



The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER OCTOBER 2013

Next meeting

Venue: The auditorium behind the main building at Christian Brothers College (CBC), Mount Edmund, Pretoria Road, Silverton, Pretoria.

Date and time: Wednesday 23 October at 19h15.

Programme:

- **Beginner's Corner:** by Johan Smit.
- **What's Up?** by Danie Barnardo.
- 10 minute break — library will be open.
- **Main talk: "Selenography - sketching the moon"** by Vincent Netmann.
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Michelle Ferreira.

Next observing evening

Friday 18 October from sunset onwards at the Pretoria Centre Observatory, which is also situated at CBC. Turn left immediately after entering the main gate and follow the road.

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Pretoria Centre practical observing Friday 20th September 2013 report by Neville Young

Nature appears to have taken on a rule that decrees cold fronts must come through Pretoria on a Friday night – just in time to make for chilly and sometimes damp Saturday morning fun runs and bicycle rides. This has certainly been my experience during this 2013 winter. The week of the September practical started with high temperatures. Patrick, Kirsten and Louis had read in the newspapers about the Pretoria club's open practical evening and decided they would move into summer mode by learning some astronomy.

Young Brent had used my solar system model two weeks previously as part of his school science expo project. His mother Madeleine had found the model on my website and bought it, giving Brent just a day or two to learn how to use it, which he was able to do using the video demonstrations on my website. Having told them about our club and its Friday night practical, they both were looking excitedly forward to seeing the night sky through telescopes.

The clouds rolled out over the Friday daytime skies. I had hopes that they might disperse at dusk as sometimes does happen. Jen and I arrived shortly after 6 to find club member Rudolf there and a teenage girl Hanlie with her mother Marianne. Hanlie had heard that she could be tested for her Voortrekker Astronomy Badge at the practical and was looking for a 'Johan Viljoen'. Not being able to help them with her badge, I decided to get Hanlie to build my solar system model so that at least she could learn why the planets appear where we do actually see them and thus be able to go home not having wasted her Friday evening entirely. The clouds did not leave one square degree of sky uncovered. (See a photo of Neville's solar system model on the next page.)

That Friday was the start of school holidays. Traffic on the highways was heavy. An accident near the Lynnwood Road off ramp slowed traffic to a crawl which made Madeleine abort her attempt to bring Brent. The invisibility of any stars or planets made that an easy decision.

Through the darkening dusk three people strolled onto the CBC sports field, the aforementioned Patrick, Kirsten and Louis. Patrick asked if this is where the Pretoria astronomy club showed stars to the public. By this time, Hanlie had built the model and so I now had five people to rescue from their cloud-induced disappointment. For the next 90 minutes I was at least able to show them where they would have been able to see Venus, Saturn and Mercury if not for the overhead blanket. They understood how Venus has slowly risen since the end of March in the evening sky from behind the far side of the Sun to appear higher and higher above our western horizon each night, how Venus will reach its maximum altitude of 47 degrees above the horizon on the 1st of November and then drop like a stone below the horizon in only 2 months to disappear from our evening skies. Of course this gave rise to the usual question and explanation about the morning and evening stars. The scale of the tiny solar system objects against the immensity of the space they exist in was illustrated, helping them to get an idea of just how fine the alignment must be for Venus to briefly pass in direct line between the Earth and the Sun and thereby present us with the spectacle of the Venus solar transit twice every 120 years.

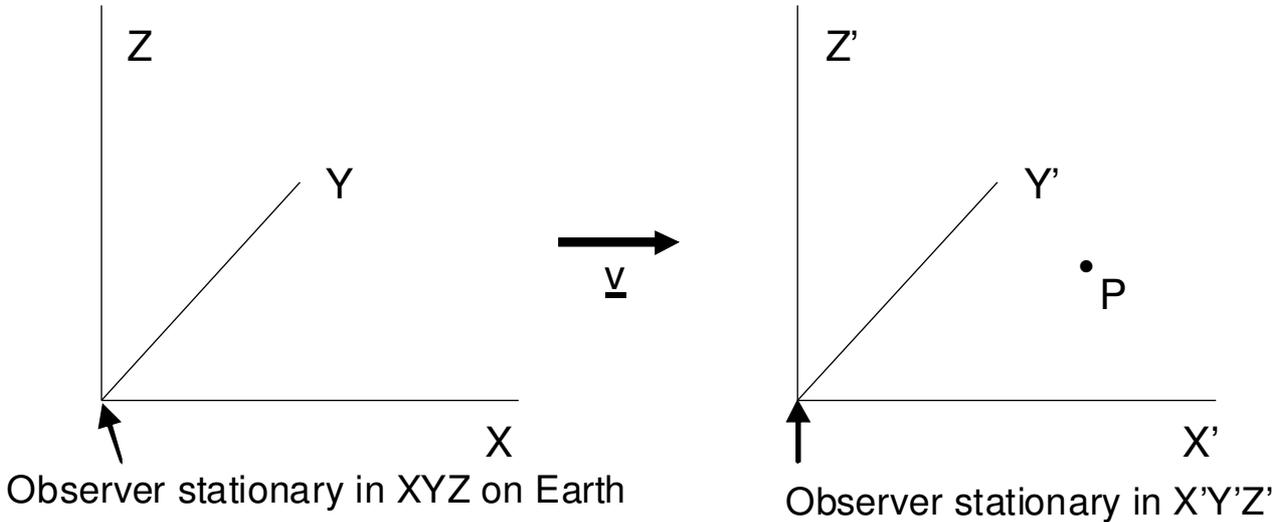
Club members Michael Moller and his wife Robynn happened to be in the area and so popped in to see what may have become of the practical. Michael used his smartphone to point to where Venus and Saturn were being hidden behind the clouds. That unfortunately was the only way the visitors could see the sky.

Hopefully the visitors will have learned enough and have been inspired to return to the next practical to feel the thrill of photons directly from the planets and stars striking their own retinas. This next practical might be the occasion when Brent not only learns to find the planets, but sees them through the eyepiece and then begins to hear about double stars, nebulae, globular clusters, Messier objects, Bennett Catalogue objects, comets, asteroids and begins a lifetime astronomy hobby or career. So – Brent looks forward to meeting you and your telescopes on Friday evening the 18th of October. Ω

Basics: evidence for the expansion of the Universe - by Pierre Lourens

According to the Big Bang theory, the Universe is expanding, and the greater the distance from Earth, the faster the expansion. The evidence usually mentioned for this is the red shift of galaxies that increases with distance. But there is additional evidence for this.

In order to understand it, consider an inertial reference frame * **X'Y'Z'** moving with constant velocity **v** relative to the inertial reference frame **XYZ** here on Earth.



An observer who is stationary in the **X'Y'Z'** frame measures a time interval **T'** between two events at point **P**, which is stationary in the **X'Y'Z'** frame. An observer who is stationary in the **XYZ** frame measures a different time interval between the same two events, namely **T**. The relationship between **T'** and **T** is given by the formula for time dilation from the Special Theory of Relativity:

$$T = T' / (1 - v^2 / c^2)^{1/2}$$

The symbols have the following meanings:

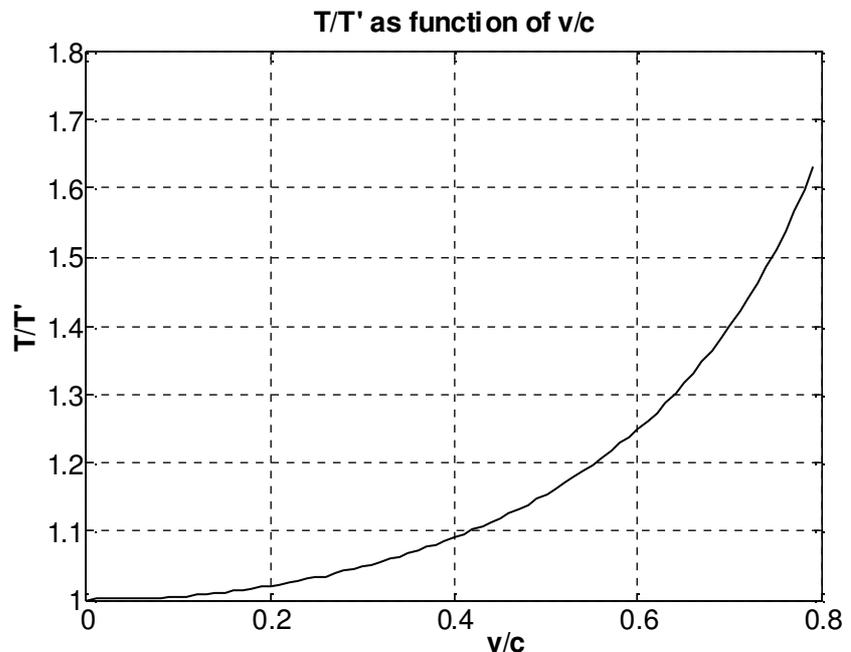
- T** : As described above.
- T'** : As described above.
- v** : Speed of **X'Y'Z'** relative to **XYZ**.
- c** : Speed of light in vacuum.

From the formula follows that

$$T / T' = 1 / (1 - v^2 / c^2)^{1/2}$$

A graph of **T/T'** versus **v/c** is shown on the right. It is clear that **T** becomes ever greater than **T'** as **v/c** increases.

Supernovae of Type Ia which do not move rapidly relative to us are known to have light curves of very uniform shape and with the same peak values (when corrections are made for differing distances). The green light curve in the figure below shows such a curve. For a Universe that expands faster the greater the distance, the Special Theory of Relativity predicts that the light curves for supernovae of Type Ia should become broader the greater the distance of the supernova from Earth.



Observations of these supernovae show that this is indeed the case. The red curve is the light curve for such a supernova that is far away. The blue curve is the light curve for one that is even farther away. (The heights of the latter two light curves were adjusted for the distance.)

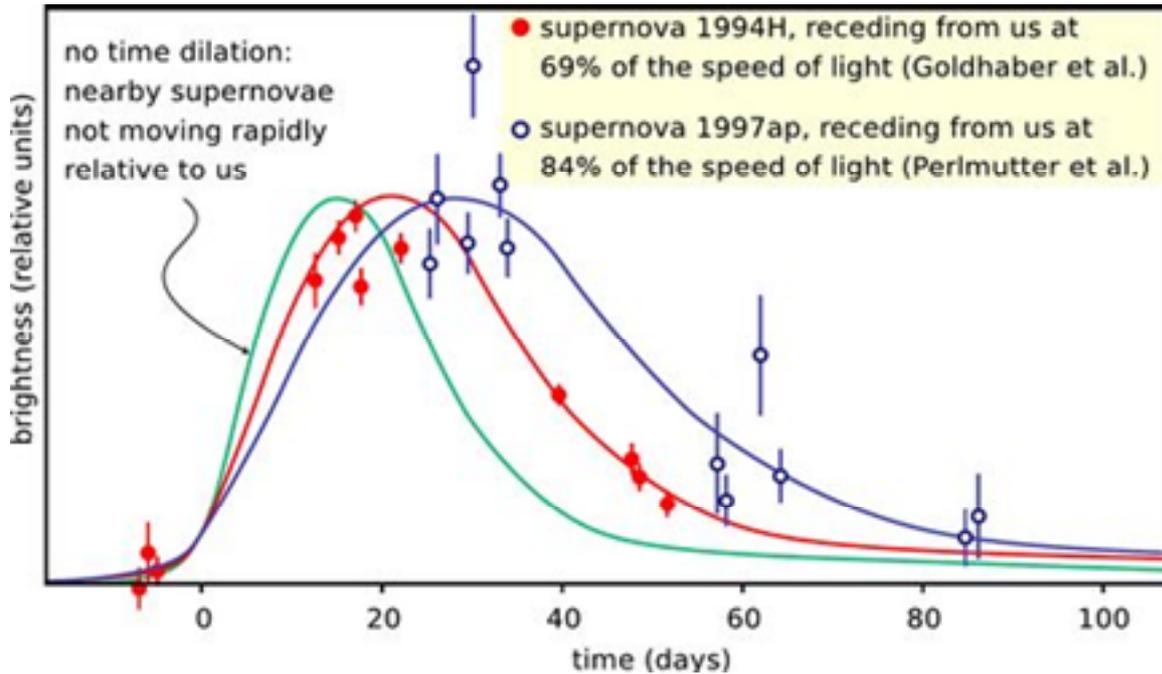


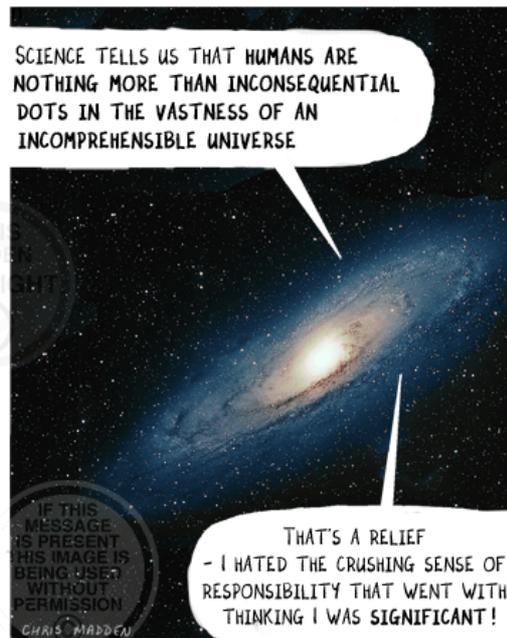
Figure caption: Special relativity predicts that, for an observer on Earth, time will appear to slow down ever more with increasing distance in a Universe that expands faster with increasing distance. This is beautifully seen in observations of Type Ia supernova explosions. Like running a movie in slower and slower motion, the explosions successively take longer to happen (as seen by an observer on Earth) the farther the supernova is from Earth.

* An inertial reference frame is one in which Newton’s first law of motion is valid.

Afterthought: Sir Isaac Newton wrote in *Philosophiæ Naturalis Principia Mathematica*: “Absolute, true and mathematical time, of itself, and from its own nature, flows equably without regard to anything external...” How wrong he was! And some of our present ideas about the Universe may be equally wrong..... Ω



"The last I heard, Medwick was working on a model black hole in his lab."



DO NOT USE WITHOUT PERMISSION OF THE ARTIST

Feature of the month: Largest known group of globular clusters by Pierre Lourens



A globular cluster is a dense cluster of stars containing hundreds of thousands of stars. The Milky Way has between 150 and 158 known globular clusters, contained in a spherical volume about 100 000 light-years across. The majority of these formed between 1 billion and 2 billion years after the Big Bang, which took place 13.7 billion years ago.

The Hubble Space Telescope has discovered a group of over **160 000** globular clusters in a volume about 2.4 million light-years across. The group is situated in the center of a group of galaxies known as Abell 1689.

Compare this group with the globular clusters of the Milky Way: the group has over 1 000 times as many globular clusters as the Milky Way, in a volume 24 times the diameter of the latter.

A correlation between the concentration of globular clusters and that of dark matter has also been found in Abell 1689. Ω <http://www.nasa.gov/press/2013/september/hubble-uncovers-largest-known-group-of-star-clusters-clues-to-dark-matter/>

55 YEARS OF NASA

THINGS DONE:

- 12 astronauts on the moon
- 4 rovers, 4 landers on Mars
- 1 spacecraft in interstellar space
- 12+ years (and counting) of humans on the International Space Station
- 30 years of flying the shuttle to build the station, repair Hubble and perform science
- 1,800 NASA-developed technologies to enable current and future missions, benefit life on Earth
- 16 satellites observing our home planet
- 7 spacecraft observing the sun
- 20 experimental 'X-Planes'
- And much, much, more...

THINGS TO COME:

- More commercial access to low-Earth orbit
- A new rocket & spacecraft to take astronauts farther than ever before
- Capturing and studying an asteroid
- Sending humans to Mars by the 2030s
- Launching the Webb Space Telescope to look at the beginnings of the universe
- MAVEN to Mars, OSIRIS-REx to an asteroid, Juno to Jupiter, New Horizons to Pluto
- Studying the home planet through Earth and space-based observations
- Making air travel safer and greener
- And much, much, more...



The **Trifid Nebula** (catalogued as **Messier 20** or **M20** and as **NGC 6514**) is an H II region located in the southern constellation Sagittarius (the Archer), which is located towards the centre of the Milky Way. Its name means “divided into three lobes”. The object is an unusual combination of an open cluster of stars and three types of nebulae. Photograph taken by Johan Moolman. Ω



Summary of “What’s Up?” to be presented on 23 October 2013
by Danie Barnardo

What's Up in November 2013

Phases of the Moon

New Moon – 3 November

First Quarter – 10 November

Full Moon – 17 November

Last Quarter – 25 November

Best observing time is in the beginning of the month from about 1 to 7 March and again at the end of the month from about 21 to 30 November.

Solar System

Mercury : visible early in morning sky just before sunrise during the second half of the month

Venus : magnificent object in early evening sky, setting at about 22:00. Visible in Sagittarius

Noteworthy items

Solar system

- **Titan wrapped in thick ice.** Saturn's large moon Titan seems like an Earth-like world, with atmosphere, weather and even lakes of liquid ethane and methane. New results from NASA's Cassini spacecraft show Titan has an icy shell far more rigid and thicker than previously believed. And there is possibly a subsurface ocean.

<http://news.discovery.com/space/astronomy/titan-wrapped-in-thick-ice-130828.htm>

- **Uranus has a Trojan.** Uranus has a tag-along companion, called a Trojan.

<http://news.discovery.com/space/astronomy/uranus-has-a-plus-one-130829.htm>

- **Voyager: 10 historic moments in Voyager's journey to interstellar space.**

<http://www.universetoday.com/104729/10-historic-moments-in-voyagers-journey-to-interstellar-space/#.Uja8K3iRoGM.email>

More about Voyager.

<http://news.nationalgeographic.com/news/2013/13/130911-voyager-interstellar-solar-system-nasa-science-space/>

<http://www.skyandtelescope.com/community/skyblog/newsblog/Onward-Voyager-to-the-Stars-223676961.html>

- **Preparing for comet ISON.** Originating from the Oort Cloud, comet ISON is on a path that will bring it within grazing distance – 1.2 million kilometers – above the Sun's photosphere on 28 November. http://www.esa.int/Our_Activities/Space_Science/Preparing_for_Comet_ISON

- **Fire-breather.** Like a dragon breathing fire, a powerful blast of plasma erupts from the corona of the Sun in this false colour view of a coronal mass ejection.

http://www.esa.int/Our_Activities/Space_Science/Fire-breather

- **Earth from space: Sahara oasis.** The Al Jawf oasis in southeastern Libya, deep in the Sahara desert, is pictured in this image from Japan's ALOS satellite.

http://www.esa.int/Our_Activities/Observing_the_Earth/Earth_from_Space_Sahara_oasis

Exoplanets

- **Brown dwarf exoplanet identified.** It seems that brown dwarfs are proving themselves to be perfectly capable of spawning their own planetary systems. Researchers reported the detection of a "relatively tightly-separated (0.87 AU) binary composed of a planetary-mass object with 1.9 (+/-0.2) Jupiter masses orbiting a brown dwarf with a mass of 0.022 solar masses." <http://news.discovery.com/space/astronomy/first-brown-dwarf-exoplanet-discovered-130726.htm>

- **Newly discovered pink exoplanet on the lighter side.** Researchers imaged this planet around a Sun-like star 57 light-years from Earth, but its origins remain a mystery.

<http://news.nationalgeographic.com/news/2013/08/130808-exoplanet-pink-low-mass-star-space-science/>

Our Galaxy

- **Astronomers discover black hole's dieting strategy.** New X-ray observations suggest how the Milky Way's super massive black hole stays so trim when faced with a feast.

<http://www.skyandtelescope.com/community/skyblog/newsblog/Astronomers-Discover-Black-Hole-Dieting-Strategy-221680601.html>

- **Embryonic star.** A star is being born in the guts of the dark cloud LDN 43 – a massive blob of gas, dust and ices. http://www.esa.int/Our_Activities/Space_Science/Sunset_in_Mordor

- **Sun's 8.2-billion-year-old twin found.** A star known as HIP 102152 is a virtual twin of our Sun, but HIP 102152 is 3.6 billion years older than our 4.6-billion-year old Sun. And there is some evidence of rocky planets around it. Is this the perfect SETI target?

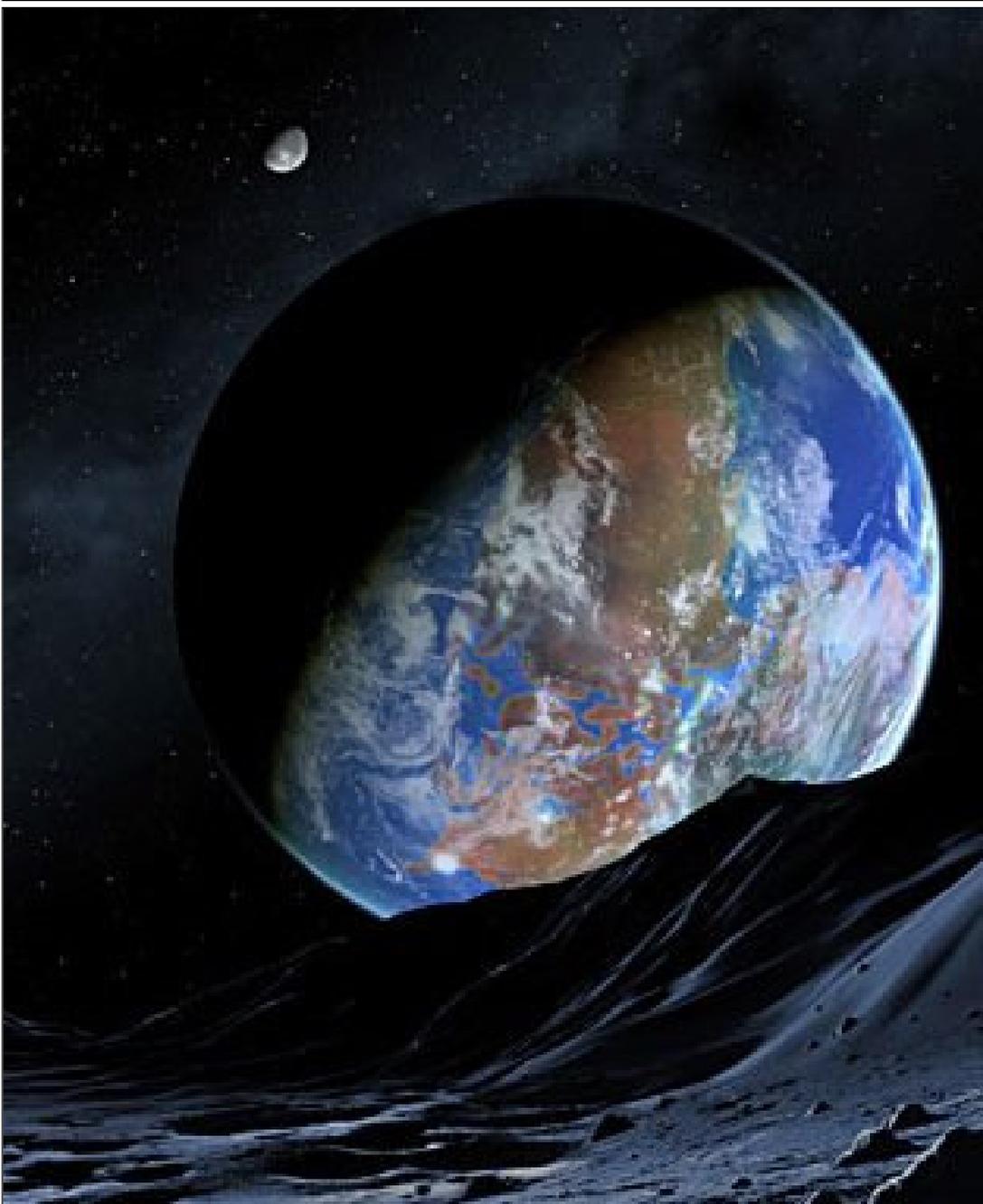
<http://news.discovery.com/space/astronomy/suns-oldest-twin-found-130828.htm>

Life

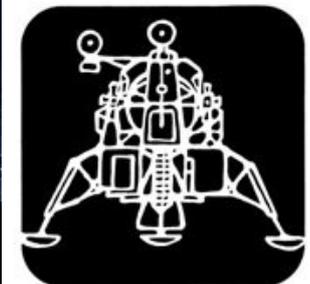
- **Strange places on Earth where life is found.** Read about the harsh environments where life is found on Earth. <http://www.livescience.com/29865-strangest-places-life-found.html>
- **California meteorite carried rare life ingredient.** Scientists have discovered unexpected ingredients for life - organic molecules never seen before in meteorites - inside a chunk of space rock that fell to Earth in California. <http://news.discovery.com/space/asteroids-meteors-meteorites/california-meteorite-primordial-chemical-life-130910.htm>

Space research

- **Movie.** ESA's fourth Automated Transfer Vehicle was launched into orbit. See a time-lapse movie of the launch. http://www.esa.int/For_Media/Photos/Highlights/Time-lapse
- **Satellite flood maps reach crisis teams via Internet.** Building on its use of satellites for responding to disasters, ESA has helped to create a service that makes flood maps available simply via the Internet. http://www.esa.int/Our_Activities/Telecommunications_Integrated_Applications/Satellite_flood_maps_reach_crisis_teams_via_Internet



Left: An artist's impression of the extrasolar planet Gliese 581c, which resembles the Earth but which has five times its mass. This shows the planet as seen from one of two imaginary moons.



The Tarantula nebula

The Large Magellanic Cloud (LMC) lies about 160 000 light-years away from Earth. The Tarantula Nebula (NGC 2070) lies at the eastern end of the LMC. The nebula is shown in this photo taken by Johan Moolman. See the newsletters for May 2008, p 9 and October 2012, p 5. Ω



Pretoria Centre committee

Chairman	Bosman Olivier	082 883 1869
Vice Chairman	Pat Kühn	082 895 5686
Secretary	Michelle Ferreira	073 173 0168
Newsletter Editor	Pierre Lourens	072 207 1403
Treasurer and Membership Secretary	Rynhardt van Rooyen	082 325 8745
Assistant Treasurer	Michelle Ferreira	073 173 0168
Librarian	Danie Barnardo	084 588 6668
Assistant Librarian	Pat Kühn	082 895 5686
Curator of Instruments	Johan Smit	072 806 2939
Public Relations Officer	Fred Oosthuizen	072 373 2865
Observing Coordinator	Percy Jacobs	082 498 4680
Webmaster	Danie Barnardo	084 588 6668
Member	Michael Poll	074 473 4785
Member	Tony Viljoen	072 247 6648

Old newsletters: All old newsletters from January 2004 onward are on our website. They contain a record of our Centre's activities as well as astronomical information.

Database: Members are reminded that a database of the books in our library is to be found on our website. The database was created by Danie Barnardo, one of our committee members.