The **PRETORIA CENTRE**

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER NOVEMBER 2006

The next meeting of the Pretoria Centre will take place at Christian Brothers College, Pretoria Road, Silverton, Pretoria

Date and time	Wednesday 22 November at 19h15
Chairperson	Hein Stoltsz
Beginner's Corner	"Telescope care" by Fred Oosthuizen
What's Up	Johan Smit

++++++++++ LEG BREAK - Library open +++++++++++++

MAIN TALK

A Cosmic Window - a general theory on cosmic dynamics

by

Andre du Preez

The meeting will be followed by tea/coffee and biscuits as usual.

The next social/practical evening will be held on Friday 17 November at the Pretoria Centre Observatory, which is also situated at CBC. Arrive anytime from 18h30 onwards.

INSIDE THIS NEWSLETTER

Last month's meeting — Michael Poll

Well, there were a few technical hitches at the last meeting, which, if nothing else, showed us that we cannot do without digital projectors, and also that a tame computer specialist is a useful thing. To the 33 members and visitors present, apologies for the hiccups.

Michael opened the evening with "Beginner's Corner" which was Part 2 of the discussion about the electromagnetic spectrum (EMS). The EMS spans a wide range of wavelengths, but as the wavelength gets shorter, and the frequency increases, the wave train carries an increasing amount of energy. The amount of energy carried by any particular wavelength is a function of the frequency and Planck's Constant.

Hein did "What's Up", telling us that Mars and Venus were more or less behind the sun; and that the November 8th transit of Mercury would not be visible from South Africa. However, Mercury and Jupiter were putting on a nice show in the west at the beginning of the month, and Uranus and Neptune are well placed in the evening sky. Saturn was the easiest planet to see this month, although it was rising after midnight. Hein also mentioned the Andromeda galaxy (M31) and the northern and southern Taurid meteor showers. For the moon, Hein drew our attention to a spiral of smaller craters on the floor of the crater Clavius. We then listened to a presentation about Sagittarius, and a song about the Universe.

Barbara Cunow presented the main topic of the evening, "Astrophotography With A Small Camera". Barbara showed us pictures she had taken of various Messier objects with an ordinary reflex camera, illustrating that one does not need a big instrument to capture them. Although some of the objects were small smudges with the equipment used, Barbara showed her picture and then showed the confirmation with reference to pictures taken with larger telescopes.

The Messier objects shown were classified into clusters - open and globular; nebulae - diffuse and planetary; supernova remnants, and galaxies. This was an excellent project for amateur astronomers to try, as it uses simple apparatus and encourages one to learn more about whereabouts of things in the sky. The meeting ended with refreshments as usual.

Last month's observing evening — Michael Poll

Oh dear! Cloud again. Only four of us were there: Michael, Wayne, Johan and a newcomer, Charl. The afternoon had been clear, but the clouds came in from the south as we watched. Only three objects were seen – Mercury, Jupiter and Vega. We did chat a while, and left at about 8.30 pm.

At this time of year the south pole of the Milky Way Galaxy is almost overhead, and the "Milky Way", through which runs the galactic equator, is placed around the rim of the horizon. Looking up at the sky at this time means that one is looking into space which is relatively free of foreground Milky Way stars, and so is one of the better places to look for galaxies.

At the next observing evening **(November 17th)** we hope to catch four of them : M31, the Andromeda Galaxy and NGC 891, also in Andromeda. NGC 891 might be a bit difficult because it is low down and edge-on, but it is one of the best examples of an edge-on spiral. NGC 891 is near the lovely double star, gamma Andromedae. The third galaxy is near the South Galactic Pole and so will be nearly overhead. This one is NGC 253. It is 10 million light years away, and is the largest member of the Sculptor Group of galaxies. The fourth galaxy we could try for is NGC 55, also in the constellation of Sculptor and also a member of the Sculptor Group.

Telescope for sale

Meade ETX-105EC with an Autostar Computer Controller, a Series 4000 26mm Eyepiece, 8x25mm Right-Angle Viewfinder, 2x Barlow Lens, Tripod & Bag, Hard Carrying Case.
Price: R10 500.00

Contact Nina van den Berg at
+27 (0)11 793-3641 (Office Hours) or +27 (0)82 498-5313

First science with SALT*

The announcement of first science with SALT very appropriately coincided with the opening of the 26th general Assembly of the International Astronomical Union (IAU) in Prague.

This type of work is not possible with any other large telescope and gives a text-book demonstration of our understanding of “polars”. “Polars” are amongst the closest binary stars known - the orbit of the two stars would fit inside the Sun.
The two components take only 90 minutes to complete an orbit. The bigger of the two stars is an M type dwarf star about a third the size of the Sun, and the other one a white dwarf star about the size of the Earth.

The white dwarf has an enormous magnetic field of about 30 million Gauss, channeling accreting gas from the M dwarf to fall in on its poles producing two hot spots on its surface.

About 95% of the light of the system comes from the two hot spots. As the two stars eclipse each other, the hot spots disappear and reappear periodically behind the M dwarf. The light curve of the system has two corresponding downward and upward steps.

The complete article can be found in:
Monthly Notices of the Royal Astronomical Society 372 (2006) 151-162.

Or, go to website
http://xxx.lanl.gov/archive/astro-ph
and download article number 0607266.

An interesting feature of the article is that it has no less than 51 authors. The SALT project is an example of “Big Science”: A large sum of money is spent to build sophisticated equipment, and then a large number of people with varying scientific and technical expertise collaborate to do research with it.

*SALT = South African Large Telescope

Atoms and Stuff Part 2 — by Michael Poll

The strong nuclear force is 10^{38} times stronger than gravity but only works over an exceedingly short range i.e. 10^{-15} of a metre. Because of this short range of action, the strong nuclear force does not hold on to the edges of the nuclei very well, especially as larger nuclei have a diameter of up to 10^{-14} of a metre (bigger by a factor of 10). This is why the sizes of nuclei are limited – if there are more than about 100 protons, electrical repulsion takes over and the nucleus disintegrates. The highest number of protons in a naturally occurring element is the 92 in uranium. Elements that are losing parts of the nucleus are referred to as being "radioactive". Radioactivity is a phenomenon associated only with the nucleus – the electrons, and therefore the chemical properties are not affected. A radioactive nucleus is unstable, and it disintegrates spontaneously by the emission of particles in order to become stable. It is the heavier elements that show this phenomenon. Of the 92 natural elements, all the ones that are of atomic number 84 (Polonium) and higher are radioactive.

The particles emitted are :
Alpha particles – these particles are neutral and are easily absorbed by paper. They consist of 2 protons and 2 neutrons, and are, in fact, helium nuclei (^{4}He). The nucleus of an element that gives off an alpha particle has lost two protons, so it changes into a different element. For example, if ^{238}U (92 protons) gives off an alpha particle, it now only has 90 protons, and becomes Thorium.
Beta particles (beta decay). These are negatively charged electrons, and are explosively emitted following the disintegration of a neutron into a proton and an electron, with the electron being emitted as the beta particle. These particles have an electric charge and can be deviated by a magnetic field. They are stopped by a thin sheet of metal. Beta radiation changes the total number of protons, so a new element is formed – although the total number of protons plus neutrons (the atomic mass) remains the same, the number of protons increases by one and the number of neutrons decreases by one. For example, when Thorium loses a beta particle the number of protons increases to 91 and it becomes Protactinium (Pa).
There are also positively charged electrons called positrons. These are formed when a proton changes into a neutron. The emission of a positron decreases the number of protons.

The emission of alpha and beta particles may be accompanied by the emission of gamma rays. For example, if a nucleus ejects a beta particle, and the daughter nucleus still has too much energy but cannot emit a particle, it emits gamma rays to achieve stability. Gamma rays are in fact electromagnetic radiation, and travel at the speed of light. The rate of decay of a radioactive nucleus is measured by its half-life, which is the time it takes for half of the radioactivity to disappear.
Energy derived from burning or other chemical reactions is derived from the forces the hold atoms together as molecules – these forces release only relatively small amounts of energy. Atomic energy is derived from forces that hold the nucleus together, and these forces are millions of times stronger. Nuclear energy can be released by (a) fission – "splitting" the nucleus, or (b) fusion – joining nuclei together.

The fission of 1 gram of uranium releases the same amount of energy as burning 3 000 000 grams (3 tons) of coal. Fission can take place naturally by radioactive decay, but as a source of power it must be promoted artificially by a chain reaction. The chain reaction involving the splitting of ^{235}U was discovered in 1939. ^{235}U is bombarded with neutrons, giving ^{236}U which is even less stable. ^{236}U ejects 2 or 3 neutrons accompanied by heat and gamma rays. The neutrons strike other ^{235}U nuclei, thus initiating the chain reaction. The chain reaction builds up in a fraction of a second, but is limited by the mass of ^{235}U that is available. A suitable mass of uranium has to be accumulated by artificial means.

Fusion is the means by which stars derive their energy, given the extremely high temperatures (15 000 000 degrees in the case of the sun) and pressures found in their cores. The sun fuses four hydrogen nuclei into one helium nucleus. One helium nucleus has only 99.32% of the mass of 4 hydrogen nuclei, but the 0.68% of excess mass cannot disappear – it is turned into energy. The sun converts 564 million tons of hydrogen into 560 million tons of helium every second. The spare 4 million tons per second is converted into energy according to the formula $E = mc^2$, where **E** is the resultant energy, **m** is the mass being converted, and **c** is the speed of light. If one gram of hydrogen is fused, the amount of energy released is approximately 630 000 000 kJ. In its 4.5 billion year life time the sun has fused only 4% of its stock of hydrogen into helium. However, when 10% of the star's mass has been converted to helium, it is now said to have a helium core. This state heralds the red giant phase - but that is another story.

Extrasolar planet hunters find triple-Neptune system

A trio of Neptune-sized worlds has been spotted circling a star 41 light years away, in the southern constellation Puppis. One of the planets is by far the smallest ever found in the "habitable zone" of a Sun-like star, where liquid water could exist.

"The astronomer's dream would be to be able to study the composition and structure of these planets to see exactly what they look like," says Christophe Lovis from the Geneva Observatory in Switzerland, whose team made the discovery.

Future space-based missions like NASA's Terrestrial Planet Finder and the European Space Agency's Darwin project could realise that dream in 15 to 20 years.

The team discovered the planets by monitoring their parent star for two years using a 3.6-metre telescope at La Silla Observatory in Chile. The parent star, HD 69830, is about 80% as massive as our Sun and is significantly dimmer.

He says the most exciting aspect of the discovery is that astronomers are uncovering ever-smaller planets in ever-larger orbits, a trend that will eventually reveal clones of Earth. "These discoveries give us a hint that low-mass, terrestrial planets are likely to be very common in our galaxy," he says.

A “continent” on Titan

Radar images taken by the Cassini probe of Titan, Saturn's largest moon, reveal a continent-size region of river valleys, hills, plains, and mountains. The area looks remarkably similar to terrain here on Earth, scientists say.

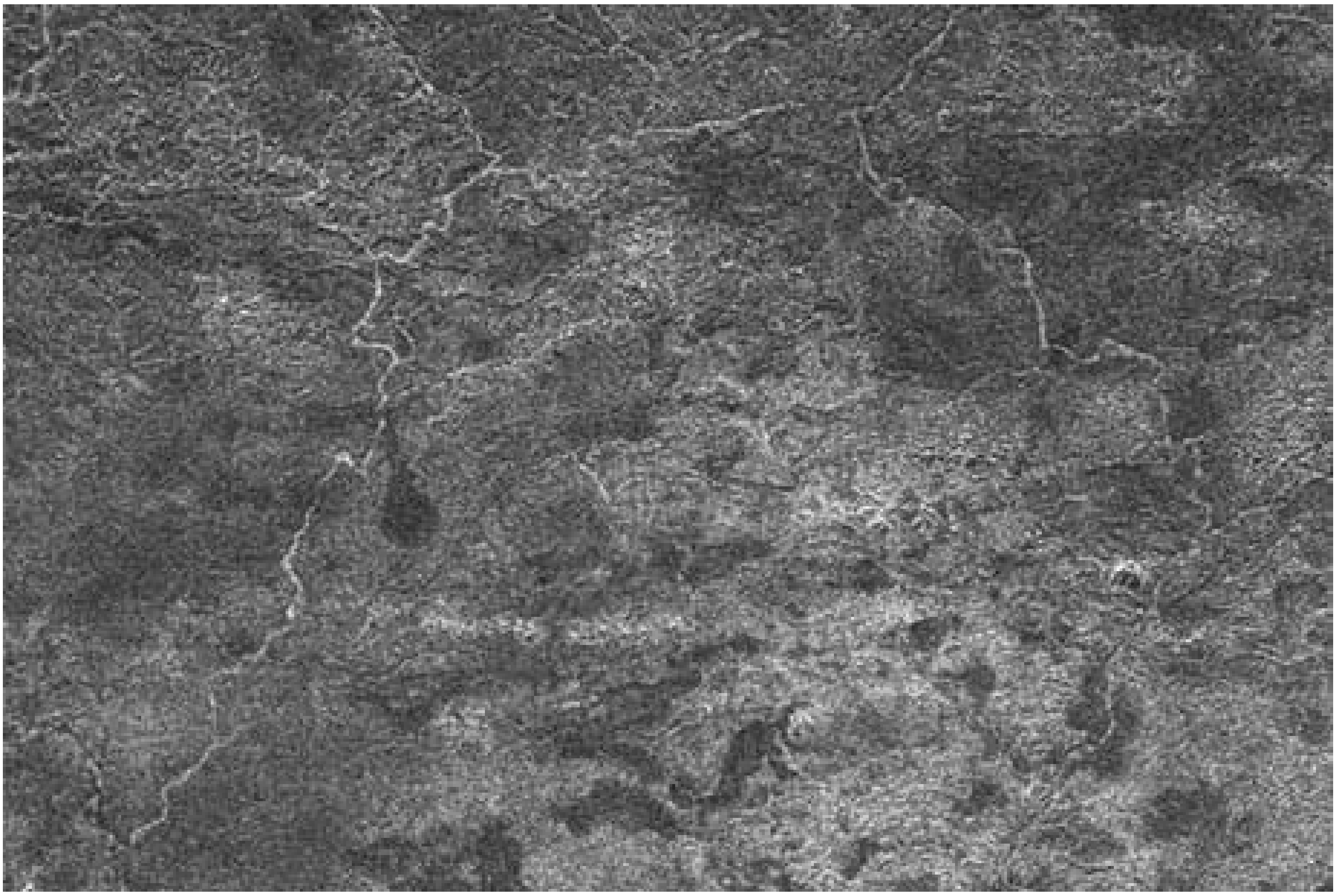
Mapping the region, called Xanadu, was one of the primary goals of the Cassini probe, now orbiting Saturn. The images were taken on an April 30 flyby that used radar to map a 4,500-kilometer-long strip of the area.

Xanadu has enticed scientists since 1994, when infrared images from the Hubble Space Telescope found a large, Australia-size bright spot on one side of Titan. The bright spot, Xanadu, is so big it covers a tenth of the moon's surface.

A radar image taken on April 30 (below) shows a network of river channels located atop Xanadu. The river channels start from the top of the image and then split to the right and left. Scientists say the region is remarkably Earthlike. "The images look much like radar images of Earth," said Jonathan Lunine, a planetary scientist from the Lunar and Planetary Laboratory at the University of Arizona in Tucson. "I'm staring at an image of Arizona on my wall, and it doesn't look a lot different."

See website:

http://news.nationalgeographic.com/news/2006/07/060721-saturn-titan.html



Big Crater Found Under Ice in Antarctica

Planetary scientists have found evidence of a meteor impact much larger and earlier than the one that killed the dinosaurs -- an impact that they believe caused the biggest mass extinction in Earth's history.

The 300-mile-wide crater lies hidden more than a mile beneath the East Antarctic Ice Sheet. And the gravity measurements that reveal its existence suggest that it could date back about 250 million years -- the time of the Permian-Triassic extinction, when almost all animal life on Earth died out.

Its size and location -- in the Wilkes Land region of East Antarctica, south of Australia -- also suggest that it could have begun the breakup of the Gondwana supercontinent by creating the tectonic rift that pushed Australia northward.

Scientists believe that the Permian-Triassic extinction paved the way for the dinosaurs to rise to prominence. The Wilkes Land crater is more than twice the size of the Chicxulub crater in the Yucatan peninsula, which marks the impact that may have ultimately killed the dinosaurs 65 million years ago. The Chicxulub meteor is thought to have been 6 miles wide, while the Wilkes Land meteor could have been up to 30 miles wide -- four or five times wider.

"This Wilkes Land impact is much bigger than the impact that killed the dinosaurs, and probably would have caused catastrophic damage at the time," said Ralph von Frese, a professor of geological sciences at Ohio State University.

Read more on website

http://www.sciencedaily.com/releases/2006/06/060601174729.htm

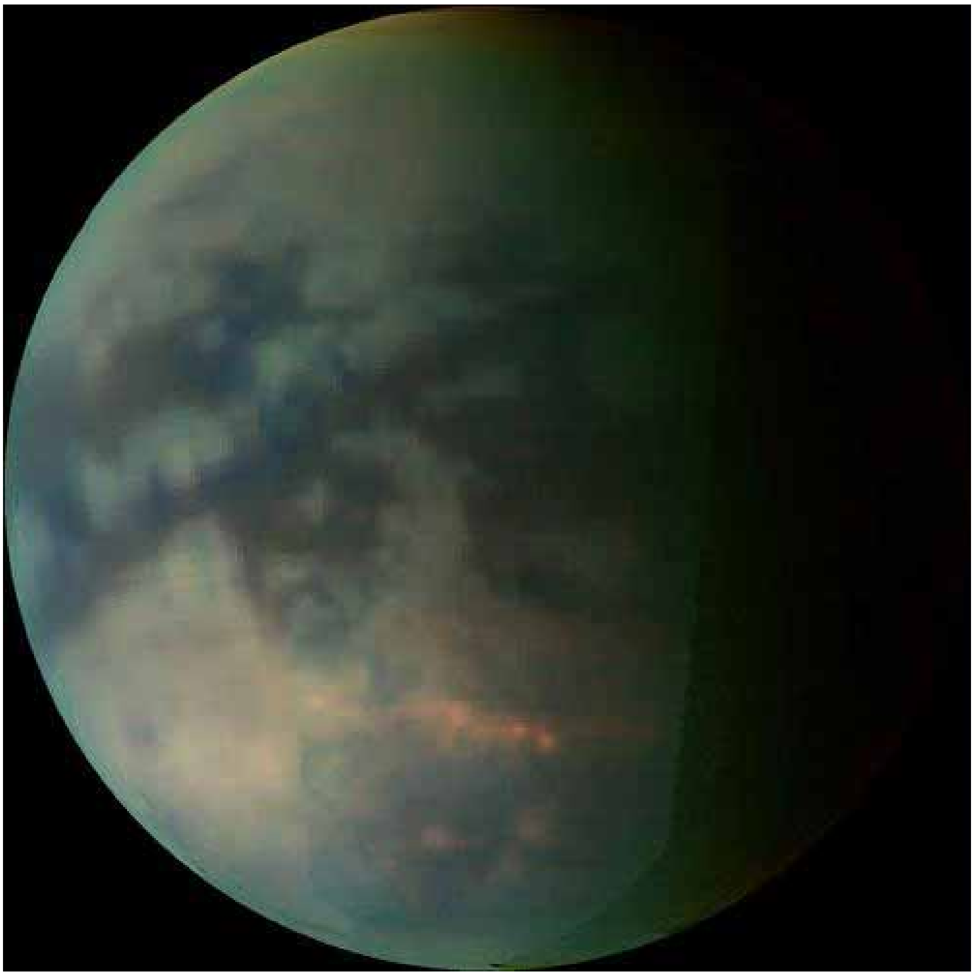
An artist’s representation of the Wilkes Land meteor striking planet Earth.

Titan from close up

This image depicts Saturn's moon Titan as seen by the visual and infrared mapping spectrometer after closest approach on a July 22, 2006, flyby by the Cassini spacecraft.It was taken at a distance of 160,000 kilometers from Titan.

For more information about the Cassini-Huygens mission:
http://saturn.jpl.nasa.gov/home/index.cfm

The visual and infrared mapping spectrometer team homepage is at:
http://wwwvims.lpl.arizona.edu.



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