The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER NOVEMBER 2020

NEXT MEETING

Internet meeting. *****

Date and time: Wednesday 25 November 2020 at 19h00.

Programme:

- "The frustrations of changing from one camera to another" by Louis Kloke .
- "Telescope optics testing and what went wrong with the Hubble Space Telescope." by Johan Smit.

Chairman: Michael Poll.

*** Johan Smit will email the link to join the meeting at 19h00. Please join as quickly as** possible. The meeting will be locked at 19h10.

TABLE OF CONTENTS

Astronomy-related articles on the Internet

Milky Way and Andromeda galaxies are already merging. The Andromeda galaxy rushes toward the Milky Way. The faint, extended halos of these two galaxies appear to have already started touching one another.
https://earthsky.org/astronomy-essentials/earths-night-sky-milky-way-andromeda-merge?utm_source=EarthSky+News&utm_campaign=56c692fd5c-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-56c692fd5c-394671529

Are there other Earths? Yes, there are lots of Earth-like exoplanets in the habitable zones of their parent stars. https://www.youtube.com/watch?v=_f2I_PoTGLU

Astronomers identify 24 possible superhabitable worlds. Are there worlds out there – orbiting distant stars – even better suited for life than Earth? Might they be older, larger, warmer, wetter and with longer-living stars? Now astronomers have identified 24 possible superhabitable worlds.
https://earthsky.org/space/superhabitable-exoplanets-better-suited-for-life-than-earth?utm_source=EarthSky+News&utm_campaign=56c692fd5c-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-56c692fd5c-394671529

Super-Earth exoplanets often have giant 'Jupiter' bodyguards. Like Jupiter in our own solar system, the giant planets in other solar systems would act as "bodyguards" protecting the smaller planets from asteroid impacts.
https://earthsky.org/space/super-earth-exoplanet-giant-jupiter-bodyguard?utm_source=EarthSky+News&utm_campaign=a3588142f2-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-a3588142f2-394671529

Top 10 things to know about asteroid Bennu.
https://earthsky.org/space/top-10-things-to-know-about-asteroid-bennu-video-tour?utm_source=EarthSky+News&utm_campaign=71a9e463bf-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-71a9e463bf-394671529

SOFIA finds water on the moon's sunlit surface.
https://earthsky.org/space/nasa-moon-announcement-monday-october-26-2020-sofia?utm_source=EarthSky+News&utm_campaign=e24d0dfced-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-e24d0dfced-394671529

Pluto's snowcapped mountains are unlike any on Earth. On Pluto, there are mountains of rock hard water ice with methane snow on their peaks.
https://earthsky.org/space/methane-snowcapped-mountains-on-pluto-new-horizons?utm_source=EarthSky+News&utm_campaign=eba8e70627-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-eba8e70627-394671529

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Super-Earth and sub-Neptune found orbiting a red dwarf star. Since red dwarf stars are the most common in our galaxy, and super-Earths and sub-Neptunes are two of the most common types of planets found so far, there should be *many* more worlds like these two out there. https://earthsky.org/space/super-earth-sub-neptune-orbiting-red-dwarf-star-toi-1266?utm_source=EarthSky+News&utm_campaign=e24d0dfced-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-e24d0dfced-394671529

Feature of the month: Dimming of Betelgeuse

According to new research, the red supergiant star Betelgeuse – which began to dim dramatically in brightness in late 2019 – might not explode for another 100 000 years. The star is also smaller and closer to Earth than was thought.

https://earthsky.org/space/betelgeuse-supergiant-smaller-closer-wont-explode-soon?utm_source=EarthSky+News&utm_campaign=71a9e463bf-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-71a9e463bf-394671529

Astronomy-related images, video clips and documentaries on the Internet

A series of short documentaries about the exploration of near Earth asteroid Bennu by NASA's OSIRIS-REx spacecraft.
https://www.youtube.com/watch?v=QunVAWABQSc

LIFE BEYOND: Chapter 1. Alien life, deep time, and our place in cosmic history.
A 30-minute documentary. It is thought-provoking.
https://www.youtube.com/watch?v=SUelbSa-OkA

Astronomy basics: What is a galaxy?

We live in a galaxy called the Milky Way. But there is so much to know about these grand and glorious star islands in space!

https://earthsky.org/astronomy-essentials/definition-what-is-a-galaxy?utm_source=EarthSky+News&utm_campaign=4cebe449b4-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-4cebe449b4-394671529

NOTICE BOARD

- **Beanies:** Beanies will be offered for sale @ R40.00 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.
- **Data base:** Members are reminded that a data base of the books in our library is to be found on our website.

Observing: Planetary nebula with a name - by Magda Streicher

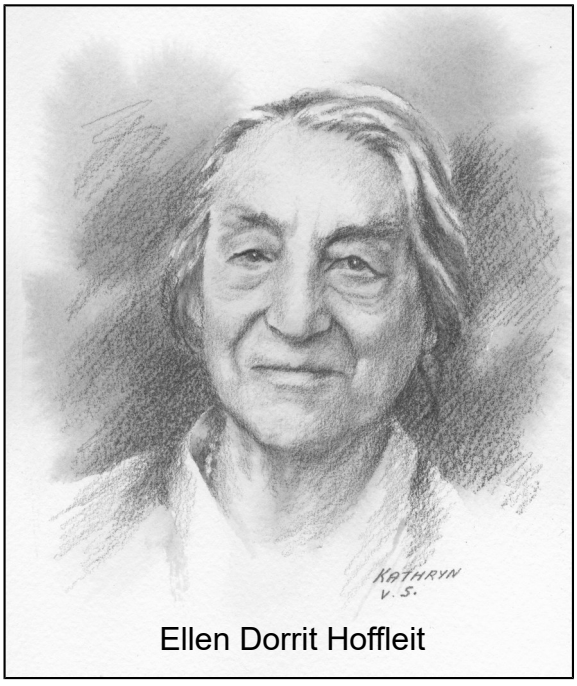
We all know the Carina Nebula, and isn't it a beautiful object! The nebula is also home to several other numbered objects among the extensive trails of gas.

A close neighbour is the planetary nebula known as Hoffleit 39. While it is probably not generally regarded as particularly special, it nevertheless has a special meaning for me. In 2006 I wrote a letter to Ellen Dorrit Hoffleit, an American senior research astronomer at Yale University, to share with her my humble way of studying the Universe through my ordinary telescope. Later, I was extremely surprised to receive a parcel in the post from her. Between the sheets of soft paper was her book *Misfortunes as Blessings in Disguise*, the story of her life. In her letter she encouraged me to keep looking at the wonderful southern skies. When Hoffleit died on 9 April 2007 she had just turned 100, having been born on 12 March 1907. She discovered the optical variability of the first-discovered quasar 3C 273.

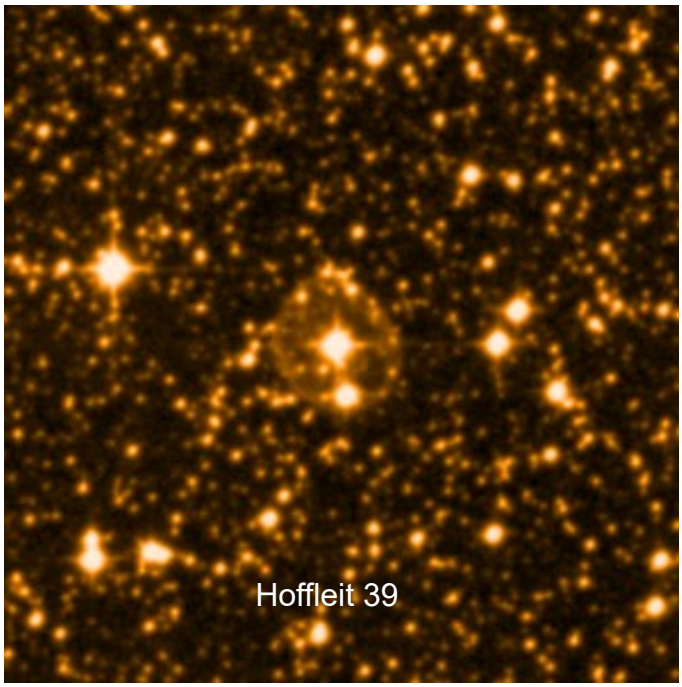
The nebula Hoffleit 39, also known as PK 288.9-00.8, is situated north-east of the Carina Nebula, just outside its edge. The star field is rather cluttered with starlight, but with care and determination this planetary nebula can be successfully searched for. First try low power with averted vision, but once you've spotted it, change to moderate to high power to study the nebula more closely. It is rather small in size and in this star-rich constellation it can easily be lost among its varied magnitude stars. The focus, however, is the bright central star – a Wolf-Rayet star – which explains the brilliance. If one looks past the bright star with fairly high magnification and averted vision, the nebula appears round, with a slightly brighter southern edge. With luck one can spot a faint star on the western edge.

One does not expect a planetary nebula in this area, so to pick one up is extremely rewarding. This particular nebula is very special – it is like sharing it again with Ellen Dorrit Hoffleit, who encouraged me to keep on seeking out the wonders of the southern skies. **Ω** **(**Magda Streicher's e-mail address: magdalena@mweb.co.za)

OBJECT	TYPE	RA	DEC	MAG	SIZE
Hoffleit 39	Planetary Nebula	10 h 54.5 m	- 60º 30.8‘	11.4	62”



Ellen Dorrit Hoffleit


Hoffleit 39

Web links for the astronomy enthusiast

- **The website for all information about the ASSA and the ASSA Centres:**
  https://assa.saao.ac.za/
- **ASSA Specialist Sections:**
  ASSA has various areas of interest. Join and participate!
  https://assa.saao.ac.za/sections/
- **ASSA Publications to download and enjoy:**
  MNASSA: https://www.mnassa.org.za/
  Nightfall: http://assa.saao.ac.za/sections/deep-sky/nightfall/
  To receive as part of ASSA membership benefits - *Sky Guide,* the astronomical handbook for Southern Africa: http://assa.saao.ac.za/about/publications/sky-guide/
- **Mail Groups to join:**
  For general ASSA related information: https://groups.io/g/ASSA-announce
  For posting general items and discussion: https://groups.io/g/ASSA-discussion
- **Social Media to join and share:**
  Facebook: https://www.facebook.com/Astrosocsa/?_rdc=1&_rdr
  Youtube: https://www.youtube.com/channel/UCJ4b1fhmPvYTOsy15YP-_JA
  Twitter: https://twitter.com/AstroSocSA
- **More web links can be found on page 118 of "2020 Sky Guide Africa South". Ω**

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What's Up? - by Michael Poll

Selected events: December 2020 to January 2021

Moon phases
First Quarter December 22nd, January 20th; **Full Moon** December 30th, January 28th;
Last Quarter December 8th, January 6th; **New Moon**: December 14th, January 13th.

The Moon
The Moon moves from rising in the east to setting in the west on a daily basis as the Earth spins on its axis, but the Moon also moves slowly eastwards in its orbit around the Earth. The eastwards movement means that the Moon is further east at a given time from one night to the next, and consequently rises up to an hour later each night. The Moon's orbital period around the Earth (e.g. New Moon to New Moon) is about 29½ days. As it moves around the sky, it can be used as a signpost to identify objects that it passes, such as the bright planets and bright stars.

Moon near bright stars (evening sky)
Near Pollux (in Gemini): December 30th & 31st and January 27th.
Near Regulus (in Leo): Night of January 29th / 30th.

Moon near bright stars (morning sky – before sunrise)
Near Pollux (in Gemini): Night of December 3rd/4th, rising 21h46 on 3rd, best before sunrise on December 4th.
Near Regulus (in Leo): December 7th, January 3rd.
Near Antares (in Scorpius): January 10th.

Planets in evening sky
Jupiter: Is a bright white object, not quite as bright as Venus, but brighter than any star.
Saturn: Is a dull yellowish object, it is fairly bright but can easily be mistaken for a star.
The Moon will be near Jupiter and Saturn on the evenings of December 16th & 17th.
Jupiter and Saturn are in conjunction with each other on December 21st - an event knows as The Great Conjunction (see separate article). By the beginning of January, Jupiter and Saturn will be disappearing into the evening twilight. Saturn is in conjunction with the Sun on January 24th, and Jupiter is in conjunction with the Sun on January 29th.
Mars is a reddish object, which becomes bright in the night sky about every two years, (when the Earth moves between Mars and the Sun). In 2020 Mars was at its brightest in October and will fade rapidly over the coming weeks. The Moon will be near Mars on December 23rd & January 20th & 21st.
Mercury is seen almost always in the twilight sky, alternating about every three months between morning and evening. Although quite bright, it may be difficult to find without prior knowledge of its position. In the southern hemisphere it is best seen in the morning sky in the first half of the year, and in the western evening sky in the second half of the year. Appearances of Mercury in the evening sky in the first half of the year, including January 2021 are not favourable for viewing – its greatest elongation of 18.6°east of the Sun is on January 24th. However it will be near Saturn and Jupiter low down in twilight on the evenings of January 10th and 11th, when the three planets set around 19h 30m.
Planet in the morning sky (east before sunrise)
Venus is the third brightest object in the sky after the Sun and Moon and is an unmistakable bright white object.
Currently Venus' presence in the morning sky is not favourable for viewing as it is rising in twilight – it rises about 1½ hours before the Sun at the beginning of December and about an hour before the Sun at the end of January. (Continued on next page.)

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The Moon will be near Venus on December 13th, and Venus will be near Antares on the morning of December 23rd, although twilight may interfere. Venus is at superior conjunction (in line with the Sun on the far side) on March 26th, thereafter it will move into the evening sky.

Selected Constellations for December & January

December: South Grus (the Crane), Piscis Austrinus, Eridanus (the River), Canis Major. (Large and Small Magellanic Clouds)

North Pegasus, Andromeda, Aries, Taurus, Orion.

January: South Piscis Austrinus, Eridanus (the River), Canis Major, Carina

North Taurus, Orion, Gemini

The Great Conjunction

Jupiter and Saturn are in conjunction on December 21st 2020. Conjunctions of these two planets are comparatively rare events, and because of the rarity, a meeting of Jupiter and Saturn is called The Great Conjunction.

Of the naked eye planets, they are the two most distant from the Sun and the rarity of Great Conjunctions is due to their slow motion around the ecliptic. Jupiter takes 11.86 years to complete an orbit and Saturn takes 29.5 years. Each year, Jupiter moves about 30° eastward against the stars of the ecliptic, while Saturn moves just over 12° annually. Periodically Jupiter catches and passes Saturn resulting in a Great Conjunction, an event which occurs on average once every 19.6 years.

In the approximately 20 years between great conjunctions, Saturn moves about 240° around the ecliptic, about 2/3 of the way around its orbit, so that, after 3 Great Conjunctions, a fourth conjunction occurs in the same part of the ecliptic as the one 60 years previously, albeit shifted eastwards by approximately 8 degrees, thus resulting in these conjunctions drifting across the entire zodiac over time.

During December 2020 the two planets can be seen approaching each other day by day. On December 1st they will be 2.2° apart, and by December 15th they will be 0.7° apart, and they will move 0.1° closer each night thereafter until conjunction on December 21st, when they will be 5.7’ apart, which is about 1/5th of the apparent diameter of the Moon. This is the closest encounter since 1623 when they were 5’ apart. It is not known whether the 1623 event was seen or recorded, but the pair were only 13° east of the Sun.

The circumstances of the Great Conjunction on December 21st 2020 are:

Elongation from the Sun: 30°

Great Conjunction in right ascension: 2020 Dec 21 13h22

Great Conjunction in ecliptic longitude: 2020 Dec 21 18h37

As seen from Pretoria, they will become visible in twilight from about 19:15 (SAST), when they will be 21° above the western horizon. They will set at 21:00, two hours after the Sun. Jupiter will be at magnitude -2.0 and Saturn will be at magnitude 0.5. Both objects will lie in the constellation of Capricornus.

The ecliptic longitude is measured in eastwards in degrees from the March (“Vernal”) Equinox. Ecliptic Longitude tells how far around the ecliptic the planet is. For planetary conjunctions the Ecliptic Longitude is the preferred use because the conjunctions we are most interested in take place near the ecliptic, although describing a conjunction in Right Ascension is also correct.

As can be seen from this table of future Great Conjunctions, the two planets will not be so close together again until 2080. (Continued on next page.)

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Conjunctions in ecliptic longitude

October 31, 2040	12:02:47	Jupiter	1°08' south of	Saturn	20.8° West	Libra
April 7, 2060	22:36:24	Jupiter	1°07' north of	Saturn	41.9° East	Gemini
March 15, 2080	01:49:55	Jupiter	6' north of	Saturn	43.5° West	Capricorn

Usually when Jupiter overtakes Saturn there is only a single conjunction, but if the conjunction takes place while the planets are making their retrograde loops, there can be a **triple conjunction**. Such an event occurred in 1980 -1981 as can be seen in this table:

Conjunctions in ecliptic longitude:

December 31, 1980	21:17:24	Jupiter	1°03' south of	Saturn	90.9° West of Sun	Libra
March 4, 1981	19:14:36	Jupiter	1°03' south of	Saturn	155.9° West of Sun	Libra
July 24, 1981	04:13:35	Jupiter	1°06' south of	Saturn	63.8° East of Sun	Libra

Triple conjunctions of two outer planets can only occur when their opposition dates are close together. In the case of Jupiter – Saturn triples, the opposition dates must be ≤ 1.7 days apart:

1981 Jupiter at opposition: March 26th 07h 43m
Saturn at opposition: March 27th 06h 40m

The last three triples of Jupiter and Saturn were:

1682-1683
1940-1941
1980-1981.

The next triple will be in 2238.

This writer did not see the actual conjunction event in 1961, but I did see them in the evening sky in Capricornus in the following (northern summer).
It was the first time that I had ever identified the two planets.

February 19, 1961	00:07:18	Jupiter	14' south of	Saturn	34.9° West	Capricorn

The 2000 encounter was too close to the Sun, but they were seen close together later in the year.

May 28, 2000	15:56:27	Jupiter	1°09' north of	Saturn	14.9° West	Taurus

The current encounter will be “repeat” of the one I saw in 1960. *Tempus fugit!*

Acknowledgements: Dominic Ford, Joel Rao, Jeffrey L Hunt, Space.com.
The tables of conjunction dates are from Wikipedia.

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The Geminid Meteor Shower

The Geminid shower is one of the most prolific meteor streams of the year, and is active during the period December 4th to December 16th, with a sharp peak of maximum activity on the mornings of December 13th and 14th. The meteors are slow and yellowish, with about 4% displaying persistent trains. If observations are made over the whole period of visibility, the current slow build up to maximum and the variations in brightness may be seen.

The best time to observe the shower is from about midnight onwards. The radiant point of the meteors is in Gemini, which will be in the north east, but drifting towards the north towards morning twilight..

The shower was first noted in 1862, by Robert P. Greg (Manchester, England), and independently by B. V. Marsh and Prof. Alex C. Twining in the United States. During the 1870s, observations of the Geminids became more numerous as astronomers realized that a new annual shower had been discovered.

A major advance in the understanding of this meteor stream was made in 1947 when Fred Whipple was able to determine the orbital elements using data obtained from Harvard Meteor Project. The orbit of the Geminids has a period of only 1.65 years, a high eccentricity (i.e. it is very elongated), The eccentric orbit places perihelion within the orbit of Mercury, and aphelion in the main asteroid belt, between the orbits of Mars and Jupiter. The plane of the orbit is inclined 23 degrees to the plane of the Earth's orbit.

A major question concerning the Geminid stream involved its origin. Meteor streams are thought to be the dusty debris released by comets, but while the Geminids provide one of the most predictable annual displays they had no known parent body. This changed in 1983 - on October 11th during a search for moving objects amidst the data gathered by the Infrared Astronomical Satellite (IRAS), Simon Green (Leicester University) and John K. Davies noticed fast moving object in the constellation of Draco on seven consecutive scans. The object was an asteroid at 16th magnitude, and it received the preliminary designation 1983TB. Within two weeks of the discovery of 1983TB, Fred Whipple reported that its orbital elements were almost identical to those of the Geminid meteor stream. Additional observations confirmed the link. At last the parent body of this stream had been discovered, and it was proposed that 1983TB, rather than being an asteroid, was an extinct comet that somehow got trapped into an unusually tight orbit.

The asteroid received the permanent designation of 3200 Phaethon, named after the mythical son of Helios. Phaethon gets closer to the sun than all the other Apollo asteroids, so it has the smallest perihelion distance of all the known minor planets - it gets as close as 21 million kilometres (0.14 astronomical unit) from the Sun, one third of the average distance of Mercury. The previous record holder was Icarus, 7.0 million kilometres further out.

This was the first time that an asteroid had been definitely linked to a meteor shower and it subsequently serves as an important link between comets and meteor streams - the Geminids may be comet debris after all if Phaeton *is* the dead nucleus of a burned-out comet. **Ω**

References

Minor Planet 1983 TB News Note Sky & Telescope January 1984 p 5.
Is 3200 Phaethon a dead comet? John K Davies Sky & Telescope October 1985 p 317.
Phaethon and the Geminids News Note Sky & Telescope December 1990 p 587.