



The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER SEPTEMBER 2011

Next meeting

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

Date and time: Wednesday 28 September at 19h15.

Programme:

- **Beginner's Corner:** "Using astro software - Neville's riddle" by James Thomas.
- **What's Up?:** by Percy Jacobs.
- 10 minute break - library will be open.
- **Main talk:** "New developments - solar system objects" by Dr Hubrecht Ribbens.
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Bosman Olivier.

Next observing evening: Friday 23 September at the Pretoria Centre Observatory, which is also situated at CBC. Turn left immediately after entering the main gate and follow the road. Arrive from sunset onwards.

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Last month's observing evening - by Johan Smit

Another late winter evening with clear skies awaited the regulars and visitors. It did not turn out as busy as expected, but the evening was well attended, including a group of visitors that repeated their visit of the previous evening. At some stage during the evening 9 telescopes were counted on the field.

Again one of the visitors brought his new scope and we quickly managed to familiarise him with the scope and soon he was able to find his own favourites. I am glad to report that he also attended the next Wednesday's meeting and we gained another friend and member.

Johan even got re-acquainted with one of his neighbours who are also interested in astronomy. They have been living close to each other, not being aware of their shared passion, until the practical evening brought them together. So, come to our viewing evenings—you never know who you might meet there.

Saturn was well viewed by all, because it will soon disappear from the evening sky. Johan brought his by now well-known Long-drop telescope and this was used to good effect on Saturn and other small objects. He has changed the finder system on the scope and this was tested under real conditions. As usually happen, design improvements were identified and the re-design of the finder is in progress.

Due to the number of visitors we did not do much observing, but rather spent the time explaining various topics from stellar evolution, to cosmic distances, to African star lore, and how to identify the sign of the zodiac to an eager audience.

In between these activities many visitors were entertained by views of the typical winter gems like M6 and M7, the usual favourites around Crux, the Jewel box and Omega Centauri, because they will soon disappear from our skies for a while. We even managed to catch a glimpse of Sagittarius A.

The other favourites in the north were not neglected and everyone saw the Ring Nebula, the Dumbbell Nebula and Albireo. The coathanger cluster was also shown to those who brought along binoculars.

It was another busy evening with a lot of talking and explaining and not too cold. Johan even put on a jacket, just so that the others did not feel so cold on his behalf. Soon we can start doing viewing in shorts and a T-shirt, or at least Johan will.

Outreach reports - by Johan Smit

Unika scouts, 25 August 2011:

Johan Smit did a presentation to high school learners about telescope optics and practical observing. The same group of scouts always do duty at the annual Scope-x event. An informal invite to join them on their next camping trip outside the city was mentioned. Not much convincing will be needed to accept this invite.



Irene primary school, 01 September 2011:

We were invited by the school's maths academy to do a talk and provide some star gazing. Johan Smit did a short talk about the movement of the sky and how to judge angular distances in the sky. It was a pleasure to talk to kids who actually enjoy maths, and the enthusiasm

at the scopes was wonderful to experience. It was also one of the best behaved groups of learners that we have seen. There were at least 50 learners and their parents. Many thanks to Pat Kühn, Percy Jacobs, Danie Barnardo, Bosman Olivier, Anton Grobler and George Dehlen who brought scopes to help with the viewing. As a bonus we were provided with very nice food and other refreshments. I am sure that this will become a regular event.

SA Hunters and Conservation Society youth camp, Pienaarsrivier, 02 September 2011:

Danie Barnardo did a short talk about the night sky, after which we entertained the children and adults with some star gazing. Bosman Olivier and Johan Smit assisted with the event. The event took place on a farm under dark skies and we have made friends with the owner and will probably go there in future again. We were provided with food, and I can vouch for the hunter's ability to braai meat. It was the best fillet steaks I had in a long time. If you missed out---sorry to hear that. To top off a perfect evening, a special certificate was awarded to each of our members that attended.

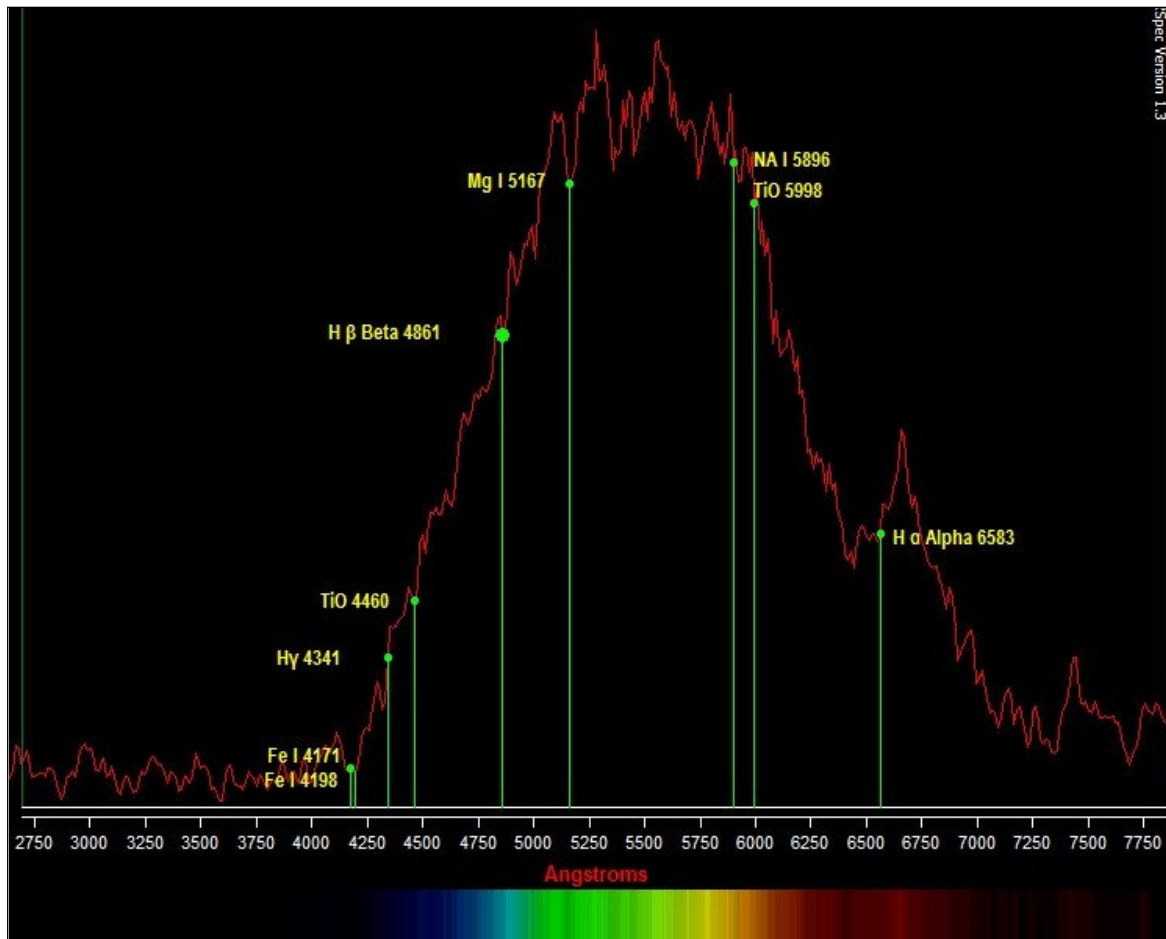
Queenswood scout event, Waverley, 06 September 2011:

Johan Smit did a short presentation about the movement of Earth and the Moon to explain the lunar phases and eclipses. They will qualify for their astronomy badge after they have recorded the phases of the Moon over the next month. Thys Maree and George Dehlen assisted with the event. It was again a pleasure to meet some children who are genuinely interested in science. As a bonus we were again provided with food. The people in Waverley know how to make proper vetkoek and mince. We would not mind to be invited again.

If the trend of feeding the astronomers continues like this, we will end up with some chubby outreach attendees, but we do not mind. Meeting all the nice people and places makes it worthwhile. If you missed out on these events—all I can say is---sorry to hear that.

Spectrum of Antares - by Percy Jacobs

See Percy's comments on the next page.





Above is shown the Rainbow Optics grating and the cylindrical lens used. For more information about Antares, visit the website <http://en.wikipedia.org/wiki/Antares>

The spectrum shown on the previous page is the first attempt by me at taking a photo of a spectrum and having it analyzed. The spectrum is of the red supergiant star Antares (Alpha Scorpii). This whole exercise has been some years in the making and started with the telescope, then the grating, then reading to understand spectroscopy, then the tracking table, then the practice of spectrum photo taking and then the use of the software program (which was the easiest).

I took a photo of a reference star and the star's 1st order spectrum and used the Rspec software (as discussed in the August 2011 issue of the magazine **Sky and Telescope**) to convert pixels to angstroms and generate the analyzed spectrum as shown. I used a Rainbow Optics grating, eyepiece, cylindrical lens, camera and then the Rspec program.

Last month's meeting - by Fred Oosthuizen

There were 27 members and 4 visitors in attendance. Percy Jacobs presented a detailed report on "What's Up?" and Pat Kühn presented "Beginners Corner" on the barn door tracking device.

Our main speaker for the evening was Professor Robert de Mello Koch who occupies the South African Research Chair in Fundamental Physics and String Theory in the School of Physics, University of the Witwatersrand.

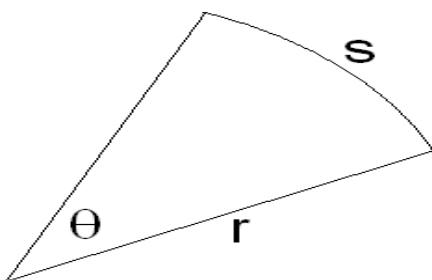
Summary of Professor Robert de Mello Koch talk

DUALITY, SPACETIME AND QUANTUM MECHANICS

String theory is (at present) the most promising candidate for a theory of QUANTUM GRAVITY: When the words "quantum and gravity" are used, they are used with a very precise meaning in mind. When we talk about gravity, we mean general relativity.

Einstein's theory of gravity:- In Einstein's theory, "gravity as a force" is replaced by "gravity as geometry".

Geometry is a recipe to measure lengths and angles. Therefore the use of geometry to replace forces dictates that particles move on the shortest possible "straight line" between two points.



$$s = r \theta$$

Einstein's theory gives us two pieces of information, it tells us that:

- Mass/Energy curve spacetime.
- Particles move along the shortest possible lines (geodesics).

We now know what is meant by the word gravity in the phrase "quantum gravity" but what do we mean by the word "quantum"? Apart from gravity, we have three other forces in nature: The Electromagnetic force, the Strong nuclear force and the Weak nuclear force.

In classical physics, we are used to thinking that we

can specify precisely where a particle is and how fast it is going. If we can describe what forces act on our particle, we can say exactly where it will be at any instant in the future and exactly how fast it is going at the time.

In quantum theory we **can't** simultaneously know where our particle is and how fast it is going. This is not because we are bad at experiments. It is a statement about nature.

We can only associate probabilities with given experimental outcomes. This quantum feature affects the different forces. If we start with the electromagnetic and gravitational force we find that the strength of those two forces gets weaker the further away from the source we are, the Strong and the Weak forces on the contrary get stronger the further away you get from the source.

Particles exchange gauge bosons (e.g. photons) this interaction occurs at well-defined places in space-time. This fact implies UV (ultraviolet) divergences in Feynman diagrams, these divergences are fatal for gravity.

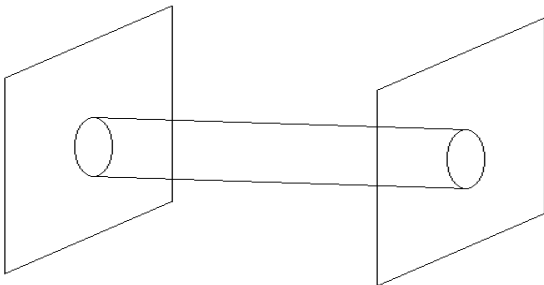
String theory proposes that all matter ultimately consists of tiny vibrating strings (or loops) of energy. These make up quarks which make up subatomic particles which make up atoms, molecules, the earth and the rest of the universe. However the size of an individual string is like comparing an atom to something like a football. This means strings will for the foreseeable future remain theoretical equations.

In string theory point particles are replaced by little loops. At large distances the massless modes determine the physics. If we know what particles are in the theory, we know what forces are predicted, namely Closed string – Gravity and Open string – Electromagnetic, Strong and Weak nuclear force.

It is **impossible** to include gravity in quantum field theory. Gravity is **required** for String theory to make sense.

The hydrogen atom was very useful in developing quantum mechanics. Is there a "hydrogen atom" for quantum gravity? YES: black holes!

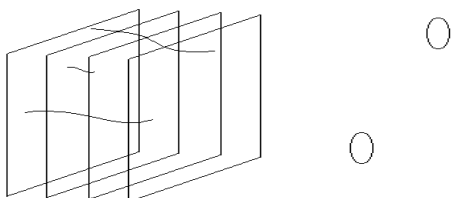
Closed string or open string



P-brane solutions; closed strings near the brane; closed string propagate in the bulk



D-brane solutions; open strings end on the brane; closed string propagate in the bulk.



Many things agree.

- Same symmetries;
- Black hole entropy;
- Hawking radiation/absorption

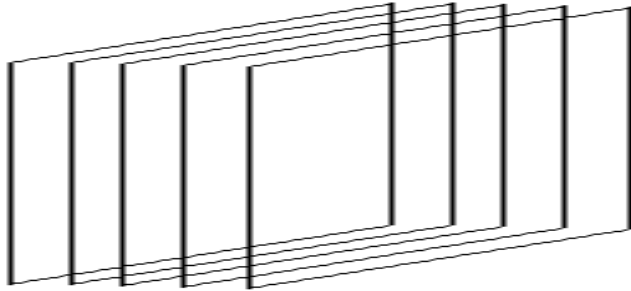
Is equivalent to super Yang-Mills theory!!

The two theories live in a different number of dimensions.

One is a string theory and the other is a quantum field theory!

Is this perhaps a way to inject “experimental results” into string theory? (We think so!)

Calculate the volume of the membrane (curvatures; 10 dimensional; gravity; classical)
or The energies m



Calculate the energy in the wiggling ends of the open strings (flat space; 4 dimensions; no gravity; quantum

BEGINNERS CORNER

BARN DOOR BASICS (Tracking platforms for SLR astrophotography) by Pat Kuhn.

Creating astrophotos without a telescope or some form of tracking device usually involves using a digital single lens reflex camera with a relatively wide angle ‘skyscape’ and time exposures of anywhere from about 2 to 300 seconds.

To reduce the noise effects, Dark Frame subtraction techniques would have to be applied with multiple stacking to boost signal to noise ratios.

Some of the major challengers are:- Focusing, Vibration and Star-trails.

Star trails are caused by the Earth's rotation. Astronomical objects appear to move through the night sky and rotate around the south celestial pole. at about 15 degrees per hour at our latitude. This causes star trails to appear on photographs of the night sky for any but the shortest exposures.

The barn door tracker on a pivotal hinge mount and polar aligned east to west will rotate the camera at 15 degrees per hour so as to keep pace with the Earth's rotation and thereby preventing star trails. The tracker can be operated by hand or motorised. If motorised it will track for up to an hour before having to be reset.

Do we really need to track?

YES! – With average equipment, fixed operation is limited to very wide angle shots, using fast lenses and also relies on good noise performance.

Tracking on the other hand gives flexibility over a wide range of focal lengths and lenses, by allowing long enough exposures to bring out the subtle detail in the image, while controlling the level of noise through the use of lower ISO settings.

Major sources of errors in Astrophotography are caused by Play (erratic error), Wobble (periodic error), Motor vibration, Manual disturbance and Tangent error.

All these problems can be eliminated to a large degree by the use of a well designed but simple BARN DOOR TRACKING device.

Acknowledgements and further information.

- Sky and Telescope – various articles
- Gary Seroniks website garyseronik.com
- Wikipedia – ‘Barn Door Tracker’
- M. Cornington – ‘Astrophotography for Amateurs’.
- Doug Sharp – Brough astronomy; UK.
- George Y Haig et al
- Steve Tonkin – ‘A better Barn Door.’

Telescope mirror for sale

A six inch (150 mm), about F8, aluminized telescope mirror, machine manufactured in Britain during the early 1960s, of fair quality and in good condition, is for sale. Any offers welcome. Contact Cornelis Plug at plugc@mweb.co.za or call 012 654 3000.

Notice about MNASSA

MNASSA (**M**onthly **N**otes of the **A**stronomical **S**ociety of **S**outhern **A**frica) is, from the August 2011 issue, not printed any more, but only available online in **pdf** format. The August 2011 issue is ready and can now be downloaded from the MNASSA Download Page at <http://www.mnassa.org.za/>. Two versions are available: in ebook quality (2.2 MB) or print quality (9 MB). It is also in booklet format, ready to be printed out, stapled and folded to form an A5 booklet.



Above: Comet C/2009 P1, aka comet Garrad imaged on the 30th August 2011. 34 x 30 second light frames were stacked for the final image above. Done by Kos Coronaios, chairman of the Soutpansberg Astronomy Club. Image put into this newsletter with his kind permission. See the second last news item on page 11 of this newsletter.

Summary of “What's Up?” to be presented on 28 Sept - by Percy Jacobs

Moon

First Quarter	– 4 th Oct
Full Moon	– 12 th Oct
Last Quarter	– 20 th Oct
New Moon	– 26 th Oct
Dark Sky	– 1st week of month & last 2 weeks of month (good viewing time)

Planets

Mercury - mag. (-)1.1

Visible for about 1 hr after sunset but is quite near the Sun. Will be very difficult to see.

Venus - mag. (-)3.9
Visible for about an hr after sunset – low on horizon

Mars - mag. (+)1.3
Rises about 02:30 and visible until sunrise
In the east just below cancer

Jupiter - mag. (-)2.9
Rises after sunset and visible the whole night
In the east next to Aries

Saturn - mag. (+)0.7
Sets with the sun
And rises just before dawn at month end

Uranus - mag.(+)5.7
Visible all night – sets just before dawn
Between Pisces & Cetus in the east

Neptune - mag. (+)7.8
Visible for most of the night, setting at around 03:00
In Aquarius

Events

28th Oct @ 19:00 – Venus flanked by Mercury with a 6% illuminated moon above in the west

Meteor Showers (explain more at meeting)

The Orionid Meteor Shower - Peak – 21st Oct @ 01:00 – look for Radiant just below Orion – 30/hr

Constellations

- Aquarius - represents a man pouring water from a bucket
- Cetus - the sea monster
- Taurus – the bull
- Aries - the ram
- Grus - the crane
- Octans - contains the South Celestial Pole. It is named after the octant, precursor to sextant
- Pegasus - the thundering horse of Zeus and the carrier of his lightning bolts.
- Piscis Austrinus - represented as a fish lying on its back drinking the waters pouring from the jar of Aquarius.

“ASSA Top 100” Observers

Louis Kloke	8
Michael Poll	4
Pat Kühn	11
Percy Jacobs	8
Grant Thompson	16
George Dehlen	41
Total	88

Basics: The magnitude scale in astronomy - by Pierre Lourens

The Greek astronomer Hipparchus devised a scale of magnitudes to estimate the brightness of stars with the naked eye. These were magnitudes 1, 2, 3, 4, 5 and 6. The larger the magnitude, the fainter the star. Each grade of magnitude was considered twice the brightness of the following grade. It turned out later that if a star with intensity **I** is one magnitude brighter than a star with intensity **I₀**, then the ratio of their intensities is about 2.5. I. e.,

$$I / I_0 \approx [2.5]^{m_0 - m}$$

As the accuracy of measurement of the intensity of starlight increased, astronomers realized that they needed to define a magnitude system that was precise. But they wanted a system that agreed at least roughly with that of Hipparchus, so that the magnitude values for stars according to the new system would be roughly the same as in the old star catalogues. There was leeway in the choice of another factor in place of **2.5** and the choice of **m₀** to fix the magnitude scale.

They noted that stars classified by Hipparchus as having magnitudes 1 and 6, which differ by 5 magnitudes, have an intensity ratio of almost exactly 100. This ratio was then taken to be **exactly** 100. In order to find another value instead of **2.5**, take **X** in place of **2.5** and **I / I₀ = 100** and **m₀ - m = 5** in the approximate equation above and make it an exact equation.

Then $100 = X^5$

so that $X = (100)^{1/5}$

Then $X = 2.512$

to 4 digits, which is accurate enough. The number **(100)^{1/5}** is known as Pogson's Ratio.

Then $I / I_0 = [2.512]^{m_0 - m}$ (1)

so that $m = m_0 - (5/2) \log_{10}(I / I_0)$ (2)

What remains is to choose an arbitrary reference star, measure its intensity **I₀** and **define** a value of **m₀** for it, so that for any measured value of **I**, the value of **m** is then determined. The star Vega is chosen as a reference star. Its measured intensity is

$$I_0 = 2 \times 10^{-8} \text{ Watt / meter}^2$$

The value of **m₀** for it was originally defined to be **0**, but was later adjusted to

$$m_0 = + 0.03$$

The magnitude scale is then fixed. **m** is known as the **apparent magnitude**. For any star, the apparent magnitude **m** can then be determined from equation (2) by substituting the measured value of **I** for the star in it.

The absolute magnitude **M** of a star is its apparent magnitude **m** at a distance of 10 parsec from the star. To obtain an equation for **M** in terms of **L**, consider the equation

$$I = L / (4 \pi d^2)$$
(3)

I is the intensity of starlight from the star measured here on Earth.

L is the luminosity of the star.

d is the distance of the star from Earth.

From equation (1) and (3), the following formula for **M** in terms of **L** can be derived:

$$M = - (5 / 2) \log_{10} L + \text{a known constant}$$

and the following formula also:

$$m - M = -5 + 5 \log_{10} d \quad \dots\dots\dots(4)$$

with d in parsecs.

Formula (4) is nothing but formula (3) in a different form. In formula (4), m is a measure of I and M is a measure of L .

Solve for d from this equation. Obtain

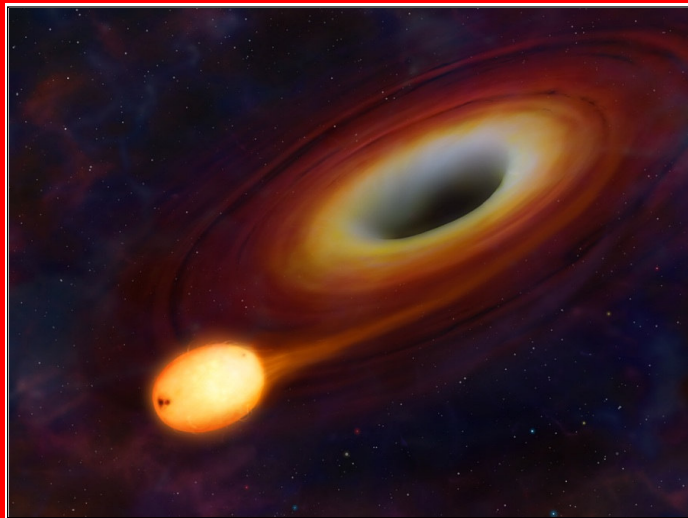
$$d = 10^{(m - M + 5) / 5}$$

with d in parsecs.

The quantity $m - M$ is known as the **distance modulus**. A modulus is a measure of some physical quantity. In this case $m - M$ is a measure of the distance d to the star under consideration. That is, once $m - M$ is known, d is known: it can be calculated from the last equation.

Web links

- **The Necklace Nebula.** This planetary nebula was only recently discovered by the Hubble Space Telescope. It is situated in the constellation Sagitta (The Arrow).
<http://www.oneminuteastronomer.com/4545/necklace-nebula/>
<http://blog.al.com/space-news/2011/08/necklace-nebula-is-hubbles-lat.html>
- **The rose-red glow of star formation.** NGC 371 is an open cluster surrounded by a nebula of ionized hydrogen that glows rose-red. It is a site of star formation.
<http://www.sciencecentric.com/news/11033006-the-rose-red-glow-star-formation.html>
- **What's on Venus?** If you descended down through Venus' atmosphere, you would be eaten by the acid in the perpetual clouds consisting of sulphuric acid. On the surface, you would be roasted, crushed and suffocated. It's like hell on Venus.
<http://news.discovery.com/space/whats-on-venus.html>



FEATURE OF THE MONTH: A black hole scuttles a star

A black hole 3.8 billion light-years from Earth tore apart a star that drifted within its gravitational pull. After consuming the star, the black hole released a high-energy beam of gamma- and x-rays. (**Editor's note:** It went "BÙÙÙÙRRRP!!".) This is one of the brightest events ever recorded. The image is an artist's depiction of the awesome event.

http://www.scientificamerican.com/gallery_directory.cfm?photo_id=9A1A4E79-C6CE-14F2-

[A959C153FF0FA7C3&WT.mc_id=SA_CAT_physics_20110617](http://www.scientificamerican.com/gallery_directory.cfm?photo_id=9A1A4E79-C6CE-14F2-A959C153FF0FA7C3&WT.mc_id=SA_CAT_physics_20110617)

Tevatron particles shed light on antimatter mystery

Why the Universe is filled with matter rather than antimatter is one of the great mysteries in physics. Now we are a step closer to understanding it, thanks to an experiment which creates more matter than antimatter, just like the early Universe did.

The standard model has it that matter and antimatter were created in equal amounts in the early Universe. But if that was the case they should have annihilated in a blaze of radiation, leaving nothing from which to make the stars and galaxies. Clearly that didn't happen.

A quirk in the laws of physics, known as CP violation, favours matter. Some matter was then left over after all the antimatter in the Universe annihilated an equal amount of matter.

<http://www.newscientist.com/article/mg21128204.300-tevatron-particles-shed-light-on-antimatter-mystery.html>

News items

- **Jupiter now tops with the most moons.** The giant gas planet Jupiter now boasts two more moons, bringing the total to 65 known moons. This gives Jupiter a slight lead over Saturn which only has 62 known moons. <http://www.skyandtelescope.com>
- **Free worlds: billions of extra-stellar planetary bodies may be adrift in the Galaxy.** When is a planet not a planet? A new study claims that the Milky Way is filled with Jupiter-mass celestial objects that do not orbit any star. http://www.scientificamerican.com/article.cfm?id=free-floating-planets-microlensing&WT.mc_id=SA_CAT_SPC_20110519
- **Mars' northern polar regions in transition.** A newly released image from ESA's Mars Express shows the north pole of Mars during the red planet's summer solstice. All the carbon dioxide ice has gone, leaving just a bright cap of water ice. http://www.esa.int/esaCP/SEMA4VITPQG_index_0.html
- **Salt water may flow on Mars.** Observations from NASA's Mars Reconnaissance Orbiter have revealed possible flowing water during the warmest months on Mars. http://science.nasa.gov/science-news/science-at-nasa/2011/04aug_marsflows/
- **Other Universes finally detectable?** New method might uncover "bruises" from run-ins with other Universes. <http://news.nationalgeographic.com/news/2011/08/110809-other-universes-multiverse-big-bang-space-science-microwave/>
- **China unveils its space station plans.** China has offered the most revealing glimpse yet of its plans to deploy its own space station by 2020. The space-station project will unfold in a series of planned launches over the next ten years. http://www.scientificamerican.com/article.cfm?id=china-unveils-its-space-station&WT.mc_id=SA_CAT_SPC_20110505
- **Record breaker: very cold brown dwarf discovered.** A brown dwarf, about 75 light-years from Earth, has hit a new low. In fact, its temperature is so low that it is about as hot as the cup of tea sitting on your desk. <http://news.discovery.com/space/very-cold-brown-dwarf-discovered-110309.html>
- **Earth's first Trojan asteroid discovered.** A Trojan asteroid shares an orbit with a planet, but does not collide with it because it orbits around one of two Lagrangian points L4 or L5. <http://www.universetoday.com/87790/earths-first-trojan-asteroid-discovered/>
<http://www.universetoday.com/36046/trojan-asteroids/>
http://en.wikipedia.org/wiki/Lagrangian_point
- **Giant radio telescope scans newfound planets for signs of Intelligent life.** Researchers are using the Green Bank Telescope in West Virginia in the USA to check out some of the distant worlds being discovered in droves by NASA's Kepler spacecraft. <http://blogs.scientificamerican.com/observations/2011/05/17/giant-radio-telescope-in-w-virginia-scans-newfound-planets-for-signs-of-intelligent-life/>
- **Noctilucent clouds.** 80 km above the ground in the mesosphere, silvery blue clouds, known as "noctilucent" or "night shining" clouds, sometimes appear. Read about research and see a videoclip. http://www.nasa.gov/mission_pages/aim/news/notilucent-change.html
- **Comet C/2009 P1, aka comet Garradd.** The comet will continue to brighten during the rest of 2011 and into 2012, when it should reach magnitude 7.1 by February 2012. See image on page 7 of this newsletter. See also charts showing its path at <http://www.rasnz.org.nz/Comets/2011Garradd.htm>
- **The Higgs particle and the Large Hadron Collider.** Ripples of excitement swept through the physics community last month when physicists reported what looked like glimpses of the long-sought Higgs particle. However, after having gathered and analyzed more data, a physicist said: "We see no striking evidence of anything that could resemble a discovery." <http://www.guardian.co.uk/science/2011/aug/22/higgs-boson-signals-fade>



Barnard's Loop

Barnard's Loop (catalogue designation Sh 2-276) is an emission nebula in the constellation of Orion. It is part of a giant molecular cloud which also contains the Horsehead nebula (image below) and the Orion nebula. The loop takes the form of a large arc centered approximately on the Orion Nebula. The stars within the Orion Nebula are believed to be responsible for ionizing the loop.

The image on the left shows Barnard's Loop imaged with a combination of white light and hydrogen alpha light bringing out the colour and detail of this vast structure.

http://en.wikipedia.org/wiki/Barnard%27s_Loop



Pretoria Centre committee

Chairman	Johan Smit	072 806 2939 [Mobile]	
Vice Chairman	Danie Barnardo	084 588 6668 [Mobile]	
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Assistant Treasurer	Percy Jacobs	082 498 4680 [Mobile]	
Member	Hein Stoltsz	083 302 5096 [Mobile]	
Assistant Librarian	Pat Kühn	082 895 5686 [Mobile]	
Assistant Curator	Andrie van der Linde	083 632 4894 [Mobile]	
Member	Johan Hartmann	083 276 1323 [Mobile]	
Member	Gareth Gregory	073 220 6824 [Mobile]	

Meteor shower

