ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

Durban 'nDaba

Monthly Newsletter of the Durban Centre - August 2019

Table Of Contents

Member Submissions Disclaimer

The views expressed in 'nDaba are solely those of the writer and are not necessarily the views of the ASSA Durban Centre, nor that of the Editor.

Chairman's Chatter

By Piet Strauss

Dear members,

Our AGM on 10 July was well attended and we handed certificates to all those who successfully attended the Basic Astronomy course and the Astrophotography course. If you were not at the meeting, certificates will be available at our next meeting on 14 August. We broke from tradition and had an interesting talk on environmental issues in Australia and New Zealand, by Jean Senogles.

During July, we remembered the first "Man on the Moon" 50 years ago. We celebrated this, together with many people across the world, on Friday 12th July. A special viewing evening was held with about 30 people attending. As often happened at our viewings, the clouds moved in and there was a light drizzle. Fortunately we had an excellent documentary movie to watch inside. It was good to have some members of the public attending; hopefully we will see them at future events again.

Some of us assisted with telescopes at an event held at the Nelson Mandela Youth Center in Chatsworth. This was arranged by ACRU from UKZN to promote Astronomy to the youth. Viewing conditions were quite good on a cold winter night.

The Monteseel Star Party was a huge success, again with good viewing conditions. About 300 people attended this evening. Thanks to all our members who assisted.

We held the first Committee Meeting following the election of members and allocated portfolios.

The new portfolio allocation is contained in the n'Daba. I would like to thank all members who are again willing to assist.

A reminder that the ASSA National AGM will take place in our Pavilion meeting venue 0n 7 August, starting at 19:30. You are welcome to attend and meet the people responsible for National Portfolios.

Our next meeting is on 14 August. Our main Speaker will talk on Quantum Physics and how it relates to Cosmology. Indeed, a talk not to be missed.

Clear skies and good viewing

Piet

Lost-in-Space Galaxy, NGC 6503

By Brian Ventrudo

NASA/ESA HUbble Space Telescope image shows galaxy NGC 6503. The galaxy, which lies 18 million light-years away, is at the edge of a strangely empty patch of space called the Local Void. This new image shows a very rich set of colours, adding to the detail seen in previous images.

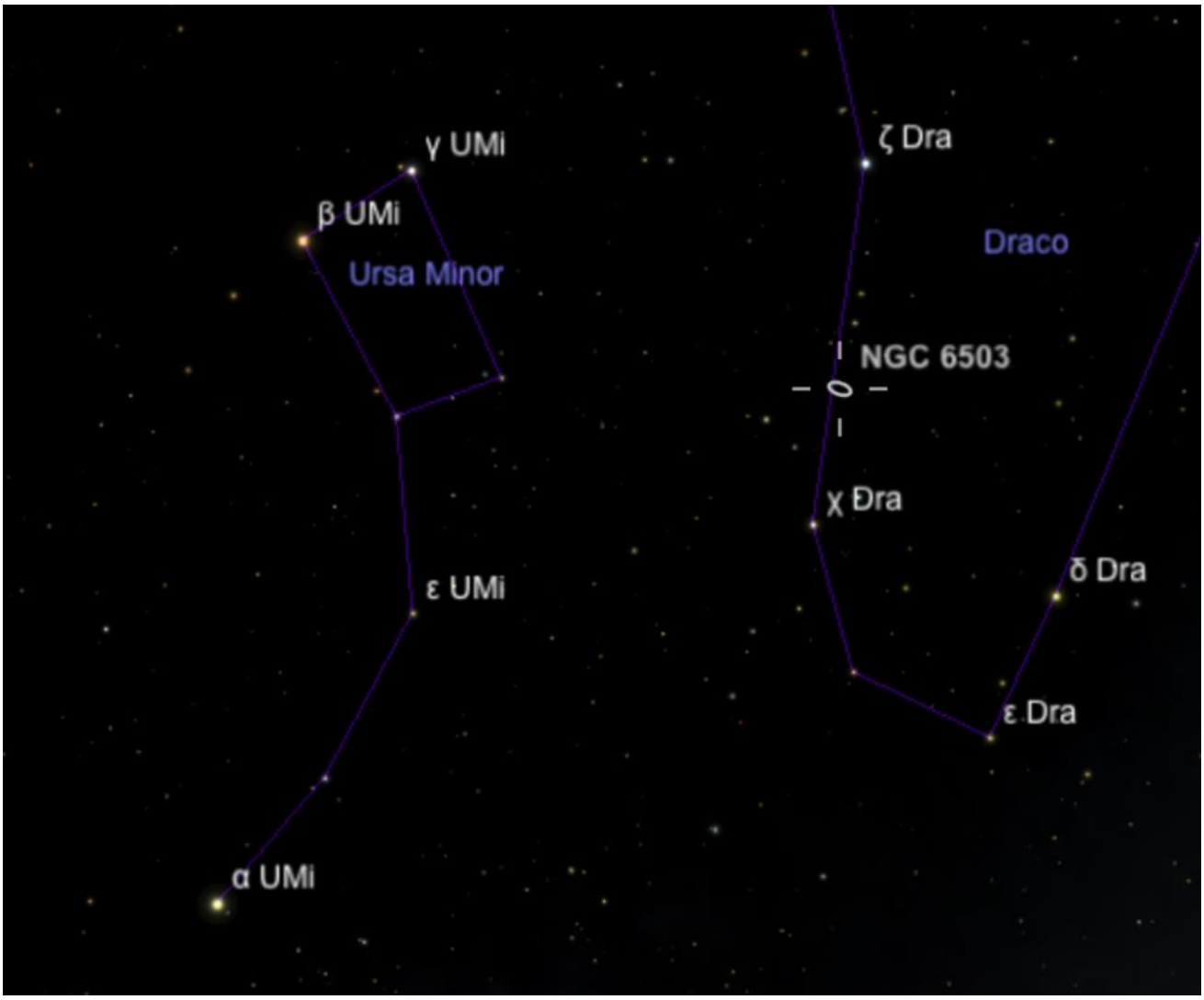
Thanks to gravity, most galaxies clump together in groups or clusters, so a neighboring galaxy is usually never far away. But the galaxy NGC 6503 has found itself in a lonely position, perched at the edge of a strangely empty patch of space called the Local Void. The galaxy is near enough and bright enough to spot with a small telescope in the northern constellation Draco, the Dragon.

The Local Void is a huge stretch of space that is at least 150 million light-years across. It appears empty of stars or galaxies. NGC 6503's odd location on the edge of this void led some stargazers to call it the "Lost-In-Space galaxy".

NGC 6503 is 18 million light-years away from us in the northern circumpolar constellation of Draco. It's some 30,000 light-years across, about a third of the size of the Milky Way, and is classified as a dwarf spiral galaxy.

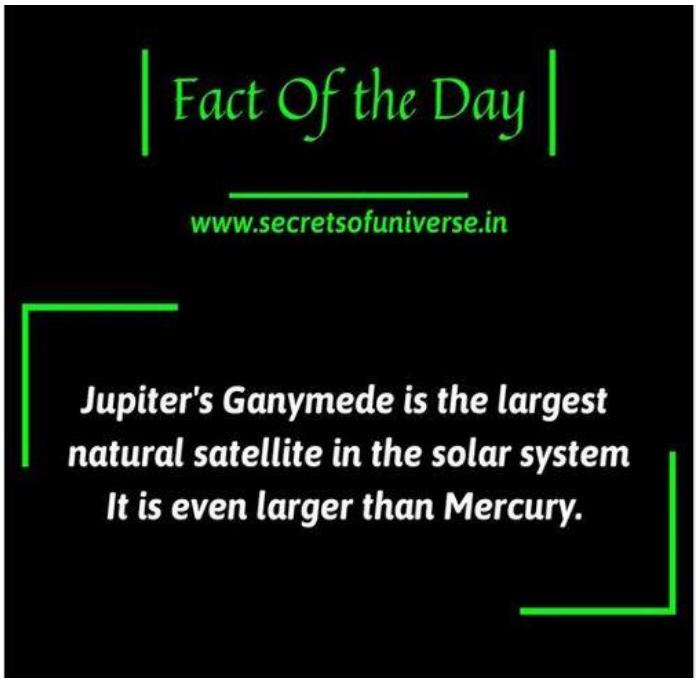
… Lost-in-Space Galaxy

The Hubble Space Telescope image (above) shows NGC 6503 in striking detail and with a rich set of colors. Bright red patches of gas can be seen scattered through its swirling spiral arms, mixed with bright blue regions that contain newly forming stars. Dark brown dust lanes snake across the galaxy's bright arms and center, giving it a mottled appearance.
Courtesy of NASA/HST.



Location of galaxy NGC 6503 in the constellation Draco.

It takes a little gumption to see this galaxy for yourself. NGC 6503 is magnitude 10.2, so you'll need reasonably dark sky to spot it with a 3″or 4" telescope. It is a tilted spiral, so it retains a high surface brightness. The galaxy sits on a line between the stars chi (χ) and zeta (ζ) Draconis, about 1/3 of the way from the former to the latter. Unlike many objects of comparable brightness, NGC 6503 was overlooked for a long time. The German university student Arthur von Auwers first saw the galaxy with a 2.6-inch telescope in 1854. Located not far from the Little Dipper, this object is not visible in the southern hemisphere.



At The Eyepiece

August 2019 by Ray Field

THE MOON is NEW on the 1st, First Quarter on the 7th, FULL on the 15th, Last QUARTER on the 23rd and NEW again on the30th (Black Moon). A Black Moon is the name given to the second NEW Moon in a month.

MERCURY is visible in the morning sky at dawn until late in the month.

VENUS is too near to the Sun to be seen this month. It is at superior conjunction on the 14th when the Sun lies between the Earth and Venus.

MARS is also too near the Sun to be seen this month.

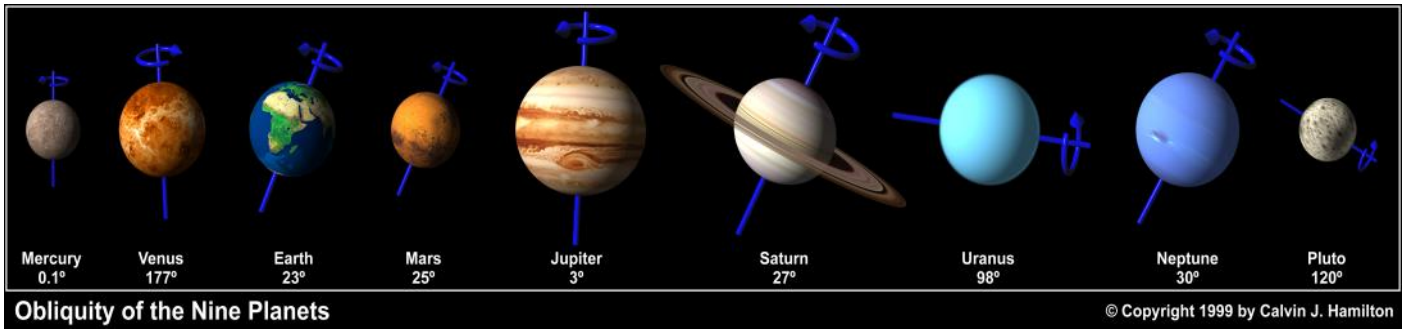
JUPITER can be seen near Antares in Scorpius, from sunset until before dawn. Its four brightest moons can be seen to change places relative to Jupiter and themselves from night to night with the aid of a small telescope. Page 37 of ASSA SKY GUIDE has a table of their movements for the month.

SATURN can be seen from sunset until before dawn. It lies below the "TEAPOT" asterism in Sagittarius and is easily visible to the naked eye as quite a bright "star".

URANUS, in Aires, is barely visible to the naked eye but with binoculars is it easier. A finder chart is given on page 79 of ASSA SKY GUIDE 2019 as well as observing details.

NEPTUNE, in Aquarius, is even fainter than Uranus and is below naked eye visibility. It can be seen in binoculars as a dim "star". A finder chart is given on page 79 of SKY GUIDE 2019.

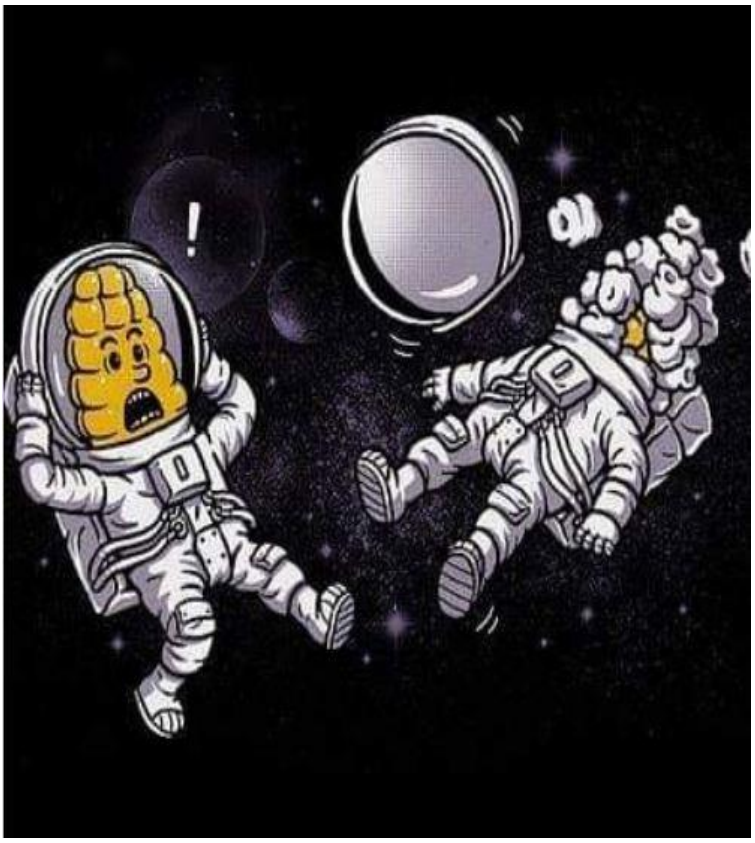
CERES, the largest of the asteroids with a diameter of 685 kilometers, was discovered in 1801. It has a mean distance from the Sun of about 412 million kilometers. It takes 4.6 years to orbit the Sun. A finder chart is found on page 39 of SKY GUIDE 2019.



… At The Eyepiece

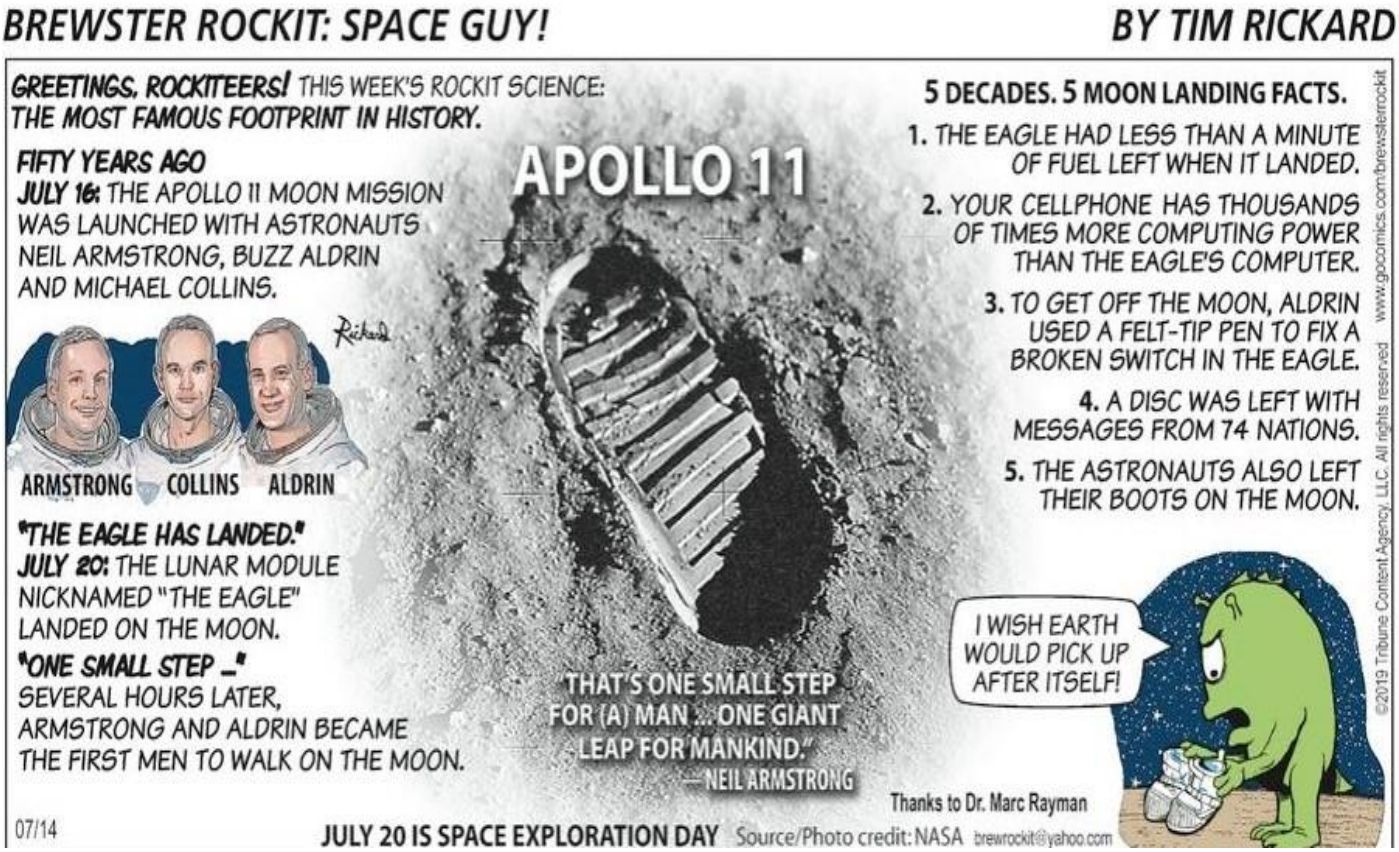
The Comet 29 P / SCHWASSMANN, with a period of 15 years, will be passing through the constellations of Aquarius and Pisces this year. This comet is known to have periodic outbursts from time to time. It was nearest the Sun in March this year. For more details please see page 85 of SKY GUIDE 2019.

METEORS. Per SKY GUIDE there are no bright meteor showers expected this month.



THE STARRY SKY for AUGUST 2019. After sunset in the evening sky, The Southern Cross is starting to get low over the south west. Arcturus has almost set over the north west and Spica is very low over the western horizon. Scorpius and Sagittarius are almost overhead. Vega is low over north and the famous "Ring Nebula" M57 is near it. The "Southern Birds" constellations of Grus, the Crane, with its two bright stars and Pavo the Peacock are rising over the south east.

REFERENCES: ASSA SKYGUIDE 2019, Norton's Star Atlas, Stars of the Southern Sky by Sir Patrick Moore and Philips' Planisphere for 35 degrees South.



The Cover Image - Lobster Nebula

Imaged by John Gill, text from various sources

The region known as NGC 6357, is actually a nebula made up of multiple clusters that are home to some of the biggest and brightest stars in the Milky Way. This is an emission nebula, located in the Scorpio constellation, the nebula houses an environment ripping apart with chaos. Those infant stars are heating up cosmic dust and gases, and creating bubbles in the gas with radiation. Supernova explosions add to the mix.

This region, well known as a fast paced star birth one, hosts many very massive and luminous stars. Its central open cluster (Pismis 24) hosts at least 20 stars with masses above 10 solar masses, with some above 100 solar masses. It has another nickname: “War and Peace” Nebula, because, seen in infrared light, the western part resembles a dove, while its eastern one looks like a skull.

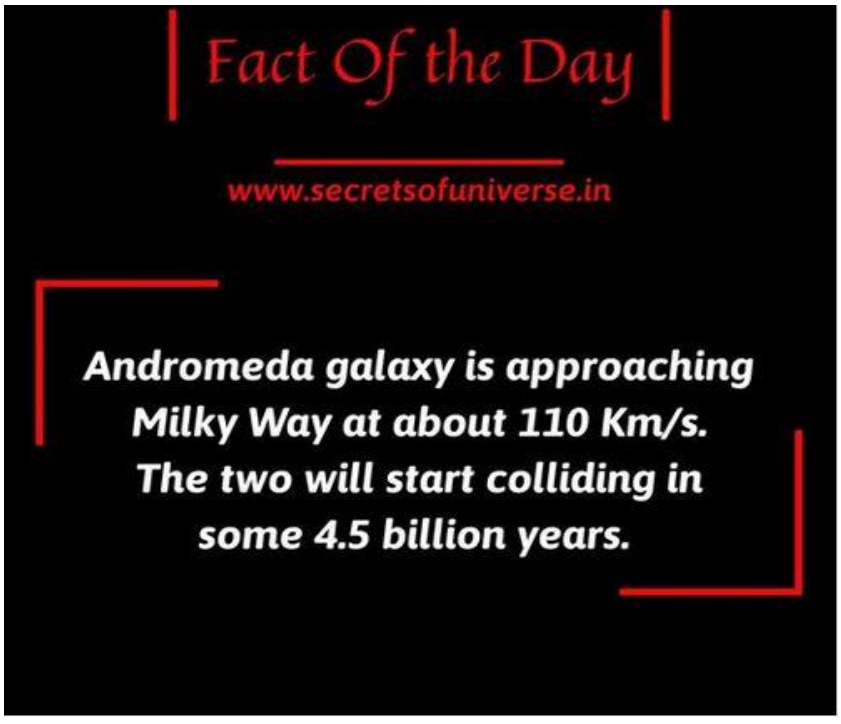
The nebula contains many proto-stars shielded by dark disks of gas, and young stars wrapped in expanding "cocoons" or expanding gases surrounding these small stars. It is also known as the Lobster Nebula.

It is located about 5500 light years away from Earth.

As a matter of curiosity, in 2012, a group of people filed a petition to the International Astronomical Union to change its name to “Madokami Nebula“, due to its alleged similarity to this Japanese comic character… The petition fell short of the requested 25,000 supporters needed to open the discussion…

space is not black

On this night I was lucky enough to get 6 hours of imaging time. Starting at 18:30, setup and alignment went perfectly with the first image starting at 20:00 and finishing up just after 02:00. Then some quick calibration images, packed up the equipment and off to a warm bed…



Tech Specs:

- APM apo 107/700 telescope, 0.75 focal reducer on Celestron CGX mount
- ZWO 1600 cooled mono camera - Ha, Sii & Oiii filters
- ZWO 120 mono camera for guiding
- Processed in PixInsight.
- 6 hours integration time
- 60 Flats/Filter and 36 Darks

Jupiter

From https://solarsystem.nasa.gov

Jupiter is the fifth planet from our Sun and is, by far, the largest planet in the solar system – more than twice as massive as all the other planets combined. Jupiter's stripes and swirls are actually cold, windy clouds of ammonia and water, floating in an atmosphere of hydrogen and helium. Jupiter's iconic Great Red Spot is a giant storm bigger than Earth that has raged for hundreds of years.

Jupiter is surrounded by 79 known moons. Scientists are most interested in the Galilean satellites – the four largest moons discovered by Galileo Galilei in 1610: Io, Europa, Ganymede and Callisto. Jupiter also has several rings, but unlike the famous rings of Saturn, Jupiter's rings are very faint and made of dust, not ice. Jupiter is named for the king of the ancient Roman gods.

Size and Distance

With a radius of 43,440.7 miles (69,911 kilometers), Jupiter is 11 times wider than Earth. If Earth were the size of a nickel, Jupiter would be about as big as a basketball.
From an average distance of 484 million miles (778 million kilometers), Jupiter is 5.2 astronomical units away from the Sun. One astronomical unit (abbreviated as AU), is the distance from the Sun to Earth. From this distance, it takes Sunlight 43 minutes to travel from the Sun to Jupiter.
A 3D model of Jupiter, a gas giant planet. Credit: NASA Visualization Technology Applications and Development (VTAD) › Download Options

Orbit and Rotation

Jupiter has the shortest day in the solar system. One day on Jupiter takes only about 10 hours (the time it takes for Jupiter to rotate or spin around once), and Jupiter makes a complete orbit around the Sun (a year in Jovian time) in about 12 Earth years (4,333 Earth days). Its equator is tilted with respect to its orbital path around the Sun by just 3 degrees. This means Jupiter spins nearly upright and does not have seasons as extreme as other planets do.

Formation

Jupiter took shape when the rest of the solar system formed about 4.5 billion years ago, when gravity pulled swirling gas and dust in to become this gas giant. Jupiter took most of the mass left over after the formation of the Sun, ending up with more than twice the combined material of the other bodies in the solar system. In fact, Jupiter has the same ingredients as a star, but it did not grow massive enough to ignite.

About 4 billion years ago, Jupiter settled into its current position in the outer solar system, where it is the fifth planet from the Sun.

Structure

The composition of Jupiter is similar to that of the Sun—mostly hydrogen and helium. Deep in the atmosphere, pressure and temperature increase, compressing the hydrogen gas into a liquid. This gives Jupiter the largest ocean in the solar system—an ocean made of hydrogen instead of water. Scientists think that, at depths perhaps halfway to the planet's center, the pressure becomes so great that electrons are squeezed off the hydrogen atoms, making the liquid electrically conducting like metal. Jupiter's fast rotation is thought to drive electrical currents in this region, generating the planet's powerful magnetic field.

It is still unclear if, deeper down, Jupiter has a central core of solid material or if it may be a thick, super-hot and dense soup. It could be up to 90,032 degrees Fahrenheit (50,000 degrees Celsius) down there, made mostly of iron and silicate minerals (similar to quartz).

… Jupiter

Surface

As a gas giant, Jupiter doesn’t have a true surface. The planet is mostly swirling gases and liquids. While a spacecraft would have nowhere to land on Jupiter, it wouldn’t be able to fly through unscathed either. The extreme pressures and temperatures deep inside the planet crush, melt and vaporize spacecraft trying to fly into the planet.

Atmosphere

Jupiter's appearance is a tapestry of colorful cloud bands and spots. The gas planet likely has three distinct cloud layers in its "skies" that, taken together, span about 44 miles (71 kilometers). The top cloud is probably made of ammonia ice, while the middle layer is likely made of ammonium hydrosulfide crystals. The innermost layer may be made of water ice and vapor. The vivid colors you see in thick bands across Jupiter may be plumes of sulfur and phosphorus-containing gases rising from the planet's warmer interior. Jupiter's fast rotation—spinning once every 10 hours—creates strong jet streams, separating its clouds into dark belts and bright zones across long stretches.

With no solid surface to slow them down, Jupiter's spots can persist for many years. Stormy Jupiter is swept by over a dozen prevailing winds, some reaching up to 335 miles per hour (539 kilometers per hour) at the equator. The Great Red Spot, a swirling oval of clouds twice as wide as Earth, has been observed on the giant planet for more than 300 years. More recently, three smaller ovals merged to form the Little Red Spot, about half the size of its larger cousin. Scientists do not yet know if these ovals and planet-circling bands are shallow or deeply rooted to the interior.

Potential for Life

Jupiter’s environment is probably not conducive to life as we know it. The temperatures, pressures and materials that characterize this planet are most likely too extreme and volatile for organisms to adapt to. While planet Jupiter is an unlikely place for living things to take hold, the same is not true of some of its many moons. Europa is one of the likeliest places to find life elsewhere in our solar system. There is evidence of a vast ocean just beneath its icy crust, where life could possibly be supported.

Moons

With four large moons and many smaller moons, Jupiter forms a kind of miniature solar system. Jupiter has 79 confirmed moons.

Jupiter's four largest moons - Io, Europa, Ganymede and Callisto - were first observed by the astronomer Galileo Galilei in 1610 using an early version of the telescope. These four moons are known today as the Galilean satellites, and they're some of the most fascinating destinations in our solar system. Io is the most volcanically active body in the solar system. Ganymede is the largest moon in the solar system (even bigger than the planet Mercury). Callisto’s very few small craters indicate a small degree of current surface activity. A liquid-water ocean with the ingredients for life may lie beneath the frozen crust of Europa, making it a tempting place to explore.

… Jupiter

Rings

Discovered in 1979 by NASA's Voyager 1 spacecraft, Jupiter's rings were a surprise, as they are composed of small, dark particles and are difficult to see except when backlit by the Sun. Data from the Galileo spacecraft indicate that Jupiter's ring system may be formed by dust kicked up as interplanetary meteoroids smash into the giant planet's small innermost moons.

Magnetosphere

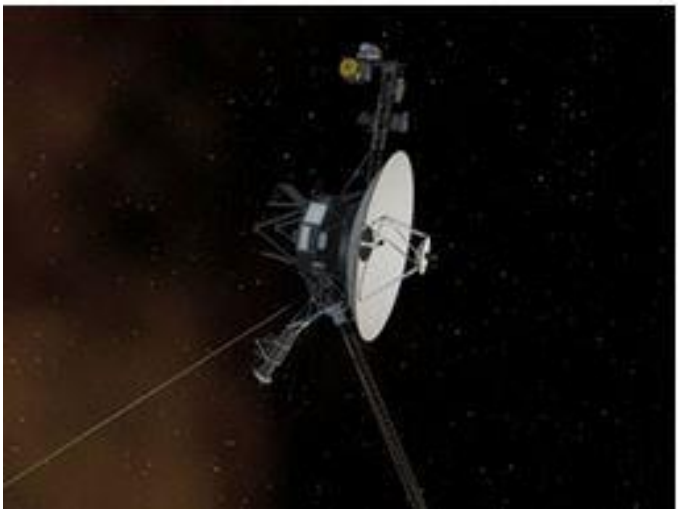
The Jovian magnetosphere is the region of space influenced by Jupiter's powerful magnetic field. It balloons 600,000 to 2 million miles (1 to 3 million kilometers) toward the Sun (seven to 21 times the diameter or Jupiter itself) and tapers into a tadpole-shaped tail extending more than 600 million miles (1 billion kilometers) behind Jupiter, as far as Saturn's orbit. Jupiter's enormous magnetic field is 16 to 54 times as powerful as that of the Earth. It rotates with the planet and sweeps up particles that have an electric charge. Near the planet, the magnetic field traps swarms of charged particles and accelerates them to very high energies, creating intense radiation that bombards the innermost moons and can damage spacecraft.

Jupiter's magnetic field also causes some of the solar system's most spectacular aurorae at the planet's poles.

Exploration

More recently, this planet has been visited by passing spacecraft, orbiters and probes. Pioneer 10 and 11 and Voyager 1 and 2 were the first to fly by Jupiter in the 1970s, and since then we've sent Galileo to orbit the gas giant and drop a probe into its atmosphere. Cassini took detailed photos of Jupiter on its way to neighboring Saturn, as did New Horizons on its quest for Pluto and the Kuiper Belt. NASA's Juno spacecraft, which arrived in the Jovian system in July 2016, is currently studying the giant planet from orbit.

(left) Early Juno science results have revealed Jupiter as a complex, gigantic, turbulent world, with Earth-sized polar cyclones, plunging storm systems that travel deep into the heart of the gas giant, and a mammoth, lumpy magnetic field.



Voyager 1 (right) successfully flew by both the Jupiter and Saturn systems before continuing out into the farthest most reaches of our solar system.

… Jupiter

Significant Events

1610: Galileo Galilei makes the first detailed observations of Jupiter.

1973: Pioneer 10 becomes the first spacecraft to cross the asteroid belt and fly past Jupiter.

1979: Voyager 1 and 2 discover Jupiter's faint rings, several new moons and volcanic activity on Io's surface.

1992: Ulysses swung by Jupiter on Feb. 8, 1992. The giant planet's gravity bent the spacecraft's flight path southward and away from the ecliptic plane, putting the probe into a final orbit that would take it over the sun's south and north poles.

1994: Astronomers observe as pieces of comet Shoemaker-Levy 9 collide with Jupiter's southern hemisphere.

1995-2003: The Galileo spacecraft drops a probe into Jupiter's atmosphere and conducts extended observations of Jupiter and its moons and rings.

2000: Cassini makes its closest approach to Jupiter at a distance of approximately 6.2 million miles (10 million kilometers), taking a highly detailed true color mosaic photo of the gas giant.

2007: Images taken by NASA's New Horizons spacecraft, on the way to Pluto, show new perspectives on Jupiter's atmospheric storms, the rings, volcanic Io, and icy Europa.

2009: On 20 July, almost exactly 15 years after fragments of comet Shoemaker-Levy slammed into Jupiter, a comet or asteroid crashes into the giant planet's southern hemisphere.

2011: Juno launches to examine Jupiter's chemistry, atmosphere, interior structure and magnetosphere.

2016: NASA's Juno spacecraft arrives at Jupiter, conducting an in-depth investigation of the planet's atmosphere, deep structure and magnetosphere for clues to its origin and evolution.

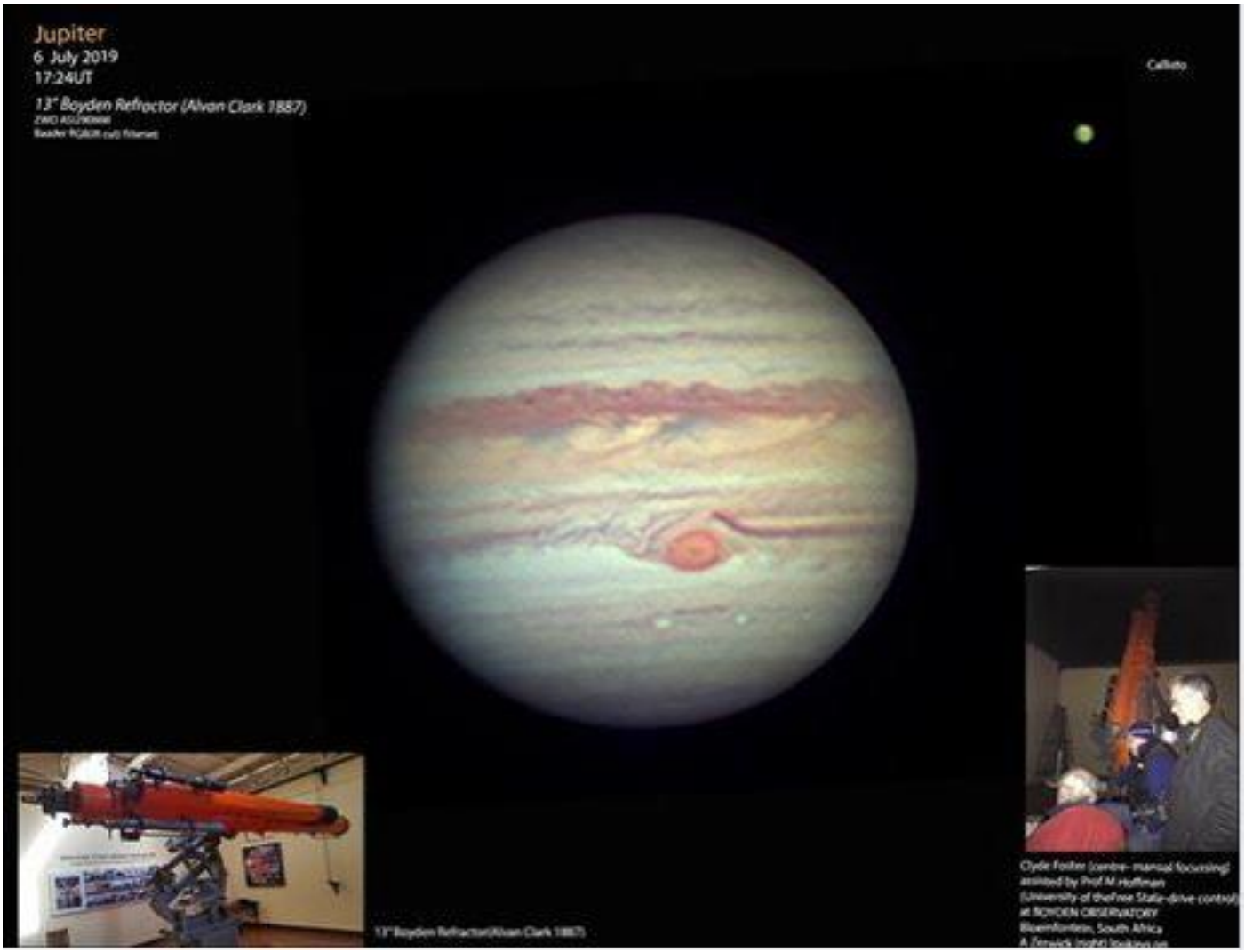
Clyde Foster - ASSA Shallow Sky Director

Jupiter with the 13" Boyden Refractor. The Jupiter image (RGB colour) that we captured with the historic (Alvan Clark 1887) Boyden Refractor last weekend at Boyden Observatory, Bloemfontein. I have read in an old article that the main lens was designed to be installed in two different ways. One optimised for visual observation and the second for photographic.

It was clear during processing that the Green wavelength appeared to be the best, so I am fairly certain that the lens is currently installed for visual observation. Red was not quite as good as the Green, and the Blue showed some scattering (this may well be improved in the "photographic mode"), which made the colour balance a bit tricky (I just hope I have done the instrument justice). I had to manually focus (a bit of a challenge!), whilst being assisted by Prof Matie Hoffman of the University of the Free State who managed the drive system.

My thanks to Dawie van Jaarsveld for his (usual!) support and also delighted that August Zerwick and Martie Blignaut Zerwick were able to share the experience.

… Jupiter



Clyde Foster, the ASSA Shallow Sky Director image of Jupiter, amazing detail!!

Jupiter on 10 July. Things have certainly quietened down around the Great Red Spot, but there is still potential for more activity with further anticyclonic storms approaching the GRS hollow. I managed to get a nice view of the moon Ganymede, which shows some surface features. Its shadow is just impinging onto Jupiter at upper left.

EPSC-DPS 2019. Delighted to have official confirmation of acceptance of the abstract that was submitted for the European Planetary Science Congress in Geneva in September. Scheduled as an oral presentation on Monday afternoon, 16th September in the Jupiter session. It has been (and still is!) a pleasure working with co-authors John Rogers, Shinji Mizumoto, Andy Casely and Marco Vedovato as we, together with other imagers and Jupiter specialists, have followed the amazing developments around the Great Red Spot over the last 6 months, which will form the substance of the presentation. My special thanks to John for his review and submission of the abstract whilst I was in the Drakensberg. Wonderful also to be sharing the session with some very special and esteemed friends and colleagues. EPSC 2019 is being held jointly this year with a session of the Division for Planetary Sciences (American Astronomical Society).

Congratulations Clyde, fantastic achievement!!!

… Jupiter

Jupiter was appropriately named after the king of the gods. It's massive, has a powerful magnetic field, and more moons that any planet in the Solar System. Though it has been known to astronomers since ancient times, the invention of the telescope and the advent of modern astronomy has taught us so much about this gas giant.

It's no secret that Jupiter is the largest planet in the Solar System. But this description really doesn't do it justice. For one, the mass of Jupiter is 318 times as massive as the Earth. In fact, Jupiter is 2.5 times more massive than all of the other planets in the Solar System combined. If Jupiter got any more massive, it would actually get smaller. Additional mass would actually make the planet more dense, which would cause it to start pulling it in on itself. Astronomers estimate that Jupiter could end up with 4 times its current mass, and still remain about the same size.

Astronomers call Jupiter a failed star, but that's not really an appropriate description. While it is true that, like a star, Jupiter is rich in hydrogen and helium, Jupiter does not have nearly enough mass to trigger a fusion reaction in its core. This is how stars generate energy, by fusing hydrogen atoms together under extreme heat and pressure to create helium, releasing light and heat in the process.

This is made possible by their enormous gravity. For Jupiter to ignite a nuclear fusion process and become a star, it would need more than 70 times its current mass. If you could crash dozens of Jupiters together, you might have a chance to make a new star. But in the meantime, Jupiter shall remain a large gas giant with no hopes of becoming a star.

For all its size and mass, Jupiter sure moves quickly. In fact, with an rotational velocity of 12.6 km/s (~7.45 m/s) or 45,300 km/h (28,148 mph), the planet only takes about 10 hours to complete a full rotation on its axis. And because it's spinning so rapidly, the planet has flattened out at the poles a little and is bulging at its equator.

In fact, points on Jupiter's equator are more than 4,600 km further from the center than the poles. Or to put it another way, the planet's polar radius measures to 66,854 ± 10 km (or 10.517 that of Earth's), while its diameter at the equator is 71,492 ± 4 km (or 11.209 that of Earth's). This rapid rotation also helps generate Jupiter's powerful magnetic fields, and contribute to the dangerous radiation surrounding it.

The Clouds On Jupiter Are Only 50 km Thick. That's right, all those beautiful whirling clouds and storms you see on Jupiter are only about 50 km thick. They're made of ammonia crystals broken up into two different cloud decks. The darker material is thought to be compounds brought up from deeper inside Jupiter, and then change color when they reacted with sunlight. But below those clouds, it's just hydrogen and helium, all the way down.

The Great Red Spot on Jupiter is one of its most familiar features. This persistent anticyclonic storm, which is located south of its equator, measures between 24,000 km in diameter and 12–14,000 km in height. As such, it is large enough to contain two or three planets the size of Earth's diameter. And the spot has been around for at least 350 years, since it was spotted as far back as the 17th century.

The Great Red Spot was first identified in 1665 by Italian astronomer Giovanni Cassini. By the 20th century, astronomers began to theorize that it was a storm, one which was created by Jupiter's turbulent and fast-moving atmosphere. These theories were confirmed by the *Voyager 1* mission, which observed the Giant Red Spot up close in March of 1979 during its flyby of the planet.

However, it appears to have been shrinking since that time. Based on Cassini's observations, the size was estimated to be 40,000 km in the 17th century, which was almost twice as large as it is now. Astronomers do not know if or when it will ever disappear entirely, but they are relatively sure that another one will emerge somewhere else on the planet.

… Jupiter

When people think of ring systems, Saturn naturally comes to mind. But in truth, both Uranus and Jupiter have ring systems of their own. Jupiter's were the third set to be discovered (after the other two), due to the fact that they are particularly faint. Jupiter's rings consist of three main segments – an inner torus of particles known as the halo, a relatively bright main ring, and an outer gossamer ring.

These rings are widely believed to have come from material ejected by its moons when they're struck by meteorite impacts. In particular, the main ring is thought to be composed of material from the moons of Adrastea and Metis, while the moons of Thebe and Amalthea are believed to produce the two distinct components of the dusty gossamer ring.

This material fell into orbit around Jupiter (instead of falling back to their respective moons) because if Jupiter's strong gravitational influence. The ring is also depleted and replenished regularly as some material veers towards Jupiter while new material is added by additional impacts.

Compasses would really work on Jupiter. That's because it has the strongest magnetic field in the Solar System. Astronomers think the magnetic field is generated by the eddy currents – i.e. swirling movements of conducting materials – within the liquid metallic hydrogen core. This magnetic field traps particles of sulfur dioxide from Io's volcanic eruptions, which producing sulfur and oxygen ions. Together with hydrogen ions originating from the atmosphere of Jupiter, these form a plasma sheet in Jupiter's equatorial plane.

Farther out, the interaction of the magnetosphere with the solar wind generates a bow shock, a dangerous belt of radiation that can cause damage to spacecraft. Jupiter's four largest moons all orbit within the magnetosphere, which protects them from the solar wind, but also make the likelihood of establishing outposts on their surface problematic. The magnetosphere of Jupiter is also responsible for intense episodes of radio emission from the planet's polar regions.

As of the penning of this article, Jupiter has a 67 confirmed and named satellites. However, it is estimated that the planet has over 200 natural satellites orbiting it. Almost all of them are less than 10 kilometers in diameter, and were only discovered after 1975, when the first spacecraft (*Pioneer 10*) arrived at Jupiter.

However, it also has four major moons, which are collectively known as the Galilean Moons (after their discovered Galileo Galilei). These are, in order of distance from Jupiter, Io, Europa, Ganymede, and Callisto. These moons are some of the largest in the Solar System, with Ganymede being the largest, measuring 5262 km in diameter.

Jupiter was first visited by NASA's *Pioneer 10* spacecraft in December 1973, and then *Pioneer 11* in December 1974. Then came the *Voyager 1 and 2* flybys, both of which happened in 1979. This was followed by a long break until *Ulysses* arrived in February 1992, followed by the *Galileo* space probe in 1995. Then *Cassini* made a flyby in 2000, on its way to Saturn. And finally, NASA's *New Horizons* spacecraft made its flyby in 2007. This was the last mission to fly past Jupiter, but it surely won't be the last.

Illustration of Jupiter and the Galilean satellites. Credit: NASA

Jupiter is the third brightest object in the Solar System, after Venus and the Moon. If you see a really bright star high in the sky, then you're looking at Jupiter. Get your hands on a pair of binoculars, and if you know someone with a telescope, that's even better. Using even modest magnification, you might even spot small specks of light orbiting it, which are its Galilean Moons. Just think, you'll be seeing precisely what Galileo did when he gazed at the planet in 1610.

Fomalhaut

From Wikipedia, the free encyclopedia

DSS image of Fomalhaut, field of view 2.7×2.9 degrees.

Credit NASA, ESA, and the Digitized Sky Survey 2. Acknowledgment: Davide De Martin (ESA/Hubble)

Fomalhaut /ˈfoʊməl.hɔːt/, designation Alpha Piscis Austrini (α Piscis Austrini, abbreviated Alpha PsA, α PsA) is the brightest star in the constellation of Piscis Austrinus and one of the brightest stars in the sky. It is a class A star on the main sequence approximately 25 light-years (7.7 pc) from the Sun as measured by the Hipparcos astrometry satellite. Since 1943, the spectrum of this star has served as one of the stable anchor points by which other stars are classified. It is classified as a Vega-like star that emits excess infrared radiation, indicating it is surrounded by a circumstellar disk. Fomalhaut, K-type main-sequence star TW Piscis Austrini, and M-type, red dwarf star LP 876-10 constitute a triple system, even though the companions are separated by several degrees.

Fomalhaut holds a special significance in extrasolar planet research, as it is the center of the first stellar system with an extrasolar planet candidate (designated Fomalhaut b, later named Dagon) imaged at visible wavelengths. The image was published in *Science* in November 2008. Fomalhaut is the third-brightest star (as viewed from Earth) known to have a planetary system, after the Sun and Pollux.

Nomenclature

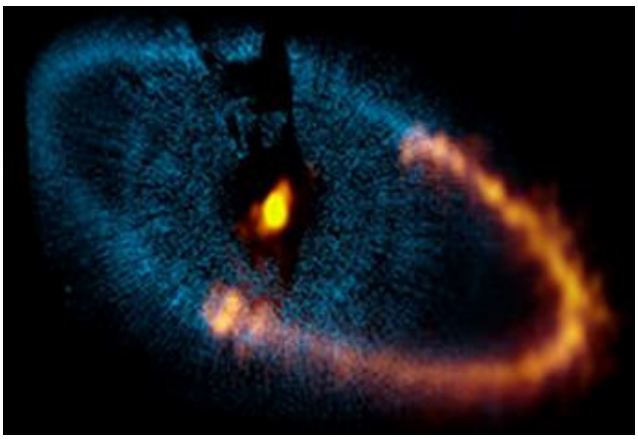
α Piscis Austrini (Latinised to *Alpha Piscis Austrini*) is the system's Bayer designation. It also bears the Flamsteed designation of *24 Piscis Austrini*. The classical astronomer Ptolemy put it in Aquarius, as well as Piscis Austrinus. In the 1600s Johann Bayer firmly planted it in the primary position of Piscis Austrinus. Following Ptolemy, John Flamsteed in 1725 additionally denoted it *79 Aquarii*. The current designation reflects modern consensus on Bayer's decision, that the star belongs in Piscis Austrinus. Under the rules for naming objects in multiple star systems, the three components – Fomalhaut, TW Piscis Austrini and LP 876-10 – are designated A, B and C, respectively. On its discovery, the planet was designated Fomalhaut b.

… Fomalhaut

The star's traditional name derives from *Fom al-Haut* from scientific Arabic فم الحوت*fam al-ḥūt (al-janūbī)* "the mouth of the [Southern] Fish" (literally, "mouth of the whale"), a translation of how Ptolemy labeled it. In 2016, the International Astronomical Union organized a Working Group on Star Names (WGSN) to catalog and standardize proper names for stars. The WGSN's first bulletin of July 2016 included a table of the first two batches of names approved by the WGSN, which included the name Fomalhaut for this star.

In July 2014, the International Astronomical Union (IAU) launched a process for giving proper names to certain exoplanets. The process involved public nomination and voting for the new names. In December 2015, the IAU announced the winning name was Dagon for this planet. The winning name was proposed by Todd Vaccaro and forwarded by the St. Cloud State University Planetarium of St. Cloud, Minnesota, United States of America, to the IAU for consideration. Dagon was a Semitic deity, often represented as half-man, half-fish.

Fomalhaut A



Dust ring around Fomalhaut from the Atacama Large Millimeter/submillimeter Array (ALMA)

At a declination of −29.6°, Fomalhaut is located south of the celestial equator, and hence is best viewed from the Southern Hemisphere. However, its southerly declination is not as great as that of stars such as Acrux, Alpha Centauri and Canopus, meaning that, unlike them, Fomalhaut is visible from a large part of the Northern Hemisphere as well. Its declination is greater than that of Sirius and similar to that of Antares. At 40°N, Fomalhaut rises above the horizon for eight hours and reaches only 20° above the horizon, while Capella, which rises at approximately the same time, will stay above the horizon for twenty hours. Fomalhaut can be located in northern latitudes by the fact that the western (right-hand) side of the Square of Pegasus points to it. Continuing the line from Beta to Alpha Pegasi towards the southern horizon, Fomalhaut is about 45˚ south of Alpha Pegasi, with no bright stars in between.

Properties

Fomalhaut is a young star, for many years thought to be only 100 to 300 million years old, with a potential lifespan of a billion years. A 2012 study gave a slightly higher age of 440±40 million years. The surface temperature of the star is around 8,590 K (8,320 °C). Fomalhaut's mass is about 1.92 times that of the Sun, its luminosity is about 16.6 times greater, and its diameter is roughly 1.84 times as large.

Fomalhaut is slightly metal-deficient compared to the Sun, which means it is composed of a smaller percentage of elements other than hydrogen and helium. The metallicity is typically determined by measuring the abundance of iron in the photosphere relative to the abundance of hydrogen. A 1997 spectroscopic study measured a value equal to 93% of the Sun's abundance of iron. A second 1997 study deduced a value of 78%, by assuming Fomalhaut has the same metallicity as the neighboring star TW Piscis Austrini, which has since been argued to be a physical companion. In 2004, a stellar evolutionary model of Fomalhaut yielded a metallicity of 79%. Finally, in 2008, a spectroscopic measurement gave a significantly lower value of 46%.

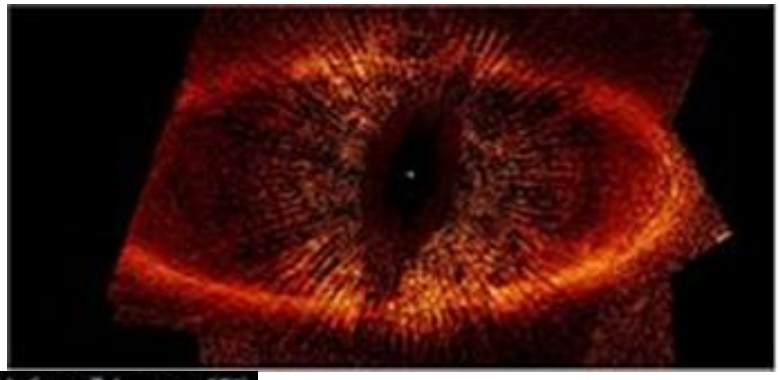
… Fomalhaut

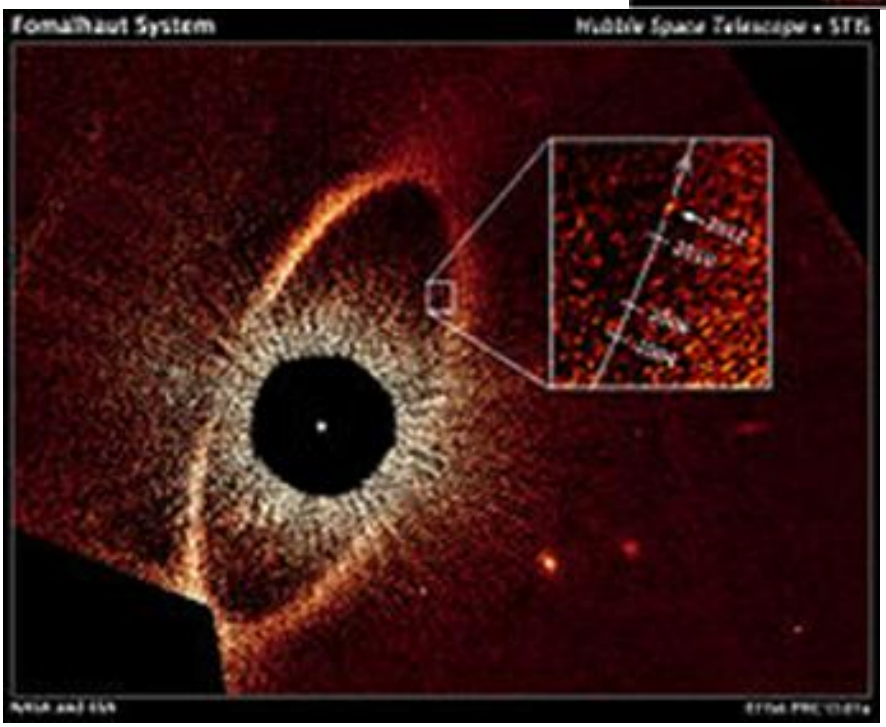
Fomalhaut has been claimed to be one of approximately 16 stars belonging to the Castor Moving Group. This is an association of stars which share a common motion through space, and have been claimed to be physically associated. Other members of this group include Castor and Vega. The moving group has an estimated age of 200±100 million years and originated from the same location. More recent work has found that purported members of the Castor Moving Group appear to not only have a wide range of ages, but their velocities are too different to have been possibly associated with one another in the distant past. Hence, "membership" to this dynamical group has no bearing on the age of the Fomalhaut system.

Debris disks and planet

ALMA image of Fomalhaut's Debris Disc

The debris disk around the star





Debris ring around Fomalhaut showing location of planet Fomalhaut b - imaged by Hubble Space Telescope's coronagraph. (January 8, 2013) (NASA).

… Fomalhaut

Fomalhaut is surrounded by several debris disks.

The inner disk is a high-carbon small-grain (10–300 nm) ash disk, clustering at 0.1 AU from the star. Next is a disk of larger particles, with inner edge 0.4-1 AU of the star. The innermost disk is unexplained as yet.
The outermost disk is at a radial distance of 133 AU (1.99×10^{10} km; 1.24×10^{10} mi), in a toroidal shape with a very sharp inner edge, all inclined 24 degrees from edge-on. The dust is distributed in a belt about 25 AU wide. The geometric center of the disk is offset by about 15 AU (2.2×10^{9} km; 1.4×10^{9} mi) from Fomalhaut. The disk is sometimes referred to as "Fomalhaut's Kuiper belt". Fomalhaut's dusty disk is believed to be protoplanetary, and emits considerable infrared radiation. Measurements of Fomalhaut's rotation indicate that the disk is located in the star's equatorial plane, as expected from theories of star and planet formation.

On November 13, 2008, astronomers announced an object, which they assumed to be an extrasolar planet, orbiting just inside the outer debris ring. This was the first extrasolar orbiting object to be seen with visible light, captured by the Hubble Space Telescope. A planet's existence had been previously suspected from the sharp, elliptical inner edge of that disk. The mass of the planet, Fomalhaut b, was estimated to be no more than three times the mass of Jupiter, but at least the mass of Neptune. There are indications that the orbit is not apsidally aligned with the dust disk, which may indicate that additional planets may be responsible for the dust disk's structure.

However, M-band images taken from the MMT Observatory put strong limits on the existence of gas giants within 40 AU of the star, and Spitzer Space Telescope imaging suggested that the object Fomalhaut b was more likely to be a dust cloud. In 2012, two independent studies confirmed that Fomalhaut b does exist, but it is shrouded by debris, so it may be a gravitationally-bound accumulation of rubble rather than a whole planet.

Herschel Space Observatory images of Fomalhaut reveal that a large amount of fluffy micrometer -sized dust is present in the outer dust belt. Because such dust is expected to be blown out of the system by stellar radiation pressure on short timescales, its presence indicates a constant replenishment by collisions of planetesimals. The fluffy morphology of the grains suggests a cometary origin. The collision rate is estimated to be approximately 2000 kilometre-sized comets per day.

Observations of the star's outer dust ring by the Atacama Large Millimeter Array point to the existence of two planets in the system, neither one at the orbital radius proposed for the HST-discovered Fomalhaut b.

If there are additional planets from 4 to 10 AU, they must be under 20 M_J; if from 2.5 outward, then 30 M_J.

Fomalhaut B (TW Piscis Austrini)

Fomalhaut forms a binary star with the K4-type star TW Piscis Austrini (TW PsA), which lies 0.28 parsecs (0.91 light-years) away from Fomalhaut, and its space velocity agrees with that of Fomalhaut within 0.1±0.5 km/s, consistent with being a bound companion. A recent age estimate for TW PsA (400±70 million years) agrees very well with the isochronal age for Fomalhaut (450±40 million years), further arguing for the two stars forming a physical binary.

… Fomalhaut

The designation TW Piscis Austrini is astronomical nomenclature for a variable star. Fomalhaut B is a flare star of the type known as a BY Draconis variable. It varies slightly in apparent magnitude, ranging from 6.44 to 6.49 over a 10.3 day period. While smaller than the Sun, it is relatively large for a flare star. Most flare stars are red M-type dwarfs.

The TESS telescope detected weak evidence of a possible planet orbiting Fomalhaut B, but the observation is based on only three transits and won't be confirmed or disproven until the area of the sky is re-surveyed in 2019 or 2020. If it exists, the planet has a radius of approximately 0.92 Earth radii, and orbits the star every 10.05 days at a distance of roughly 0.082 Astronomical Units. However, its orbital period is close to the star's rotation period, suggesting it could be an artifact.

Fomalhaut C (LP 876-10)

LP 876-10 is also associated with the Fomalhaut system, making it a trinary star. In October 2013, Eric Mamajek and collaborators from the RECONS consortium announced that the previously known high-proper-motion star LP 876-10 had a distance, velocity, and color-magnitude position consistent with being another member of the Fomalhaut system. LP 876-10 was originally catalogued as a high-proper-motion star by Willem Luyten in his 1979 NLTT catalogue; however, a precise trigonometric parallax and radial velocity was only measured quite recently. LP 876-10 is a red dwarf of spectral type M4V, and located even further from Fomalhaut A than TW PsA—about 5.7° away from Fomalhaut A in the sky, in the neighbouring constellation Aquarius, whereas both Fomalhaut A and TW PsA are located in constellation Piscis Austrinus. Its current separation from Fomalhaut A is about 0.77 parsecs (2.5 light-years), and it is currently located 0.987 parsecs (3.22 light-years) away from TW PsA (Fomalhaut B). LP 876-10 is located well within the tidal radius of the Fomalhaut system, which is 1.9 parsecs (6.2 light-years). Although LP 876-10 is itself catalogued as a binary star in the Washington Double Star Catalog (called "WSI 138"), there was no sign of a close-in stellar companion in the imaging, spectral, or astrometric data in the Mamajek et al. study. In December 2013, Kennedy et al. reported the discovery of a cold dusty debris disk associated with Fomalhaut C, using infrared images from the Herschel Space Observatory. Multiple-star systems hosting multiple debris disks are exceedingly rare.

Etymology and cultural significance

Fomalhaut has had various names ascribed to it through time, and has been recognized by many cultures of the northern hemisphere, including the Arabs, Persians, and Chinese. It marked the solstice in 2500 BC. It was also a marker for the worship of Demeter in Eleusis.

It was called *Hastorang* by the Persians, one of the four "royal stars".

The Latin names are *ōs piscis merīdiāni, ōs piscis merīdionālis, ōs piscis notii* "the mouth of the Southern Fish".The name *Difda al Auwel* comes from the colloquial Arabic الضفدع الأول*aḍ-ḍifdiʿ al-ʾawwal* "the first frog" (the second frog is Beta Ceti).

The Chinese name 北落師門/北落师门 (Mandarin: Běiluòshīmén), meaning *North Gate of the Military Camp*, because this star is marking itself and stands alone in *North Gate of the Military Camp* asterism, Encampment mansion (see: Chinese constellation). 北落师门 (Běiluòshīmén), westernized into *Pi Lo Sze Mun* in R.H. Allen's work.

… Fomalhaut

To the Moporr Aboriginal people of South Australia, it is a masculine being called *Buunjill*. The Wardaman people of the Northern Territory called Fomalhaut *Menggen* —white cockatoo. Fomalhaut/Earthwork B, in Mounds State Park near Anderson, Indiana, lines up with the rising of the star Fomalhaut in the fall months, according to the Indiana Department of Natural Resources. In 1980, astronomer Jack Robinson proposed that the rising azimuth of Fomalhaut was marked by cairn placements at both the Bighorn and Moose Mountain Medicine Wheels in Wyoming, USA and Saskatchewan, Canada, respectively.

The *New Scientist* magazine termed it the "Great Eye of Sauron", due to its shape and debris ring, when viewed from a distance, bearing similarity to the aforementioned "Eye" in the Peter Jackson *Lord of the Rings* films.

USS *Fomalhaut* (AK-22), named after the star and was a United States navy amphibious cargo ship.

Fomalhaut is also the setting for numerous works of fiction and games.

Occultation August 15th

By Nigel Wakefield

IOTA/IOTA-ES occultation update for (1) Ceres / UCAC4-344-077652 event

on 2019 Aug 15, 20:50 UT Visible from S Africa

Summary
On 2019 Aug 15 UT, the 960.9 km diameter asteroid (1) Ceres will occult a 12.2 mag star in the constellation Scorpius for observers along a path across Southern Africa.

In the case of an occultation, the combined light of the asteroid and the star will drop by 0.04 mag to 8.61 mag (the magnitude of the asteroid) for at most 79.8 seconds.

This update is based on UNSO/Flagstaff astrometry for the asteroid kindly provided by Hugh Harris, astrometry for the asteroid kindly provided by Bill Owen, astrometry for the asteroid kindly provided by the IAU Minor Planet Center.

This work has made use of data from the European Space Agency (ESA) mission Gaia (http://www.cosmos.esa.int/gaia), processed by the Gaia Data Processing and Analysis Consortium (DPAC, http://www.cosmos.esa.int/web/gaia/dpac/consortium). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement.

The event at a glimpse

- Rank: 100
- Date and approx. time of event: 2019 Aug 15, 20:43 - 2019 Aug 15, 21:02
- Geocentric midpoint of event [JD]: 2458711.36993750
- Magnitude of target star: 12.16
- Magnitude drop [mag]: 0.04
- Estimated maximum duration [s]: 79.8
- Moon: 100 % sunlit, 84° distance
- Sun: 100° distance
- Rough path description: Southern Africa

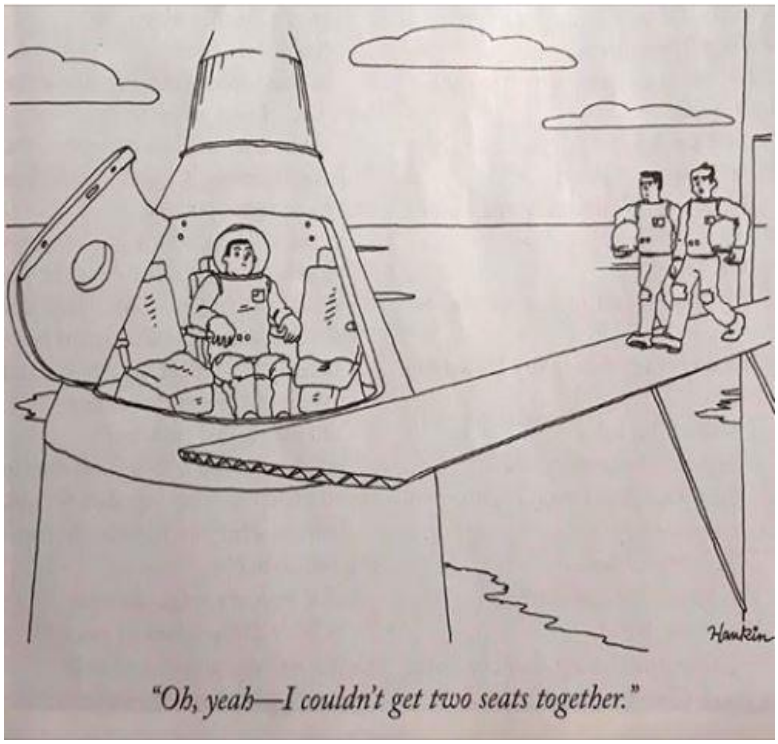
Additional comments

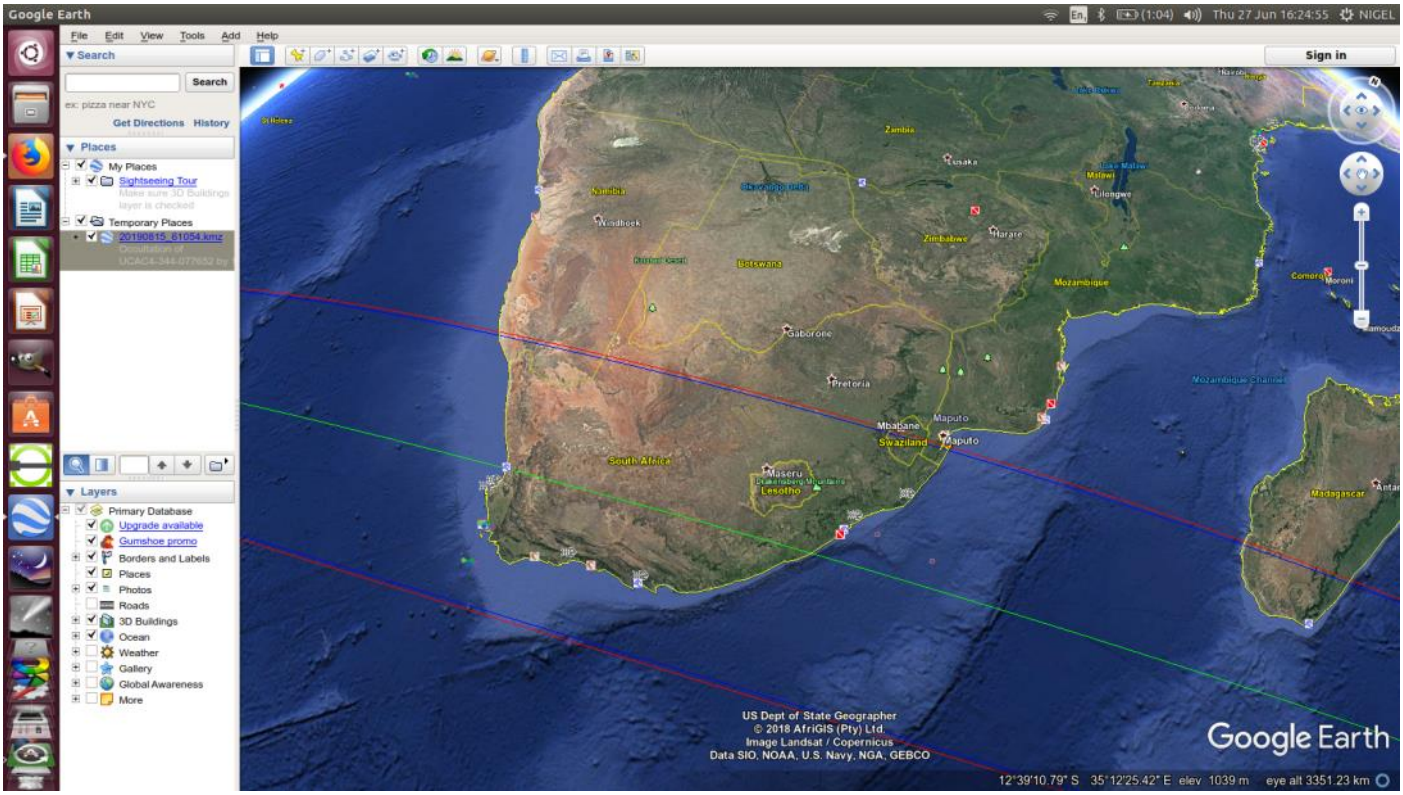
- Very low mag drop

The occultation path

- Approximate projected width [km]: 961
- 1 sigma uncertainty interval [path widths]: +/- 0.01
- 1 sigma uncertainty interval [seconds]: +/- 1.8
- 1 sigma uncertainty interval approx RA,DE ["]: (+/- 0.013, +/- 0.009)
- 1 sigma uncertainty ellipse (major, minor, PA): (0.014", 0.008", 112°)
- Approx speed of asteroid's shadow [km/s]: 12.0340

Website for maps:
http://www.asteroidoccultation.com





Path Coordinates:
Occultation of UCAC4-344-077652 by 1 Ceres on 2019 Aug 15

	Centre			Star	Star	Sun	Path Limits			Error Limits		Alt	
E. Longitude			Latitude		U.T.		Alt	Az	Alt	Limit 1	Limit 2	Limit 3	Limit 4	Crn
o	'	"	o ' "		h m s		o	o	o	o ' "	o ' "	o ' "	o ' "	
27	0	0	-31 29 1		21 0 12		31	263	-65	-35 51 30	-27 06 40	-35 58 52	-26 58 50	-0.01
28	0	0	-31 22 28		21 0 16		31	262	-66	-35 44 49	-26 59 47	-35 52 38	-26 51 57	-0.01
29	0	0	-31 15 24		21 0 20		30	262	-67	-35 38 60	-26 52 23	-35 45 56	-26 44 32	-0.01
30	0	0	-31 7 50		21 0 24		29	261	-67	-35 30 54	-26 44 26	-35 38 45	-26 36 35	-0.01
31	0	0	-30 59 45		21 0 28		28	261	-68	-35 23 13	-26 35 58	-35 31 04	-26 28 06	-0.01
32	0	0	-30 51 10		21 0 32		27	260	-69	-35 15 30	-26 26 58	-35 22 55	-26 19 05	-0.01
33	0	0	-30 42 4		21 0 36		26	260	-69	-35 60 23	-26 17 26	-35 14 16	-26 09 32	-0.01
34	0	0	-30 32 27		21 0 39		25	259	-70	-34 57 14	-26 07 22	-35 05 08	-25 59 27	-0.01

The image of a pair of interacting galaxies called Arp 273 was released to celebrate the 21st anniversary of the launch of the NASA/ESA Hubble Space Telescope.

The distorted shape of the larger of the two galaxies shows signs of tidal interactions with the smaller of the two. It is thought that the smaller galaxy has actually passed through the larger one.

Credit: NASA, ESA and the Hubble Heritage Team (STScI/AURA)

The Month Ahead

MEETINGS:

- The next meeting will be the AGM to be held on Wednesday 14 August 2019 @ 19:30.
- The speaker will be Prof. Francesco Petruccione - Quantum Physics and Cosmology.

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
- Joining Fee: R 35

- EFT: **The Astronomical Society of Southern Africa - Natal Centre**.
- Bank: Nedbank
- Account No. **1352 027 674**
- Branch: Durban North
- Code **135 226**
- Reference: Please include your initials and surname

POSTAL ADDRESS:

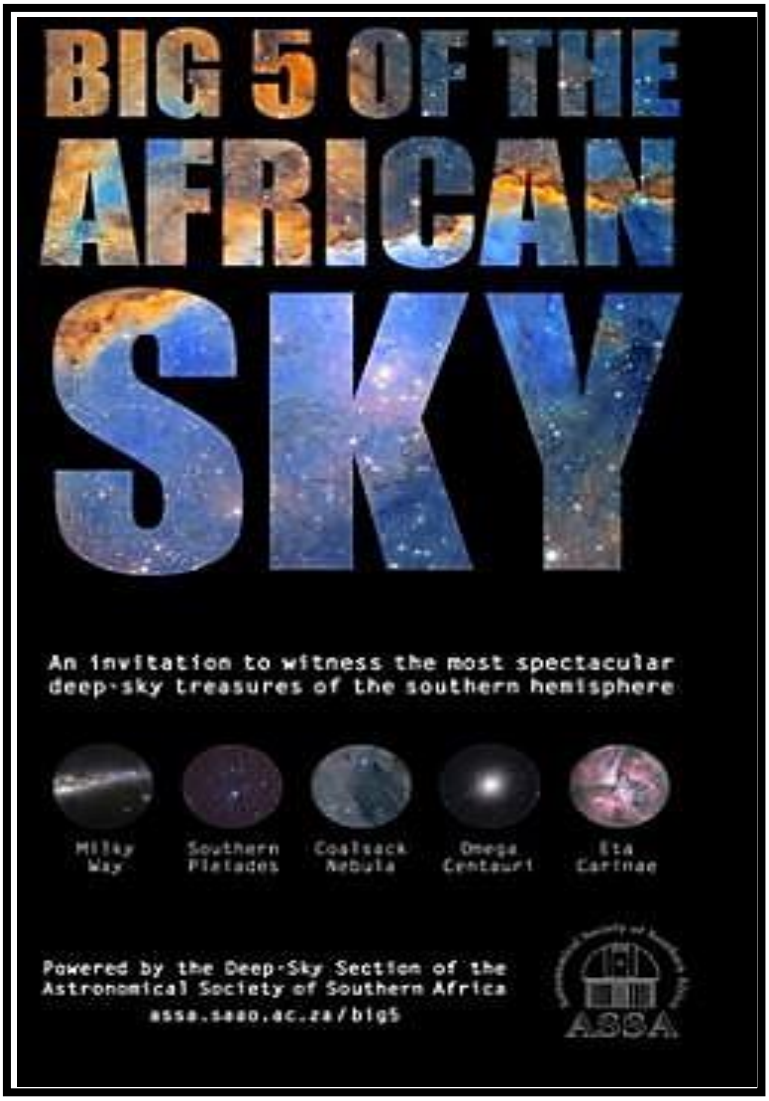
- P O Box 20578, Durban North, 4016 or hand over to the treasurer.

CONTACTS:

Chairman	Piet Strauss	(+27) 83 703 1626
Vice Chair	Debbie Abel	(+27) 83 326 4084
Secretary	Avril Soobramoney	(+27) 82 266 2600
Treasurer	Brian Finch	(+27) 82 924 1222
Observatory Director	Mike Hadlow	(+27) 83 326 4085
Equipment Curator	Mike Hadlow	(+27) 83 326 4085
Publicity & Librarian	Clair Odhav	(+27) 83 395 5160
Out-Reach - Public & Meet & Greet	Sheryl Venter	(+27) 82 202 2874
Out-Reach - Schools	Sihle Kunene	(+27) 83 278 8485
Special Projects	Corinne Gill	(+27) 84 777 0208
Marist College Liaison	Moya O`Donoghue	(+27) 82 678 1103
‘nDaba Editor, Website & Facebook	John Gill	(+27) 83 378 8797

ELECTRONIC DETAILS:

- Website: www.astronomydurban.co.za
- Emails : AstronomyDurban@gmail.com



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!

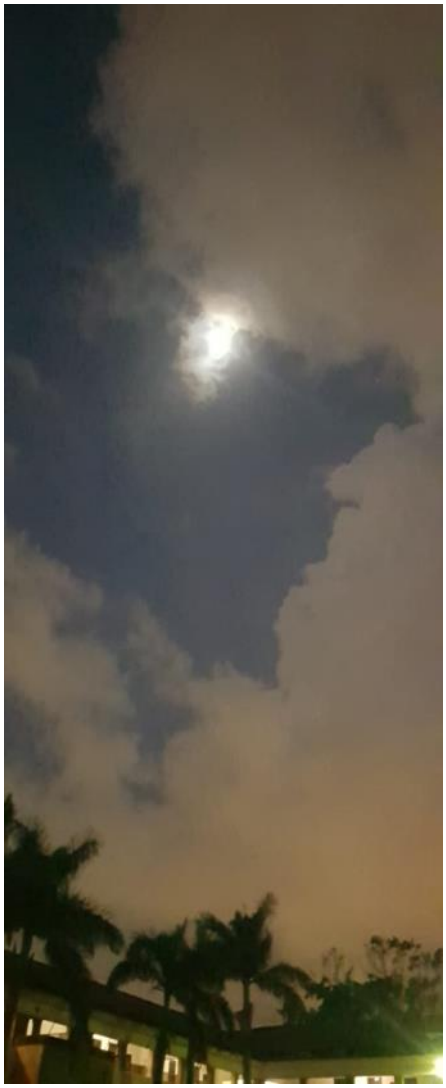
Public Viewing Roster ASSA Durban

Name	Phone	Name	Phone	New Moon	Public Viewing
Maryanne Jackson	**082 882 7200**	**John Gill**	**083 378 8797**	**01 Aug 2019**	**02 Aug 2019**
Debbie Abel	**083 326 4084**	**Sheryl Venter**	**082 202 2874**	**30 Aug 2019**	**30 Aug 2019**
Debbie Abel	083 3264 084	Mike Hadlow	083 326 4085	28 Sep 2019	27 Sep 2019
Mike Hadlow	083 326 4085	Navi Naidoo	084 466 0001	28 Oct 2019	25 Oct 2019

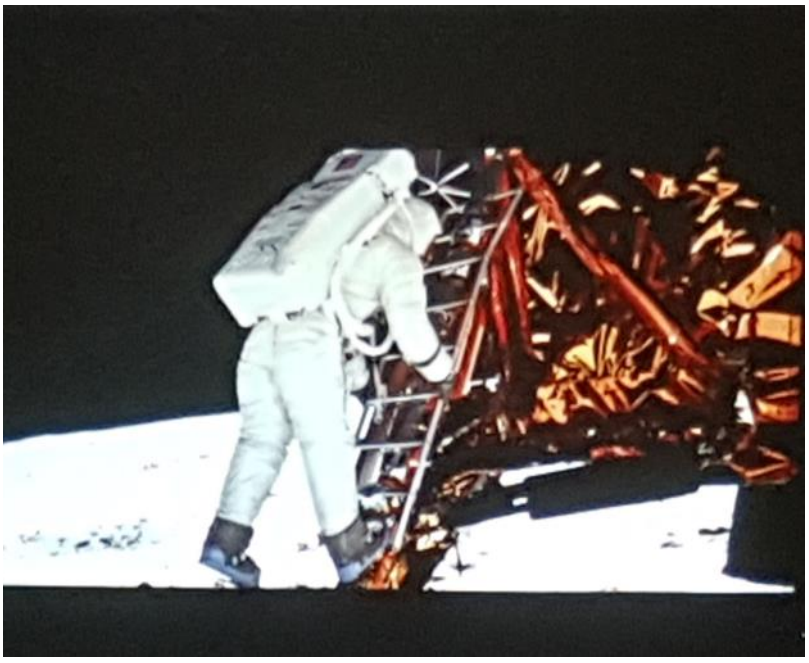
Members Moments

50th Anniversary of the Moon Landing

The special event viewing evening was held at St Henry's Marist College. Telescopes were set up in the parking area and when the clouds came over, all moved into the hall to watch the documentary celebrating the 50th Anniversary of the moon landing.



… Members Moments



… Members Moments

The Monteseel Conservancy outreach event was held on Saturday 27th July which attracted over 300 people.

The weather held up with clouds staying away and it not being too cold; resulting in a great viewing evening enjoyed by all.

Coffee, food and refreshments were on offer by the conservancy members, which was well received.

An emergency service call was made to bring a telescope mount left behind by one of the ASSA members. Name withheld on request!!!

Pre-Loved Astronomical Equipment

Partial Lunar Eclipse on 16 July photographed by Mike Hadlow with an Orion 5” and iPhone.

2019 Special

Green Laser Pointers 50mW

R 350.00

Contact : Piet 083 703 1626
on WhatsApp or SMS.

Available at next ASSA meeting

Tasco 46-114500

Diameter = 114mm

Focal Length = 1000mm

Coated optics

Extra eyepieces

Hasn’t been used much

Paid R 4 500

Asking Price R 1 500

Celestron 6SE

I still have all of the original packaging. Telescope is in excellent condition (Optically and mechanically) and is still used for Astrophotography and outreach projects.

The imaging cameras for Astrophotography are not included in the package. The telescope runs on an external 12v supply, either using an AC adapter (not included) or a 12v cigarette lighter port (cable included).

Contact Amith Rajpal 083 335 8800

Amith.Rajpal@coretecit.co.za

Retail Price is over R 23 000 **Asking Price: R 17 500**

Plus loads of extra equipment

Standard items (included):
1. Original 2" Steel tripod.
2. 1.25" Diagonal.
3. 1.25" 25mm ELux Eyepiece.
4. Red Dot Finder.
5. Tripod Spreader.
6. Cover for Corrector Plate
7. Optical Tube Assembly
8. Fully GoTo 6SE mount