The PRETORIA CENTRE
of the
Astronomical Society of Southern Africa
www.pretoria-astronomy.co.za

NEWSLETTER JULY 2019

NEXT MEETING

Venue: The auditorium behind the main building at Christian Brothers College (CBC), Mount Edmund, Pretoria Road, Silverton, Pretoria.
Date and time: Wednesday 24 July at 19h15.
Programme:

- **Annual General Meeting.** It will be short and sweet (about 30 minutes). Come and speak your mind about society matters and vote for new committee members.
- **What's Up?** by Michael Moller.

---------- **10-minute break — library will be open.** ----------

- **Main talk:** "Celebration of the first visit of the moon by humans in July 1969" by Frik le Roux and other members *****.
- **Socializing over tea/coffee and biscuits.**

The chairperson at the meeting will be Johan Smit.

***** See page 4 for more information on this.

NEXT OBSERVING EVENING

Friday 19 July from sunset onwards at the Pretoria Centre Observatory, which is also situated at CBC. Turn left immediately after entering the main gate and follow the road.

CONTENTS

Astronomy-related articles on the Internet

Seven far-out discoveries about the Universe's beginnings.
https://www.livescience.com/65773-facts-about-the-big-bang.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190624-ls

Mysterious 'bathtub rings' of Titan replicated on Earth. Researchers suspect the features function a great deal like rings in a bathtub, where solids that were once dissolved in a liquid are left behind as that liquid evaporates. Now, there's a new piece of evidence bolstering this theory.
https://www.livescience.com/65785-titan-bathtub-rings-explained.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190625-ls

Astronomers have decoded a weird signal coming from a strange, 3-body star system. Two similar stars are orbiting one another, and a brown dwarf is orbiting one of them in a very close orbit. One side of the brown dwarf always faces one side of that star.https://www.livescience.com/65794-brown-dwarf-detected.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190626-ls

Life on icy alien worlds may resemble creatures under submerged Hawaiian volcano. https://www.livescience.com/65800-underwater-volcano-life-enceladus.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190627-ls

Astronomers spotted a car-size asteroid just hours before impact. Fortunately, it burnt up in the atmosphere. It made a spectacular fireball. The kinetic energy released was equivalent to about 6000 tons of exploding TNT.
https://www.livescience.com/65810-car-size-asteroid-hits-earth.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190628-ls

How this huge, super fast asteroid stayed hidden in near-Earth orbit.
https://www.livescience.com/65903-rare-giant-asteroid-found-close-orbit.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190711-ls

Astronomy-related images and video clips on the Internet

The first-ever black hole image, explained in 500 words. Those of you who were so unlucky to miss prof Roger Deane's presentation last month, have a look at the video clip on this website. https://www.vox.com/science-and-health/2019/4/10/18304682/first-black-hole-photo-event-horizon-telescope

Satellite image captures a total solar eclipse and a hurricane in one awesome shot.
https://www.livescience.com/65862-total-solar-eclipse-hurricane-barbara-photo.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190704-ls

In photos: Total solar eclipse 2019.
https://www.msn.com/en-za/news/techandscience/in-photos-total-solar-eclipse-2019/ss-AADL9cI?ocid=spartandhp

Astronomy basics: 50 interesting facts about planet Earth

https://www.livescience.com/19102-amazing-facts-earth.html

Observing: Surprise galaxy in Orion - by Magda Streicher

Orion is known as the mighty hunter, but to me it truly feels like an old friend visiting me with a bag full of treasures. Orion has it all: a variety of objects, all the different types of nebulae, and many surprises. Orion contains more bright stars than any other constellation, and within its boundaries lies Betelgeuse, one of the most outstanding red giant stars known to us. The constellation's seven brightest stars are all in the range of magnitude 2.

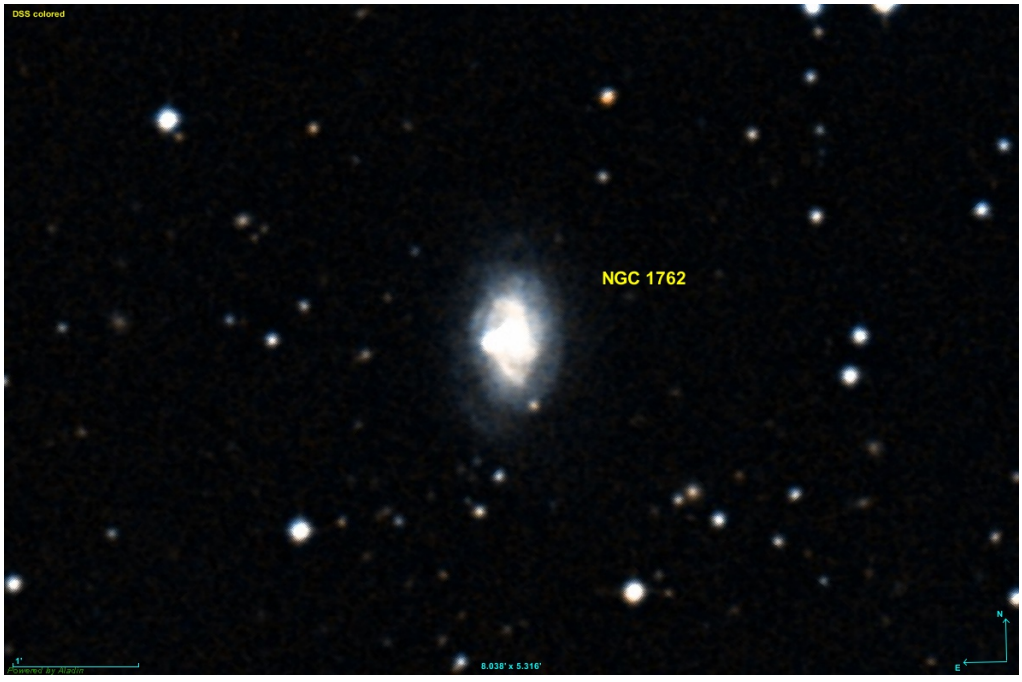
One such a surprise – and perhaps many of you will not know this – is that the mighty hunter has a few galaxies hidden in its north-western pocket. Most of these are fairly faint, and a telescope is necessary for us to be able to observe them.

The north-western shoulder star of Orion, gamma Orionis, and the eastern belt star, the magnitude 2.4 delta Orionis, form a triangle to the west with the spiral galaxy **NGC 1762**. It is not a very bright galaxy, but it is nevertheless worth the trouble to find this surprising object in Orion. Of course, it is desirable to go in search of dark night sky conditions away from the city's demanding light pollution. The galaxy displays a soft, round glow with a strong star-like nucleus. A faint star is situated very close to the nucleus's eastern side. It is elongated in a north-south direction, with a soft outer envelope which is perhaps more prominent towards the north-western side. Two magnitude 11 stars form a triangular shape towards the south-east with the galaxy, with a notable magnitude 6 pair of stars just 24' to the west. One-degree further west is the 4.4 magnitude star pi Orionis, which is a good reference point.

Two more galaxies in the Orion constellation are worth a visit and of moderate brightness. NGC 1713 is a 12.7 elliptical galaxy approximately 2.5 degrees south of pi Orionis. NGC 1924 is a barred spiral of magnitude 12.5, making this galaxy the brightest of the Orion family of galaxies.

Orion generously shares an abundance of splendid objects with us that can be observed with the naked eye, binoculars and a telescope.

NAME	TYPE	RA	DEC	MAG	SIZE
NGC 1762	Galaxy	05h 03.6m	+01° 34' 22"	12.6	1.7 x 1.1



NOTICE BOARD

Astronomical data mining. Scientists from ESA need your help to spot the tracks of asteroids in images from the HST. This will lead to a better understanding of the history and current state of the Solar System, as well as identify potential impact threats to Earth. www.zooniverse.org/projects/sandorkruk/hubble-asteroid-hunter/classify

MNASSA. The April 2019 issue can be downloaded from http://www.mnassa.org.za/

NIGHTFALL. The newsletters of the Deep-Sky Section can be downloaded from http://assa.saao.ac.za/sections/deep-sky/nightfall/

What's Up. Consult the *ASSA website* at http://assa.saao.ac.za/, the *Cape Centre Facebook* page at http://www.facebook.com/capecentre or the SAAO *What's Up* page at http://www.saao.ac.za/public/all-whats-up/ for observing highlights this month. The SAAO *Viewing the Sky* page at http://www.saao.ac.za/public/viewing-the-sky/ contains a wealth of general information about observing, including a list of interesting objects in the Southern sky, calendars of solar and lunar information including eclipses and a page of useful websites.

Beanies. Beanies will be offered for sale @ R45.00 each at every monthly meeting, until they are sold out.

Old newsletters: All old newsletters from January 2004 onward are on our website. They contain a record of our Centre's activities as well as astronomical information.

Database: Members are reminded that a database of the books in our library is to be found on our website.

Pretoria Centre committee

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This month's main talk

Frik le Roux and some other members will each speak for a short time about this momentous event that took place 50 years ago. Other, older members are invited to come and share their memories of the event and present old photographs and memorabilia of it. At the end, a video clip of the event will be shown. **Ω**

The photographs below were taken by Neville Young at the observing evening on 21 June. They show students from Sefako Mkgatho University (SMU). (It used to be called Medunsa.) They are the students to whom he presents an astronomy course there. Our monthly observing evenings are part of their course. The man with the white beard is our chairman, Johan Smit. **Ω**

Summary of coming presentation on 24 July under "What's Up?" - by Michael Moller

What's up in August 2019?

Moon phases (see image below)

New: Aug 1
Full: Aug 15
Best evening viewing:
Last two weeks.

Planets

Mercury
Low in the morning sky
Aug 10: Max western elongation (19 deg)
Sep 4: Superior Conjunction

Venus
Not favorably positioned
Aug 14: Superior Conjuction

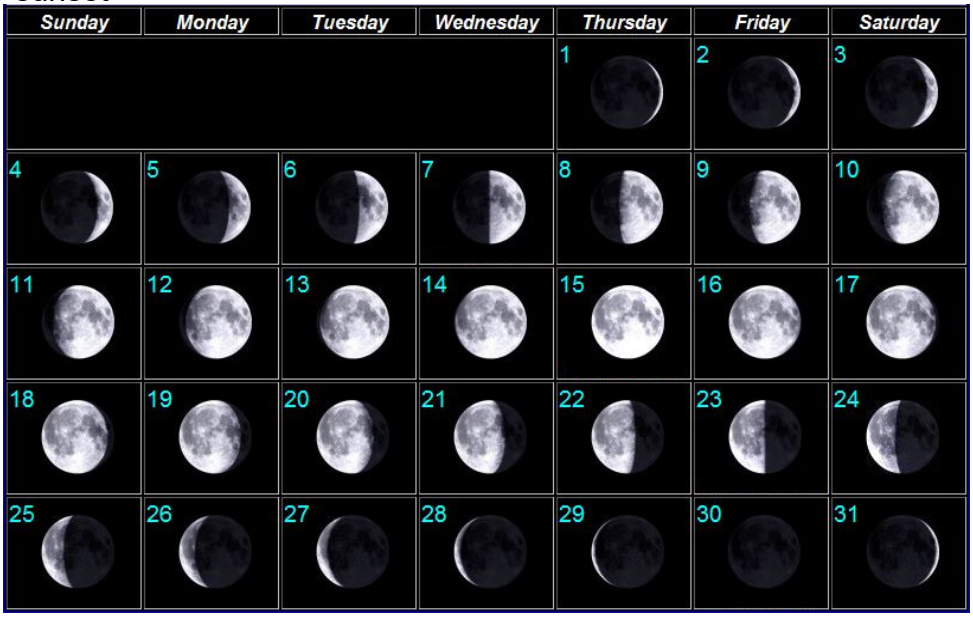
Mars
Not favorably positioned
Sep 2: Conjunction

Jupiter
In Ophiuchus, next to Antares
High in the east (almost overhead) after sunset
Sets around 2am
Aug 10: Moon near

Saturn
In Sagittarius
High in the east after sunset
Sets around 4am
Aug 12: Moon near

Uranus
In Aries
Rises around 23:00
Mag 5.7
Aug 21: Moon near

Neptune
In Aquarius
Rises around 19:30
Mag 7.8
Aug 17: Moon near



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Constellations – South

Pavo
Octans
Musca
Centaurus

Constellations – East

Sagittarius
Aquila
Capricorn
Aquarius
Sculptor

Constellations – North

Hercules
Lyra
Cygnus

ASSA 100 - Picks

68, NGC6121: M4 Globular in Sco
50, NGC 4594: Sombrero Galaxy (Vir)
51, Coal Sack (Cru)
52, NGC 4755: Jewel Box (Cru)
53, NGC 4833: Southern Butterfly Cluster (Mus)

Space news

Aug 1: Virgin Orbit, Launcher One
Aug 5: Russian Proton from Baikonur
Aug 8: ULA Atlas V
Aug 22: Russian Soyuz new abort test from Baikonur
Aug : Russian Rocket Earth survey

ISS Viewing

Aug 17, 19:34:36 to 19:36:15
Alt 27 deg NW
Mag -1.9
Aug 18, 18:45:13 to 18:49:29
Alt 39 deg NNW
Mag -3.2
Aug 20 18:42:23 to 18:48:34
Alt 47 deg W
Mag -2.9 **Ω**

June 21st 2019 observing evening report
- by Michael Poll and Neville Young

It was quite a jolly evening, with a clear sky, no Moon, two bright planets, a number of visitors and the eleven medical students from Sefako Makgatho University (SMU) who are doing an optional astronomy module as part of their university studies (and it was not too cold!). Johan S, Michael, Gregory and Neville were there from the Centre and we had three telescopes.

There were various activities. Michael was introducing one visitor to the southern sky – the Southern Cross, and other asterisms and stars in the area – the False Cross, the Diamond Cross and the bright star Canopus. We were matching up the "ship" Argo Navis via an app on his smartphone – i.e Carina (the keel) and Vela (the sails). Puppis (the poop deck or stern) was too low to pick out, and there are no bows of the ship represented. (In his original chart, Beyer did not depict the bows – maybe they were lost in mist or had splintered on the Clashing Rocks at the mouth of the Black Sea, although in the original myth it was part of the stern that was nipped off by Clashing Rocks, not the bows).

The SMU students observed Crux and Scorpius again, they also noted Corvus, Leo and Virgo in particular, and they identified the right angle in the Antares, Arcturus, Spica triangle.

There was discussion with the visitors and students about the planets moving against the star background. For example Jupiter was in Scorpius now and would be in Sagittarius next year and that it would overtake Saturn in December 2020. This led on to the concept of the ecliptic, because the sun also appears to move through the star background along this path as the Earth revolves around it – the constellations that the Sun moves through at are the zodiacal signs and we drew the line from Leo through Virgo to Libra Scorpius and Sagittarius, noting that as the sun passes through them it is moving south and gets higher in the sky until it is in Sagittarius in December.

The fact that Mars only comes around every two years or so led onto a discussion about synodic periods. The Earth overtakes Mars every two years and two months but passes Jupiter about every 13 months and Saturn about every year and two weeks.

It was explained that the official name of the Southern Cross is the word "Crux" which is in Latin, and that all the official names of the constellations are in Latin. The reason for this was that if the name was translated into a home language the name would be different in other languages, but the Latin name would be understood whatever the home language – the same applies to Latin species designations in biology

In between all these discussion we did do some telescope viewing! Jupiter is now well up in the east in the early evening with the star Antares above it. The students had their second look at Jupiter following the first a month ago, and it still fascinated them and they should now remember the names of the Galilean moons by reciting the mnemonic ' I Enjoy Good Cooking'. This was their first glimpse of Saturn and it was as stunning for them as it always is for all those seeing it for the first time.

Open clusters we looked at included the Jewel Box, the Southern Pleiades (IC2602, which includes Theta Carinae), and Messier 7 in Scorpius. Double stars we looked at were Alpha Centauri, Alpha Crucis (actually a triple), and Beta Scorpii.

Later on Neville commented, while looking at Corvus, that there were quite a number of constellations where the alpha star was not the brightest, but we noted that in some cases, at least, the star with the lowest value of right ascension (i.e the westernmost star) was given priority. In many cases this is true of labelling the components of double stars. Michael noted that Vela does not even have an alpha or beta star – when Argo Navis was split up the alpha and beta stars were re-allocated to Carina where they now reside as Alpha Carinae and Beta Carinae – Canopus and Miaplacidus respectively.

Neville thanks the Centre members for "edutaining" the students but noted that the most difficult aspect of astronomy for them is that that they struggle to grasp how to dress warmly for an observing session! **Ω**

Chairman's report for meeting on 26 June 2019 - by Michelle Ferreira

The meeting was very well attended by both members and visitors. This could be attributed to the speaker of the evening, Prof. Roger Deane, from the University of Pretoria, who presented the main talk on the Imaging of a Black Hole. Beginner's Corner was presented by Pierre Lourens with the subject being Titan, a moon to Saturn and What's Up for July was presented by Percy Jacobs.

In Beginner's Corner Pierre took us through the physical characteristics of Titan, the largest of the 62 known moons of Saturn. Discovered in 1655 by the Dutch astronomer Christiaan Huygens, Titan was the first known moon of Saturn. It is also the second-largest natural satellite in the Solar System. It is the only known moon in our solar system known to have a thick atmosphere. Titan is 50% larger than Earth's moon and 80% more massive. It would appear 11.4 times larger in the sky than the Moon from Earth. Titan is primarily composed of ice and rock materials. It only receives about 1% as much sunlight as Earth and only 10% thereof reaches its surface.

Until the Cassini-Huygens mission in 2004 provided new information, including the discovery of liquid hydrocarbon lakes in Titan's polar regions, its dense atmosphere prevented an understanding of Titan's surface. This mission showed that the geologically young surface is generally smooth, with few impact craters, although mountains and several possible cryovolcanoes have been found.

Titan is the only known moon with a significant atmosphere and its atmosphere is the only nitrogen-rich dense atmosphere in the Solar System aside from Earth's. Scientists have long speculated that conditions on Titan resemble those of early Earth, though at a much lower temperature, since Titan's methane cycle is analogous to Earth's water cycle, at the much lower temperature of about 94 K. Titan is also the only satellite with lakes on its surface and though it has been speculated that it could be habitable, it does have a methane/ethane cycle instead of a water cycle as on Earth.

Thereafter the What's Up for the month of July was presented by Percy Jacobs, a summary of which was included on the newsletter that was distributed preceding this meeting. He did bring to our attention that there will be an event on the 2nd of July when a total solar eclipse will take place. This eclipse will however not be seen from South Africa. The "end" part of the eclipse can
be seen in Chile or Argentina in South America. The only place where the total solar eclipse would be visible, is Oneo, a small and uninhabited atoll of the Pitcairn Islands in the Pacific Ocean.

This took us through to the main talk on the Imaging of a Black Hole, as presented by Prof. Roger Deane. He was presented to the meeting by Neville Young as a professor currently with the University of Pretoria with his research interests being binary supermassive black holes, strong gravitational lensing, wide-field VLBI surveys, black hole shadow detection with the Event Horizon Telescope, radio interferometry techniques, high redshift galaxies. Prof. Deane acknowledged Prof. Michael Feast for being a role model to himself. Sadly Prof. Michael Feast, a British-South African astronomer passed away on 1st April 2019.

The talk commenced with an introduction as to what a black hole is and an overview of what an Event Horizon Telescope (EHT) is. Wikipedia definition "A black hole is a region of spacetime exhibiting gravitational acceleration so strong that nothing - no particles or even electromagnetic radiation such as light - can escape from it." and "The Event Horizon Telescope (EHT) is a large telescope array consisting of a global network of radio telescopes."

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Initially the concept of black holes was considered a ridiculous notion and that nature should conspire to prevent them. However, over a period of 100 years there has been a shift in this thinking.

On 22 December 1915 in a note to Albert Einstein, Lieutenant Karl Schwarzschild provided the first exact solution to the Einstein field equations of general relativity, for the limited case of a single spherical non-rotating mass, the same year that Einstein first introduced general relativity. Thus, the first modern solution of general relativity that would characterize a black hole was found by Karl Schwarzschild, although its interpretation as a region of space from which nothing can escape was first published by David Finkelstein in 1958.

The size of a black hole is the distance at which light cannot escape and this is known as the event horizon. This distance depends only on mass and spin. There are two types of black holes, namely a stellar mass black hole and a supermassive black hole. This last one was the primary target of the EHT. A supermassive black hole would form in the centre of Galaxies and be in the order of 1 million to 10 billion times the mass of the Sun. So, the question is, how do we see an image of something we cannot see? And the answer is, by looking at the shadow of a black hole. Then the next question would be, how to make an image of a black hole shadow.

Telescopes can look instead for the shadow or silhouette of a black hole's event horizon against its accretion disk. That's what the Event Horizon Telescope, or EHT, did in April 2017, collecting data that has now yielded the first image of a supermassive black hole, the one inside the galaxy M87.

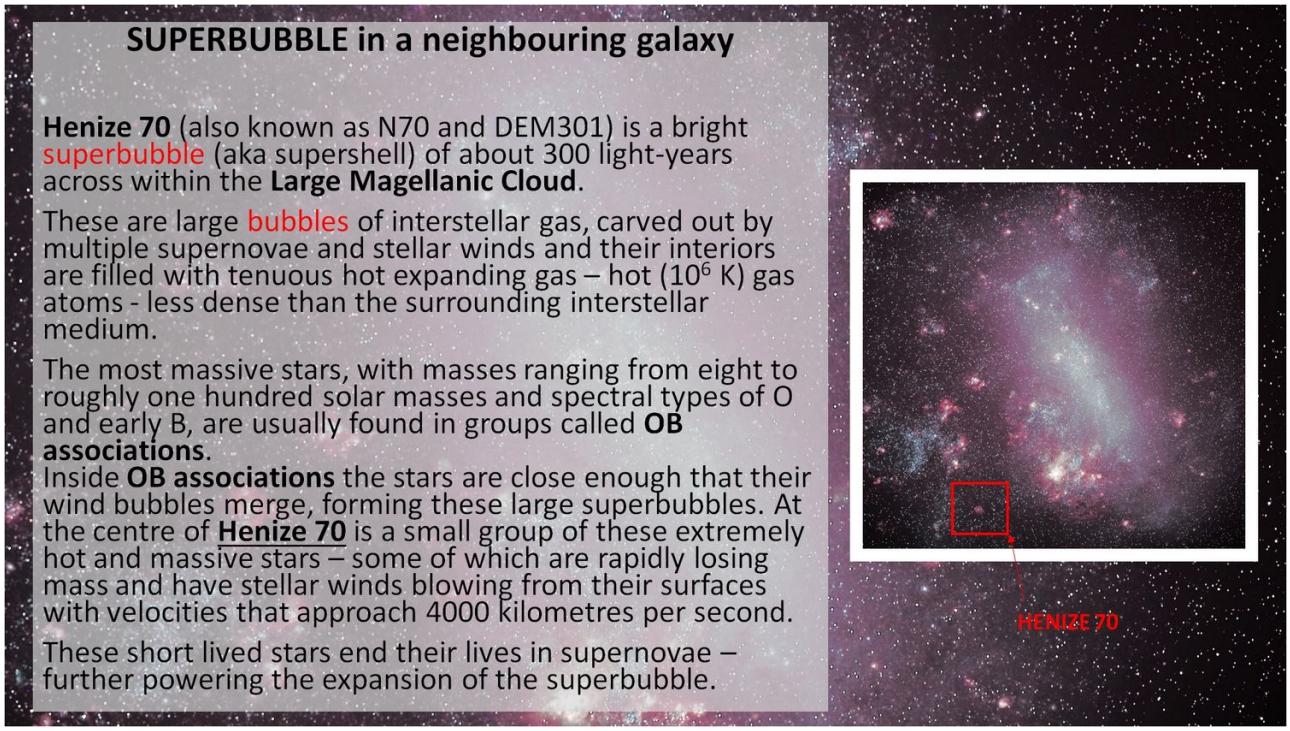
The eight telescopes that were used in this collaboration were Submillimeter Array – Hawai, James Clark Maxwell Telescope - Hawai, Submillimeter Telescope – Ariz, Large Millimeter Telescope - Mexico, Atacama Large Millimeter submillimeter Array (ALMA) - Chile, Atacama Pathfinder Experiment (Apex) - Chile, South Pole Telescope - Antarctica and IRAM 30-meter - Spain and comprised the EHT.

The project of imaging M87's black hole required observatories across the globe working in tandem as one virtual Earth-sized giant radio dish with sharper vision than any single observatory could achieve on its own. The diameter of that virtual dish is equal to the length of the longest distance, or baseline, between two telescopes in the network. For the EHT in 2017, that was the distance from the South Pole to Spain. The EHT can be visualised as a broken mirror that software stiches together. The largest separator determines the sharpness of images, and that is why the team needed to construct an earth sized telescope. The angular resolution of an earth sized telescope is 20 microarcseconds. In order to image the extreme of physics, we had to go to the extremes of nature/earth.

In summary, the team used this global array of antennas to image an object the apparent size of a doughnut on the moon.

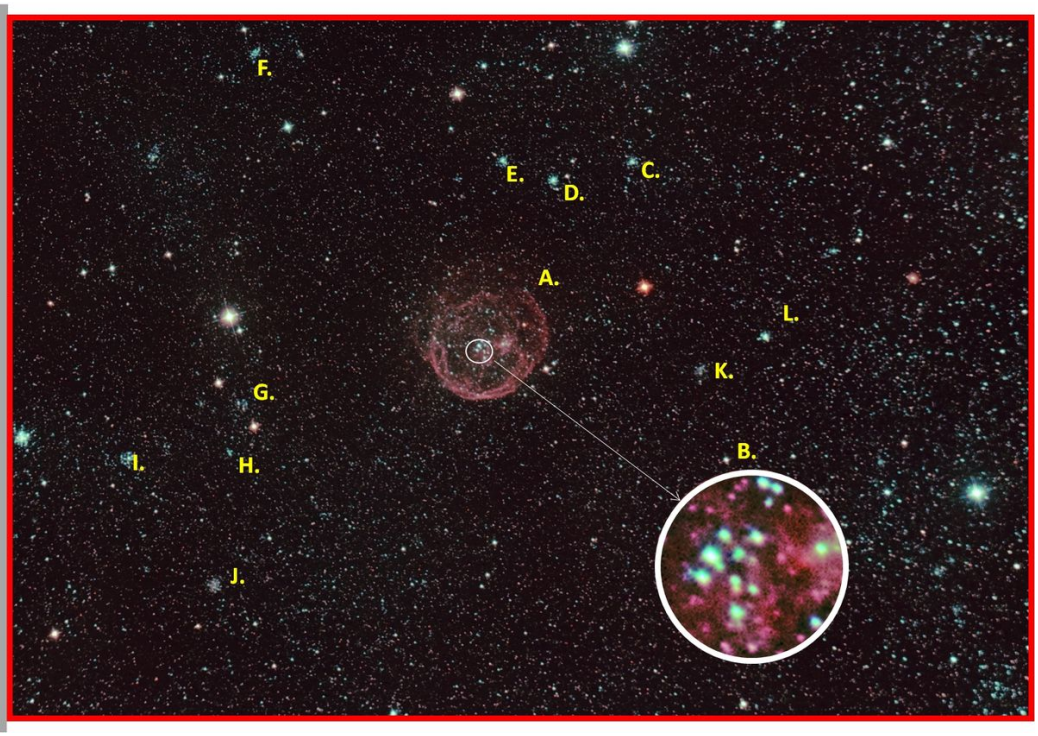
The meeting closed with the usual coffee and biscuits and a lively discussion of the talk by those present. **Ω**

Henize 70 in the LMC. Photographs, annotations and text below by Johan Moolman.



A. **Henize 70**
B. Part of the **OB association** (LH114), with open cluster SL673 at it's "heart").
Open clusters:
C. SL 693
D. SL 690
E. SL 695
F. NGC 2114 (Mag 12.5)
G. KMHK 1271
H. KMHK 1256
I. SL 666
J. SL 651
K. SL 671
L. SL 675

SL represents the Shapley Lindsay catalogue for clusters in the LMC published in 1963. **KMHK** is a newer catalogue published in 1990.



Feature of the month: Drone to Titan – by Pierre Lourens

At last month's meeting, I spoke about Titan, one of the moons of Saturn. At the end, I mentioned three proposed missions to Titan: a balloon, a drifter on a lake and a drone. Now NASA has selected a drone with 8 rotors and it will be called "Dragonfly". It will be launched in 2026 and will arrive on Titan in 2034, 15 years from now.

It will fly through Titan's atmosphere and take high definition images of the surface, make measurements and do analyses. It will do so leapfrog style. Batteries will be recharged while landed using radioisotope thermoelectric generators *****. Titan's low gravity and dense atmosphere makes this a suitable way to explore Titan. Read all about the mission and see an animation of the landing sequence at

https://www.skyandtelescope.com/astronomy-news/were-going-to-titan-dragonfly/?k=uSjcHgQUF9bu4A2rjukBNUhSEd9gsj%2BMsl6ZgLBIURM%3D&utm_medium=email&utm_source=newsletter&utm_campaign=sky-mya-nl-190628&cid=DM126459&bid=1228423839

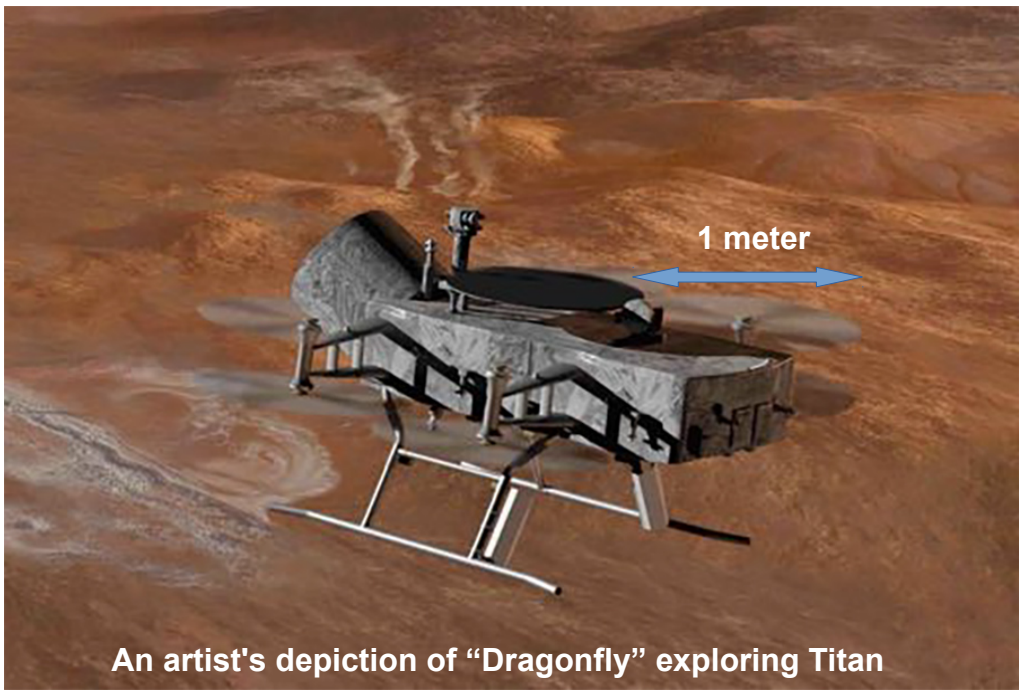
Thanks to Percy Jacobs who sent me this web link.

*** A bit of physics** – what is a radioisotope thermoelectric generator?

A radioisotope is an isotope of an element that is radioactive. In this case, the radioisotope is plutonium-238.

A thermoelectric generator is a device that produces an electric current, making use of a temperature difference. It has no moving parts. The ones (8 of them) in "Dragonfly" involve the use of thermocouples, and are based on the Seebeck effect. The decay of plutonium-238 will generate heat that heats one end of a thermocouple, and the other end will be kept cold by the cold atmosphere of Titan, the temperature of which is -179.5 ºC at the surface.

For an explanation of a thermocouple and the Seebeck effect, see https://www.bing.com/videos/search?q=seebeck+effect+thermocouple&&view=detail&mid=4D44B64268848D87ABD34D44B64268848D87ABD3&&FORM=VRDGAR



An artist's depiction of "Dragonfly" exploring Titan