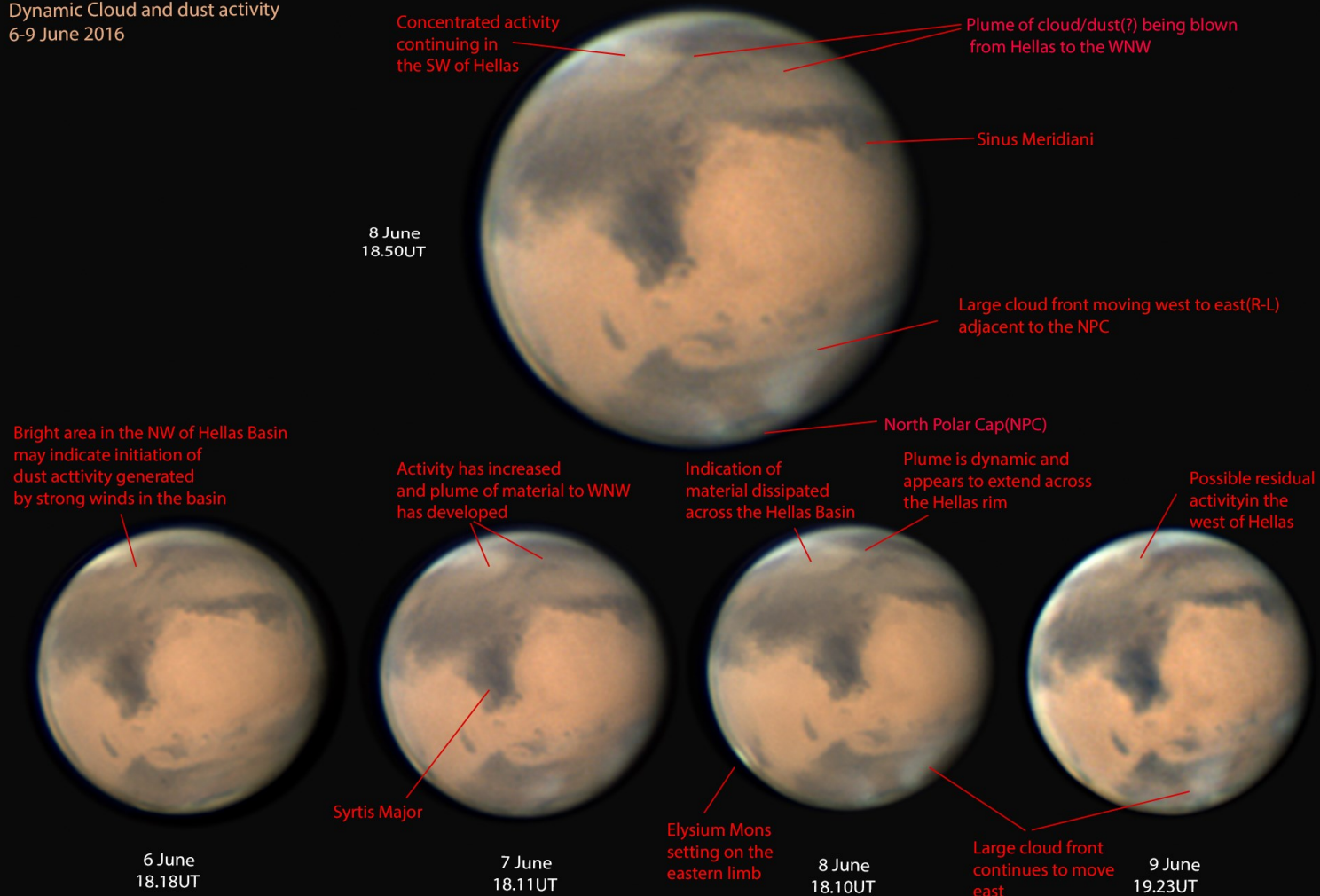




'NDABA

Mars

Dynamic Cloud and dust activity
6-9 June 2016



355mm SCT Edge HD
f/33, 3x Televue Barlow
ZWO ASI224MC
Baader L filter

Clyde Foster
Centurion South Africa

Monthly Newsletter of the Durban Centre

October

Table of Contents

Chairman's Chatter	3
Touring the Backbone of Cygnus	5
At the Eyepiece	9
The Director Clyde Foster	11
Astronomia Sky Celestial Tourbillon Watch	12
Jupiter	15
The Cover Image - Mars	17
Philae Found	22
The Month Ahead	24

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Chairman's Chatter

By Mike Hadlow

Dear Members,

We are already into 10th month of the year, what is supposed to be the start of the rainy season. So far, it hasn't materialised although we have had cloudy skies and not much time for good viewing. I'm off to do the Fish river canoe marathon next week in the Karoo at Craddock, so I hope to have clear skies and good viewing.

The society had a busy time last month starting with the annular solar eclipse on 1 September. The weathered played ball and we viewed the eclipse through two solar telescopes and a projection through a finder scope by John Visser, before the South Wester came through and it clouded over. We probably had in the order of 200 members of the public viewing the eclipse through the scopes and viewing glasses that were sold to members of the public. Through 'magic' organisation by Logan Govender we managed to get significant publicity from the event including a mention and interviews on SABC 3 TV and eTV news that evening, an interview on a local radio station and print media.

Thanks to all those who participated in the event. Particular to Richard who managed to sell 35 eclipse viewers.

We have also commenced our workshop on the operation of the society's telescope by members of the society for public viewing. The final session will be on the 6th October, after which we hope to have a few new crews to operate the public viewing.

Our guest speaker for the monthly meeting held on the 14th was Dr Megan Govender who gave us an informative and entertaining presentation titled "The Science of Fun".



... Chairman's Chatter

Although moving into the cloudy season the sky of the past month has again had a number of fantastic viewing evenings, the highlight for me being able to see Venus and Jupiter only 15' apart which resulted an extremely bright object on the western horizon on 27 August .

The Observatory was open for public viewing on Friday 2 September. We had three families viewing for a short time but the skies clouded over and we closed the dome at about 19H30.

The next public viewing will be on the 30 September and after having an article in the Independent on Saturday on 17 September titled , "Gaze upon the city's midnight sky, Durban's observatory is open to the public once a month", we expect it to be well attended.

Viewing for the next few weeks is still likely to be good although with the current drought we should be praying for rain and not clear sky. But just in case, as always, check your Sky Guides, and follow 'At The Eyepiece For October 2016 by Ray Field' in this publication of the nDaba and enjoy your viewing.

Wishing you clear skies and great viewing,

Mike



Touring the Backbone of Cygnus, the Swan

September 16, 2016 By [Brian Ventrudo](#)



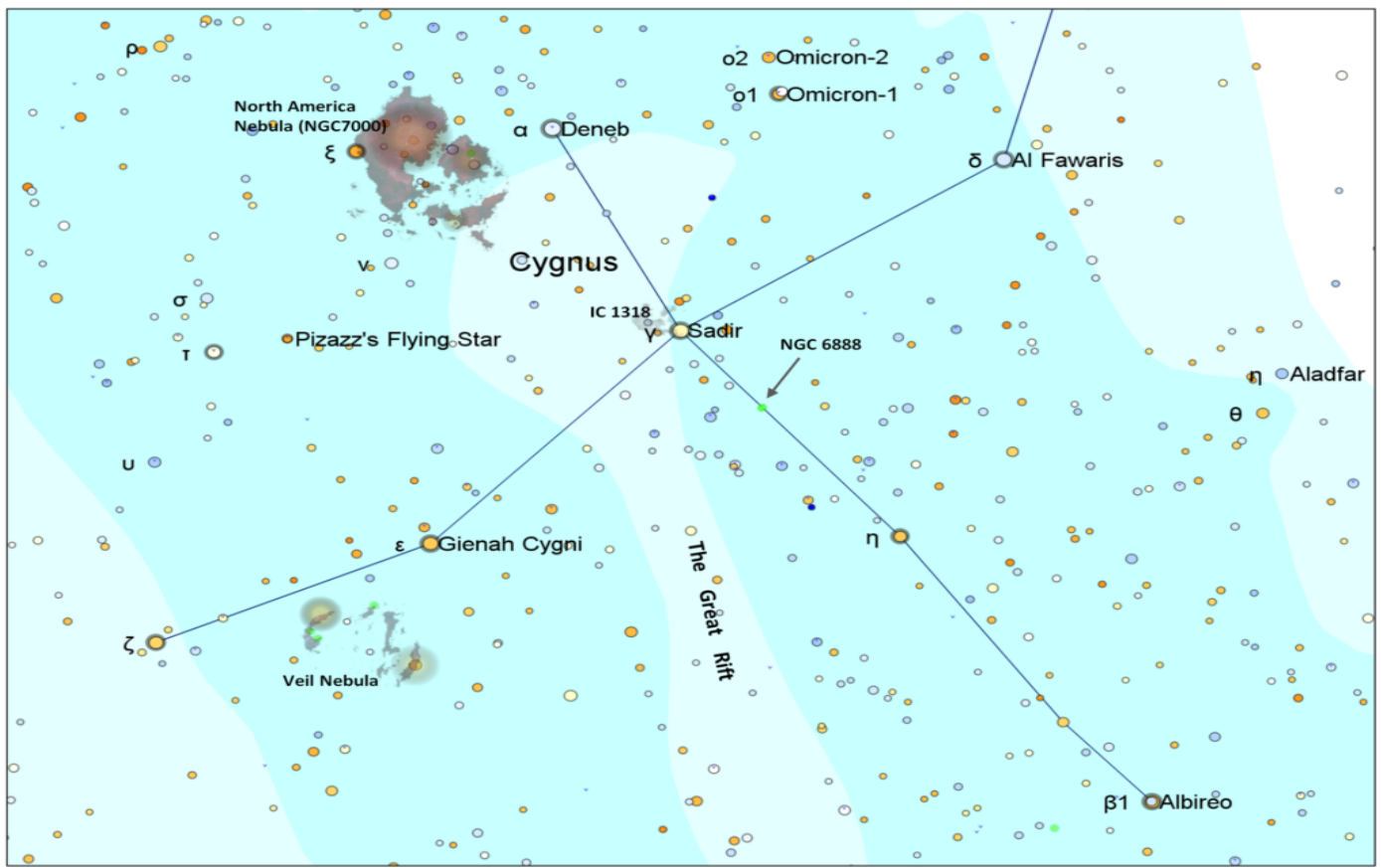
The Milky Way through the constellation Cygnus.
The dark cloud bisecting the Milky Way is the Great Rift.

In the late days of northern summer, the constellation Cygnus lies nearly overhead in the mid-evening hours. A long, conspicuous constellation, Cygnus stretches along the diffuse arc of the Milky Way and is packed full of lovely deep-sky objects for stargazers of all skill levels.

Cygnus is an ancient star group and goes back at least 2,000 years. In Greek legend, Cygnus was a friend of Phaeton, the son of Helios, the Sun god. Phaeton met his demise while foolishly trying to drive his father's sun-chariot across the sky. When Phaeton fell into the river Eridanus, Cygnus begged Zeus to turn him into a swan so he could fly down to retrieve his friend's body. In doing so, however, he gave up his immortality. Zeus was touched by the selfless act of Cygnus in honoring his friend, so he cast the swan in a place of honor in the night sky.

The main part of the constellation Cygnus forms the asterism known as the "Northern Cross", with Deneb (α Cygni) at the top of the cross and Albireo (β Cygni) at the base. The center of the cross is the star Sadr (γ Cygni), and the tips of the arms of the cross are marked by δ Cygni to the northwest and Gienah (ϵ Cygni) to the southeast. When viewing Cygnus as a swan, Deneb marks the tail, Albireo the nose, and delta and epsilon mark the wingtips. From Deneb to Albireo, the constellation spans about 22° .

... Cygnus, the Swan



A map of the constellation Cygnus showing the objects in this sky tour.

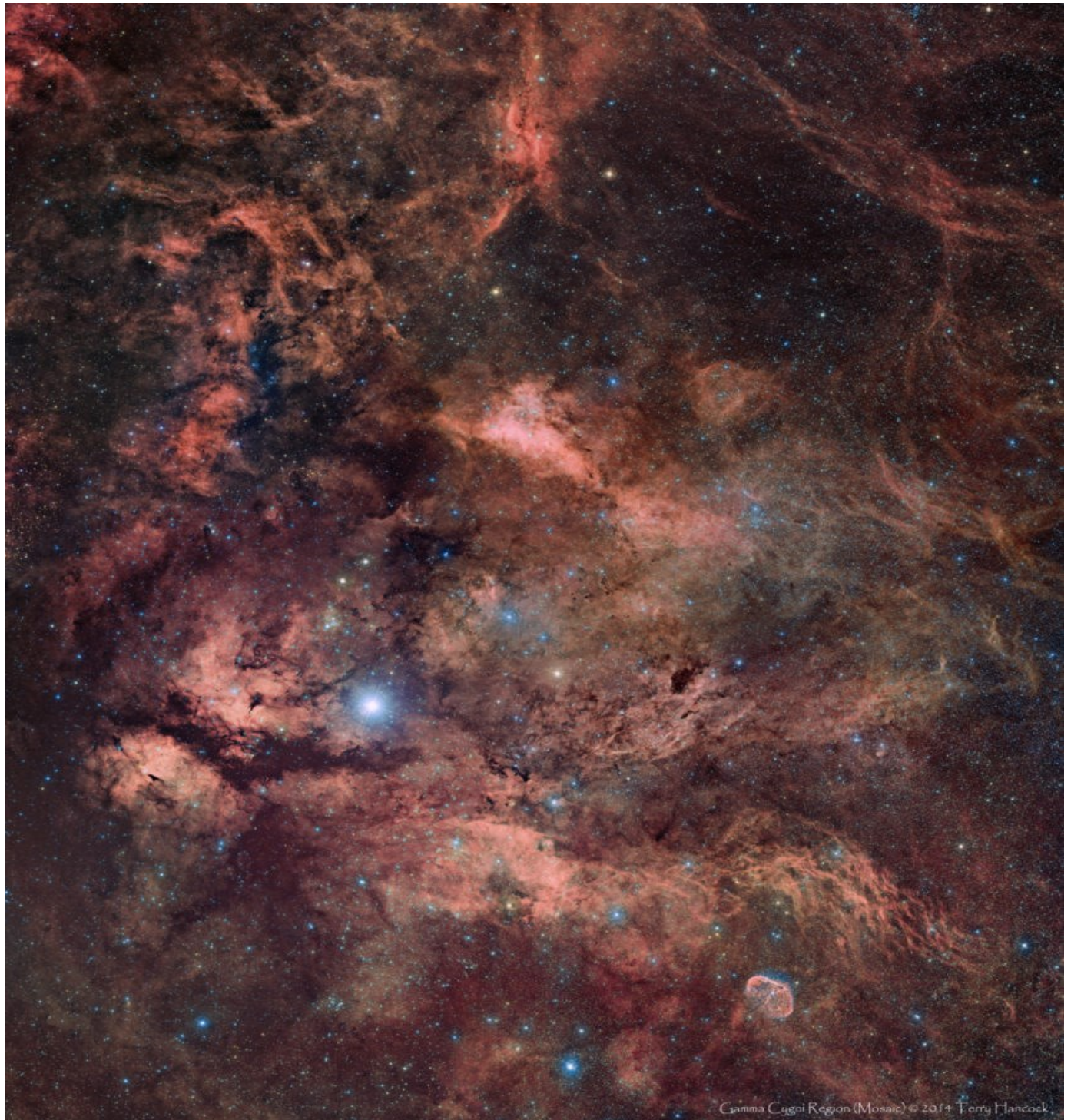
Let's look along the backbone of the Swan from Deneb to Albireo and stop to see a few sights along the way that are worthy of inspection on a northern summer evening. (Note: These sights are also visible from most populated parts of the southern hemisphere where the constellation is visible over the northern horizon in the mid-evening hours in August through October).

Deneb. At magnitude 1.3, alpha (α) Cygni ranks as the 19th-brightest star in the sky. It is one of the intrinsically brightest stars known, with an absolute magnitude of -8.4. It is too far away for an accurate determination of distance, but astronomers believe Deneb to be 50,000 to 200,000 times brighter than our Sun and 20 times as massive as our Sun. Deneb is a white type A2 Ia supergiant and was once likely a blue-white O-type star before it ran out of hydrogen fuel in its core. It's now quickly evolving into an M-type red supergiant.

Sadr. Another supergiant star, Sadr or γ (gamma) Cygni, marks the chest of the Swan. This whitish-yellow star lies about 1,800 light years away and outshines our Sun by a factor of 33,000. Sadr is only about 12 million years old and, like Deneb, it won't last much longer before it detonates as a supernova.

IC 1318. Near Sadr lies a complex region of nebulosity, the brightest of which is IC 1318. This cloud of gas is set alight by an energetic Wolf-Rayet star nearby. Just half a degree to the northwest of Sadr lies an open star cluster NGC 6910. This Y-shaped cluster features two 7th-magnitude yellow-white stars at the top of each tip of the "Y". The entire region spans about 3°. Dark sky and a good nebula filter help you glimpse IC 1318.

... Cygnus, the Swan



The region around the star Sadr or gamma Cygni, just left of center, including the nebulosity of IC 1318 and the Crescent Nebula, NGC 6888, at bottom right. Image credit: [Terry Hancock](#).

Crescent Nebula. Yet another nebula energized by a Wolf-Rayet star, the Crescent Nebula is an ethereal and challenging sight in a small scope. The nebula, cataloged as NGC 6888, is about 1/3 of the way from Sadr to the star Eta Cygni. A 4" or larger scope, a good nebula filter, and dark sky will reveal the little nebula visually. It looks like the number '3' or the 'euro' symbol €. Near the midpoint of the nebula you can see the 7th-magnitude Wolf-Rayet star that's generating an intense stellar wind.

... Cygnus, the Swan

Eta Cygni. Further along the backbone of Cygnus lies the star eta (η) Cygni. At a distance of 135 light years, this star is much closer than Sadr or Deneb and is far less intrinsically bright. It has a mass of about 2.5 suns. It's also getting a little long in the tooth. The star has run out of hydrogen in its core and started to burn helium into carbon, swelling into a red giant in the process.



The double star Albireo
or beta Cygni

(credit: Hewholooks through
Wikipedia Commons)

Albireo. This is one of the finest double stars in all the heavens. Albireo is a spectacular binary star for a small telescope and a stunning example of contrasting star colors. The 3rd-magnitude component of this star shines a golden-yellow. Some 35" away, the fainter 5th magnitude component is a sapphire-blue. Any telescope, even at low magnification, will resolve this lovely star. You might even split it in a good pair of binoculars.

The Milky Way and The Great Rift. Look between the stars Sadr and Albireo for a thick and bright stretch of Milky Way called the "Cygnus Star Cloud", an unresolved mass of stars along the plane of the Milky Way. Just west of Deneb begins "The Great Rift", a long band of darkness that runs southwest towards the horizon and appears to split the Milky Way in two. The image of the top of the page shows the Milky Way and Great Rift through Cygnus. Grab a pair of binoculars and sweep this part of the sky to see a rich and rewarding display of countless pinpoint stars.



At The Eyepiece For October 2016

by Ray Field

THE MOON is NEW on the 1st, First Quarter on the 9th, Full on the 16th, Last Quarter on the 22nd and NEW again on the 30th.

MERCURY is in the morning twilight during the first half of the month. It is highest above the eastern horizon at sunrise on the 1st. It reaches superior conjunction with the Sun on the 27th when it will be closest to the Sun as observed from the Earth.

VENUS becomes the bright "evening star" after sunset this month. It rises higher above the western horizon in the early evening sky each day during the month. It is close to the thin crescent Moon, very low above the western horizon, on the 3rd. Venus passes between Antares and Saturn in Scorpius the 27th.

MARS is in Sagittarius this month near the "lid of the Teapot Asterism". Its reddish hue is still noticeable.

JUPITER was in conjunction with the Sun on the 26th of last month but is still too close to the Sun as seen from Earth to be observed. It does appear low over the eastern horizon at sunrise towards the end of the month. It becomes the bright "morning star" for the remainder of the year as it climbs higher each day.

SATURN remains near Antares in Scorpius all month. Venus passes between Antares and Saturn on the 27th.

URANUS, a faint object, is in opposition on the 15th and will be visible all night. It is just on the verge of naked-eye visibility under perfect viewing conditions. It is in the constellation of Pisces above the "Square of Pegasus". The Moon is near Uranus on the 16th.



The Helix Nebula or NGC 7293, also known as the "Eye of God"

Imaged by :John Gill

... At The Eyepiece

NEPTUNE, in Aquarius, is even fainter than Uranus and needs a telescope to be seen. The Moon is near Neptune on the 13th.

Note: The diagrams on pages 48 and 49 of ASSA SKYGUIDE 2016, show the movements of the bright planets against the starry background.

METEOR SHOWERS: The ORION meteor shower, best observed from 2.00 a.m. until dawn, reaches its maximum on the 21st. Page 51 of ASSA SKYGUIDE has a diagram tracing the path of the radiant of this shower, from below Betelgeuse on the 5th to the feet of Gemini on the 31st.

THE STARRY SKY: The Southern Cross is almost at its lowest above the horizon and Grus and Pavo are well placed above the south east. The Southern Fish" Pisces Austrinus, with its one bright star Fomalhaut, is near its highest over the south. I use this constellation to help me find the large, magnitude 6, planetary nebula "the Helix", NGC 7293, which I have seen in my 11 X 80 binoculars from a dark site. The bright star Achenar is getting higher over the south east. The bright globular cluster 47 Tucanae lies between Achenar and the South Celestial Pole. The "Square of Pegasus" is over the north, with the Andromeda Galaxy M31 down to its right. There is a nice double star, Gamma Arietis to the right of the Square.

REFERENCES: 2016 ASSA SKYGUIDE Africa South, Stars of The Southern Skies by Sir Patrick Moore, The Southern Sky by Wallace and Reidy, Norton's Star Atlas, Handbook of the Constellations by Verenberg and Blank and Philips' Planisphere for 35 Degrees South.



New ASSA Directory of Shallow Sky

by Clyde Foster

"Having recently been appointed as Director of the Shallow Sky section of ASSA, on a recent trip to visit my family at Bothas Hill, it was great to be able to arrange a meeting with John Gill and Peter Dormhel, resulting in some very interesting discussion.

On the afternoon I returned home to Centurion, an early twilight session gave me some really nice seeing conditions for my Mars captures. Mars, with Saturn closely behind, is positioned almost overhead in the early evening, nicely placed in amongst the bright stars of Scorpius. It is however receding from the earth and is rapidly reducing in size. Although well placed at present, its size, of less than 11 arc seconds now, makes it a challenging target. I am finding that at this time of year there are short gaps of reasonable seeing, with conditions deteriorating badly as the sky darkens.

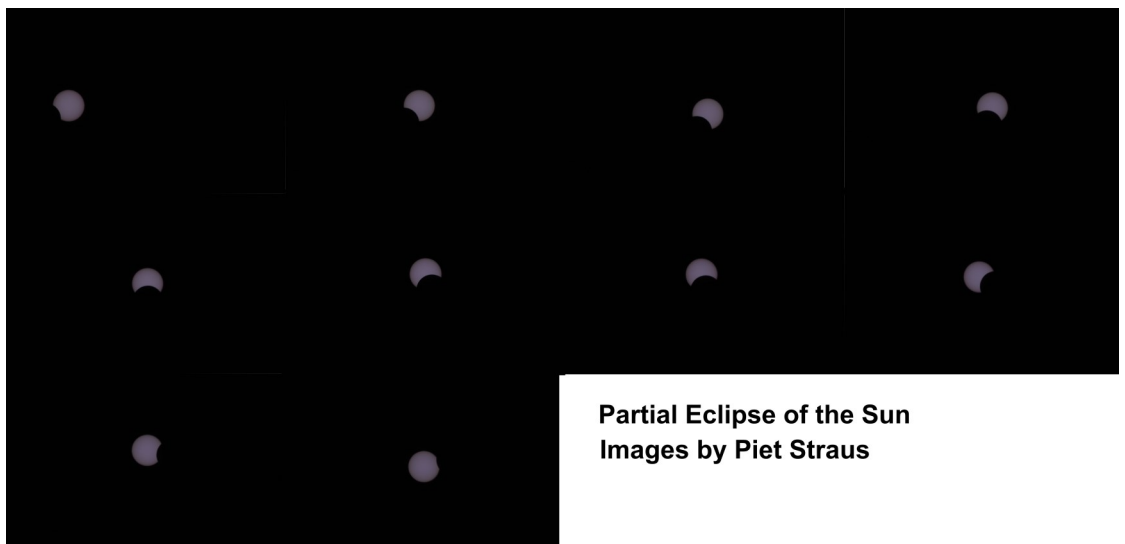
The attached image set(27 August) is fairly standard for me now. Due to the short windows of reasonable seeing, I am tending to use a colour camera rather than the more "normal" methodology of capturing separate R, G and B filtered images and combining into an RGB composite. During processing I split out the R, G and B channels as this provides insight into the atmospheric conditions on Mars at the time of capture.

Typically I am using a high speed camera (in this case the ZWO ASI290MC), cropped down to a field of interest of +- 400x400 pixels, operating at about 140fps and on Mars I capture for 90 secs in order not to be impacted by the planets rotation. Of the 11000-13000 frames, I usually align and stack 2000 of them (depending on how good the seeing was) in Autostakkert2! before wavelet sharpening the image in Registax. Final processing is done in Photoshop. There are a number of more complex steps that can be included as required. I use different settings for the various planets and the moon.

I also attach a second image (18 August) which is maybe a bit more aesthetically pleasing. Towards the top of the image is the white south polar cap(SPC), which is receding as the southern spring progresses. At upper left below the SPC is the dusky Hellas basin which appears to be filled with mixed cloud(Dust, CO₂, H₂O) and below Hellas is the dark, well known, Syrtis Major. Sinus Sabeaus is the dark feature extending to the right. Extensive clouds are in the North Polar region towards the bottom of the image. These will eventually reconstitute into the North Polar cap as the Northern winter progresses.

As per my discussions with John and Peter, on one of my regular trips to the family, we will try and co-ordinate a short presentation on planetary and lunar imaging for those that are interested."

Regards, Clyde



Partial Eclipse of the Sun
Images by Piet Straus

Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon Watch

by [Ariel Adams](#)

At Baselworld 2016, [Jacob & Co.](#) introduced a brand-new version of the crowd-pleasing Astronomia mega-watch called the Jacob & Co. Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon. Not intended as a replacement, but rather as a supplement to the original [Jacob & Co. Astronomia \(hands-on here\)](#), the "Jacob & Co. Astronomia Sky" adds a few complications and actually has a smaller case size.



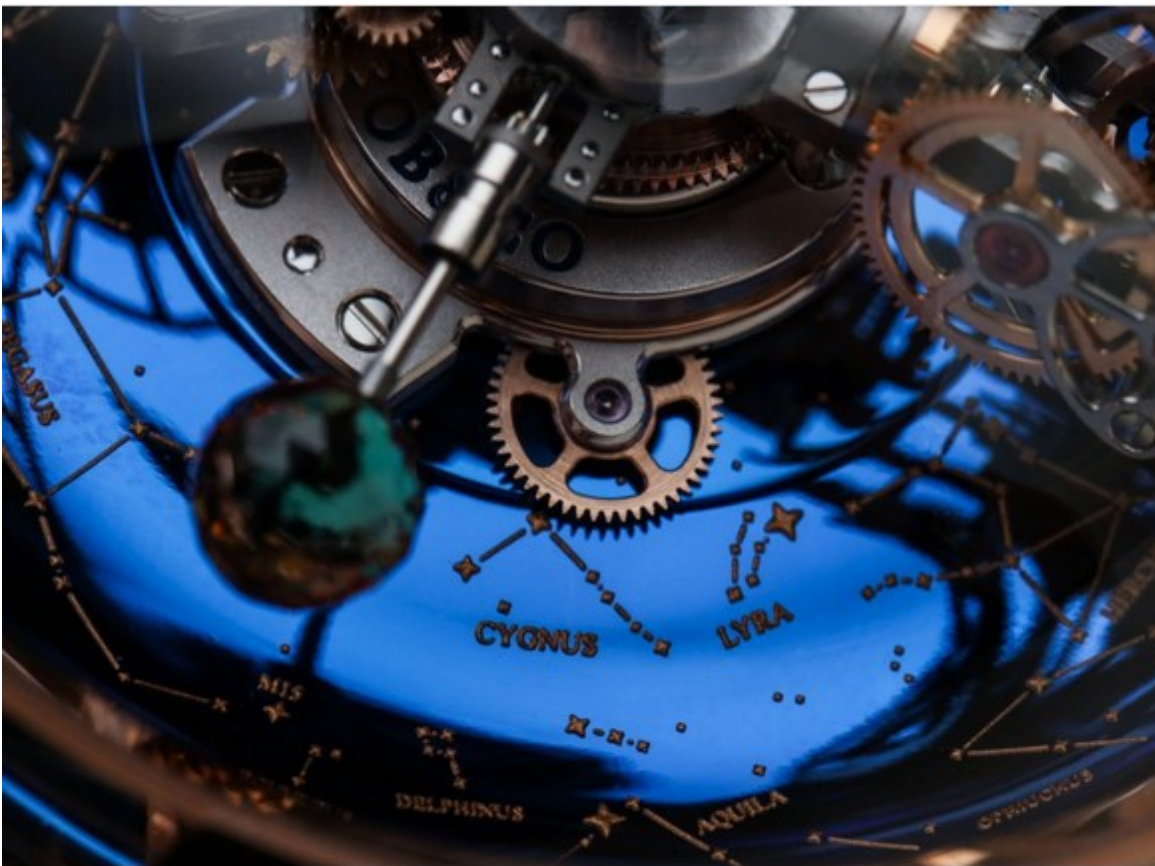
Down from the 50mm-wide size of the standard Astronomia, the Jacob & Co. Astronomia Sky is "just" 47mm wide and 25mm thick. No one wears a watch like this because it is slim, but Jacob & Co. was called upon to make a more wearable version of its interesting Astronomia. Also note that our images of the Jacob & Co. Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon are of a pre-production prototype. One of the crucial missing elements in this prototype watch is a lack of antireflective coating on the sapphire crystals. This makes legibility rather poor and the watch details almost impossible to photograph through the crystal. Just mentioning that since "final" versions of the watch will not have these crystal glare issues as much.

This debut version of the Jacob & Co. Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon comes in a 18k rose gold case with a large domed sapphire crystal on top and a middle sapphire crystal ring around the side of the case. It makes viewing the interior of the watch and the movement very simple and attractive. And, yes, there is a pen to go with it. Well, actually these are pens to go with the Astronomia collection watches overall, and they were produced in collaboration with Jacob & Co. by Italian Visconti. These are also pre-production prototypes, and they will come in 18k rose gold and 18 white gold.

... Tourbillon Watch

The entire point of the Astronomia was to offer a "four armed" movement which had a dial for the time (that spins to remain upright as the entire movement structure rotated on its axis), tourbillon (that technically moves on two axis points), a spinning seconds indicator, and a spinning orb opposite the seconds indicator. The Jacob & Co. Astronomia Sky more or less retains this functionality (although the style and execution is different) and adds some astronomical complications.

Look around the periphery of the dial through the side of the case, and you'll see a month indicator that uses a small hand which follows along the 12-month scale which goes entirely around the face. Now, look at the center of the four-armed movement structure, and on top of it you'll find a small orb designed to look like the earth. This earth orb has a half-sphere shroud which moves around it in order to act as a day/night indicator. There are two axis points here to note, and they are the 24-hour rotating of the day/night indicator as well as the fact that the earth spins around each 20 minutes, since that is the rotation time of the four-armed movement. The small "globe" itself is produced from titanium and then hand-lacquered and engraved.



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On the dial of the watch under the movement is a celestial star map with a series of zodiac indicators. This face is produced from blued titanium (similar to what we've loved in De Bethune watches for a long time) and has an oval "sky indicator" hand. The entire watch face actually makes a full rotation once per year, and the oval sky indicator hand makes a full rotation each sidereal day (about a day) in order to show the stars visible from the northern hemisphere.

As you can see, Jacob & Co. wanted to add a healthy amount of astronomical information to its Astronomia watch, and I think they did a nice job in the Jacob & Co. Astronomia Sky, while actually making the timepiece smaller. Of course, the watch remains a serious "display piece" with most of the value being in the design and showiness of the fancy mechanics.

Compared to the original Astronomia, the movement design is a bit altered in the Jacob & Co. Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon. The "Jacob Cut" diamond is here replaced with a Jacob Cut orange-colored sapphire that spins, making a full rotation each minute, and is shaped like an orb with 288 facet cuts. Opposite this Jacob Cut sapphire crystal is the second indicator hand which is meant to go with some wavy structures that together are intended to represent an orbiting satellite.

The movement inside of the watch is the exclusive to Jacob & Co (and again produced by Studio7h38) caliber JCAM11. Manually wound, the movement is made of 395 parts and operates at 3Hz (21,600bph) with a power reserve of 60 hours. The movement is marvelous to look at with its complexity and focus on being visually entertaining to view in operation.

Combining 18k rose gold and blue (with a matching blue alligator strap), the Jacob & Co. Astronomia Sky has a decidedly regal look to it. This time around, Jacob & Co. did not include any diamonds on it, but if I know Mr. Arabo, then diamonds will be coming on a future version of the Jacob & Co. Astronomia Sky.



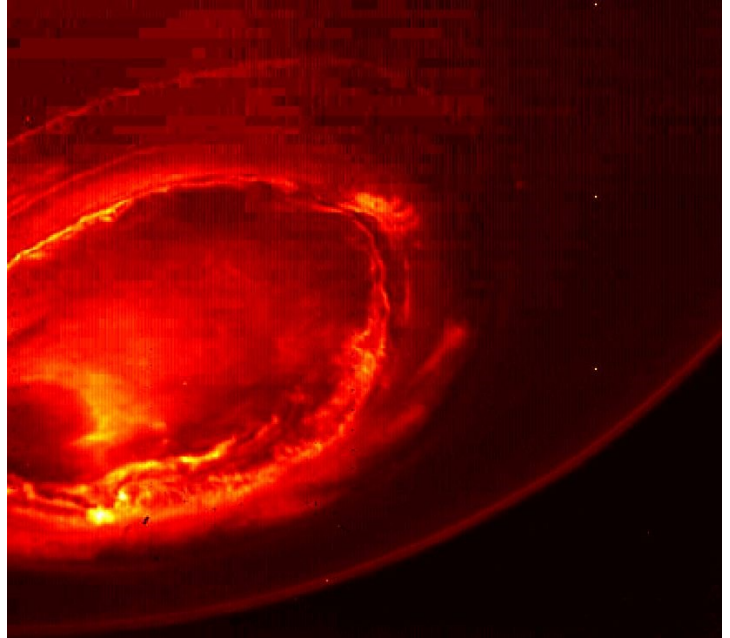
Like most of the watches produced by the brand, the Jacob & Co. Astronomia Sky is part of a limited edition, and this one is just 18 pieces. I can't wait to see the final version with the appropriate sapphire crystals, as I think this and the entire Astronomia watch collection represent some of the most interesting "out there" watches which are clearly very lavish, but aren't the types of watches we immediately assume will look best on an oligarch. I can see the Jacob & Co. Astronomia Sky on the wrist of a successful, albeit beneficent ruler! Price for this version of the Jacob & Co. Astronomia Sky Celestial Panorama Gravitational Triple Axis Tourbillon is **\$680,000**. jacobandco.com

Jupiter

WOW!!! JUST IN: Fabulous new views of Jupiter's Poles by Juno! Unlike anything encountered in the Solar System... NASA's Juno spacecraft has sent back the first-ever images of Jupiter's north pole, taken during the spacecraft's first flyby of the planet with its instruments switched on. The images show storm systems and weather activity unlike anything previously seen on any of our solar system's gas-giant planets. This infrared image shown here from Juno provides an unprecedented view of Jupiter's southern aurora. Such views are not possible from Earth.

Juno successfully executed the first of 36 orbital flybys on Aug. 27 when the spacecraft came about 2,500 miles (4,200 kilometers) above Jupiter's swirling clouds. The download of six megabytes of data collected during the six-hour transit, from above Jupiter's north pole to below its south pole, took one-and-a-half days. While analysis of this first data collection is ongoing, some unique discoveries have already made themselves visible.

"First glimpse of Jupiter's north pole, and it looks like nothing we have seen or imagined before," said Scott Bolton, principal investigator of Juno from the Southwest Research Institute in San Antonio. "It's bluer in color up there than other parts of the planet, and there are a lot of storms. There is no sign of the latitudinal bands or zone and belts that we are used to -- this image is hardly recognizable as Jupiter. We're seeing signs that the clouds have shadows, possibly indicating that the clouds are at a higher altitude than other features."



Read more here: <https://www.nasa.gov/feature/jpl/jupiter-s-north-pole-unlike-anything-encountered-in-solar-system>

Full size image here: https://www.nasa.gov/sites/default/files/thumbnails/image/pia21033_jiram_aurora_d.png

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... Jupiter

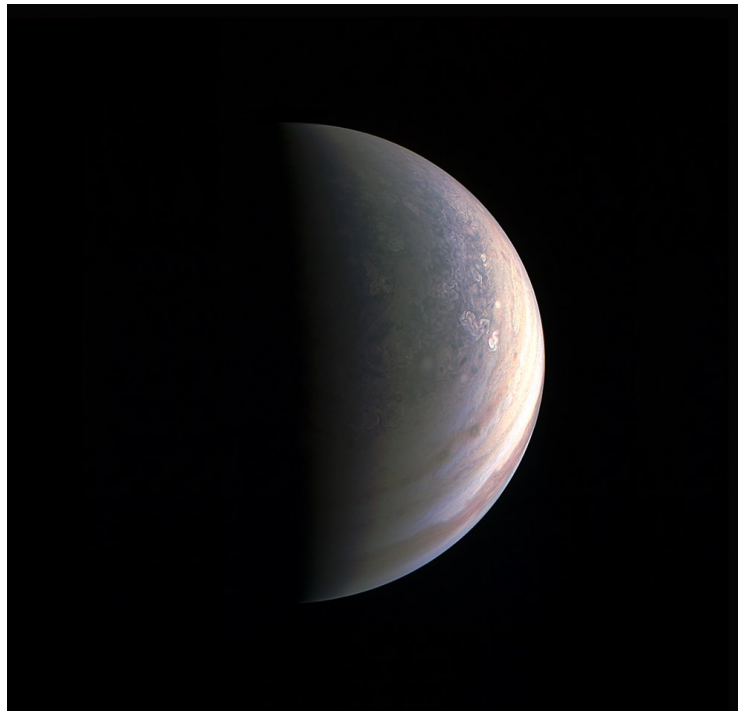
“Saturn has a hexagon at the north pole,” said Bolton. “There is nothing on Jupiter that anywhere near resembles that. The largest planet in our solar system is truly unique. We have 36 more flybys to study just how unique it really is.”

Along with JunoCam snapping pictures during the flyby, all eight of Juno’s science instruments were energized and collecting data. The Jovian Infrared Auroral Mapper (JIRAM), supplied by the Italian Space Agency, acquired some remarkable images of Jupiter at its north and south polar regions in infrared wavelengths.

“JIRAM is getting under Jupiter’s skin, giving us our first infrared close-ups of the planet,” said Alberto Adriani, JIRAM co-investigator from Istituto di Astrofisica e Planetologia Spaziali, Rome. “These first infrared views of Jupiter’s north and south poles are revealing warm and hot spots that have never been seen before. And while we knew that the first-ever infrared views of Jupiter’s south pole could reveal the planet’s southern aurora, we were amazed to see it for the first time. No other instruments, both from Earth or space, have been able to see the southern aurora. Now, with JIRAM, we see that it appears to be very bright and well-structured. The high level of detail in the images will tell us more about the aurora’s morphology and dynamics.”

Among the more unique data sets collected by Juno during its first scientific sweep by Jupiter was that acquired by the mission’s Radio/Plasma Wave Experiment (Waves), which recorded ghostly-sounding transmissions emanating from above the planet. These radio emissions from Jupiter have been known about since the 1950s but had never been analyzed from such a close vantage point.

“Jupiter is talking to us in a way only gas-giant worlds can,” said Bill Kurth, co-investigator for the Waves instrument from the University of Iowa, Iowa City. “Waves detected the signature emissions of the energetic particles that generate the massive auroras which encircle Jupiter’s north pole. These emissions are the strongest in the solar system. Now we are going to try to figure out where the electrons come from that are generating them.”



The Juno spacecraft launched on Aug. 5, 2011, from Cape Canaveral, Florida and arrived at Jupiter on July 4, 2016. JPL manages the Juno mission for the principal investigator, Scott Bolton, of Southwest Research Institute in San Antonio. Juno is part of NASA's New Frontiers Program, which is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama, for NASA's Science Mission Directorate. Lockheed Martin Space Systems, Denver, built the spacecraft. Caltech in Pasadena, California, manages JPL for NASA.

More information on the Juno mission is available at these sites:

<http://www.nasa.gov/juno>

<http://missionjuno.org>

The public can follow the mission on Facebook and Twitter at:

<http://www.facebook.com/NASAJuno>

<http://www.twitter.com/NASAJuno>

The Cover Image - Mars

Mars is the fourth planet from the Sun, and has been known since ancient times for its reddish color. Mars is named after the Roman god of war, and takes that name from its color. Perhaps because its bloody hue, its close proximity to Earth, and its seasonally-changing surface features, Mars has played a larger role in human culture and mythology than any other planet.

Since ancient times, Mars has been identified with battle, blood, courage, fierce dedication, aggression and victory. The Greek name for Mars is Ares. The names chosen in modern times for Mars's two tiny moons, Phobos ("fear") and Deimos ("terror"), refer mythologically to the horsemen of Ares, and make an astronomical link to the ancient Apocalyptic Horsemen.

In Norse mythology and wider Germanic paganism, Tiw or Tyr was a one-handed god associated with combat and pledges. The second day of the work week, Tuesday, gets its name from an Old English word meaning "Tiw's day". The name is based on Latin dies Martis, "Day of Mars"; compare: French mardi, Spanish martes, and Italian martedì.

Orbit and Observation

Mars orbits the Sun at about 1.5 times the average distance of the Earth, with a an orbital period of 687 days. Mars's orbit eccentricity (0.0934) is about six times greater than the Earth's, so its distance from Earth varies widely - from 35 million miles (59 million km) at a "favorable" opposition near the orbit's perihelion, to 248 million miles (399 million km) at superior conjunction near its aphelion. Because of this, Mars varies greatly in its apparent size, from 3.5 to 25 arc seconds, and in brightness from magnitude -2.9 to +1.7.

In a small telescope, Mars shows many of the surface features that sparked the imagination of science fiction writers. Prominent white polar caps are visible, as are odd dusky markings on its surface. These markings show that Mars rotates once every 24 hours and 37 minutes - so its day is almost the same length as Earth's. Mars also has an axial tilt very similar to Earth's, and has seasons like the Earth. The polar caps shrink and expand during the Martian summer and winter, and the dark patterns on its surface also display seasonal changes. Mars has an atmosphere with sparse clouds, and exhibits occasional dust storms which sometimes grow to cover the entire planet's surface for a few weeks.

Once we began to study Mars with telescopes, that planet's intriguing similarities with Earth became apparent. It was the American astronomer Percival Lowell in the early 1900s who first proposed that Mars was the home of a dying civilization, which built canals to carry water across its rusty deserts, from the polar ice caps to cities along the equator. That vision was popularized in the novels of H. G. Wells and Edgar Rice Burroughs, and captured the popular imagination, but it ultimately proved to be false.

The first spacecraft mission to fly by Mars (Mariner 4, in 1965) revealed a vast, barren wasteland of craters. Mars's atmosphere was only 1% as dense as Earth's at the surface, and composed of 95% carbon dioxide (with small percentages of nitrogen and argon). There was no protective ozone layer, and no magnetic field to shield the surface from deadly solar radiation. Its surface was cold - the average temperature is -81° F (-63° C), with a minimum of -200° F (-140° C), and a maximum of 68° F (20° C) on the warmest days at the equator.

... Mars

These conditions made the surface of Mars completely inhospitable to life as we know it. The large number of craters seemed to indicate that Mars was a dead world, geologically speaking, as well. However, subsequent spacecraft exploration showed that Mars was perhaps not quite such a dead place after all. Mariner 9, which entered orbit around the planet in 1971 and mapped its surface in high detail for the first time, revealed the presence of huge volcanoes and vast canyon systems. The tallest of the volcanoes, Olympus Mons ("Mount Olympus"), is about 17 miles (27 km) high - about three times the elevation of Mount Everest! - and is 340 miles (550 km) across at its base. Olympus Mons is both the largest volcano and the tallest mountain in the solar system, and is aptly named for the home of the gods.

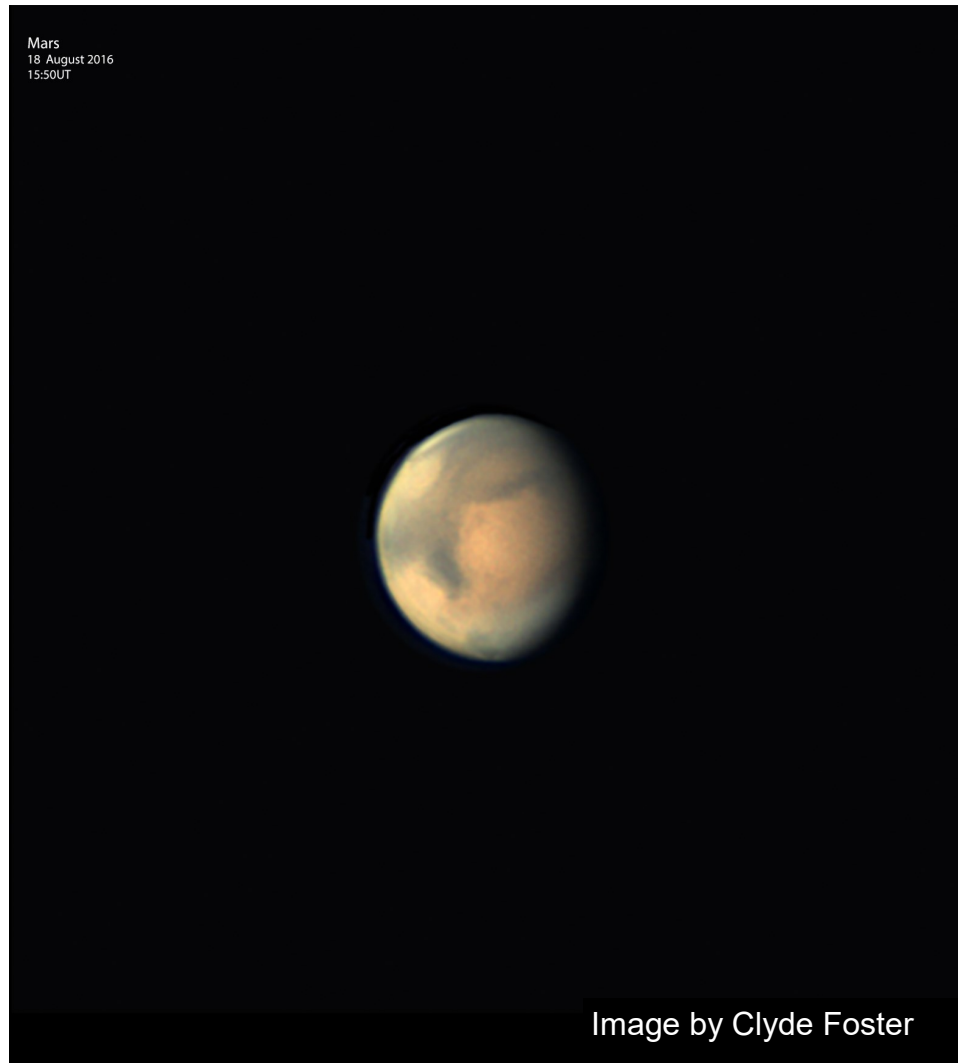
The deepest and longest canyon system on Mars is Valles Marineris (the "Mariner Valley"), and is up to 4 miles (7 km) deep, 120 miles (200 km) wide, and 3000 miles (5000 km) long. It is the largest known crevice in the solar system, and if placed on Earth, it would span the entire United States. Mars was clearly home to some significant geological activity in its past.

Of 38 launches from Earth in an attempt to reach Mars as of mid-2012, only 19 have succeeded - a failure rate of 50%. This high failure rate is informally called the "Mars Curse", and is sometimes facetiously used to "explain" recurring difficulties in reaching the Red Planet.

More importantly, spacecraft images showed surface features that seemed to indicate the presence of water: channels, dry riverbeds, and flood plains. Features such as these look strikingly similar to features on Earth which have been created by liquid water. But on Mars, unlike Earth, liquid water is all but nonexistent today.

Currently, most of Mars's water is buried beneath the surface or frozen as ice in the polar caps. Mars's permanent polar caps are made of water ice; the seasonal expansion and contraction of the polar caps is actually due to the presence of carbon dioxide ice freezing out of the atmosphere - Mars's polar regions never become warm enough for water to melt.

The first spacecraft to successfully land on Mars (Viking 1, in 1976) detected minute trace amounts of water vapor in the atmosphere. Later missions, particularly NASA's Spirit and



... Mars

Opportunity rovers which landed on Mars in 2004, confirmed that the Martian surface was once covered by abundant amounts of liquid water. The Opportunity rover photographed mineral formations, dubbed "blueberries", which could have only formed in the presence of liquid water.

The Mars Phoenix mission, which landed near Mars's north polar region in 2008, may have photographed deposits of water ice directly under the lander itself. These ice deposits were revealed when the lander's rockets blasted away the overlying topsoil. Later, photographs showed what appeared to be droplets of liquid water condensing briefly on the lander's legs, before evaporating into the thin, dry atmosphere.

In September 2015, NASA confirmed that liquid Water flows on Mars today. The Mars Reconnaissance Orbiter (MRO) photographed dark, narrow streaks that ebb and flow over time. They darken and flow downhill during warm seasons, and fade in cooler seasons. A spectrometer on MRO detected hydrated salts on slopes where mysterious streaks are seen, corroborating that they are indeed formed by liquid water.

The cold, desolate planet's atmosphere is so thin that water will freeze or evaporate away quickly. Ancient Mars had rivers and lakes, and so much have had a much denser, warmer atmosphere. But where did that atmosphere go? In 2015, NASA's MAVEN (Mars Atmosphere and Volatile Evolution) probe revealed that most of Mars' atmosphere has been stripped away by the solar wind - a stream of charged atomic particles flowing from the Sun.

This problem is much worse for Mars than for Earth, because Mars, unlike Earth, has no magnetic field to deflect those particles. Mars is currently losing 10 tons of atmosphere per day, and 10 - 20 times more during solar outbursts.

Life on Mars?

The Viking landers of the 1970s carried experiments to detect the presence of life. They looked for organic compounds in the Martian soil; they introduced a liquid nutrient solution into the soil and looked for gases released by metabolizing organisms; and they traced the release of metabolic gases from nutrient solution labelled with radioactive carbon-14.

The first two experiments failed to detect any organic molecules or metabolic gas exchange. But the third experiment detected a steady stream of radioactive gases from the soil. Unfortunately, subsequent attempts failed to generate the same results, and today's majority opinion is that the Viking landers failed to conclusively detect life.

Currently, the prevailing view is that chemical reactions with the Martian soil explain Viking's results. A sufficiently strong oxidizing molecule would react with the water Viking added to produce oxygen and hydrogen, and with the nutrients to produce carbon dioxide. The Martian soil, continuously exposed to ultraviolet light from the Sun, has built up a thin layer of a very strong oxidant.

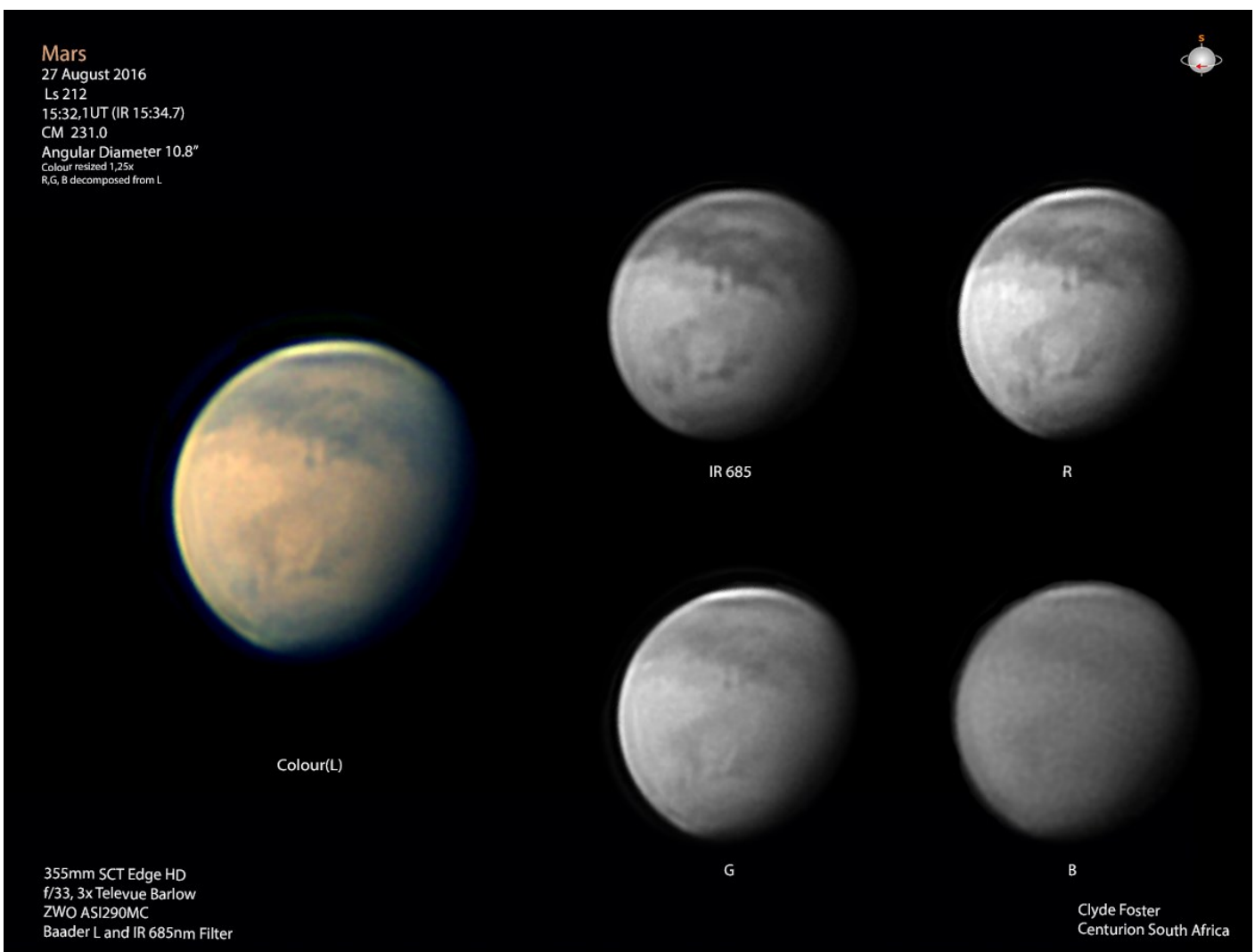
In 2008, the Phoenix lander detected perchlorate (a strong oxidizer) in the Martian soil, supporting the chemical interpretation of Viking's results. But as recently as 2011, some scientists argue for a biological interpretation, i.e. that Viking really did find life. It may be best to say that while Viking did not conclusively prove the existence of life on Mars, it did not conclusively disprove it, either.

... Mars

The first spacecraft to successfully land on Mars (Viking 1, in 1976) detected minute trace amounts of water vapor in the atmosphere. Later missions, particularly NASA's Spirit and Opportunity rovers which landed on Mars in 2004, confirmed that the Martian surface was once covered by abundant amounts of liquid water. The Opportunity rover photographed mineral formations, dubbed "blueberries", which could have only formed in the presence of liquid water.

Meteorites from Mars have landed on Earth, blasted from the Red Planet's surface by enormous asteroid impacts. Preserved in Antarctic ice, these meteorites are known to have originated on Mars, because the composition of gases trapped inside their porous interiors exactly matches that of the Martian atmosphere.

One particular Martian meteorite discovered in Antarctica in 1984, called ALH84001, became the subject of great controversy in 1996. That year, NASA scientists announced that amino acids and other organic compounds had been discovered inside ALH84001. They also showed images of microscopic structures inside the meteorite, resembling (but much smaller than) fossilized bacteria on Earth. These discoveries were first announced as solid evidence that life had actually arisen on Mars. But this conclusion was immediately disputed by other scientists, who argued that the evidence could also be explained by non-biological processes. The situation is unresolved, and in late 2009 some scientists reasserted that Martian meteorites still provide strong evidence of life on ancient Mars.



... Mars

Earth-based observations of Mars in 2003 revealed trace amounts of methane in the Martian atmosphere. Methane is quickly destroyed in the Martian atmosphere in a variety of ways, so this discovery indicates that some ongoing process is releasing the gas. Much of the methane in Earth's atmosphere is released by living organisms as they digest nutrients. However, other purely geological processes, like vulcanism and the oxidation of iron, also release methane. Right now, we don't have enough information to tell whether biology or geology - or both - are producing methane on Mars.

NASA's Mars Science Laboratory (MSL), nicknamed "Curiosity", landed on Mars in August 2012, inside Gale crater near Mars' equator - a site that had been selected from orbital photos which showed evidence of a habitable environment in the past. The rover sampled Mars' atmosphere for methane between October 2012 and June 2013 - and detected none. A few months later, Curiosity detected a sudden burst of the gas, deepening the mystery.

During its first year on Mars, Curiosity began driving toward Mount Sharp, a sediment-covered, 3-mile-high peak at the center of Gale crater. Researchers confirmed that liquid water persisted on the crater floor millions of years ago. While Curiosity has not yet found any evidence of life, more results are expected as the complex data from NASA's most ambitious Mars mission have yet to be analyzed.

The evidence is clear that Mars once had a much warmer, wetter past. There is a possibility that life once existed, or still exists, on Mars. Because of that possibility, Mars remains a primary target of our space exploration.

Moons of Mars

Mars has two tiny moons, Phobos and Deimos. Both moons were discovered by Asaph Hall in 1877. Both are tidally locked with Mars, always showing the same face to the planet; and both orbit Mars very close to the plane of its equator. Phobos and Deimos are both small rocky bodies, resembling asteroids. This has fueled speculation that they actually are captured asteroids.

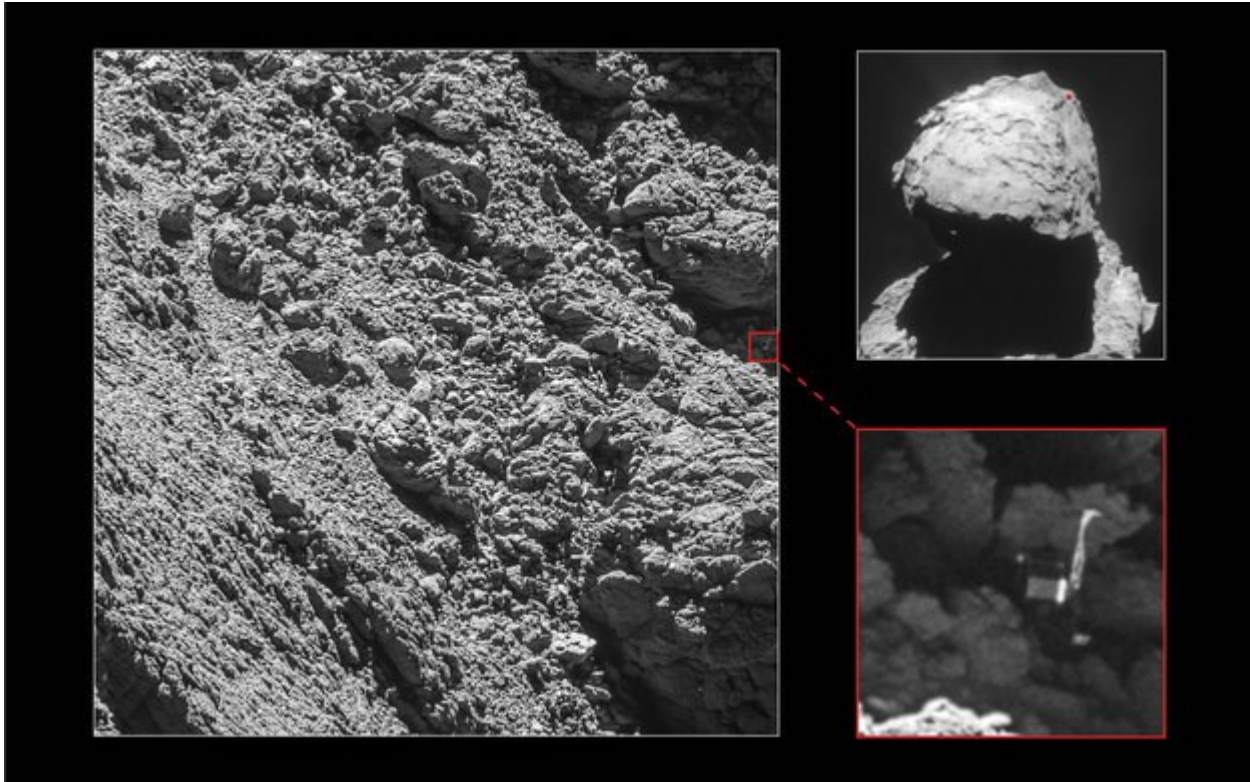


The main alternative hypothesis is that Phobos and Deimos accreted in their present positions, perhaps from material ejected by an impact on Mars - similar to the prevailing theory for the origin of the Earth's Moon.

Philae Found - 5 September 2016

Less than a month before the end of the mission, Rosetta's high-resolution camera has revealed the Philae lander wedged into a dark crack on Comet 67P/Churyumov–Gerasimenko. The images were taken on 2 September by the OSIRIS narrow-angle camera as the orbiter came within 2.7 km of the surface and clearly show the main body of the lander, along with two of its three legs.

The images also provide proof of Philae's orientation, making it clear why establishing communications was so difficult following its landing on 12 November 2014.



“With only a month left of the Rosetta mission, we are so happy to have finally imaged Philae, and to see it in such amazing detail,” says Cecilia Tubiana of the OSIRIS camera team, the first person to see the images when they were downlinked from Rosetta yesterday.

“After months of work, with the focus and the evidence pointing more and more to this lander candidate, I’m very excited and thrilled that we finally have this all-important picture of Philae sitting in Abydos,” says ESA’s Laurence O’Rourke, who has been coordinating the search efforts over the last months at ESA, with the OSIRIS and Lander Science Operations and Navigation Center (SONC, CNES) teams.

Philae was last seen when it first touched down at Agilkia, bounced and then flew for another two hours before ending up at a location later named Abydos, on the comet’s smaller lobe. After three days, Philae’s primary battery was exhausted and the lander went into hibernation, only to wake up again and communicate briefly with Rosetta in June and July 2015 as the comet came closer to the Sun and more power was available.

... Philae Found

However, until today, the precise location was not known. Radio ranging data tied its location down to an area spanning a few tens of metres, but a number of potential candidate objects identified in relatively low-resolution images taken from larger distances could not be analysed in detail until recently.

While most candidates could be discarded from analysis of the imagery and other techniques, evidence continued to build towards one particular target, which is now confirmed in images taken unprecedentedly close to the surface of the comet.

At 2.7 km, the resolution of the OSIRIS narrow-angle camera is about 5 cm/pixel, sufficient to reveal characteristic features of Philae's 1 m-sized body and its legs, as seen in these definitive pictures.

"This remarkable discovery comes at the end of a long, painstaking search," says Patrick Martin, ESA's Rosetta Mission Manager. "We were beginning to think that Philae would remain lost forever. It is incredible we have captured this at the final hour."

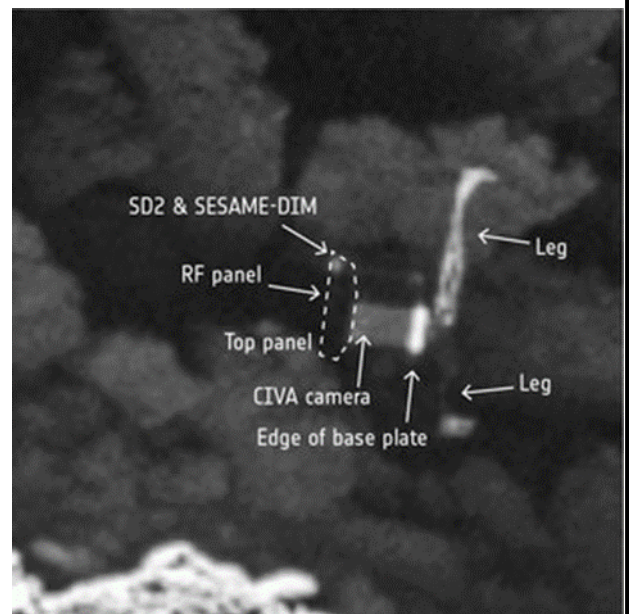
"This wonderful news means that we now have the missing 'ground-truth' information needed to put Philae's three days of science into proper context, now that we know where that ground actually is!" says Matt Taylor, ESA's Rosetta project scientist.

"Now that the lander search is finished we feel ready for Rosetta's landing, and look forward to capturing even closer images of Rosetta's touchdown site," adds Holger Sierks, principal investigator of the OSIRIS camera.

The discovery comes less than a month before Rosetta descends to the comet's surface. On 30 September, the orbiter will be sent on a final one-way mission to investigate the comet from close up, including the open pits in the Ma'at region, where it is hoped that critical observations will help to reveal secrets of the body's interior structure.



Philae close-up



Philae close-up labeled

The Month Ahead

MEETINGS:

The next meeting will be on Wednesday 12th October @ 19:30. The topic is "How geologists know there has been climate change through geological history" by Michael Watkeys

MNASSA:

Monthly Notes of the Astronomical Society of Southern Africa. Go to www.mnassa.org.za to download your free monthly copy.

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... The Month Ahead

SCOPE X:

Saturday 15 October at the Johannesburg Military Museum. Star talks, Amateur telescope making, astronomical and telescope vendor displays, food etc, etc. This is a worthwhile event to talk to other astronomers and see what people are doing in other ASSA centres.

TELESCOPE & OBSERVATORY TRAINING:

This training started on 20 September covering Schedule, Activities, Telescope Theory and Basic Navigation. The next session is on 27 September covering Observatory Checklist, Practical Demonstration and Exercises. Finally on 4 October will cover more Practical Exercises, Occurrence Log, Summary and Closure. These sessions start at 19:00 until 21:00.

SKY GUIDE 2017:

Please give Richard Rowland your details so we can place the order for this wonderful and helpful book on what is happening in the sky at night for 2017.

INTERNATIONAL OBSERVE THE MOON NIGHT - 8 October:

International Observe the Moon Night (InOMN) is an annual worldwide public event that encourages observation, appreciation, and understanding of our Moon and its connection to NASA planetary science and exploration.

Everyone on Earth is invited to join the celebration by hosting or attending an InOMN event — and uniting on one day each year to look at and learn about the Moon together.

