ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

Durban 'nDaba

Monthly Newsletter of the Durban Centre - September 2020

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Member Submissions Disclaimer

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Chairman's Chatter

By Piet Strauss

Dear Members,

We are now officially in Spring, starting with a cold and wet 1st of September.

The lockdown at level 2 is allowing us a bit more freedom but it is certainly not safer outside, we need to continue to take care and stay safe.

We have decided to not have "in person" meetings yet, but rather continue with our Zoom meetings, hosted by Gerald de Beer. The first in August was generally a success, although some members had difficulty hearing or signing in.

Prof Mike Kosch has kindly given us a PDF copy of his presentation. You will not be able to have the sound but can view the slides on our website (astronomydurban.co.za) under the "Links" menu.

Our next meeting will be on Wednesday 9 September at 7:30 pm via Zoom. The main speaker is Dr Adriana Marais. Her topic is "Off-World: How the Voyage to Mars will Evolve Earth". We will send you the Zoom link by Tuesday.

There is some good news on our "postponed" trip to Sutherland and Hermanus. The airline has agreed that our vouchers will remain valid until April 2022. The best time of the year is to go during March/April.

The view from the Committee is that we do not commit to a date yet, but wait until we know how the Covid 19 spread develops.

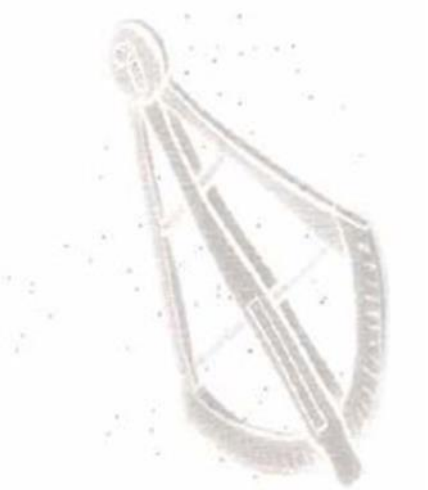
Hope we see you on the Zoom meeting on Wednesday at 19:30.

Stay safe and clear skies,

Piet

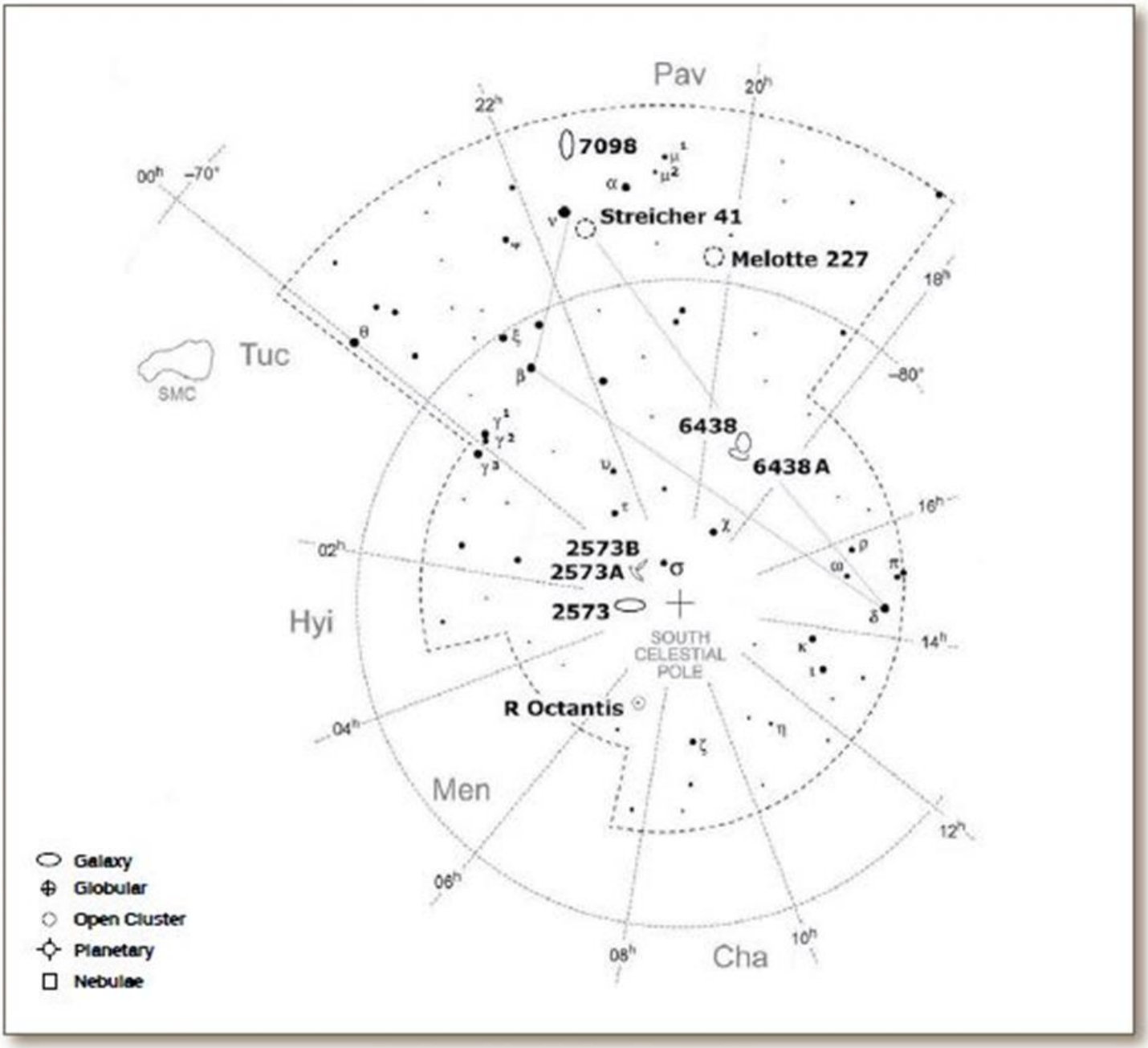
Astronomy Delights:
OCTANS Heading for the Pole

By Magda Streicher



Octans is not exactly a constellation that would attract much attention and in addition, it doesn't contain any really bright stars to indicate its shape. But don't underestimate this southern polar constellation. It contains at least a handful of galaxies, a few open star clusters and around 30 double stars.

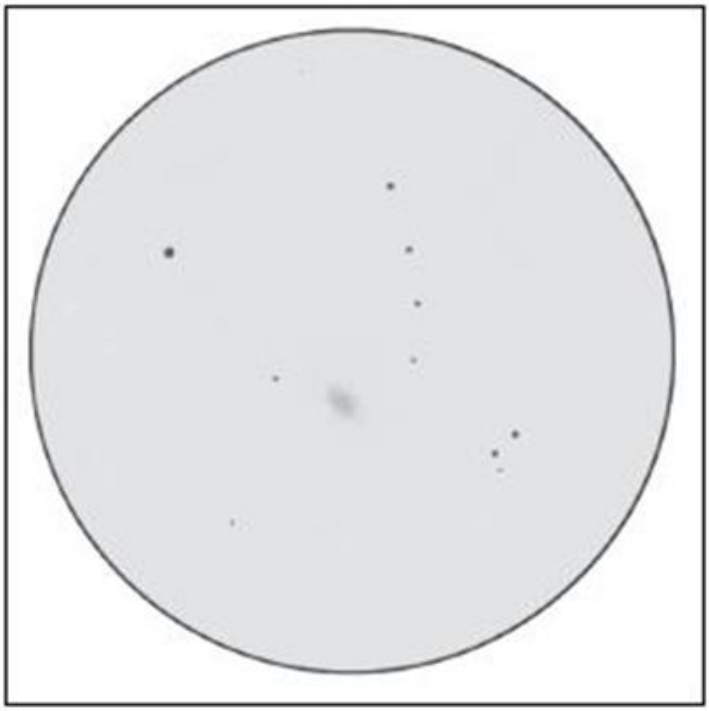
The constellation was apparently named by Nicolas Louis de Lacaille during his visit to the Cape of Good Hope. It is believed that a comedy was even written by John Hadley in 1730 to honour the octant.



The constellation of Octans

… OCTANS Heading for the Pole

The three brightest stars in the constellation form a characteristic triangle with nu, beta and delta Octantis. The sentiments go back to the old seafarers who, in ideal conditions, actually saw the constellation's brighter stars revolving around the pole and were assured of the fact that they were sailing southwards. The south-western heel point, completing the constellation triangle, is the double star delta Octantis. The wide double star nu Octantis is fairly bright and consists of a pair of magnitude 8 yellow coloured stars. The magnitude 5.2-star alpha Octantis can be picked up 2 degrees west of nu Octantis. A little further north is the double star mu Octantis, two beautiful butter-yellow coloured stars, underlined by a string of faint stars in an east-west direction. Because the pole is turning around relatively fast, directions relate to early summer southern hemisphere evenings.



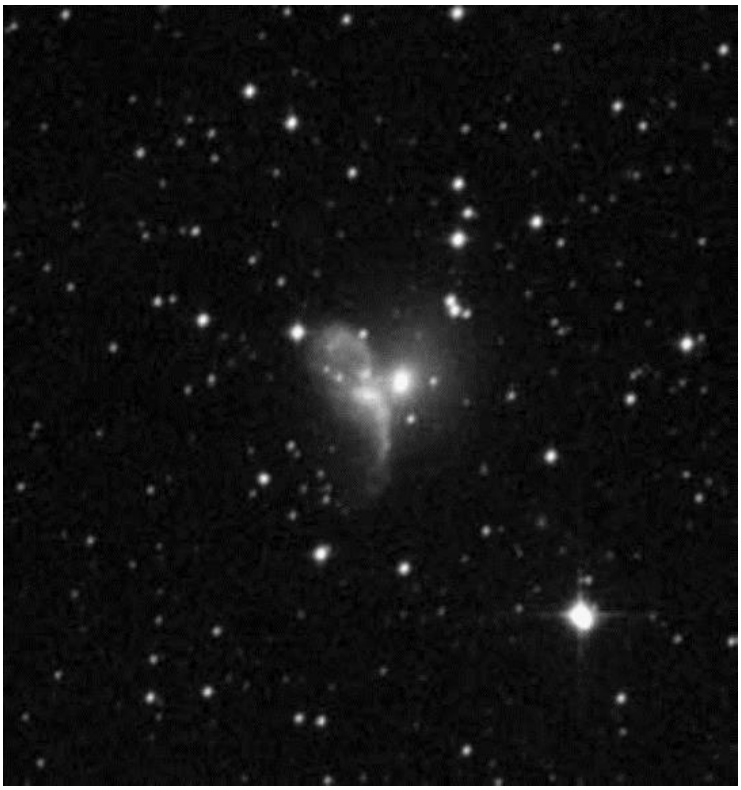
NGC 2573 – Galaxy

Only 40' east of the southern celestial pole, the nearest galaxy, **NGC 2573**, Polarissima Australis, can be found. The galaxy displays a small, slightly eastwest oval puff of light, with low surface brightness and a barely brighter nucleus. The western edge of the galaxy seems to be slightly hazier. A string of more or less evenly spaced stars runs almost 8' towards the south, starting just off the galaxy's eastern edge. It is not an easy object to observe at all. NGC 2573 companion galaxies **NGC 2573A** and **NGC 2573B**, only a few arc-minutes away with both slightly oval in shape. However, the fact that this is a trio of famous galaxies does not make it at all easy to discern, even when using high magnification through a moderate telescope.

The variable star R Octantis is situated approximately 4 degrees south of NGC 2573 and varies between magnitude 6 to 13 in only 13 months. Astronomers designate the first variable star discovered in a constellation with the letter R.

Several galaxies call the area around the southern pole home, and was surprised by the brilliance of the merging two galaxies **NGC 6438** and **NGC 6438A**, situated nearly 5 degree.es north-west of NGC 2573 .

The soft oval of the two combined galaxies is relatively obvious. Higher magnification reveals an extension like a wisp attached to the main galaxy's southern end indicates the companion galaxy NGC 6438A which seems elongated. At both ends of these two galaxies, faint pinpoint stars can be seen. A yellow colour magnitude 10 star is situated towards the south-west.



NGC 6438 and NGC 6438A
Photograph: In-The-Sky

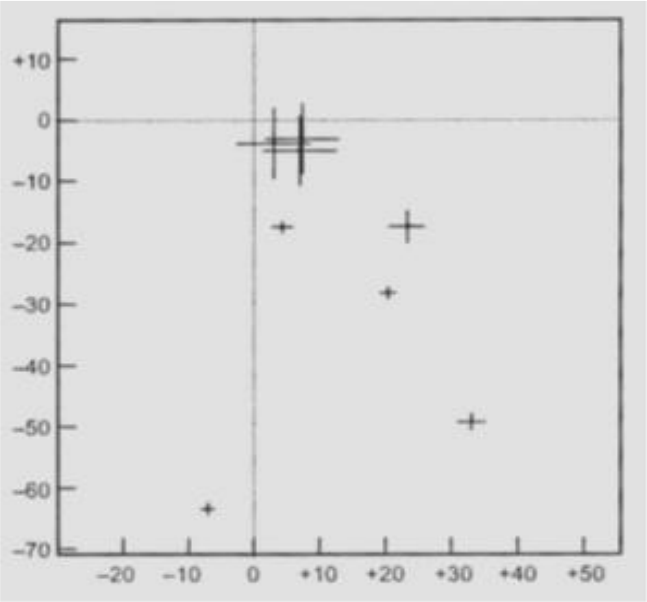
… OCTANS Heading for the Pole

The open star cluster **MELOTTE 227** is situated in a long triangle with alpha and nu Octantis. The main focus is a scattered group of about 20 stars in an elongated northsouth direction, roughly 40’ in size. This grouping contains a few bright stars and a large handful of fainter ones showing a relatively close formation. Towards the west of this group is a prominent string of stars which could well be part of the group.

LEFT: MELOTTE 227 Photograph: WEBDA

In this part of the constellation I came across an asterism now listed in the Deep Sky Hunters Catalogue as **STREICHER 41**. It was great to discover an asterism in our heritage constellation Octans. This star grouping reminds me, in a way, of a glass filled with stars.

RIGHT: STREICHER 41 – Photograph: DSS



LEFT: Diagram – Auke Slotegraaf

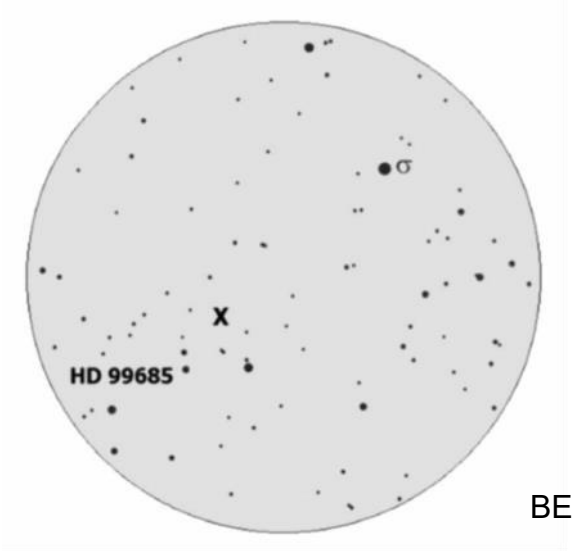
The Vector-point diagram indicates the brightest stars in the asterism Streicher 41. The abscissa shows motion measured in milli arc-seconds per year while the ordinate plots proper motion times in Declination.

The galaxy **NGC 7098** is situated only one degree from the border with the constellation Indus. It displays a soft, somewhat circular glow in a north-east to southwest direction and accompanies an outstanding bright star-like nucleus and a soft halo around it. A string of four magnitude 11 stars situated directly towards the north-east of this galaxy.

RIGHT: NGC 7098 – Photograph: Wikipedia

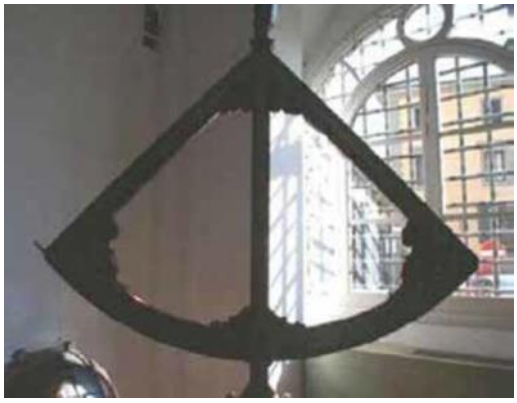
… OCTANS Heading for the Pole

I would venture to believe that the part of the night sky containing the south celestial pole does leave some of us feeling little nostalgic. The magnitude 5.4-star sigma Octantis also called Polaris Australis, came closest to the south celestial pole in 1866 when it was just 43' away. The invisible pole position is now heading towards the magnitude 4.3-star delta Octantis. Because of my adventurous nature often wanting to explore the impossible, I felt compelled to find the exact location.



A mere half a degree from magnitude 5.4 sigma Octantis, this special point can be found in the night sky, but definitely not without effort. The unknown, yet well-known, point in the starry sky is only 12' of the relatively bright magnitude 7.8-star **HD 99685,** the bottom star of an obvious string of three stars in steps of brightness indicates the way. However, it seems that a magnitude 14-star is the closest star to true south, only 3' away from the celestial south pole.

BELOW: South Celestial Pole Photograph: Kos Corinado



ABOVE: A replica of the octant in the Florence Science Museum – Photograph: Belinda Streicher le Roux

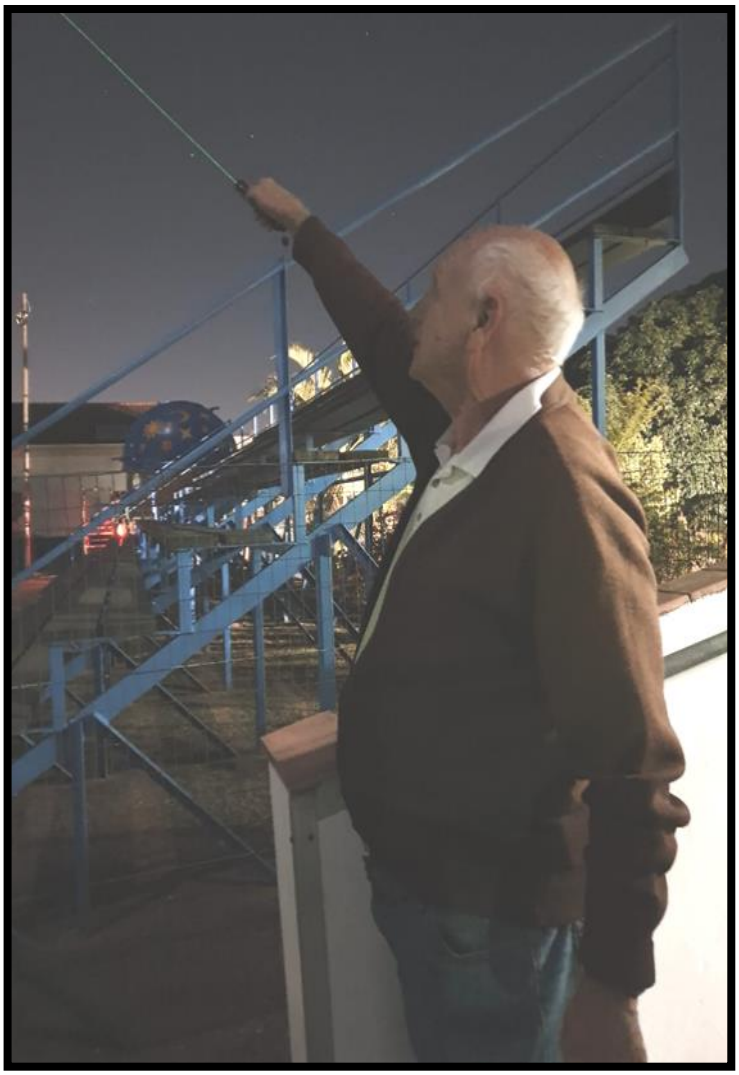
OBJECT	TYPE	RA	DEC	MAG	SIZE
NGC 2573	Galaxy	01h42m.0	-89°20'.0	12.8	2'×0.7'
R Octantis	Variable Star	05h26m.1	-86°23'.0	6.4 13.2	Period 406 days
NGC 6438	Galaxy	18h22m.3	-85°24'.0	12.5	1.7'×1.4'
NGC 6438A	Galaxy	18h22m.7	-85°25'.0	13.2	3.2'×1.4'
MELOTTE 227	Open Cluster	20h12m.3	-79°17'.4	5.3	45'
STREICHER 41 DSH J2126.9-7753	Asterism	21h26m.9	-77°53'.0	9	16'
NGC 7098	Galaxy	21h44m.3	-75°07'.0	11.4	4'×2.3'
NGC 2573B	Galaxy	23h07m.2	-89°07'.0	13.5	1.1'×0.4'
NGC 2573A	Galaxy	23h12m.2	-89°08'.0	13.8	1.3'×0.3'

LEFT: Octans Reference

I hope the thought occurs to you to look up the spot we call the southern starry pole, perhaps it's just the thought that's important when one looks at the few faint stars around this strategic point.

At the Eyepiece

September 2020 by Ray Field



The Sun reaches overhead and crosses the equator of the earth on the 22nd September 2020 marking the vernal equinox for the Southern hemisphere.

The Moon is full on the 2nd, Last quarter on the 10th, New on the 17th and First quarter on the 24th. The International Observer the Moon night is on the 26th. The Moon is near Mars on the 6th, Aldebaran on the 9th, Pollux on the 13th, Venus on the 14th, M44 (Beehive) on the 14th, Regulus on the 15th, Mercury on the 19th, Antares on the 22nd, Jupiter, Saturn and Pluto on the 25th.

Mercury will be visible in the evening twilight over the West all month. The Moon will be near Mercury on the 19th.

Venus is a brilliant object in the morning twilight all month. The Moon is near Venus on the 14th.

Mars, in Pices, is fairly near the equator of the sky above the “Square of Pegasus” all month and is well places for observation. It is a very bright, reddish-orange coloured object and it rises about 21:00 mid-month. The Moon is near Mars on the 6th and Mars outshines Jupiter from mid-month.

Jupiter and Saturn, near the “Teapot” asterism in Sagittarius, make and easy, bright pair to see in the night sky as soon as it gets dark. They set at about 03:00 mid-month.

The faint planet Uranus, in Aires, is visible all night. The chart for even fainter Neptune is also given on page 79 of ASSA Sky Guide.

Comets. A chart is given on page 44 of Sky Guide, showing the path of comet 88/p Howell, during September, when the comet passes through Libra, Scorpius, and Ophiuchus. At best it might become a binocular object peaking about the end of September. Although well-placed for observing from South Africa, it is not expected to be a bright naked-eye object.

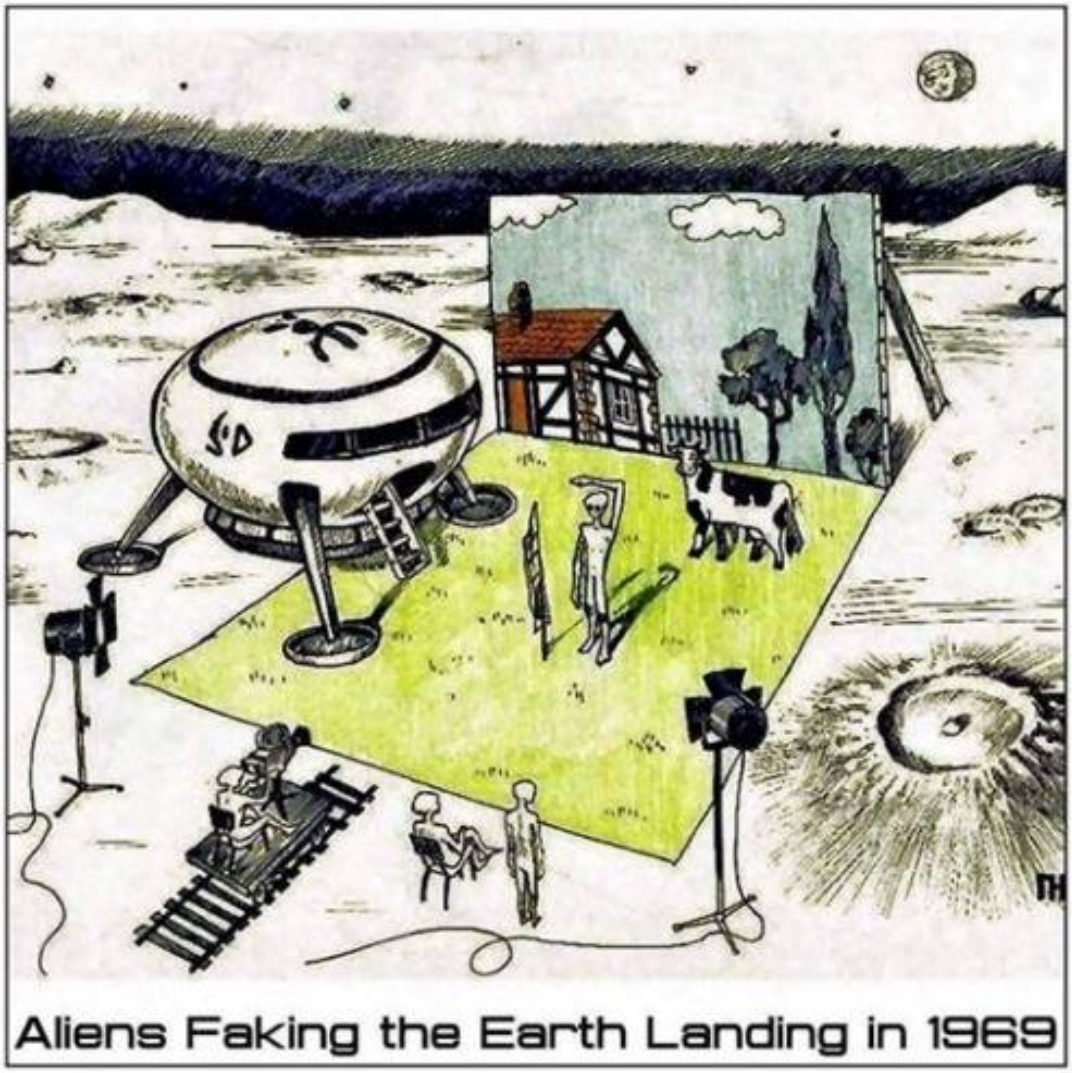
Meteors. There are no bright meteor showers expected this month per ASSA Sky Guide page 86.

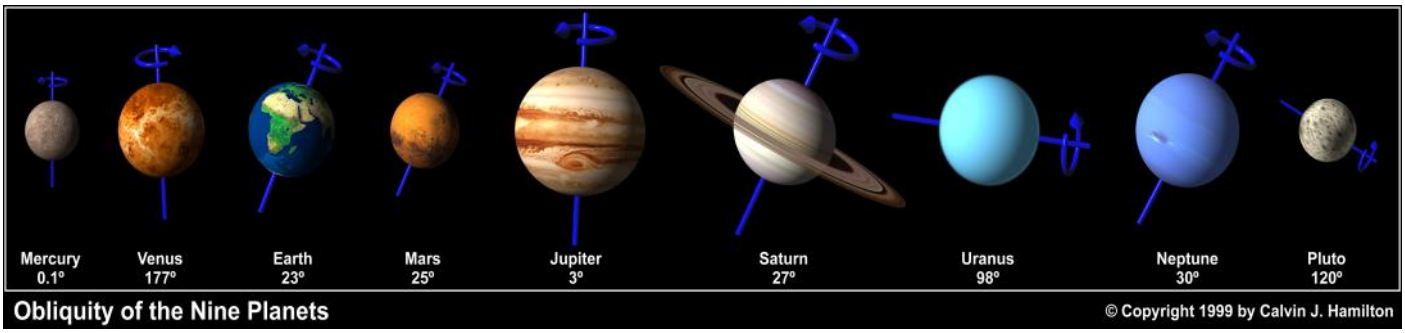
The Starry Sky. From Durban mid-month at 20:00, the Southern Cross and pointers are well on the way to setting over the South West. The bright star, Canopus lies right on the Southern horizon. The bright star, Achernar is rising over the South East. Above Achernar are the two brightest stars of Grus, the Crane, and to their left is Fomalhaut.

… At the Eyepiece

To the right of Grus is the brightest star of the constellation of Pavo, the Peacock and is 231 light year away. North of Pavo are the constellations of Sagittarius and Scorpius. Then stretching North of the constellations is the big constellation of Ophiuchus, which touches the head of Hercules, which has its feet on the Northern horizon. To the right of Hercules are two bright stars low down. Vega in Lyra, the Harp, which contains the famous planetary nebula Messier 57 or the Ring nebula, and to the right of Vega the bright star Deneb in the constellation of Cygnus, the swan. This constellation looks like an inverted cross sloping up to the left. The stare Alberio, at the highest end of the “cross” is a beautiful coloured double star, one blue and one orange. They are a beautiful bright pair.

References include ASSA Sky Guide 2020, Nortons Star Atlas and Reference Handbook, Stars of the Southern Sky by Sir Patrick Moore and Philips Planisphere for 35º South.





The Blinking Planetary Nebula

By Brian Ventrudo

A Hubble Space Telescope image of the Blinking Planetary Nebula NGC 6826 (with additional processing by Judy Schmidt)

While the Milky Way along the backbone of the constellation Cygnus, the Swan, offers many fine targets for stargazers, the wings of the constellation are also well worth exploring, especially in the months of July through October when the constellation lies near the meridian. In this short tour, let's tiptoe through the western wing of the Swan and inspect the remarkable Blinking Planetary, NGC 6826, and a few more intriguing deep-sky objects.

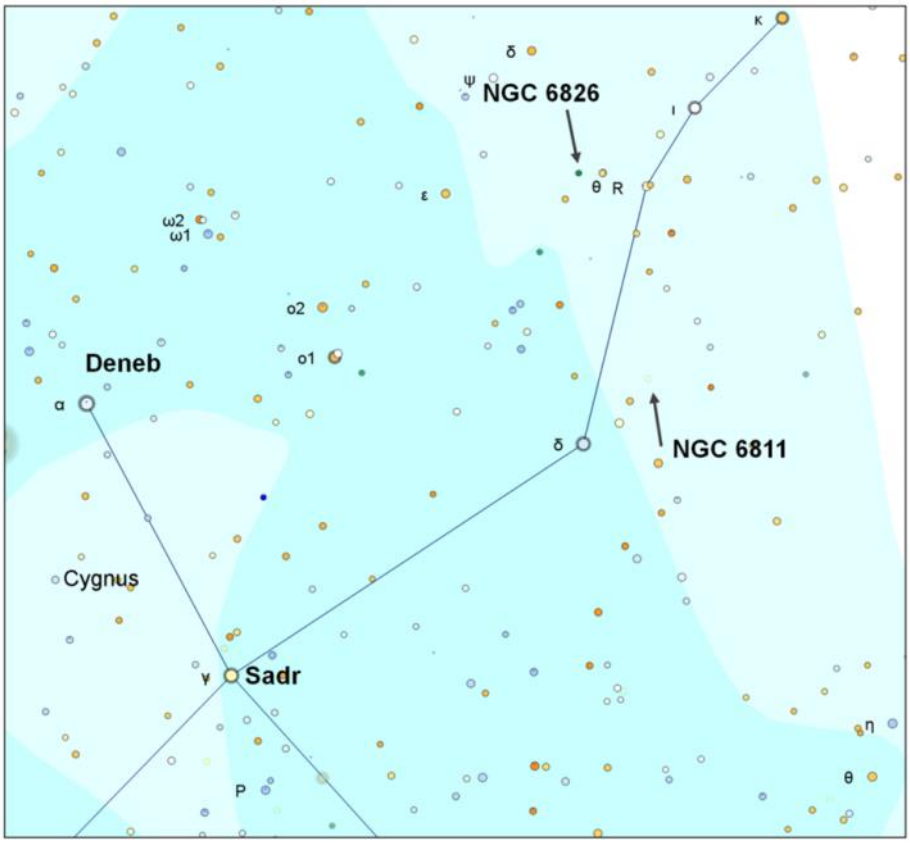
Before we get to the Blinking Planetary, let's look at the brightest star in this part of the sky. It's δ (delta) Cygni, a 3rd magnitude triple star system about 165 light years away. Such a bright star in a prominent part of the sky deserves a proper name, but most star maps just label it δ Cygni, though some call it Rukh or Al-Fawari. Future generations will surely assign another name to this star. When the wobbling Earth directs its axis towards δ Cygni in a little more than 9,200 years, it will be called, for a time, the North Star.

Have a look at the star with your telescope and you'll see the main 3rd-magnitude component as a blue-white gem. The bone-white 6th-magnitude companion lies about 2.4″ away, which makes it challenging to discern in unsteady sky. You'll need 75x or so to split this pair in a small telescope. The much fainter red dwarf companion shines at 12th magnitude and is very hard to pick out from the background stars.

OK, now let's get to the Blinking Planetary. Cataloged as NGC 6826, it's just southeast of the star iota (ι) Cygni, and just west of a line extended from kappa (κ) to iota (ι) with a length equal to the distance between the two stars. The 9th-magnitude planetary is fairly small, just 25″ in apparent diameter, so it appears nearly star-like at 50x. You can determine if you have indeed found the nebula by increasing magnification to enlarge the disk. At 120x or more, the nebula will reveal an obviously oval shape and a subtle blue-green color. The 10th-magnitude central star of NGC 6826 is quite obvious in a small telescope. This star is generating the nebula as it casts off its outer layers from its blazing hot central core.

The Blinking Planetary is an object that most dramatically demonstrates the effect of averted vision. Stare directly at this blue-green planetary nebula for several seconds and you see only the central star. Look slightly to the side and the faint nebula around the star appears suddenly. When you switch from straight on to averted vision, the nebula appears to blink on and off. It's darned impressive. Using a nebula filter (such as a UHC or OIII filter) increases the contrast of the nebula against the background sky, but ruins the blinking effect.

… Blinking Planetary Nebula



Location of NGC 6826, the Blinking Planetary, in the western wing of Cygnus, the Swan. The star cluster NGC 6811 is also shown (created with SkyX Serious Astronomer Edition by Software Bisque).

…The Blinking Planetary Nebula

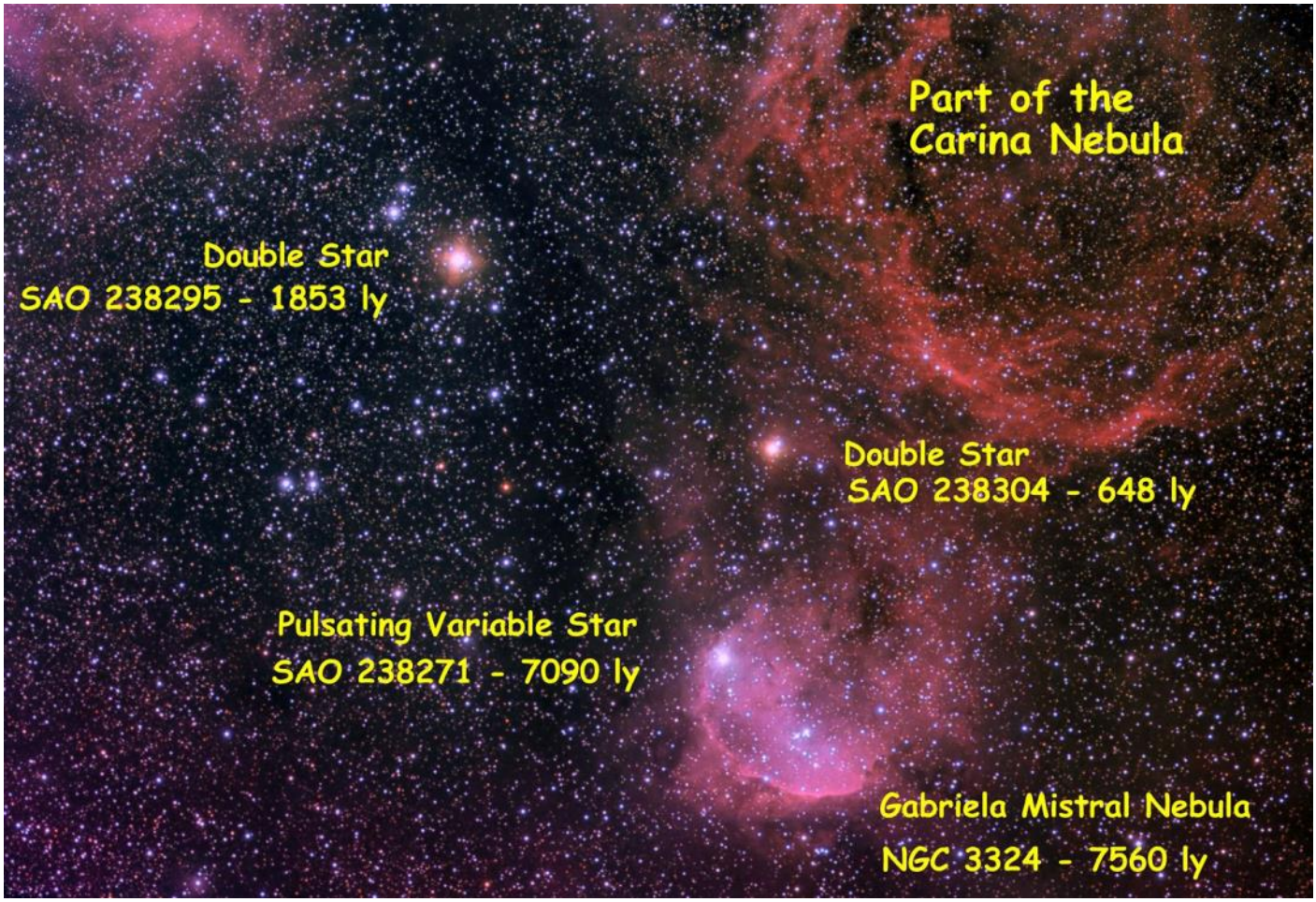
Above: The open star cluster NGC 6811 in Cygnus (credit: Roberto Mura/Wikipedia)

If you're hungry for more stargazing, look for the lovely little open star cluster NGC 6811. It's just west of the line between δ Cyg and ι Cyg and much closer to the former. The little cluster is most fascinating for the assortment of shapes it resembles. Some say it looks like a smoke ring, some say it resembles the Liberty Bell, and others see Nefertiti's headpiece, for example.

Crank your telescope up to a moderate magnification around 50-80x and observe the cluster closely and carefully. What shape do you see?

The Cover Image - NGC 3324

By John Gill



TECH SPECS:

- APM 107/700 apo telescope on CGX mount
- ZWO1600mm camera gain 180 for 240 seconds
- 30 x Ha, 25 x Sii, 25 x Oiii
- 45 Darks & 60 Flats per filter

Can you name the below famous five astronomers?

Last months famous five astronomer were: Vera Rubin, George Ellery Hale, Pythagoras, Edmond Halley, Aryabhata

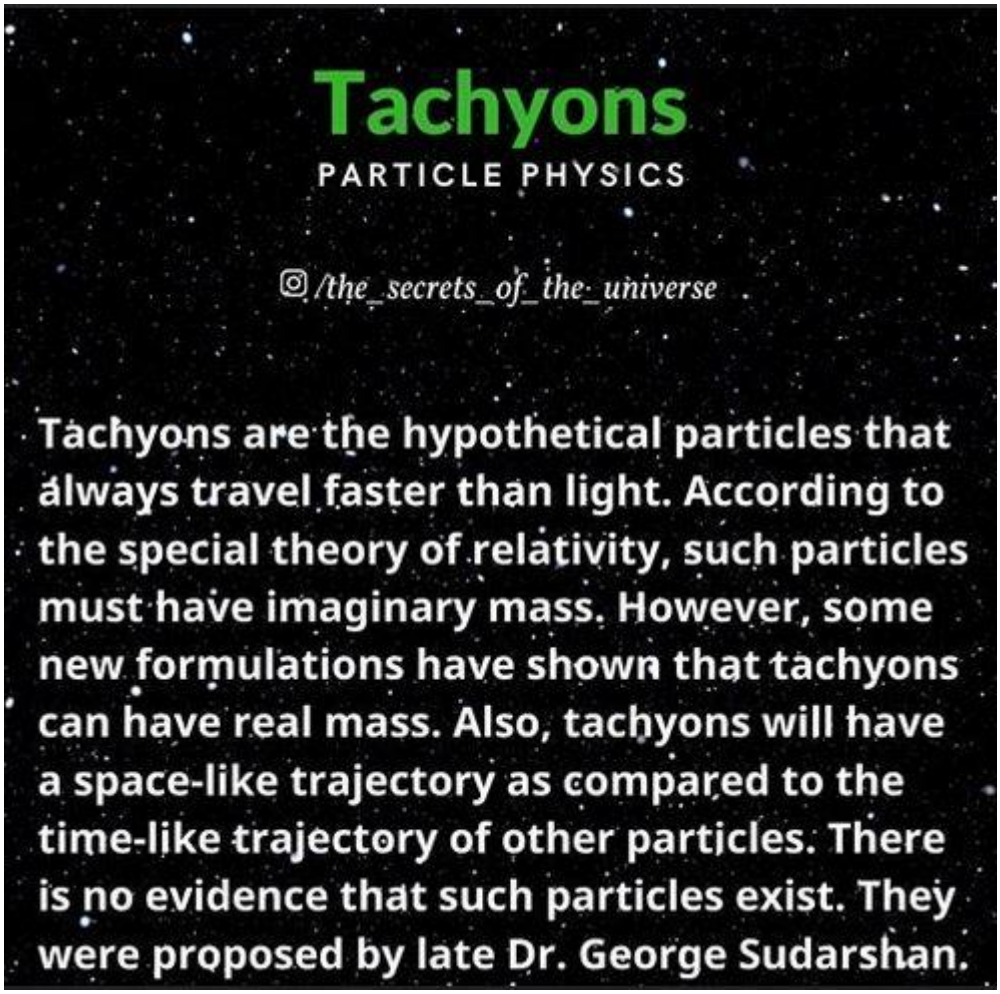
Why the Starry Sky is Black

by Semir Aliomerovic'

When we look at the starry sky and think about what we see - at some point almost everyone asks the same question. If the universe is infinite and there are billions of stars and galaxies in the sky - why is the sky black. Why doesn’t the whole sky shine with the radiance of the stars that are in all the directions of the sky we are looking at? It was expected to be so, but paradoxically it is not. The crystal clear sky is like coal black. This photometric paradox is called the Olbers paradox, and it is not easy to explain.

There are several theories related to the Olbers paradox, and two give a perfectly acceptable answer. We all know that light has finite speed and that the universe is huge. The size of the universe (and the speed of expansion) is so large that light from distant stars has not yet reached us. In addition, both the age and the expansion of the universe affect how we see the starry sky. As the age of the universe increases, so does the number of stars whose light reaches us. The age of the universe is estimated at approximately 13 billion years, and from what we see in the sky - we can say that the universe is "very young". If the universe were 10,000 billion years old - because of the many stars formed, the sky would shine in all directions. We see what we see.

Since the speed of light is finite, we will always see a limited part of the universe. In the depths of space, galaxies are gaining momentum and are constantly moving away from us. This is due to the interaction of gravity, which begins to accelerate galaxies. When they reach a speed equal to the speed of light - galaxies reach the limit of our visible universe. After that, they move at a speed higher than the speed of light and become invisible to us. Of course, all those many galaxies and billions of stars still exist in them - but we don't see them anymore. This theory has estimated that the visible universe is 13 billion years old, and that the actual size (according to some calculations) of the "visible and invisible" universe is approximately 90 billion years.



Ulugh Beg

The legendary Muslim astronomer, prince of stars.

By TRT World

Born into noble Timurid lineage, Ulugh Beg gained fame for his intellect and pioneering strides in astronomy and mathematics.

The story goes that American counterparts to Alexei Leonov — a Russian cosmonaut who became the first human to conduct a spacewalk on 18 March 1965 (then-USSR), asked a favour of him, openly expressing their desire to see Samarkand (present-day Uzbekistan) to better understand the place that shaped legendary astronomer Ulugh Beg's life.

Ulugh Bey was born a Timurid ruler, the grandson of the legendary central Asian conqueror, Timur (known as Tamerlane in the West). When Timur learned that his son Shahrukh had had a son, he stopped his offensive on Mardin and forgave the people of the city in order to celebrate Muhammad Taraghay's (Ulugh Bey Mirza) arrival.

Timur loved Ulugh Beg and married him off at the age of 10. When just 16, he became the Khan of Turkistan (a historical region in Central Asia). The real reason for Beg's fame is neither due to him being Timur's grandson, nor the impact of his reign. It is because as well as sitting on a throne, he was a scholar - a uniquely pioneering one at that.

Like the rest of the Mirzas at Timur's palace, he had access to a top notch education. In contrast to his grandfather Timur, Ulugh Beg's vocation and passion was in science and art.

He was a musician, philosopher, hafiz, hunter and had a talent for astronomy and mathematics. As the Islamic calendar and prayer timings are linked to lunar movements, the first observatories started appearing in the Muslim world in the 9th century and coincided with a peaked interest for Muslims in astronomy and mathematics. There were several observatories from Qurtuba and Toledo, to Cairo and Baghdad. Up until Ulugh Beg's reign, hundreds of astronomers and mathematicians had already been produced in the Muslim world.

The Maragha observatory was one that had impressed Ulugh Beg, however. Since Jamshid al Kashi and Qaḍi Zada al Rumi became his lecturers, Ulugh Beg's conquests mainly focused on the sky, stars and planets, rather than on countries on earth. During his reign, Ulugh Beg avoided war as much as he could, and spent nearly his entire wealth on art, science and cultural events.

Ahead of his time

In 1417, he founded a madressa, or religious school. Unlike others, however, the one he built in Samarkand - which still exists in the Registan Square - the subjects of mathematics and astronomy were among the most prioritised.

Three years later, in 1420, he also established his own observatory outside Samarkand on a rocky hill three stories high reaching a height of approximately 30m. It was one of the largest in the pre-modern era and was beautifully decorated with glazed tiles and marble plates.
The most remarkable instrument in Ulugh Beg's there was the huge Fakhri sextant which boasted a radius of 40m, making it, at the time, the largest astronomical instrument in the world of that type.

Ulugh Beg's mural sextant, constructed in Samarkand, Uzbekistan during the 15th century

… Ulugh Beg

The Fakhri sextant determines basic constants in astronomy: the inclination of the ecliptic to the equator, the point of the vernal equinox, the length of the tropical year, and other constants arising from observation of the sun. It was built chiefly for solar observations in general, and for those of the moon and the planets, too.

The main reason behind the sextant's success was the accuracy it gave due to its large size. On the arc of the sextant, divisions of 70.2 cm represented one degree, while marks separated by 11.7mm corresponded to one minute, while marks spaced only 1mm apart represented five seconds. Items known to have been used in Samarkand include astrolabes, quadrants, sine and versed sine instruments, as well as an armillary sphere, a parallactic ruler, and a triquetrum.
It is known that various well-known Muslim astronomers had worked there and some of the most extensive observations of planets and fixed stars at any Islamic observatory were made here. Here are some results of a study of the yearly movements of the five bright planets known in the time of Ulugh Beg:

Thus the difference between Ulugh Beg's data and that of modern times relating to the first four planets falls within the limits of two to five seconds. As it can be observed in the data, Ulugh Beg's results are almost the same as those found through modern technology.
The star catalogue of Ulugh Beg in 1437 represents the only large scale observations of star coordinates made in the Islamic realm in the medieval period after Hipparchus. The catalogue includes more than thousand stars.

TRTWORLD

Ulugh Beg Value	True Value
Saturn 12° 13' 39"	12° 13' 36" (d' Alembert)
Jupiter 30° 20' 34"	30° 20' 31" (d' Alembert)
Mars 191° 17' 15"	191° 17' 10" (Lalande)
Venus 224° 17' 32"	224° 17' 30" (Lalande)
Mercury 53° 43' 13"	53° 43' 3" (Lalande)

Source: perthobservatory.com

Under his leadership, observations also included the measurement of the obliquity of the ecliptic (angle between the celestial equator and the tropic of Cancer) as 23 degrees and 30'17" (the actual value at the time was 23 degrees and 30'48") and that of the latitude of Samarkand as 39 degrees and 37'33" N. (modern value: 39 degrees and 40′).

He measured the solar year in 1437, starting with the Spring Equinox at 365 days 5 hours, 49 minutes and 15 seconds - more accurate than Copernicus would later estimate. He determined the Earth's axial tilt as 23.52 degrees, which remains the most accurate measurement to date.

… Ulugh Beg

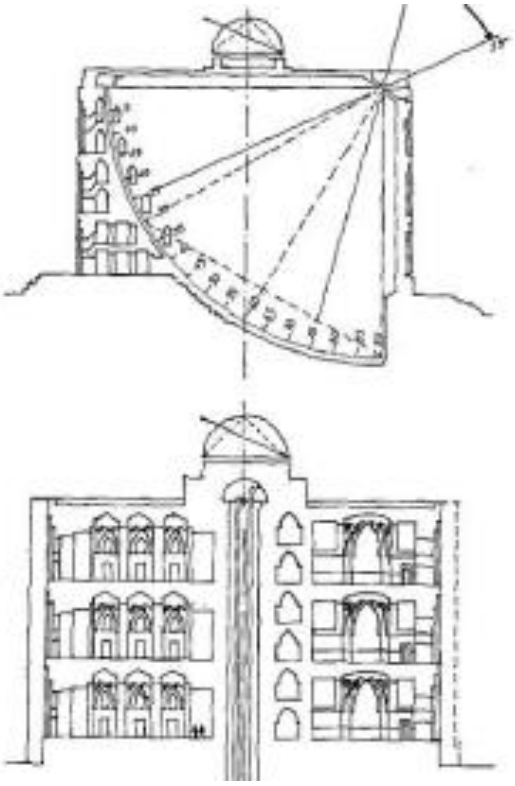
Moreover, it is believed that Ulugh Beg is linked with a Persian astronomical handbook called the Zij that stands out for the accuracy with which its tables were computed. The handbook includes four chapters based on chronology, trigonometry and spherical astronomy, planetary positions, and astrology. In mathematics, he wrote accurate trigonometric tables of sine and tangent values correct to at least eight decimal places.

He was one of the first to advocate and build permanently mounted astronomical instruments. Ulugh Beg was most certainly the most important observational astronomer of the 15th century. That he achieved all of this two centuries before the invention of the first telescope, speaks volumes of his talent and skill. Following a publication of the Latin version of his works in London, in 1650, he became known in Europe.

A museum called The Ulugh Beg Observatory was built in 1970 in Samarkand as a commemoration, and there one can view Beg's Star Charts and the Zij-i Sultani. These are said to be copies, with the original drawings being kept in Oxford, England.
A crater on the moon was named after him by the German astronomer Johann Heinrich von Madler on his 1830 map of the Moon, and the main-belt asteroid discovered in 1977 was named after him by Chernykh at Nauchny

Above: Ulugh Beg Observatory Samarkand, Uzbekistan

Top Left, Botton Left & Below Left & Below:
Fakhri Sextant - The Mystical Raven



Ancient Valleys on Mars May Have Been Carved by Glaciers

By Leah Crane

Early Mars may have looked like Devon Island in Canada

Mars's southern highlands are covered in vast networks of valleys that are thought to have been created by running water long ago. But a new analysis suggests they may actually have been carved out by glaciers, indicating that early Mars may have been cold and icy, not warm and wet.

To determine how Mars got its trenches, Anna Galofre at Arizona State University and her colleagues examined data on 10,276 of these features in 66 valley networks across the planet. They compared the topology of the valleys with a set of 40,000 simulations of valleys formed by four different sources of erosion: rivers created by rain or snow, glacial movement, water melting beneath glaciers, and groundwater seeping up through the surface.

The researchers used a computer analysis to group the valleys by topological characteristics, including how any tributaries branch off them, the relationship between length and width of the valleys and the curving of their paths.

Despite prior, less detailed work suggesting that most or all of the valleys should come from groundwater flowing to the surface, they found that just 3 of the 66 networks were most likely to be the result of this. In contrast, 22 seemed to have been formed by water melting and flowing beneath glaciers.

Nine of the networks were most similar to simulated networks formed directly by glaciers, 14 were closest to rivers formed by precipitation and 18 weren't distinct enough to be confidently attributed to any one formation mechanism, probably because of erosion over billions of years

… Ancient Valleys on Mars

“Glaciation can explain a lot of those valleys very easily without having to invoke any strange mechanisms to explain things like channels flowing uphill or huge spaces between valleys,” says Galofre. “We can finally reconcile what the climate models have been saying for a long time – that extensive glaciation was likely to occur in the past – with the geological record.”

The idea that many of the valleys resulted from glaciers suggests that huge areas on early Mars were probably covered in enormous ice sheets. This is a controversial idea, says Galofre, because many studies have suggested that Mars was warmer in its past.

Luckily, even colossal sheets of ice wouldn’t kill the idea of life on Mars. “The ice sheets could provide an environment that’s not so bad for life – it would be thermally stable, protected by ice from dangerous radiation on the surface, and it could supply a steady reservoir of water,” says Galofre. “It would be a slightly different environment to the warm and wet Mars that many people think of on ancient Mars, but still an environment where life could thrive.”

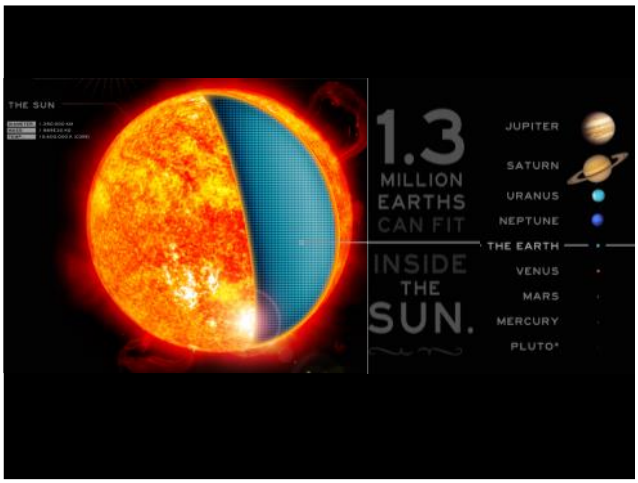
NASA’s Perseverance rover, which launched on 30 July, will help answer the question of whether Mars used to be habitable and look for signs of ancient life there. When it arrives in February 2021, it will start looking for evidence on the surface and may help us figure out if the planet was actually warm and damp or if it was cold and covered in sheets of ice.

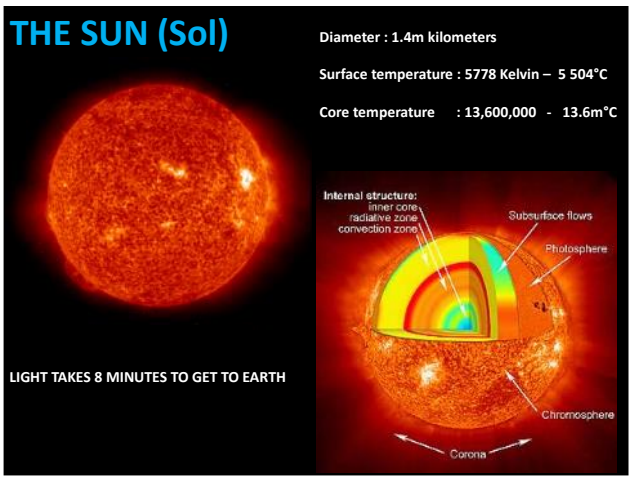
Sun Facts

Our own Sun, located a mere 150 million km away is average example of all the stars in the Universe. Our own Sun is classified as a G2 yellow dwarf star in the main sequence phase of its life. The Sun has been happily converting hydrogen into helium at its core for 4.5 billion years, and will likely continue doing so for another 7+ billion years. When the Sun runs out of fuel, it will become a red giant, bloating up many times its current size. As it expands, the Sun will consume Mercury, Venus and probably even Earth.

All stars begin from clouds of cold molecular hydrogen that gravitationally collapse. As they cloud collapses, it fragments into many pieces that will go on to form individual stars. The material collects into a ball that continues to collapse under its own gravity until it can ignite nuclear fusion at its core. This initial gas was formed during the Big Bang, and is always about 74% hydrogen and 25% helium. Over time, stars convert some of their hydrogen into helium. That’s why our Sun’s ratio is more like 70% hydrogen and 29% helium. But all stars start out with 3/4 hydrogen and 1/4 helium, with other trace elements.

If you could collect all the stars together and put them in piles, the biggest pile, by far, would be the red dwarfs. These are stars with less than 50% the mass of the Sun. Red dwarfs can even be as small as 7.5% the mass of the Sun. Below that point, the star doesn’t have the gravitational pressure to raise the temperature inside its core to begin nuclear fusion. Those are called brown dwarfs, or failed stars. Red dwarfs burn with less than 1/10,000th the energy of the Sun, and can sip away at their fuel for 10 trillion years before running out of hydrogen.



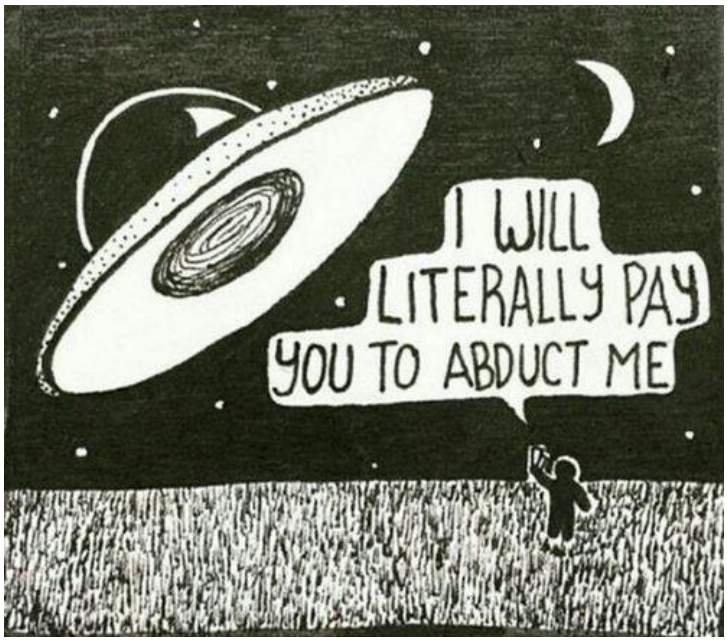


The Lonely Cloud

By John Gill

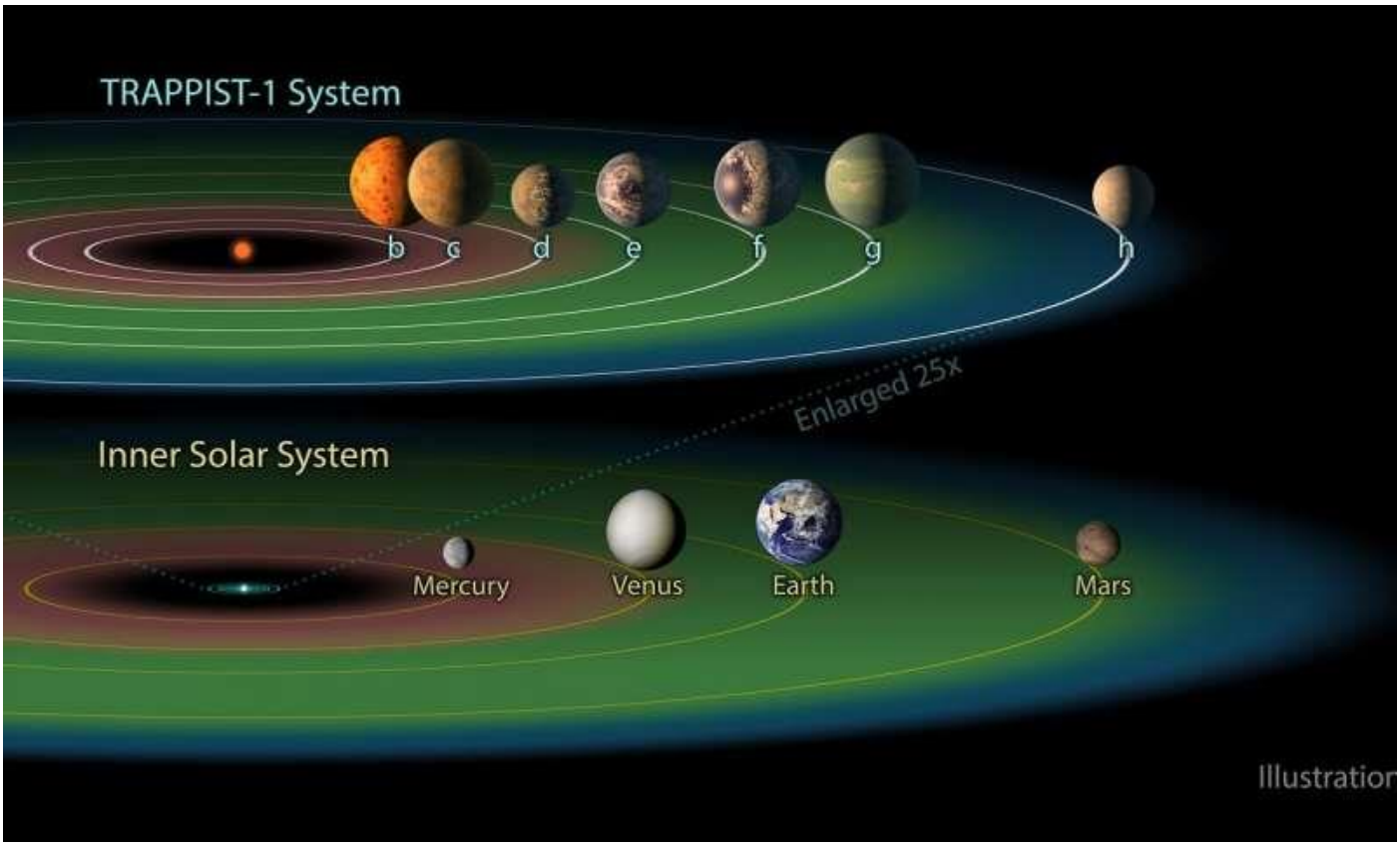
This image of the Carina Nebula is from the World Wide Telescope. Overlaid, is my image of a tiny cloud of gas and dust. My image is 79x54 arc-minutes. Now, see if you can find the location of “The Cover Image”.

I suspect that this cloud is a remnant of the Carina nebula that somehow got detached from the main nebula. The bright spot near the center of the main image is the Homunculus Nebula that was created during the great eruption of 1841 when Eta Carinae briefly became the second-brightest star in the night sky, after Sirius.



Surprising Number of Exoplanets Could Host Life

by Jules Bernstein



The Trappist-1 planetary system has three planets in its habitable zone, whereas our system only has one. Credit: NASA/JPL-Caltech

Earth. A new study shows other stars could have as many as seven Earth-like planets in the absence of a gas giant like Jupiter.

This is the conclusion of a study led by UC Riverside astrobiologist Stephen Kane published this week in the *Astronomical Journal*. The search for life in outer space is typically focused on what scientists call the "habitable zone," which is the area around a star in which an orbiting planet could have liquid water oceans - a condition for life as we know it.

Kane had been studying a nearby solar system called Trappist-1, which has three Earth-like planets in its habitable zone. "This made me wonder about the maximum number of habitable planets it's possible for a star to have, and why our star only has one," Kane said. "It didn't seem fair!"

His team created a model system in which they simulated planets of various sizes orbiting their stars. An algorithm accounted for gravitational forces and helped test how the planets interacted with each other over millions of years. They found it is possible for some stars to support as many as seven, and that a star like our sun could potentially support six planets with liquid water.

"More than seven, and the planets become too close to each other and destabilize each other's orbits," Kane said.

Why then does our solar system only have one habitable planet if it is capable of supporting six? It helps if the planets' movement is circular rather than oval or irregular, minimizing any close contact and maintain stable orbits.

… Exoplanets

Kane also suspects Jupiter, which has a mass two-and-a-half times that of all the other planets in the solar system combined, limited our system's habitability.

"It has a big effect on the habitability of our solar system because it's massive and disturbs other orbits," Kane said.

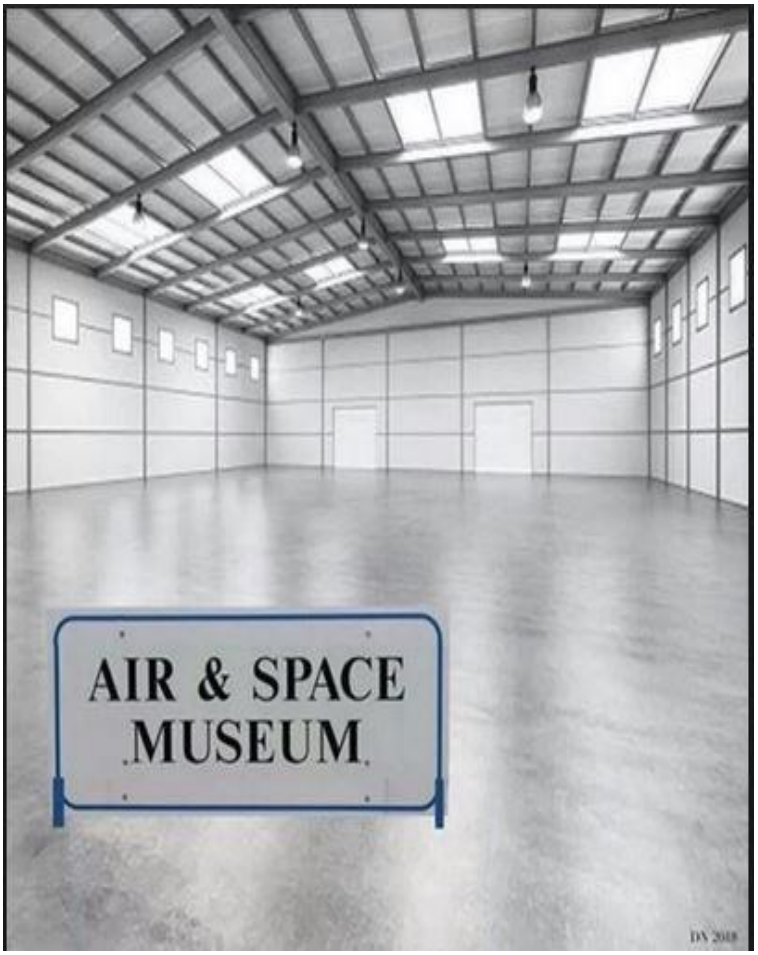
Only a handful of stars are known to have multiple planets in their habitable zones. Moving forward, Kane plans to search for additional stars surrounded entirely by smaller planets. These stars will be prime targets for direct imaging with NASA telescopes like the one at Jet Propulsion Laboratory's Habitable Exoplanet Observatory.

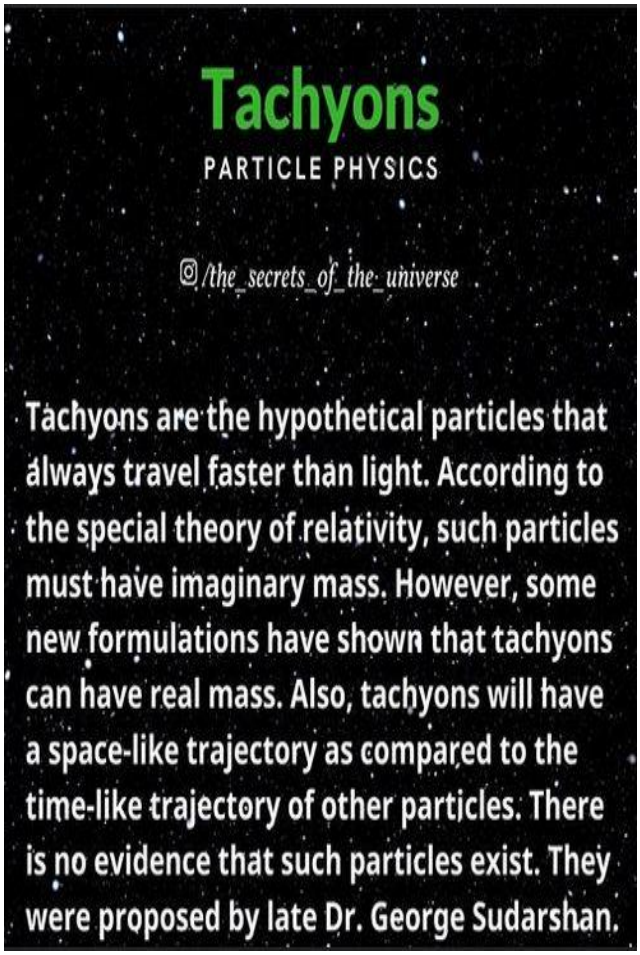
Kane's study identified one such star, Beta CVn, which is relatively close by at 27 light years away. Because it doesn't have a Jupiter-like planet, it will be included as one of the stars checked for multiple habitable zone planets.

Future studies will also involve the creation of new models that examine the atmospheric chemistry of habitable zone planets in other star systems.

Projects like these offer more than new avenues in the search for life in outer space. They also offer scientists insight into forces that might change life on our own planet one day.

"Although we know Earth has been habitable for most of its history, many questions remain regarding how these favorable conditions evolved with time, and the specific drivers behind those changes," Kane said. "By measuring the properties of exoplanets whose evolutionary pathways may be similar to our own, we gain a preview into the past and future of this planet—and what we must do to main its habitability."





The Human Body in Space

From NASA Human Research Program

What happens to your body in space? NASA's Human Research Program has been unfolding answers for over a decade. Space is a dangerous, unfriendly place. Isolated from family and friends, exposed to radiation that could increase your lifetime risk for cancer, a diet high in freeze-dried food, required daily exercise to keep your muscles and bones from deteriorating, a carefully scripted high-tempo work schedule, and confinement with three co-workers picked to travel with you by your boss.

But what, exactly, happens to your body in space, and what are the risks? Are risks the same for six months on the space station versus three years on a Mars mission? No. There are several risks NASA is researching for a Mars mission. The risks are grouped into five categories related to the stresses they place on the space traveler: Gravity fields, isolation/confinement, hostile/ closed environments, space radiation, and distance from Earth.

Scott Kelly was the first American to spend nearly one year in space aboard the International Space Station, twice the normal time. Science takes time, and researchers are eagerly analyzing results of the mission to see how much more the body changes after a year in space. One year is a stepping stone to a three-year journey to Mars, and Scott's data will help researchers determine whether the solutions they've been developing will be suitable for such long, onerous journeys.

Beware, what you're about to read can be scary. But the good news is NASA has been working to solve these problems with some of the most brilliant minds in the field. Rest assured, when we take the next giant leap to Mars, we will be ready.

Gravity Fields

Gravity Fields. There are three gravity fields you would experience on a Mars mission. On the six-month trek between the planets, you would be weightless. On the surface of Mars, you would live and work in approximately one-third of Earth's gravity, and when you return home you will have to readapt to the gravity we take for granted. Transitioning from one gravity field to another is trickier than it sounds. It affects your spatial orientation, head-eye and hand-eye coordination, balance, locomotion, and you're likely to experience motion sickness. If you have to land a spacecraft on Mars, it could be a pretty dangerous situation. NASA has learned that without gravity working on your body, your bones lose minerals, with density dropping at over 1% per month. By comparison, the rate of bone loss for elderly men and women on Earth is from 1% to 1.5% per year.

Even after returning to Earth, your bone loss might not be corrected by rehabilitation, so you could be at greater risk of osteoporosis-related fractures later in life. If you don't exercise and eat properly, you will lose muscle strength, endurance, and experience cardiovascular deconditioning since it does not take effort to float through space. The fluids in your body will shift upwards to your head, which could put pressure on your eyes causing vision problems. You're apt to develop kidney stones due to dehydration and increased excretion of calcium from your bones. Medications react differently in your body in space. Nutrition, including eating enough, becomes important, otherwise you could compromise your health since nutrients are required for the function of every cell and system in your body.

The Key: By analyzing how your body changes in weightlessness and after returning to Earth's gravity, protection against these changes for a Mars mission can be developed. Functional task testing is in place to help detect and minimize the effects of space on your balance and performance. Fine motor skills testing is done to detect any changes in your ability to interact with your computer-based devices.

… The Human Body in Space

Distribution of the fluids in your body will be closely monitored, to help evaluate any connection to changes in your vision. Compression cuffs worn on your thighs will help keep the blood in your lower extremities to counteract those vision changes. Your back pain would be monitored by obtaining spinal ultrasounds. You will perform periodic fitness self-evaluations that help researchers better understand the decline in cardiovascular function that can occur during spaceflight. Some medicines, like potassium citrate (K-Cit), may help you combat the physiological change that could increase the risk for developing kidney stones. Bisphosphonates drugs have shown to be effective in preventing bone loss. NASA has also designed an efficient way to collect and measure how much urine you produce in space, which is essential to human research since it reveals key information about your health. You will get proper nutrition, including vitamin D supplements since you can't walk outside under the sun. And last, good old regular exercise has been shown to keep your heart healthy, your bones and muscles strong, your mind alert, your outlook more positive, and may even help with your balance and coordination.

Isolation/Confinement

Isolation/Confinement. NASA has learned that behavioral issues among groups of people crammed in a small space over a long time, no matter how well trained they are, are inevitable. Expedition crews selected for a stay aboard the space station are carefully chosen, trained, and supported to make sure they can work effectively as a team for six months. Crews for a Mars mission will undergo even more scrutiny and preparation, since they will travel farther and longer than any previous human, being more isolated and confined than we can imagine. The types of problems you may encounter are a decline in mood, cognition, morale, or interpersonal interaction.

You could also develop a sleep disorder because your circadian rhythm might be thrown off due to the 38 extra minutes each day on Mars, or by a small, noisy environment, or the stress of prolonged isolation and confinement. Depression could occur. Fatigue is inevitable given that there will be times with heavy workload and shifting schedules. Still, periods of monotony may lead to boredom rearing its ugly head. Misunderstandings and impaired communications with your team members might impact performance and mission success.

A lack of fresh food and mean variety, or deficiency in nutrition, may further contribute to physiological and cognitive decrements. Also, far more autonomy will be required due to the very long communication delays over the vast distances from the space vehicle to Earth. And then there's the possibility of the third-quarter effect, where morale and motivation decline three-quarters of the way into a mission, regardless of how long the mission lasts. The more confined and isolated humans are, the more likely they are to develop behavioral or cognitive conditions, and psychiatric disorders.

The Key: NASA has been studying people in isolated and confined environments for years, and has developed methods and technologies to counteract possible problems. They are using clever devices like actigraphy that help you to assess and improve your sleep and alertness by recording how much you move and how much ambient light is around you. New lighting, spurred by the development of Light-Emitting Diode (LED) technology, will soon be used on the space station to help you align your circadian rhythms which will improve sleep, alertness, and performance. You can assess the effect of fatigue on your performance with a five-minute self-test. Journals give you a safe place to vent your frustrations and give researchers a tool to study behavioral issues and other things that are on the minds of crewmembers who are living and working in isolation and confinement. All of these methods and technologies will help us prepare for longer, farther exploration missions.

… The Human Body in Space

Hostile/Closed Environments

Hostile/Closed Environments. NASA has learned that the ecosystem inside the spacecraft plays a big role in everyday astronaut life. Microbes can change characteristics in space, and microorganisms that naturally live on your body are transferred more easily from person to person in closed habitats like the space station. Your stress hormone levels are elevated and your immune system is altered, which could lead to increased susceptibility to allergies or other illnesses, and disease. Every inch and detail of your living and working quarters must be carefully thought-out and designed. Just like you wouldn't want your house to be too hot, too cold, cramped and crowded, very loud, or not well lit, you wouldn't enjoy working and living in such a dwelling in space either.

The Key: NASA is using technology to monitor the air quality of the space station to ensure the atmosphere is safe to breathe and not contaminated with gases like formaldehyde, ammonia, and carbon monoxide. Your urine and blood samples are analyzed to ensure the stress of space flight hasn't caused infectious illnesses like the Epstein-Barr virus to be reactivated. And the risk of microbes that may cause disease to you and your crewmembers will be evaluated using advanced molecular techniques.

Various parts of your body and the space station are swabbed for analysis of the microbial population that inhabits the environment. Effective monitoring techniques are in place to identify how your immune system changes in space by analyzing blood, saliva, and urine samples. Your living quarters and work environment are carefully planned and evaluated to ensure that designs balance comfort and efficiency. And the lighting will be similar to what you experience naturally on Earth, thanks to the new LED lighting system.

Space Radiation

Space Radiation. The most dangerous aspect of traveling to Mars is space radiation. On the space station, astronauts receive over ten times the radiation than what's naturally occurring on Earth. Our planet's magnetic field and atmosphere protect us from harsh cosmic radiation, but without that, you are more exposed to the treacherous radiation. Above Earth's protective shielding, radiation exposure may increase your cancer risk. It can damage your central nervous system, with both acute effects and later consequences, manifesting itself as altered cognitive function, reduced motor function, and behavioral changes.

Space radiation can also cause radiation sickness that results in nausea, vomiting, anorexia, and fatigue. You could develop degenerative tissue diseases such as cataracts, cardiac, and circulatory diseases. The food you eat and the medicine you take must be safe and retain their nutrient and pharmaceutical value, even while being bombarded with space radiation. A vehicle traveling to Mars and a habitat on Mars will need significant protective shielding, which is nonetheless futile against some types of space radiation.

… The Human Body in Space

The Key: The space station sits just within Earth's protective magnetic field, so while our astronauts are exposed to ten times higher the radiation than on Earth, it's still much less than the radiation a mission to Mars will encounter, and of a different type. Shielding, monitoring, and operational procedures control the radiation risks to acceptable levels to keep you safe. To learn what happens above low Earth orbit, NASA has extensively used ground research facilities to study how radiation affects biological systems, and more importantly, how to protect them. They are developing unique ways to monitor and measure how radiation affects you while living in space, and to identify biological countermeasures. Finally, methods to optimize shielding are being studied to help protect us on a journey to Mars.

Distance from Earth

Distance from Earth. Planning and self-sufficiency are key. How far away is Mars? 140 million miles from Earth on average. In contrast the moon is only 0.239 million miles away. With a communication delay of up to twenty minutes one-way while on Mars and the possibility of equipment failures, you must be able to complete the mission on your own. And what type of food and medicine would you pack if you had to go on a three-year trip without access to a grocery store or pharmacy? Hopefully you plan correctly.

The Key: NASA is using the space station to figure out what types of medical events happen in space over six months and what types of skills, procedures, equipment, and medication are needed, so you will have a good idea of what you'll need to pack for Mars. You can produce Intravenous (IV) solution from purified space station cabin water, and then mix it with salt crystals to produce normal saline for medical administration. Even if you aren't a doctor, you and your crew mates would perform ultrasound scans on yourself using training you received before flight to monitor your bone and organ health. NASA is studying and improving food formulation, processing, packaging, and preservation systems to ensure the nutrients remain stable and the food remains acceptable. Space-resilient medications and packaging that preserve the integrity of pharmaceuticals for long duration missions have also been developed.

NASA is taking action on all of these risks and trying to minimize or mitigate the negative effects on the human body. The results of the one-year mission will provide more insight into these changes over a longer period of time, and present a stepping stone for even longer missions. When we send humans on a journey to Mars, we will make sure that we have conquered the unknowns to ensure a safe trip home back to the gravity we know and love.

ASSA Durban - Minutes of the Meeting

12 August 2020 - 19:30-21:00 via Zoom

Attendees:

Mike Kosch	Piet Strauss	Debbie Abel	Claire Odhav
Corinne & John Gill	Sihle Kunene	Sheryl Venter	Mike Hadlow
Amith Rajpal	Carol & Bill Cuthbert	Chanu Chetty	Charles
Jean Senogles	Don Orsmond	Graeme Leslie	Graham Alston
John Visser	Avril Soobramoney	Brian Finch	Murray McKenzie
Ooma Rambilass	Rinus Wiersma	Robert Suberg	Maryanne Jackson
Michael Benet	Yesen Govender	Prea Mohambery	Gerald & Linda de Beer

1. Welcome:

   The Chairman, Piet Strauss, welcomed all attendees and noted 3 apologies; then went onto introduced the Speaker of the evening's meeting - Professor Michael Kosch.

2. Speaker

   Prof. Kosch, presented a very interesting talk about his time spent working in Antarctica, which included slides and photographs of his experiences.

   Closing his speech, Prof. Kosch noted—"The air is 1000 times cleaner there than anywhere else on the planet; so the sky is black, and the star field and stargazing is unbelievable," which led to much envy being expressed amongst the members keen on astrophotography.

   A brief question and answer session was held which led to some interesting questions and discussion.

   The Chairman thanked Prof. Kosch for his presentation which was found to be of much interest to all attending; and noted the images would be placed on the website shortly.

3. ASSA National AGM - Piet Strauss mentioned a virtual meeting will be held on 13th August via WebEx which can be download from the Cisco website or the App can be downloaded from the Playstore.

4. Monthly Night Sky - Mike Hadlow presented the details of the August - September night sky.

5. Finance - Corinne Gill reported on the finances; which balances were:

   - Investment account R 58 178.92
   - Current account R 12 427.62
   - Petty Cash R 936.00
   - Membership fees: Members were reminded to please pay their membership fees ASAP as meetings would continue via Zoom.

6. Outreach/ Public and Special Events - everyone was advised no further events are being held at present due to the Covid lockdown.

7. Meeting Closed:

   - Piet Strauss thanked eveyone for attending the Zoom meeting.
   - The meeting was closed at 21:00

Notice Board

MEETINGS:

- **All meetings, star parties, out-reach and public viewing are on hold due to Covid 19 lockdown.**

MNASSA:

- Monthly Notes of the Astronomical Society of Southern Africa.
- Available at www.mnassa.org.za to download your free monthly copy.

NIGHTFALL:

- Fantastic astronomy magazine, go check it out.
- Available from the ASSA website assa.saao.ac.za/sections/deep-sky/nightfall/

MEMBERSHIP FEES & BANKING:

- Members : **R 170**
- Family Membership: **R 200** Maximum 2 members
- Cheques: **Please note no cheques will be accepted - Please pay by EFT**
- EFT: **Astronomical Society of Southern Africa - ASSA Natal Centre**
- Bank: **Nedbank**
- Account No. **1352 027 674**
- Branch: **Durban North**
- Code **135 226**
- Reference: **Please include your initials and surname**

RESIGNATIONS from ASSA - Please send an email immediately notifying the Secretary.

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Observatory & Equipment	Mike Hadlow	(+27) 83 326 4085
Publicity & Librarian	Clair Odhav	(+27) 83 395 5160
Out-Reach - Public	Sheryl Venter	(+27) 82 202 2874
Out-Reach - Schools	Sihle Kunene	(+27) 83 278 8485
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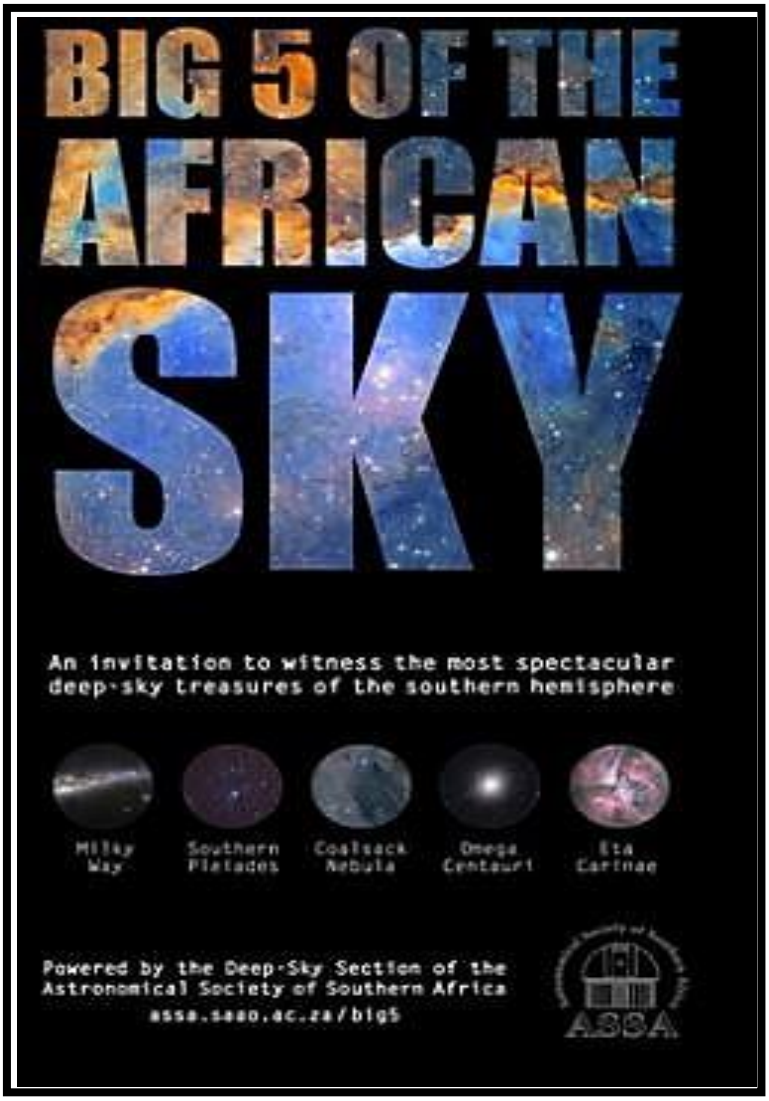
- Facebook: Astronomical Society of Southern Africa, Durban Centre



THE BIG 5 OF THE AFRICAN SKY

The magnificent southern sky is a starry realm richly sown with a treasury of deep-sky objects: star clusters, bright and dark gas clouds, and galaxies.

From this (sometimes bewildering) array five specimens of each class of object have been selected by a special Deep-Sky Task Force and are presented here as the celestial Big Five.

The representative of open star clusters is the **Southern Pleiades**. First amongst the globular star clusters is the overwhelming **Omega Centauri**. Bright nebulae are represented by the majestic **Eta Carinae Nebula**. The mysterious dark nebulae are represented by the **Coal Sack**. And the most splendid galaxy of them all is our own **Milky Way Galaxy**.

Your mission is to observe each of these beautiful objects and report back on what you have witnessed.

All submitted observations will be carefully evaluated and feedback will be given.

The names of all participants will be acknowledged on the ASSA website. Observing certificates will be awarded only on merit and issued by the Deep-Sky Section of the Astronomical Society. Have fun, and keep looking up! http://assa.saao.ac.za/sections/deep-sky/big5/honour-roll/

Image and text from ASSA http://assa.saao.ac.za/sections/deep-sky/big5/

Public Viewing Roster
ASSA Durban

Name	Phone	Name	Phone	New Moon	Public Viewing
John Gill	083 378 8797	Navi Naidoo	084 466 0001	24 Mar 2020	27 March 2020
Mike Ha[illegible]ow	[illegible]	[illegible] Abe[illegible]	[illegible] 4084	23 April 2020	24 April 2020
Maryanne Jack-son	082 882 7200	[illegible]	082 20[illegible] 2874	[illegible]2 May [illegible]020	[illegible] 2020
John Gill	083 378 8797	Corinne Gill	084 777 0208	[illegible]	[illegible]19 J[illegible]e 2020

CANCELLED