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

NEWSLETTER NOVEMBER 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 27 November at 19h15.
Programme:

- **Beginner's Corner:** "The history of the telescope" by Craig Kloke.
- **What's Up:** by Danie Barnardo.

---------- 10-minute break. Library will be open. ----------

- **Main talk:** "Exploration of Mars" by Pierre Lourens.
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Michael Moller.

NEXT OBSERVING EVENING

Friday 22 November 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.

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Astronomy-related articles on the Internet

Europa Clipper: sailing to Jupiter's icy moon. Europa Clipper is a planned NASA mission that would investigate the habitability of one of Jupiter's moons, Europa. Underneath the moon's thick water ice crust, an extensive ocean of liquid water is thought to exist. https://www.space.com/37282-europa-clipper.html

NASA's Mars 2020 will hunt for microscopic fossils. Scientists with NASA's Mars 2020 rover have discovered what may be one of the best places to look for signs of ancient life: Jezero Crater, where the rover will land on Feb. 18, 2021.
https://www.nasa.gov/feature/jpl/nasas-mars-2020-will-hunt-for-microscopic-fossils

The Mars 2020 rover. https://www.nasa.gov/mars2020

JWST. The JWST (**J**ames **W**ebb **S**pace **T**elescope) will be a large infrared telescope with a 6.5 meter diameter primary mirror. The telescope will be launched in 2021. It will be deployed at Lagrange point L2, where it will be permanently in Earth's shadow.
https://www.nasa.gov/mission_pages/webb/main/index.html

Hubble uncovers a "heavy metal" exoplanet shaped like a football.
The planet's atmosphere is so hot that iron and magnesium remain in gaseous form and stream to the upper atmosphere, where they escape into space. The sizzling planet is also very close to its star. Because of this closeness, the planet is stretched into a football shape due to gravitational tidal forces from the star and is on the verge of being ripped apart.
https://hubblesite.org/contents/news-releases/2019/news-2019-19

Astronomy-related images and video clips on the Internet

Menacing-looking 'face' formed by titanic smashup between two galaxies. See an image of a titanic head-on collision between two galaxies and an animation of the event.
https://www.nasa.gov/image-feature/goddard/2019/menacing-looking-face-formed-by-titanic-smashup-between-two-galaxies

NASA's Lucy mission clears critical milestone. Lucy will be the first space mission to study the Trojan asteroids, which orbit the Sun at the distance of Jupiter, some trailing Jupiter and some leading it. The mission will launch in October 2021. See a video clip.
https://www.nasa.gov/feature/goddard/2019/lucy-mission-clears-critical-milestone

NASA's Curiosity rover finds an ancient oasis on Mars. Watch two video clips.
https://www.nasa.gov/feature/jpl/nasas-curiosity-rover-finds-an-ancient-oasis-on-mars

Report of observing evening on October 18th 2019 – by Michael Poll

Aaaagh! Total cloud, lightning in the distant south, one attendee. End of report !

The next observing evening will be on November 22nd 2019. This is the optimum month for seeing the Andromeda Galaxy, the Square of Pegasus and Aries. The visibility, or otherwise, of the Magellanic Clouds will be an indication of the amount of light pollution. Mercury, Venus, Jupiter and Saturn will still be visible in the west after sunset. **Ω**

Astronomy basics: Solar storms and why we should care

https://www.youtube.com/watch?v=JXZj3KzT5ag

Feature of the month:
HST finds water vapour on habitable zone exoplanet for the first time

NASA's Hubble Space Telescope found water vapour in the atmosphere of K2-18b, an exoplanet in the habitable zone around a small red dwarf star about 110 light-years away in the constellation Leo.
https://hubblesite.org/contents/news-releases/2019/news-2019-50

An artist's impression of the planet K2-18b, its host star and its imaginary moon.

Observing: Two Helices - by Magda Streicher

Left: The Helix Galaxy. **Right:** The Helix Nebula, aka “Eye of God”.

One of Hubble’s most famous pictures is the planetary nebula NGC 7293, the Great Helix Nebula in the south-western corner of the Aquarius constellation. At a distance of 450 light-years it is one of the closest planetary nebulae to us. There is much to say about this faint object, which is difficult, but with a medium-sized telescope, truly dark skies and some patience it is possible to enjoy it to its full.

This extremely large object appears as a very faint, ghostly glow in a roundish annular ring shape, and is best seen using low magnification. With careful observation the light fades towards the middle area, becoming slightly darker. The very hot, white, central magnitude 13 dwarf star and a few other faint stars become evident on the dusty surface. The north-eastern and south-western peripheries of the nebula are relatively well defined and slightly brighter, with an outstanding double star rounding off the south-eastern edge. A nebular filter and dark skies are your best tools for admiring this elusive nebula. There is a faint, small, magnitude 16 galaxy, which is situated very close and just to the west of a magnitude 9 star in the north-western extremity of the nebula.

However, the constellation Ursa Major proudly houses the Helix Galaxy, NGC 2685. The galaxy has a reasonably broad middle bar with hazy, flimsy arms that look like floating candy floss woven around it. It is known as a polar ring galaxy and deep pictures show the filaments clearly encircling this star city. Even if we can’t observe this far northern galaxy in the southern hemisphere, we can at least revel in the Helix Galaxy by looking at photographs of it! **Ω**

OBJECT	TYPE	RA	DEC	MAG	SIZE
NGC 7293	Planetary Nebula	22 h 29.6 m	- 20° 48.0’	7.3	769”
NGC 2685	Galaxy	O8 h 55.6 m	+ 58° 44.3’	11	5’ x 0.2’

See also: https://www.nasa.gov/multimedia/imagegallery/image_feature_486.html

Chairperson's report for the meeting on 23 October 2019 - by Louis Kloke

The meeting was well attending with 5 visitors; the Beginner's Corner was presented by Michael Poll where he gave a very enlightening talk on the transits of Mercury across the Sun. He went into detail describing how the transit occurs on a cyclic basis every 3, 7, 10 or 13 years and depending on whether Mercury is in aphelion. Observing the transit should only be done using the correct filter or a photograph taken of the projected image. Historically Johannes Kepler predicted the transit of Mercury and Venus in November 1631 and December 1631 he unfortunately did not live to see this.

Michael Poll presented What's Up; he went into detail about the moon phases for November 2019. Venus and Mercury will prominent in the early evening sky. The Moon, Jupiter and Saturn through the month. Venus and Saturn will be close together on December 11. The constellations for November in the evening sky, in the northern sky: Cygnus, Square of Pegasus, Triangulum and Andromeda, in the east the bright stars Aldebaran, Rigel and Canopus lie along the horizon at about 20h 00 in mid-November. At this time of year the South Pole of the Milky Way passes overhead at our latitude,

so the Milky Way runs around the horizon.

Neville Young gave a very interesting talk on the science of relativity. In the late 18th century non-Euclidean geometries started to be taken seriously by mathematicians and that parallel lines meeting at infinity might not be an essential taking into account the effects of gravity in the universe. Observations had shown that Mercury had precessed by an extra degree over the past 8400 years. General relativity explained that both the fabric of space and time is warped. And that the speed at which these warps can propagate is limited. The precession of Mercury can then be explained. Einstein said: "I was sitting in a chair in the patent office in Bern when all of a sudden a thought occurred to me: 'if a person falls freely he will not feel his own weight.' I was startled. This simple thought made a deep impression upon me. It impelled me towards a theory of gravitation.' In 1801 Johann Georg von Soldner calculated the bending of light of 0.87 arcsec. After shelving the idea of light bending in 1907 Einstein applied the theory of special relativity and noted that the deflection of light would be affected by gravity and would result in the deflection of light. In 1915 Einstein predicted the deflection would be 1.75 arcseconds. Neville showed a graphic depicting the deflection of light.

So the question was how to measure the deflection of light? Waiting for a total eclipse of the Sun. The first attempt to measure the deflection of light was made in 1912 but was washed out. In 1914 the next attempt was washed out due the outbreak of World War 1 and American astronomers were washed out due to cloud. All attempts that were made between 1914 and 1918 were unsuccessful due to various reasons. In 1919 it was predicted that the Sun would be in a rich star field and the next time there would be a good star field available would be in 500 years' time. An animation was shown which showed effect of gravity on the star field. Using two glass photographic plates one without the sun and the second taken during the eclipse it was noted that the stars closet to the Sun were deflected more than those further out, thus proving that a strong gravitational field can bend light. A graph showing how the measurements improved over a period of 2000 years.

Two groups were involved in the experiment one from the Royal Observatory, Greenwich which to Sobral in Brazil and the second group from Cambridge University wen to the Island of Principe in West Africa. The leader of the expedition was organised by Frank Dyson in his capacity as The Astronomer Royal and Director of the Royal Observatory Greenwich. The different people involved in each expedition were discussed.

The cameras were mounted horizontally and focussed by means of a mirror on a stand in front of the camera that could be rotated horizontally or vertically and driven by a mechanical timing device. Similar equipment was used by the group in Principe. In both cases several exposures were taken with both cameras, but it was found that the larger telescope was not focussed and only the exposures of the 4 inch were of satisfactory quality. After much consideration and deliberation the group from Principe calculated a deflection of 1.6 arc seconds and the group from Sobral calculated a deflection of 1.9 arcseconds. **Ω**

Summary of coming presentation on 27 November under "What's Up?" - by Danie Barnardo

What's up in December 2019 and January 2020?

Moon Phases:

First quarter: 4 December 2019, 3 January 2020.
Full moon: 12 December 2019, 10 January 2020.
Last quarter: 19 December 2019, 17 January 2020.
New moon: 26 December 2019, 24 January 2020.

There is a penumbral Lunar eclipse on 10 January 2020, starting at 19:00 and ending at 23:00.

The Summer solstice is on 22 December 2019 – this will be the longest day of the year in the Southern Hemisphere.

Planets:

December 2019 - Mercury is visible at dawn till late in the month. Mars is visible in the morning sky and Venus is prominent and Saturn is still visible in the evening sky. Jupiter is also still visible for the first half of the month.

January 2020 - Mercury is an evening planet that sets 70 minutes after the Sun by the end of the month. Venus is a bright, well positioned evening planet. By the end of the month it sets about 4 hours after the Sun. Mars is a morning object low in southern Ophiuchus. Jupiter is a morning planet near the Sun on 1 January but rising about an hour before sunrise on 31 January. Saturn is in conjunction with the Sun on 14 January and not visible this month.

On 28 January 2020 a 2-days old Moon is in conjunction with Venus and Neptune, presenting an ideal opportunity to spot the elusive Neptune.

Constellations:

The summer constellations; Orion, Canis Major and Taurus is starting to be prominent and presents a lot of interesting targets. By Januray 2020, they are high up early in the evening and presents excellent viewing opportunities.

A special target is the Rosette Nebula in Monocerus (NGC 2237). This mag 4.2 nebula is a rich star-forming region with a large number of young stars in its centre and an interesting, though challenging target.

On 15 December 2019, the Moon passes within 1,17 degrees of the Beehive Cluster (M44) in Cancer and presents a similar spectacle on 12 January 2020, though this time M44 is not so near to the Moon.

Puppis, Caina and Vela, with their rich crop of deep-sky objects are starting to appear late in the evening in December 20219 and rises earlier by January 2020. Crux, which has been absent from our skies for a while or situated low on the horizon, is becoming better situated by January 2020.

Celebrations:

8 January is Earth's Rotation Day, celebrating Léon Foucault's famous experiment, the Foucault Pendulum suspended from the dome of the Pantheon in Paris, demonstrating the rotation of the Earth, in January 1851. **Ω**

NOTICE BOARD

- **New book:** "The Crowd and the Cosmos - Adventures in the Zooniverse." See https://global.oup.com/academic/product/the-crowd-and-the-cosmos-9780198842224?cc=gb&lang=en#
- **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.
- **Database:** Members are reminded that a data base of the books in our library is to be found on our website.
- **Request to members:** Members are requested to inform Danie Barnardo of any good books on astronomy that they encounter, so that he can purchase them for our library. His contact details are to be found immediately below.

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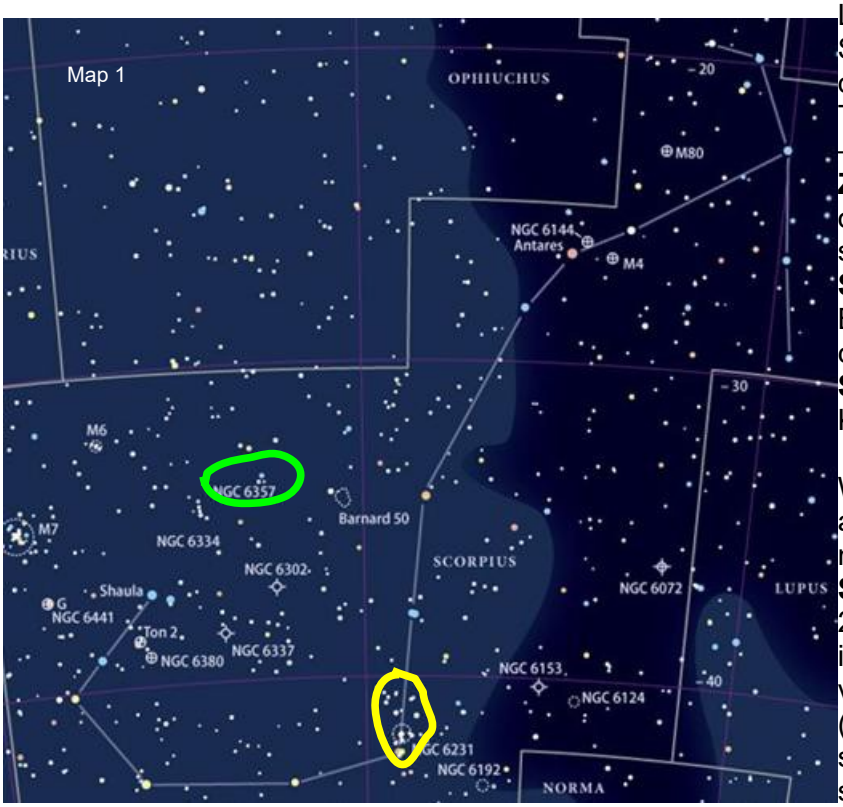
Arthropod Ally – where exoskeletons abound – by Johan Moolman

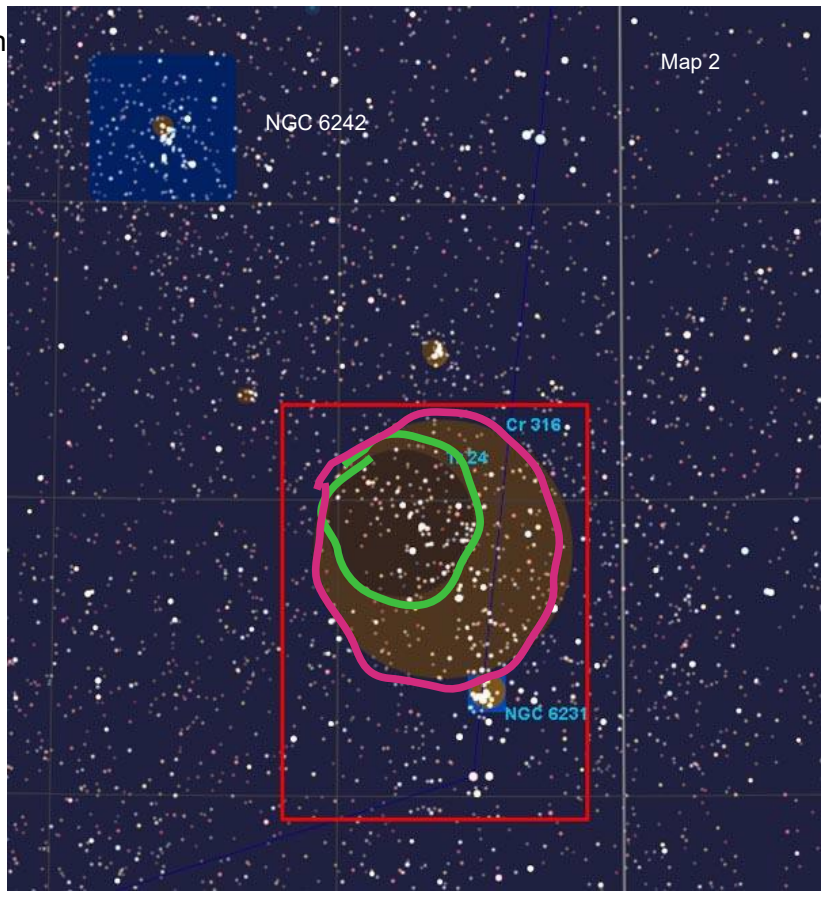
The Arachnid (Scorpius) and the Crustaceans



Located towards the tail of the Scorpion are two "seafood delights" – a prawn and a lobster. The **Prawn Nebula** - aka **IC 4628** – is located near the bright star **Zeta Scorpii:** ζ Scorpii consists of two stars in the same line of sight, separated by 7'. **Zeta-1 Scorpii** is a hypergiant star, class B and a member of the open cluster **NGC 6231**. **Zeta-2 Scorpii** is an orange giant, class K.

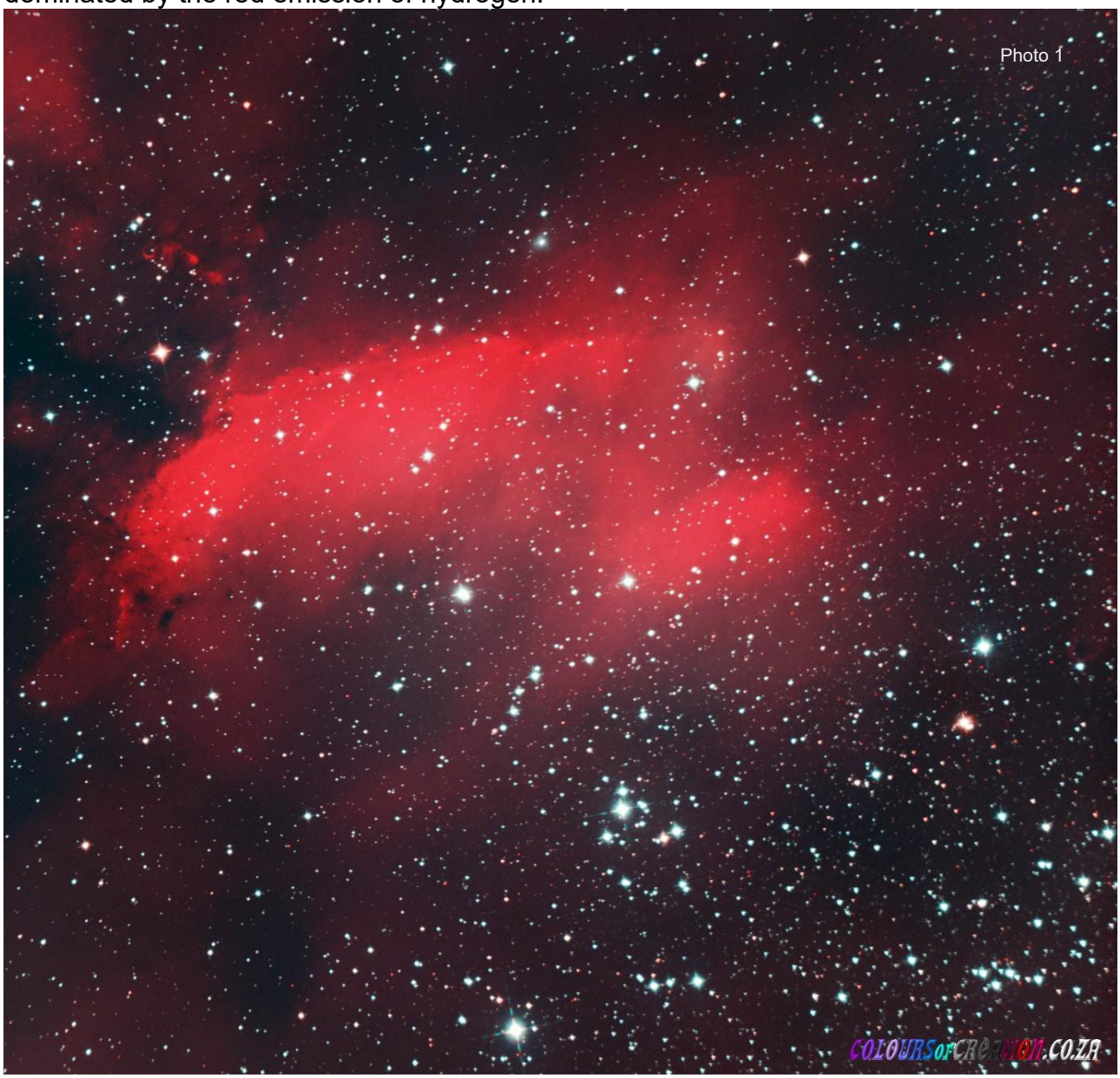
We find the **Lobster Nebula** – aka **NGC 6357** - 3.3° north-northwest of magnitude 1.6 **Shaula**: Lambda [λ] Scorpii, the 2nd brightest star in Scorpius. It is a multiple star system with **3** visible components**: λ Sco A** (which is a triple star: two class B stars and a pre-main sequence star), **λ Sco B,** separation of 42" and **λ Sco C** with a 95" separation.

The **Prawn nebula** (**IC 4628)** is an emission nebula located in the Sagittarius arm of the Milky Way, about 6 000 light-years from Earth (Photo 1). The nebula is associated with the open cluster **Trumpler 24**, and is about 250 light years in diameter, corresponding to an apparent size of 1.5 degrees, or 3-4 times the size of the full Moon. **Trumpler 24**, aka **Harvard 12**, is a loose and scattered cluster, containing about 200 stars and is about half the size of **Collinder 316** (Map 2). Both clusters are believed to be located at the core of the **Scorpius OB1 stellar association**.



These nearby hot, massive stars, millions of years young,

irradiate the nebula with invisible ultraviolet light, stripping electrons from atoms. The electrons eventually recombine with the atoms to produce the visible nebular glow, dominated by the red emission of hydrogen.



Because of its faintness, **IC 4628,** with an apparent magnitude of 7.1, was not included in the NGC catalogue. **The Prawn** was catalogued as **Gum 56** by the Australian astronomer Colin Stanley Gum, who published his catalogue of H II regions in 1955.

NGC 6231 is the bright open cluster in the photograph below, located half a degree north of Zeta Scorpii, and is part of a swath of young, bluish stars in the constellation Scorpius known as the **Scorpius OB1 association**. This cluster is estimated to be about 2–7 million years old, and is approaching the Solar system at 22 km/s. The cluster is also sometimes known as **The Northern Jewel Box**, due to its similar appearance to NGC 4755, the Jewel Box cluster, which is further south in the sky.

The cluster forms the **head** of the **False Comet** **(red bracket, photo above)**, a wider collection of stars from Scorpius OB1 running northward from Zeta Scorpii and **NGC 6231** roughly halfway toward Mu Scorpii. The **tail** is formed by two clusters, **Collinder 316** and **Trumpler 24**. Trumpler 24 is surrounded by The **Prawn Nebula (map 1)**, where the **tail** appears to **fan out**. To the naked eye this area appears **elongated and fuzzy, like a comet. It was allegedly mistaken for Comet Halley in 1986 by some observers.**

NGC 6357

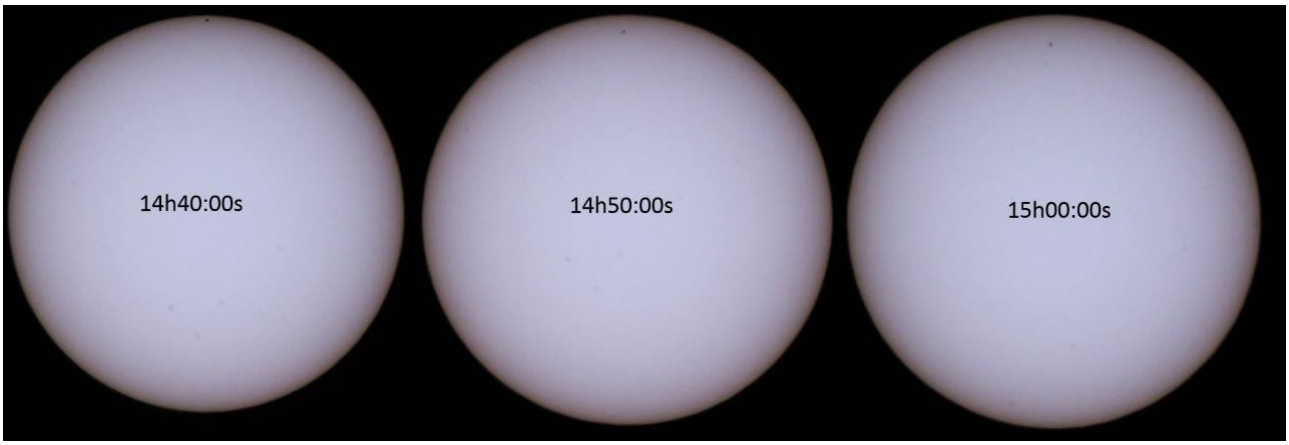
Our Lobster Nebula (**NGC 6357**) (Photograph above), lies 3.3° north-northwest of magnitude 1.6 **Shaula** (Lambda [λ] Scorpii). It is also an emission nebula, H II region with other designations of War and Peace Nebula, Sharpless 11, RCW 131 and Gum 66. It was also given the name **War and Peace Nebula** by the Midcourse Space Experiment scientists because of its appearance, which, in **infrared images** the bright, western part resembles a **dove**, while the eastern part looks like a **skull.** It is located about 5 500 light years away from Earth.

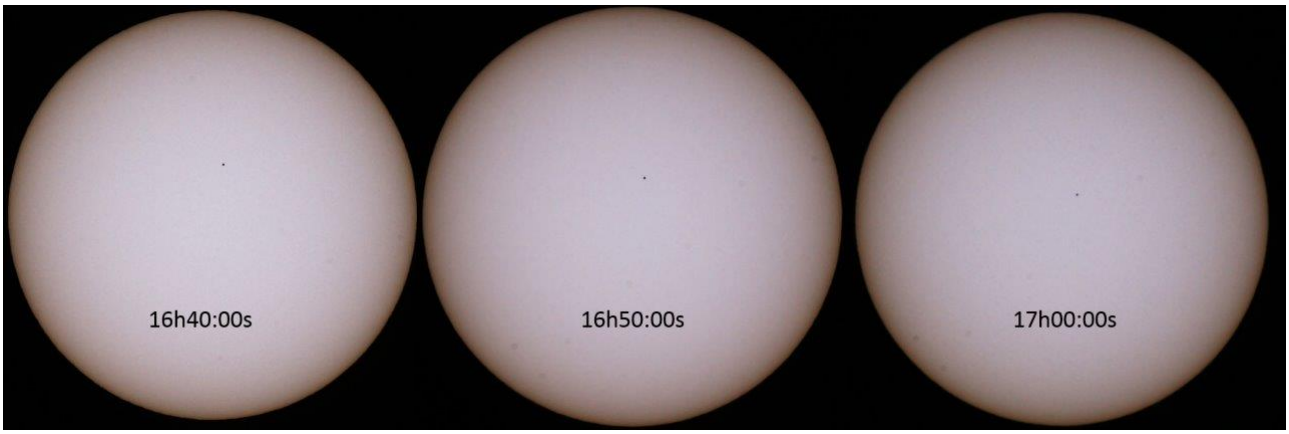
The nebula contains many **proto-stars** shielded by dark **disks of gas**, and young stars wrapped in expanding "cocoons" or expanding gases surrounding these small stars. This large nebula extends one degree on the sky. Part of the nebula is ionised by the youngest (bluest) heavy stars in the open cluster **Pismis 24**. The intense ultraviolet radiation from the blazing stars heats the gas surrounding the cluster and creates a bubble in NGC 6357. The presence of these surrounding gas clouds makes probing into the region even harder.

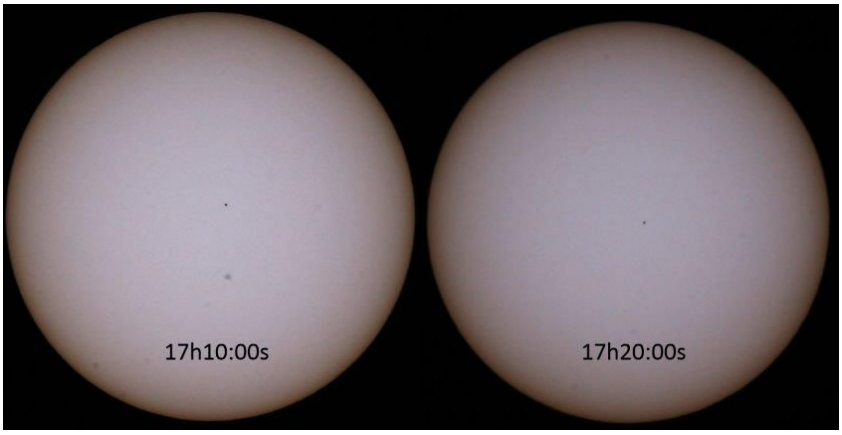
This nebula includes the above-mentioned **open cluster Pismis 24**, which is home to several massive stars. Although the **surrounding HII region NGC 6357** is prominent, the compact 10th magnitude open cluster **Pismis 24** was not identified until 1959.

In 1973, **Pismis 24** was resolved into **15 components** of which 12 were considered member stars. The brightest was numbered first as **Pismis 24-1** and tentatively considered a **supergiant**, possibly the most massive on record, approaching 300 solar masses, ***until*** it was discovered to be a multiple system of **at least three stars** of around 100 solar masses each (Photograph left) (using new NASA/ESA Hubble measurements of the star). It was later resolved into an O3.5 supergiant spectroscopic binary and an O4 giant star separated by approximately 500 AU.
Indeed, many “seafood delicatessen” await us in the arachnid.

[Maps 1 & 2: Astronomy Magazine. All photos: multiple stack, imaged from Pretoria light-polluted skies. Photo 1: Modified Nikon D850, IDAS V4 LPS filter, Photo 2 Canon 6D, Radian LPS filter. Both photos ODK 10” Optimised Dall Kirkham OTA, Losmandy Gemini 2 mount. Mount control: Cartes du Ciel. Image capture in BackYard EOS and Nikon. Autoguiding in PHD, Canon 400mm f5.6 lens, Orion Starshoot cam. PP in DeepSkyStacker, PixInsight, Paint.NET and PICASA.]

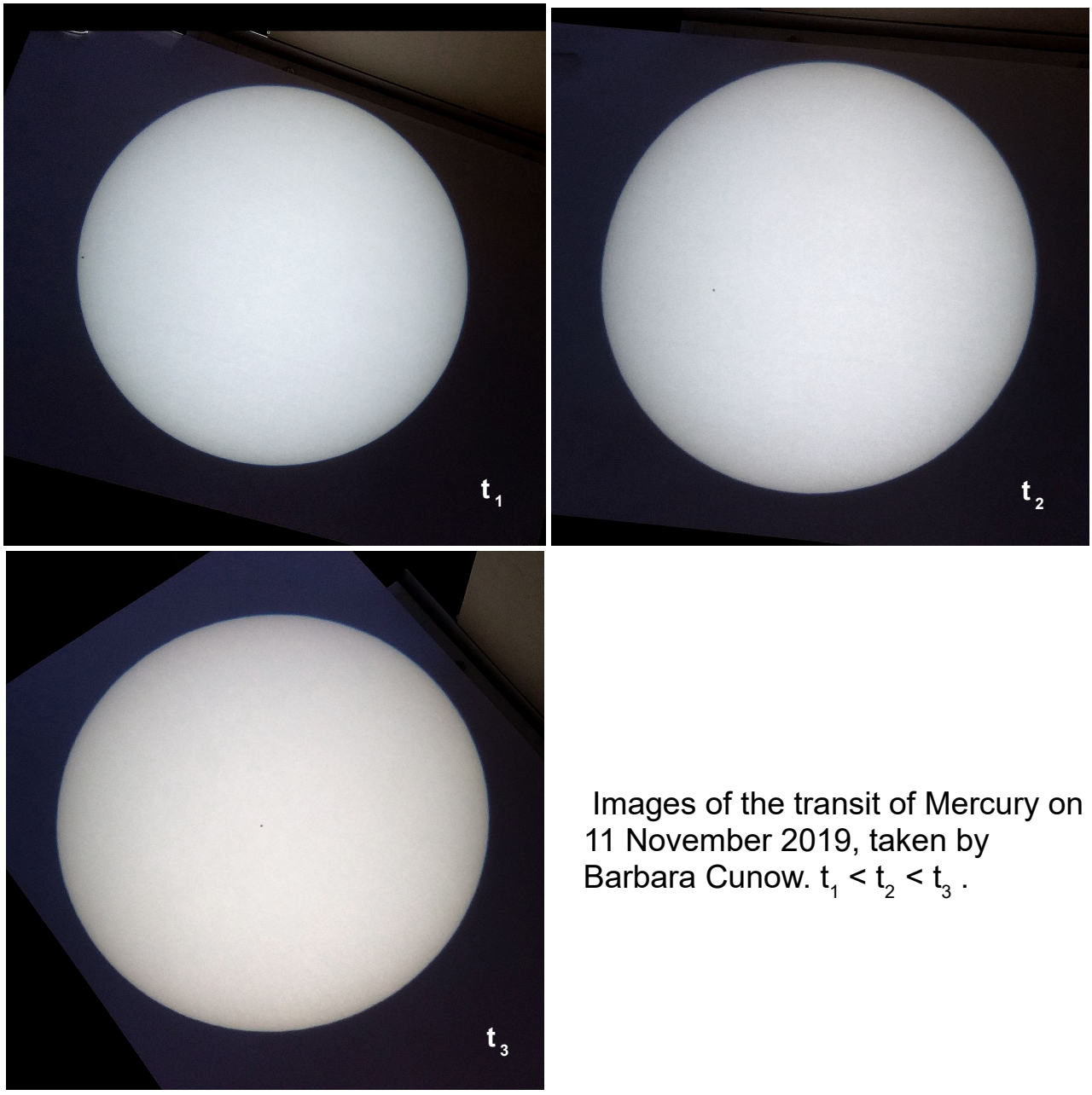






Top: Images of the transit of Mercury on 11 November 2019, taken by Johan Moolman. Soon after 17h20, clouds obscured his view of the Sun.

Top right: Johan Moolman with his equipment.



Images of the transit of Mercury on 11 November 2019, taken by Barbara Cunow. $t_1 < t_2 < t_3$.