup as the water snake nearly bit him so he could not fetch water. Zeus being a god knew the crow was telling a lie so he placed the crow in the sky on one side of the river and the cup on the other out of the crows reach and thus the crow always remains thirsty.

At this point in our summertime, Orion and all the stars and other constellations around it, seem to hang visibly above our head. The most important of which is Canis Major, known as The Great Dog, being Orion's hunting dog. The brightest star in the heaven lies therein, namely, Sirius.
Almost adjoining Taurus is a quiet looking, constellation called Auriga, the Charioteer. A constellation also belonging to our summer evening observations for it holds Messier objects: M36, M37 and M38.
To find Auriga; draw an imaginary from Mintaka in Orion's Belt, straight through Bellatrix, down to Auriga. Normally, it is fairly low in or sky but can attain a reasonable height in summer.
Within Auriga is the beautiful yellow star star, Capella whose temperature is similar to that of our sun. It is interesting to note that our Sun is termed a dwarf star, whereas Capella is known as a giant star. Capella has a luminosityof about 150 times greater than that of our Sun and is actually a binary star with a distance of about 42 light years.
The name Capella conjours up a musical tinkle but Capella is actually known as a She-Goat. Maybe the She-Goat wears a bell which tinkles and twinkles.
Capella is joined by a triangle of three fainter stars, fainter because of their great distance. Together they are called Haedi meaning Kids (young goats). These three stars are called, Epsilon, Eta and Zeta Aurigae.
Very long ago Epsilon Aurigae was known as Almaaz but it appears to be a name that is not much used today. Epsilon is interesting in that it is a very luminous supergiant, about 200,000 more powerful than our sun. Its faintness is due to it being 4600 light years away.

GALAXIES:

RAM PRESSURE STRIPPING:

By Deborah Byrd in Space | January 23, 2017

New research published January 17, 2017 by a global team of researchers focused on 11,000 relatively nearby galaxies and asked why their gas — their lifeblood for the formation of new stars — is being violently stripped away on a widespread scale. The answer, according to these scientists, relates to the great halos of dark matter thought to surround galaxies and paints a picture of these galaxies falling through these larger halos, having their star-forming gas removed in a fast-acting process called ram-pressure stripping.

The study – published in the peer-reviewed journal *Monthly Notices of the Royal Astronomical Society* – was based at the International Centre for Radio Astronomy Research (ICRAR) in Australia. It shows that the phenomenon is more prevalent than previously thought and that it drives gas from galaxies, sending them to an

early death by depriving them of the material to make new stars. Toby Brown, a PhD candidate at ICRAR and Swinburne University of Technology, led the study. He said:

During their lifetimes, galaxies can inhabit [dark matter] halos of different sizes, ranging from masses typical of our own Milky Way to halos thousands of times more massive.

As galaxies fall through these larger halos, the superheated intergalactic plasma between them removes their gas in a fast-acting process called ram-pressure stripping.

You can think of it like a giant cosmic broom that comes through and physically sweeps the gas from the galaxies.

Brown said removing the gas from galaxies leaves them unable to form new stars:

It dictates the life of the galaxy because the existing stars will cool off and grow old. If you remove the fuel for star formation then you effectively kill the galaxy and turn it into a dead object.

Brown compared the fast-acting process of ram-pressure stripping to the other main process by which galaxies run out of gas and die. The slower process is known as strangulation. He said:

Strangulation occurs when the gas is consumed to make stars faster than it's being replenished, so the galaxy starves to death. It's a slow-acting process. On the contrary, what ram-pressure stripping does is bop the galaxy on the head and remove its gas very quickly — of the order of tens of millions of years — and astronomically speaking that's very fast.

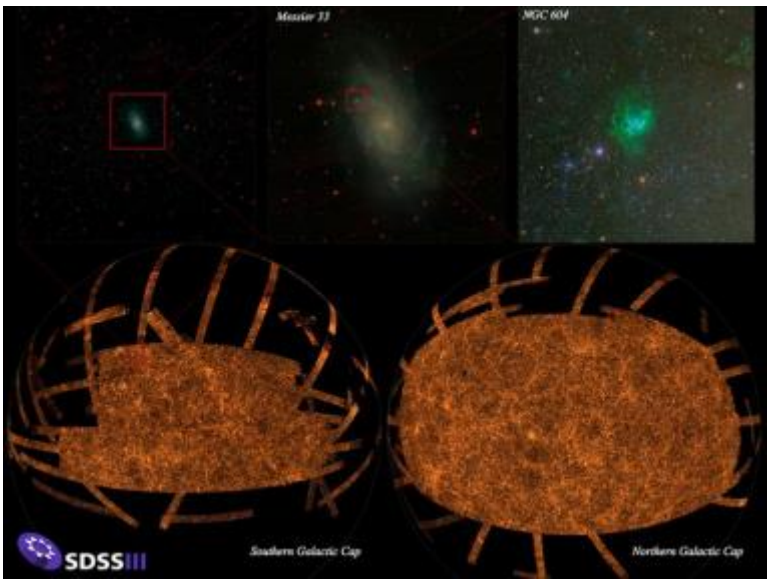
ICRAR researcher Barbara Catinella is co-author of the study. She said astronomers knew previously that *ram-pressure stripping* affected galaxies in great galaxy clusters, around which, astronomers believe, are the most massive dark matter halos in the universe. Brown explained:

This paper demonstrates that the same process is operating in much smaller groups of just a few galaxies together with much less dark matter. Most galaxies in the universe live in these groups of between two and a hundred galaxies.

We've found this removal of gas by stripping, is potentially the dominant way galaxies are quenched by their surrounds, meaning their gas is removed and star formation shuts down.

To observe the 11,000 galaxies in this study, these astronomers used an innovative technique combining the largest optical galaxy survey yet completed — the Sloan

Digital Sky Survey — with the largest set of radio observations for atomic gas in galaxies — the Arecibo Legacy Fast ALFA survey.



Here's the Sloan Digital Sky Survey "Orange Spider." It illustrates a wealth of information being obtained about galaxies via the most recent surveys. The picture in the top left shows the SDSS view of a small part of the sky, centered on the galaxy Messier 33 (M33). The middle and right top pictures are further zoom-ins on M33. The figure at the bottom is a map of the whole sky derived from the SDSS image. Visible in the map are the clusters and walls of galaxies that are the largest structures in the entire universe. Image via SDSS/ M. Blanton. Here's the Sloan Digital Sky Survey "Orange Spider." It illustrates a wealth of information being obtained about galaxies via the most recent surveys. The picture in the top left shows the SDSS view of a small part of the sky, centered on the galaxy Messier 33 (M33). The middle and right top pictures are further zoom-ins on M33. The figure at the bottom is a map of the whole sky derived from the SDSS image. Visible in the map are the clusters and walls of galaxies that are the largest structures in the entire universe. Image via SDSS/ M. Blanton.

Bottom line: A global team of researchers led by Toby Brown at ICRAR in Australia asked why 11,000 relatively nearby galaxies are having their star-forming gas stripped away. The answer paints a picture of these galaxies falling through their larger dark-matter halos, having their star-forming gas removed in a fast-acting process called ram-pressure stripping.

http://earthsky.org/space/whats-killing-these-galaxies

THE MAGELLANIC CLOUDS:

In 1519 Ferdinand Magellan, a Portuguese Explorer set out to find a route to the spice islands. He was noted for being the first to circum-navigate the world. In fact, he did not sail around the world himself, but his crew did. He was killed in the Battle of Macton in the Phillipines. However, by circum-navigating the world he finally proved that the world was round and that it was far bigger than was thought, in those times. Though named after the great explorer Magellan; the galaxies were known to the Polynesians long before Magellan found them. The Polynesians and the Maoris of New Zealand used the galaxies as navigation markers. Being very conspicuous in our southern night skies.

The Magellanic Clouds are two irregular dwarf galaxies, roughly 21 degrees apart. The distance between them is about 75000 light years. The Magellanic Clouds were always thought to be the closest galaxies to our Milky Way but, since 1994 it has been proven that the Sagittarius Dwarf and Canis Major Dwarf galaxies are closer.

Novae flare up in these Clouds from time to time, the most important one being the 1987 Supernova in the Large Magellanic Cloud,(LMC), which lies in the region of the constellation Dorado, the Sword fish. The Small Magellanic Cloud,(SMC), lies near the Constellation Mensa, meaning "table". Its name is Latin for table, though it originally depicted Table Mountain and was known as Mons Mensae, by Nicolas Louis La Caille.

Through study and observation scientists suggest that both the LMC as well as the SMC have been distorted by tidal interaction with the Milky Way because streams of neutral hydrogen connect the clouds to each other and to the Milky Way. Both Clouds are richer in hydrogen and Helium but, they are metal poor. Scientists have also theorized that the SMC is split into two parts separated by about 30000 light years. The smaller, upper part is called the Mini Magellanic Cloud, MMC, an in fact, scientists also maintain that the two parts are still moving away from each other.

The Large & Small Magellanic Clouds – www.eso.org/public/images/b01/

THE MYTH OF THE MILKY WAY:

The Aboriginees have a period they call: "The Dream time**".** This is their understanding of the world, of it's creation, and it's great stories. The Dreamtime is the beginning of knowledge, from which came the laws of existence. For survival these laws must be observed. The Dreaming world was the old time of the Ancestor Beings..

According to their beliefs all life – human, animal bird and fish makes up a network of relationships traced to the great spirit of ancestors of the "Dreamtime". Dreamtime had the supernatural beings that made everything.

Even today, Aboriginees scan the night sky, delving secrets to help them survive the hard life they lead in the vast dry land of Australia.

It was in Dreamtime, long ago a blind man lived with his wife in the dry Australian bush. Each day the blind man would send his wife out to find emu eggs for him to eat. He was an angry man and he always found ways to vent his anger on his wife. He grumbled about all she did for him and always maintained that the emu eggs she found were too small.

One day while out hunting, she came across some very large emu tracks. Very pleased with herself she thought she would follow these tracks, find the nest and bring back large eggs with which to please her husband.

She found the nest on which sat the very large emu so she threw stones at the bird to try and move it from the nest and get the eggs. Alas! That did not happen, instead, the bird stood up, ran towards her, and killed her.

When his wife never came home, he worried a bit because he was hungry. He had to feel around their dwelling to find food. He came across a bush withberries on and he ate some. They were magical and suddenly he could see. This pleased him for now he could find his wife, so he made himself some spears and set out to find his wife. He followed her track until he found her body. There, he saw this giant emu which he speared and banished to the Milky Way where it can still be seen today.

If you look up into the sky, you can see the emu stretched way out across the Milky Way. His head is the Coalsack near the Southern Cross. His head, neck, body and legs are the dark dust lanes stretching across the Milky Way. You look for the Emus in the dark dust lanes, not in the stars.

MAARTEN SCHMIDT AND QUASARS:

February 5, 1963. On this date, Caltech astronomer Maarten Schmidt solved a puzzle about the *quasi-stellar radio source* 3C273 that changed the way we think about our universe. This object appeared starlike, like a point of light, with a mysterious jet. But its spectrum – the range of wavelengths of its light – looked odd. Astronomers routinely use spectra to learn the composition of distant objects. But, in 1963, *emission lines* in the spectrum of 3C273 didn't appear to match any known chemical elements. Schmidt had a sudden realization that 3C273 contained the very ordinary element hydrogen. He realized that the spectral lines of hydrogen appeared strange because they were highly shifted toward the red end of the spectrum. Such a large *red shift* could occur if 3C273 were very distant, about three billion light-years away.

Today, hundreds of thousands of quasars are known, and many are more distant and more powerful than 3C273. It's no exaggeration to say they turned the science of astronomy on its ear. Why, for example, are these powerful quasars located so far away in space? Because light travels at a finite speed (186,000 miles per second), we are seeing distant objects in space in the distant past. In other words, quasars existed in early universe. They do not exist in our time. Why?

In the 1960s, 3C273 and other quasars like it were strong evidence against the Fred Hoyle's Steady State theory, which suggested that matter is continuously being created as the universe expands, leading to a universe that is the same everywhere. The quasars showed the universe is not the same everywhere and thus helped usher in Big Bang cosmology.

But Steady State theory had been losing ground, even before 1963. The biggest change caused by Maarten Schmidt's revelation about the quasar 3C273 was in the way we *think about* our universe.

In other words, the idea that 3C273 was extremely luminous, and yet occupied such a relatively small space, suggested powerful energies that astronomers had not contemplated before. 3C273 gave astronomers one of their first hints that we live in a universe of colossal explosive events – and extreme temperatures and luminosities – a place where mysterious black holes abound and play a major role.

According to a March 2013 email from Caltech:

In 1963, Schmidt's discovery gave us an unprecedented look at how the universe behaved at a much younger period in its history – billions of years before the birth of the sun and its planets. Later, Schmidt, along with his colleague Donald Lynden-Bell, discovered that quasars are galaxies harboring supermassive black holes billions of light-years away – not stars in our own galaxy, as was once believed. His seminal

work dramatically increased the scale of the observable universe and advanced our present view on the violent nature of the universe in which massive black holes play a dominant role.

What are quasars? Astronomers today believe that a quasar is a compact region in the center of a galaxy in the early universe. The compact region is thought to surround a central supermassive black hole, much like the black hole thought to reside in the center of our own Milky Way galaxy and many (or most) other galaxies. The powerful luminosity of a quasar is thought to be the result of processes taking place in an *accretion disk*, or disk of material surrounding the black hole, as these supermassive black holes consume stars that pass too near.

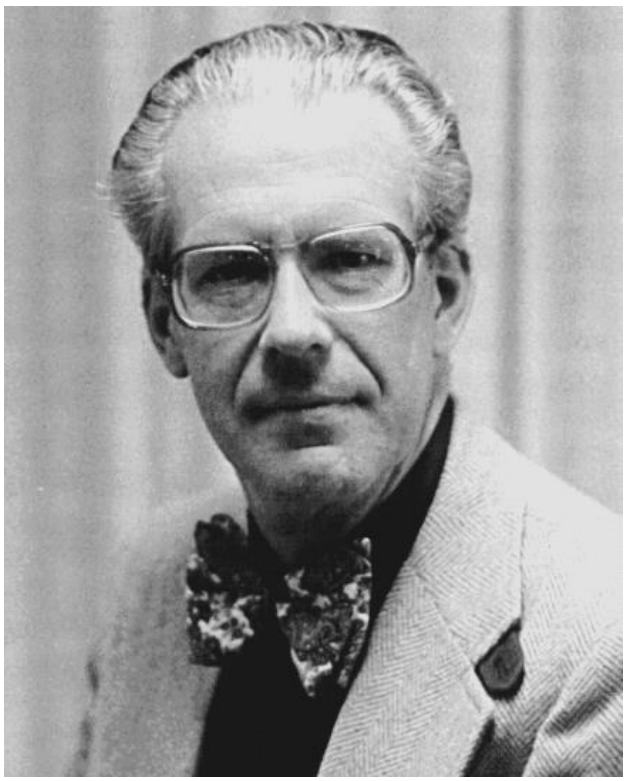
ULAS J1120+0641, farthest quasar known as of 2011. The quasar appears as a faint red dot close to the center. Composite image created from the Sloan Digital Sky Survey and the UKIRT Infrared Deep Sky Survey, via Wikimedia Commons.

The Chinese-born U.S. astrophysicist Hong-Yee Chiu coined the name *quasar* in May 1964, in the publication *Physics Today*. He wrote:

So far, the clumsily long name 'quasi-stellar radio sources' is used to describe these objects. Because the nature of these objects is entirely unknown, it is hard to prepare a short, appropriate nomenclature for them so that their essential properties are obvious from their name. For convenience, the abbreviated form 'quasar' will be used throughout this paper.

Today, the farthest known quasar is ULAS J1120+0641. Its co-moving distance is 28.85 billion light-years.

Bottom line: On February 5 1963, astronomer Maarten Schmidt's flash of inspiration led to the understanding that quasi-stellar radio sources, or quasars, exist in the very distant universe. Quasars became the most distant, and most luminous, objects known. They changed the way we think about the universe.



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