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

NEWSLETTER OCTOBER 2020

NEXT MEETING

Internet meeting. *****

Date and time: Wednesday 28 October 2020 at 19h00.

Programme:

- Talk by Percy Jacobs.
- "The 200 inch Hale telescope mirror" – by Craig Cloke.

Chairman: Johan Smit.

*** 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.

NO OBSERVING EVENING THIS MONTH

TABLE OF CONTENTS

Astronomy-related articles on the Internet

Are day and night equal at the equinox? On 22 September, Earth was at the spring equinox. But day and night are not absolutely exactly equal at that point, for two reasons. https://earthsky.org/astronomy-essentials/are-day-and-night-equal-at-the-march-equinox?utm_source=EarthSky+News&utm_campaign=eaa7bd47ff-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-eaa7bd47ff-394671529

What are white dwarf stars? https://earthsky.org/space/white-dwarfs-are-the-cores-of-dead-stars?utm_source=EarthSky+News&utm_campaign=eaa7bd47ff-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-eaa7bd47ff-394671529

Giant 'survivor' planet found orbiting dead star. For the first time, astronomers have detected a giant planet orbiting a white dwarf star in a very close orbit. This is difficult to understand. A planet orbiting a Sun-like star so closely would be destroyed when that star first expands into a red giant star before shrinking down to a small, dense, hot white dwarf star. https://earthsky.org/space/survivor-planet-wd-1856-b-orbiting-white-dwarf?utm_source=EarthSky+News&utm_campaign=eaa7bd47ff-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-eaa7bd47ff-394671529

Are there active geysers at Enceladus' north pole? Water-vapour geysers erupt from cracks at the south pole of Saturn's moon Enceladus. Scientists using Cassini data now have evidence for fresh ice at the moon's north pole, too. Could it be more geysers for this fascinating ice moon? https://earthsky.org/space/fresh-ice-enceladus-north-pole-geologic-activity?utm_source=EarthSky+News&utm_campaign=cda11dabb2-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-cda11dabb2-394671529

X-ray data reveal 1st ever planet orbiting two stars in another galaxy. Evidence has been found of a planet orbiting a binary in the Whirlpool galaxy, 23 million light-years away. One of the two stars in the binary is a massive star. The other one is thought to be a stellar remnant, either a neutron star or a black hole.
https://earthsky.org/space/1st-exoplanet-in-another-galaxy-whirlpool-m51-uls-1b?utm_source=EarthSky+News&utm_campaign=b9877d6fa8-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-b9877d6fa8-394671529

Searching for habitable exoplanets? Look for phosphorus.
https://earthsky.org/space/phosphorus-in-stars-and-biomarker-habitable-exoplanets

Top 4 most promising worlds for alien life in the solar system. Mars, Europa, Enceladus and Titan are considered by the author to be the most promising.
https://earthsky.org/space/et-alien-life-most-likely-worlds-solar-system?utm_source=EarthSky+News&utm_campaign=3c82673e4d-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c64394 5d79-3c82673e4d-394671529

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A new chemical 'Tree of The Origins of Life' reveals our possible molecular evolution. At least 3.7 billion years ago, a few simple molecules worked together to create something new. Then a few more. And, somehow, these snowballing combinations eventually produced the first very basic living organisms that would evolve and branch out to become all life on Earth. https://www.sciencealert.com/a-new-chemical-tree-of-the-origins-of-life-reveals-our-possible-chemical-evolution?utm_source=EarthSky+News&utm_campaign=3c82673e4d-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-3c82673e4d-394671529

Astronomers capture 1st direct image of young giant exoplanet. Beta Pictoris b was imaged in 2008. The young giant exoplanet Beta Pictoris c was imaged recently. https://earthsky.org/space/direct-imaging-of-exoplanet-beta-pictoris-c?utm_source=EarthSky+News&utm_campaign=5f97bdb6a2-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-5f97bdb6a2-394671529

Radar reveals 3 more subsurface polar lakes on Mars. https://earthsky.org/space/3-more-subsurface-lakes-mars-south-pole?utm_source=EarthSky+News&utm_campaign=40df63514c-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-40df63514c-394671529

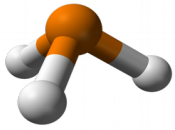
Astronomers see a star 'spaghettified' by a black hole. https://earthsky.org/space/star-spaghettified-by-black-hole-at2019qiz?utm_source=EarthSky+News&utm_campaign=e0464771c3-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-e0464771c3-394671529

Feature of the month: Life on Venus?

A substance named phosphine (PH_3) was discovered in the clouds of Venus. On Earth, phosphine is produced by certain kinds of microbes that live in oxygen-free environments.

Of course the researchers tried to rule out other explanations than microbes. They tested multiple scenarios where this gas might be produced *without* life, but they came up empty. Clara Sousa-Silva at MIT, whose career specialty is studying phosphine, said: "*It's very hard to prove a negative. Now, astronomers will think of all the ways to justify phosphine without life, and I welcome that. Please do, because we are at the end of our possibilities to show abiotic processes that can make phosphine*."

Phosphine is a colourless, flammable, very toxic gas. The ball-and-stick model here shows how the four atoms in a phosphine molecule are arranged. **Ω**



https://earthsky.org/space/life-on-venus-phosphine-biosignatures

https://earthsky.org/space/detection-phosphine-venus-clouds-sign-of-life?utm_source=EarthSky+News&utm_campaign=157c7d3416-EMAIL_CAMPAIGN_2018_02_02_COPY_01&utm_medium=email&utm_term=0_c643945d79-157c7d3416-394671529

Observing: The Hockey Stick Galaxy - by Magda Streicher

The constellation Canes Venatici, while not exactly the easiest to observe from the southern hemisphere (and definitely not in a light-polluted area), holds in its pocket a few special deep sky objects. Two of these that have captured my imagination are the galaxy NGC 4656 and its smaller companion, NGC 4657. If ever the opportunity crosses your path and a telescope is at hand, try your best to observe these special objects.

What is it all about? Well, the special nickname, Hockey Stick, says it all. The two galaxies are situated only one degree north from the border with the constellation Coma Berenices and half a degree southeast of the brighter galaxy NGC 4631 in the field of view. What makes observation less than easy is that the two combined galaxies both display low surface brightness. NGC 4656 is a faint dust streak about 15' long and only 2.5' wide and is situated in a northeast to southwest direction. It gets slowly brighter towards a wider middle area with no outstanding nucleus. The trick here is to search for slightly brighter knots on the surface to get used to the feeling of tracking down the club shape on the northeastern tip of NGC 4656. The very small companion NGC 4657 mingles well into the tip of the mother galaxy, then makes a slight turn towards the east to complete the impression of a hockey stick. It is near impossible to observe the two objects separately, but through my 16-inch with 460X I could make out some brighter uneven spots on the surface. That is about it!

In combination it is an irregular galaxy that glows at magnitude 10.4, which is not all that faint for ordinary telescopes. The two objects are probably in gravitational interaction with one each other and about 25 million light years away from us. It is a most unusual object, which again shows that the Universe with its wonderful deep sky objects will never disappoint us. **Ω**

OBJECT	TYPE	RA	DEC	MAG	SIZE
NGC 4656	Galaxy	12 h 43.8'	+32° 10'	10.4	15' x 2.4'
NGC 4657	Galaxy	12 h 44.6'	+32° 12'	12.5	1.1' x 0.7'

NGC 4656 & NGC 4657.

Image obtained with the wide-field view of the Mosaic camera on the Mayall 4-meter telescope at Kitt Peak National Observatory.

Astronomy basics: Variations in Earth's movement – by Pierre Lourens

Earth's orbit around the Sun is an ellipse with orbital eccentricity 0.017, and an extension of Earth's rotational axis from the north pole of Earth points toward a point near the star Polaris. But there are cyclical variations in Earth's orbit and in its axial direction due to gravitational perturbations from other bodies in the Solar System. These were studied by the Serbian geophysicist and astronomer Milutin Milanković in the 1920s. These variations are as follows.

Variations in the eccentricity Ɛ of Earth's orbit.

Ɛ measures the departure of an ellipse from circularity. Ɛ for an ellipse is between 0 and 1. The closer to 0 it is, the closer the ellipse is to a circle. The closer to 1 it is, the more elongated the ellipse is. See https://www.mathopenref.com/ellipseeccentricity.html
Earth's orbit varies between nearly circular (Ɛ = 0.000055) and mildly elliptical (Ɛ = 0.0679). The major component of these variations occurs with a period of 413 000 years. Other components have 95 000-year and 125 000-year cycles. They loosely combine into a 100 000-year cycle.

Variations in the axial tilt of Earth.

The angle of the Earth's axial tilt with respect to its orbital plane (i.e., the plane of the ecliptic) varies between 22.1° and 24.5°, over a cycle of about 41 000 years. The current tilt is 23.44°. Figure 1 shows the variation in Earth's axial tilt. The white line is perpendicular to the plane of the ecliptic and the red lines are extensions of Earth's rotational axis from the north pole of Earth.

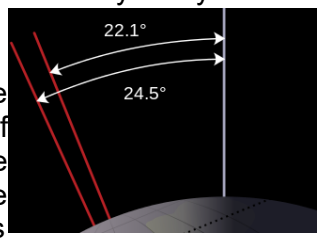


Figure 1

Axial precession and nutation.

Axial precession is the movement in the direction of Earth's axis of rotation relative to the fixed stars, with a period of 25 771.5 years. What actually precesses, is the equatorial plane of Earth, carrying Earth's axis with it. The precession is in the opposite sense than the rotation of Earth, as shown in Figure 2. The equinoxes rotate along the ecliptic with the same period. For greater clarity, see the animation at:
https://www.youtube.com/watch?v=qlVgEoZDjok

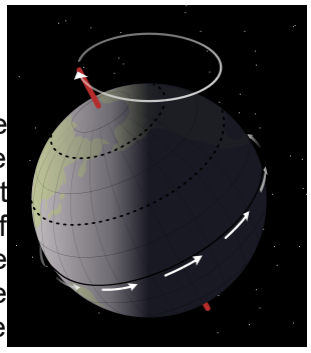


Figure 2

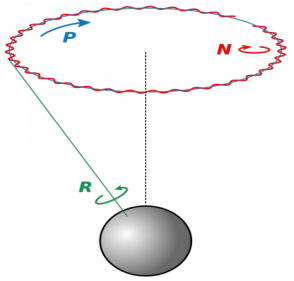


Figure 3

However, there is also a very small nutation (= nodding) of the axis (and of course of the equatorial plane) with a period of 18.6 years, shown neither in Figure 2 nor in the animation. This movement is actually a small ellipse. The resultant motion of the axis is then as shown in exaggerated fashion by the wavy red line in Figure 3. The "nodding" amounts to an angle of only about 9 arc seconds to either side of the blue circle in Figure 3. The blue circle there shows only the precession.

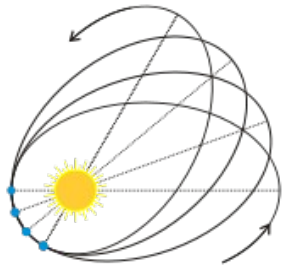


Figure 4

Apsidal rotation.

The absidal is the line connecting the perihelion and aphelion of Earth's orbit. The absidal rotates in the plane of the ecliptic, completing a full cycle every 112 000 years relative to the fixed stars, as shown in exaggerated fashion in Figure 4.

Precession of the plane of the ecliptic.

Even the plane of the ecliptic undergoes a precession. The "invariable plane" is the fixed plane that represents the angular momentum of the Solar System. Relative to the latter plane, the precession has a period of about 100 000 years. Milanković did not study this precession. It was discovered more recently. **Ω**

NOTICE BOARD

- **Planet Patrol. A new Zooniverse project.** Help find out which planet candidates from the TESS mission are real! https://www.zooniverse.org/projects/marckuchner/planet-patrol?utm_source=Newsletter&utm_medium=Email&utm_campaign=announce29sep2020
- **Full Moons get uniquely South African heritage names.** To celebrate National Heritage Month 2020, the Centre for Astronomical Heritage (CfAH) has published a unique list of authentically South African names for each Full Moon throughout each year from 2020 until 2050. https://cfah.org.za/fullmoon/
- **Recent lectures from the British Astronomical Association on the Internet.** https://www.youtube.com/user/britishastronomical
- **List of asteroid close approaches to Earth.** This is disquieting. https://en.wikipedia.org/wiki/List_of_asteroid_close_approaches_to_Earth
- **Worldwide Telescope of the American Astronomical Society.** Download free from https://worldwidetelescope.org/about/
- **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.

Chairperson's report of the meeting on 23 September 2020 - by Louis Kloke

The meeting was attended by 23 members virtually with visitors from the UK and Cape Town.

The first talk was by Bosman Olivier on "Gravitational waves". The first prediction of gravitational waves was in 1916 by Einstein and things have progressed from that point. We now can say they definitely do exist.

The second talk was by Danie Barnado on "The geology of Mars" and he showed images of the different geological formations, and the highest volcano in the Solar System (Olympus Mons). He also showed that there are highlands and lowlands in the topography of Mars. Also indications that there was water flow on the surface of Mars at some stage. He also told us that at one stage the core of Mars was liquid like that of Earth but as time has gone on the heat has dissipated and we are now left with a solid core.

The meeting concluded with general discussions amongst the members. **Ω**

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

10 SETI messages that we may not want to receive. A 21-minute documentary. https://www.youtube.com/watch?v=uKVpHTMj3XM

The Alpha Centauri system. An 8-minute documentary. https://www.youtube.com/watch?v=39VKA8vPXGg

My plek in die onbegryplike heelal – deur André Buys. 'n Dokumentêr 30 minute lank. https://www.dailymotion.com/video/x7vo3di **Wagwoord:** gryskrag92020

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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