The PRETORIA CENTRE
of the
Astronomical Society of Southern Africa
www.pretoria-astronomy.co.za

NEWSLETTER FEBRUARY 2006

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

Date and time	Wednesday 22 February at 19h15
Chairperson	Neville Young
Beginner's Corner	To be announced
What's Up	by Johan Smit

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

MAIN TALK

ASTEROIDS

A very interesting video about these potentially hazardous objects

The meeting will be followed by tea/coffee and biscuits as usual.
The next social/practical evening will be held on Friday 17 February at the Pretoria Centre Observatory, which is also situated at CBC. Arrive anytime from 18h30 onwards.

INSIDE THIS NEWSLETTER

Last month's meeting - by Neville Young

Mike Haslam chaired the first meeting of 2006. Mike's primary interest these days is steam locomotives and he spends most weekends working on these huge engines. See www.fotr.co.za to see what he gets up to. Always good to see you at the meetings Mike!

The meeting was very well attended with several new members and visitors.

Neville Young spent Beginner's Corner attempting to help us imagine Earth's orientation within the Milky Way. Knowing the orientation helps to understand not only where the Milky Way moves across our skies during the seasons, but also to understand why it takes the path it does. With this understanding, some of the nearby arms of the Milky Way can be recognised.

Johan Smit did his usual light-hearted yet informative What's Up. Besides giving us a good idea of what stars and planets can be seen in the forthcoming months, he almost pointed out that the Chinese New Year is celebrated on the 29th January, that it is their year 4704 and that it is the year of the dog. This lead very nicely to some stories of the dogs who blazed a trail into space.

Ham the Chimpanzee was launched into orbit on January 31 1961 aboard a Mercury Redstone 2 Rocket.

Due to calculation errors, Ham's flight subjected him to:

- An apogee of 253 Km instead of 185 km
- Speed of 9426 instead of 7081 km/hr
- Re-entry g's of 14,7 instead of 11
- Splashdown 97 km from nearest vessel
- His capsule capsized and leaked
- He had 300Kg of seawater onboard.
- He was rewarded with an apple and half an orange!

Observing Evening January 21st 2006 by Johan Smit & Michael Poll

More that 20 people came in spite of indolent clouds. Not much observing before 22h00. We did get a look at Mars through telescopes, but apart from that we were pleased even to get a glimpse of Orion's Belt with the naked eye! Many attendees drifted home, but after everyone has left Johan Smit reports that he, Hein, and about 4 more people stayed on hoping for some viewing. They spent most of the time just talking about various astronomy related subjects, but some holes appeared in the clouds, and they had some really spectacular views of Saturn in Hein's new 8" Dobsonian. They eventually left after 02h00. What started as a disappointment ended in a roaring success.

In between the cloud breaks Johan used his Foucault tester to have a look at Hein's telescope mirror and used the opportunity to try and explain the Foucault test to everyone there.

At events like this the main purpose is stargazing, and when viewing is good we hardly get a chance to talk to anyone. A bad viewing evening like this was perfect for just talking to each other and getting to know each other better.

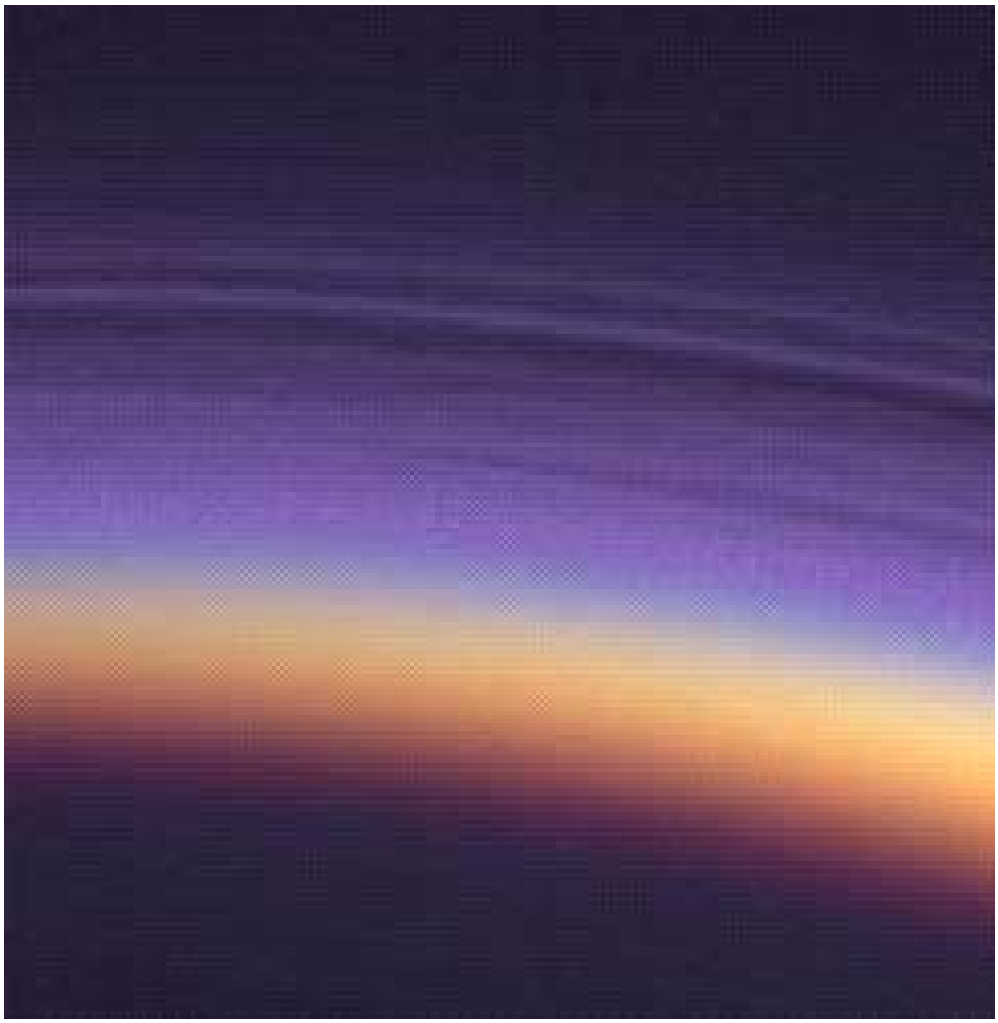
Titan’s atmosphere

Titan's atmosphere is remarkably like Earth's, but even more complex and multilayered, according to results from ESA’s Huygens probe. The lander also saw signs of lightning and found chemical clues to the source of Titan's methane, which probably bubbles up from deep inside this giant moon of Saturn.

Titan is the only satellite in the solar system to have any appreciable atmosphere. It is mainly nitrogen, like Earth’s air, but it is four times as dense as our terrestrial atmosphere. As a result, the parachute-braked descent of Huygens to the surface in January 2005 took a leisurely 2.5 hours, giving it ample time to sample the gases around it.

The atmosphere turns out to be an exotic layer-cake. It has a troposphere and stratosphere, as on Earth, divided by a boundary called a temperature inversion. But much further out – 500 kilometers above the surface and higher – Huygens’ Atmospheric Structure Instrument (HASI) detected many more such inversions, each defining its own narrow atmospheric layer.

Website: http://www.newscientistspace.com/article.ns?id=dn8395



Cassini, the Huygens probe’s mother ship, imaged the many layers of Titan's upper atmosphere in this ultraviolet image, which has been adjusted to look like true colour. (Image: NASA/JPL/SSI)

Some Cosmology by Michael Poll

What is the universe made of? It consists of energy. But… some of the energy is in the form of matter and therefore has mass*. The matter with mass is the material with which we are familiar: atoms, which together with electrons, are the basic particles of which all the tangible and visible stuff in the universe is made - the planets, the stars, the clouds of gas and the dust. The matter with mass is known as baryonic matter.

And yet… only about 5% (five percent!) of the universe is made of this familiar baryonic matter. What about the other 95%? There are two components - one is Dark Matter, which comprises about 25% of the universe, the remaining 70% is Dark Energy.

Dark Matter

Dark matter is known to exist because of its observed gravitational pull on stars, gas and galaxies. It therefore has mass (hence dark *matter* but it is non-baryonic). It consists of some type of as yet unidentified particle. Dark matter emits no electromagnetic radiation, and therefore no light.

The idea of dark matter was first conceived in 1942 by Fritz Zwicky (1898-1974). Zwicky studied the cluster of galaxies in the constellation of Coma Berenices (the "Coma Cluster"). He compared the gravitational potential energy of the cluster with the total kinetic energy (energy of movement) of the galaxies within the cluster, and found that the mass of the visible matter in the cluster was less than one tenth of the mass required to hold the cluster together. He postulated some form of unknown "dark matter" to account for the missing mass. Additional ways of measuring the mass of galaxy clusters have confirmed Zwicky's finding and proposal.

It has been shown that only 2% of the mass in a cluster of galaxies is in the form of stars. Gas *between* the galaxies (intergalactic gas) comprises 12% -14% of the cluster mass. The remaining mass is dark matter.

Dark Energy

Besides gravitational matter (ordinary baryonic matter, and dark matter), studies of galaxy clusters are confirming the existence of dark energy.

The universe is expanding, and therefore getting bigger. However, it is not the bound systems like atoms and galaxies that are expanding, nor even that the galaxies themselves are moving through space. Galaxies move apart because the space between them gets bigger - the universe gets bigger because space itself expands. Dark matter is detected indirectly because it settles into galaxies and clusters, resulting in concentrations that have an observable gravitational effect, whereas dark energy is perfectly smooth in that there are no concentrations here and there to affect how matter moves. However, dark energy does affect the expansion of the universe.

It was expected that the expansion of the universe would gradually slow down because of the gravitational pull of galaxies upon each other, but in 1998 it was shown that the expansion of the universe is accelerating. Dark energy as a repulsive force is currently the best explanation for this unexpected observation. The *rate* of expansion of the universe is expressed as the Hubble parameter H_0 (Hubble's Constant). According to Einstein's general theory of relativity the expansion rate of the universe depends on the *energy density* i.e. the amount of energy in a given volume of space. When the universe was smaller it was denser, mainly because of the concentration of baryonic matter, and most of the energy density came from this matter. The rate of acceleration at that time was faster and therefore H_0 was very high. Subsequent expansion diluted the number of particles of baryonic matter, the energy

** Energy is proportional to mass e α m. If the speed of light, c, is inserted into the equation we get the formula $e = mc^2$ - matter can be converted into energy, as happens at the center of stars.*

density of the universe became less, so the acceleration slowed down i.e. the value of H_0 became lower. Baryonic matter does not dominate any more – dark energy, although it is very feeble, now dominates the expansion of the universe. However, unlike the baryonic matter, the energy density of dark energy effectively does not change, so the universe now expands at a constant rate.

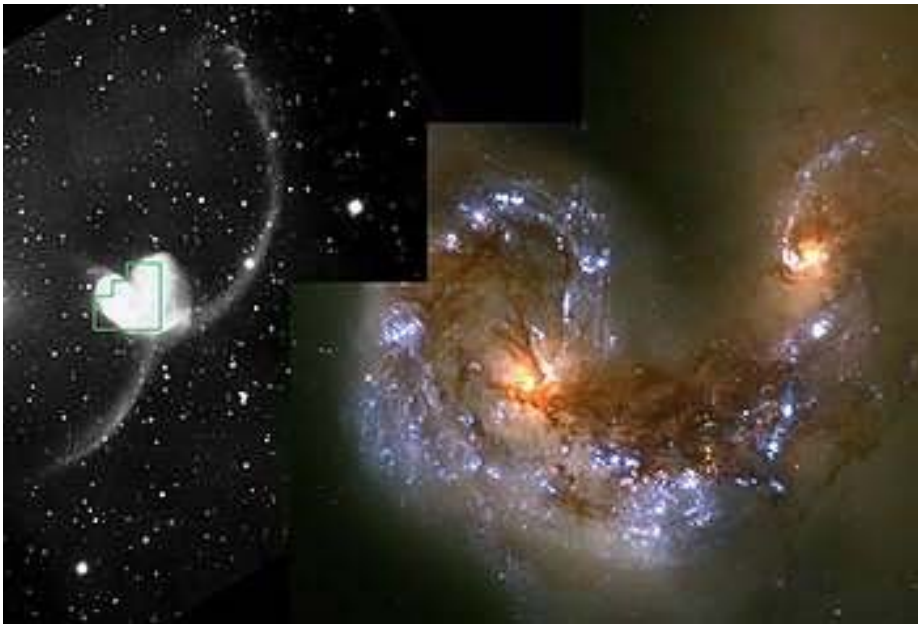
The nature of dark energy remains elusive. It is of a nearly constant density, is spread uniformly through space, and evolves very slowly, if at all. The repulsive power it imparts to each cubic centimetre of space may have changed little in the last several billion years.

Dark energy is thought to be similar to Einstein's "cosmological constant" which he originally proposed in 1917 in order to account for the universe being static. At the time of the proposal, it was thought that the universe was in a steady state i.e. it was neither expanding nor contracting. Although general relativity did not support a static universe, Einstein introduced the cosmological constant into his theory to balance the attraction of matter – there could not be a steady state if galaxies were pulling themselves together by gravity, something had to be pushing to keep them apart – so he introduced the cosmological constant. However, in 1929, Hubble showed that the universe was expanding, so in 1932 Einstein discarded the cosmological constant as not necessary, but now it seems that something similar does exist after all. As someone said – Einstein was wrong to introduce the cosmological constant, and then he was wrong to discard it! Wrong twice!

Cosmology with Galaxy Clusters Megan Donahue Sky & Telescope Dec 2004 p 32
Dark Energy and the Preposterous Universe Sean Carrol S & T Mar 2005 p 33
Cosmology in the New Millennium Wendy Freedman & Michael Turner S & T October 2003 p 30

Colliding Galaxies

The Hubble telescope has uncovered over 1,000 bright, young star clusters bursting to life in a brief, intense, brilliant "fireworks show" at the heart of a pair of colliding galaxies. The picture provides a sweeping view of the two galaxies, called the Antennae. The green shape [left] pinpoints Hubble's view. Hubble's close-up view [right] provides a detailed look at the "fireworks" at the centre of this wreck. The respective cores of the twin galaxies are the orange blobs, left and right of centre, crisscrossed by filaments of dark dust. A wide band of chaotic dust stretches between the cores of the two galaxies. The sweeping spiral-like patterns, traced by bright blue star clusters, are the result of a firestorm of star birth that was triggered by the collision.



Advertisement

Eridanus Optics CC is currently finalising an order. If you want to make use of the strong Rand to buy your telescope or other accessories, contact Andrie at 083 632 4894 or andrie@eridanusoptics.com before 17 February to ensure that your order can be processed with this consignment.

(Andrie van der Linde is a member of the Pretoria Centre.)

Observing Evening December 13th 2005 – The Moon and the Pleiades. By Michael Poll and Johan Smit.

(Star chart on next page)

The Diary for December 2005, in Sky Guide Africa South stated "December 13th 20h00: Moon occults stars in the Pleiades". Here was a celestial spectacle too good to miss, although it turned into a learning curve for some of us.

It was a nice to see the meeting so well attended - 20 or more people together with several telescopes assembled at CBC shortly after sunset. The moon was two days from full, so the Pleiades themselves could not be seen with the naked eye. With the moon not quite full, there was a thin un-illuminated rim at the preceding edge.

Early views showed that the magnitude 3.7 star Electra (17 Tauri) was to be occulted at 19h14 and this was observed. The reappearance at 20h29 was also seen. Alcyone (mag 3.0), Atlas (mag 3.8) and Pleione (5.2) seemed to be lined up for succeeding events, but the times were not listed in the Sky Guide. As the moon got closer it became evident that it was going to slide past these stars and not occult them at all from our location – you can never be sure it is going to be a "hit" unless your tables tell you!

One can hardly believe that the moon could thread its way through the cluster and miss so many stars – visual appearances would suggest that the moon is big enough in the sky to cover the whole cluster at once! However, this event serves to remind us just how small is the apparent angular diameter of the moon. The area covered by the Pleiades is four times the area of the full moon It is possible to cover the moon's diameter twice with the index finger held at arms length, and the long axis of the Southern Cross would accommodate 14 moon diameters.

In the event, Electra was the brightest star occulted from our location, the next brightest was Maia, at magnitude 3.9. Due to the social nature of the event and the amount of chatting going on, some of the occultation events were missed by some observers, but these minor disappointments were taken in good spirits.

Later we had a good look at Saturn. It was a splendid sight with the Cassini division clearly visible and the shadow of the planet on the rings. Much later in the evening Johan Smit used his Foucault tester to show the attendees what a telescope mirror looks like on a tester. Wayne's telescope was used as the test subject. This again was discussed and explained for quite some time, adding to the excitement and success of the evening.

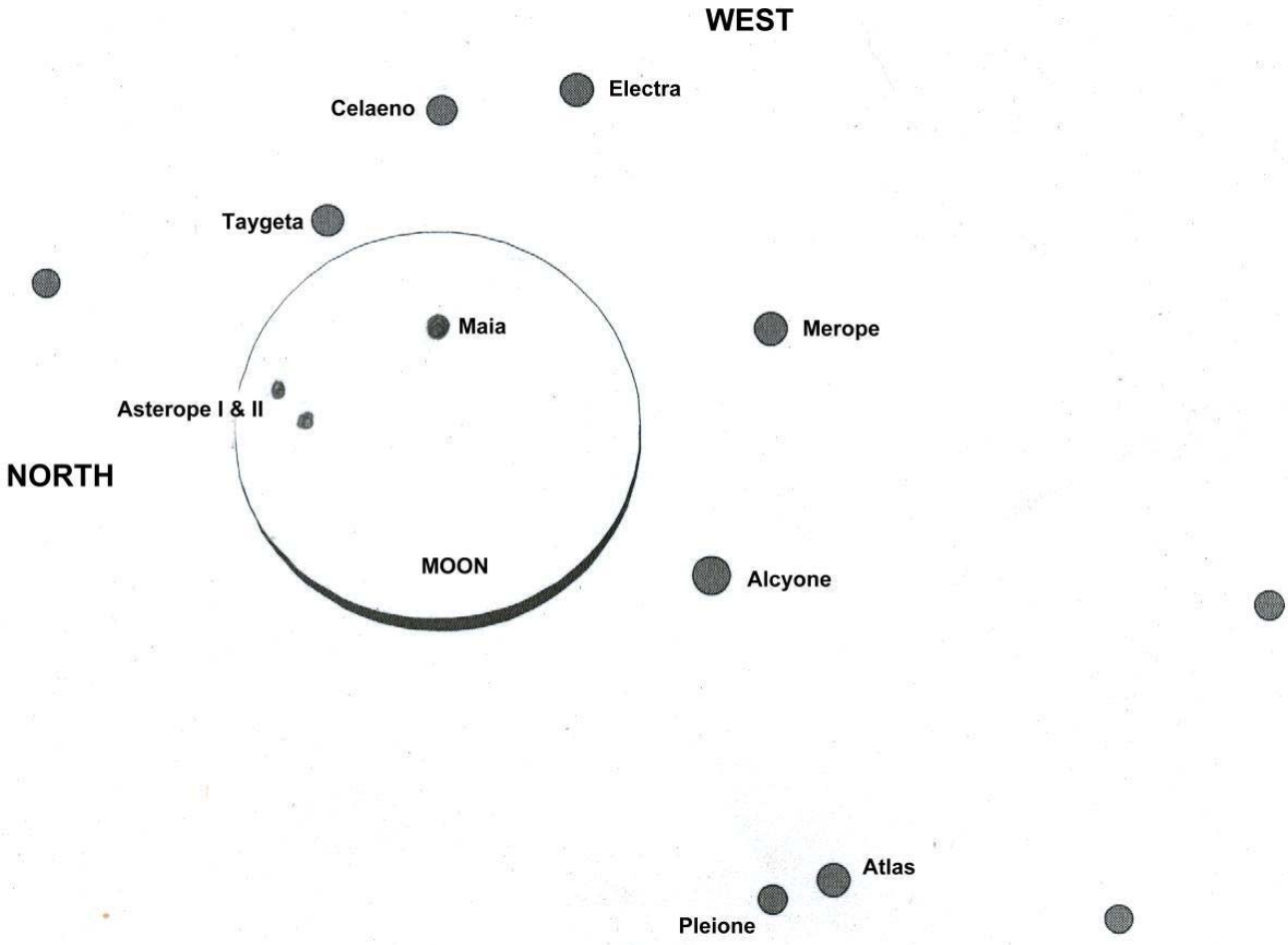
Black Hole influence

Scientists using NASA's Chandra X-ray Observatory have discovered evidence of energetic plumes of particles that extend 300,000 light years into a massive cluster of galaxies. The plumes are due to explosive venting from the vicinity of a super massive black hole, and they provide dramatic new evidence of the influence a black hole can have over intergalactic distances. In relative terms, it is as if a heat source the size of a fingernail affects the behaviour of a region the size of Earth. Website: http://www.sciencedaily.com/releases/2005/12/051202133005.htm

Low-mass extra solar planets discovered

Website addresses:
http://news.nationalgeographic.com/news/2006/01/0126_060126_newplanet.html

http://www.abc.net.au/science/news/space/SpaceRepublish_1521428.htm



Moon & Pleiades : 2005 December 13th at 21h 00 SAST

The black heart of the Milky Way

The Spitzer Space Telescope has peered through the dust at the centre of the Milky Way to capture hundreds of thousands of bustling old stars in clouds lit up by younger, massive stellar companions. The mosaic image, taken by Spitzer's infrared camera, is the deepest and sharpest view yet of an expansive stretch of the galactic centre. It reveals the galaxy's centre as a busy place, with stars packed together as they speed around the super massive black hole that lives at its heart.

NASA's Hubble Space Telescope has captured one of the most detailed astronomical images in history. The original of this Orion Nebula image is a mosaic of a billion pixels—nearly 5,000 times sharper than the 212,521-pixel version below. You can zoom in & out and pan on the original and get more information at website address:
http://hubblesite.org/newscenter/newsdesk/archive/releases/2006/01/image/a+zoom

PRETORIA CENTRE COMMITTEE

Chairman :	Neville Young 083 303 2840
Vice Chairman :	Michael Poll 012 331 1615 (h)
Secretary :	Tony Viljoen 012 654 5783 (h) 072 247 6648
Newsletter Editor :	Pierre Lourens 012 654 6366 (h) 072 207 1403
Treasurer and Membership Secretary :	Rynhardt van Rooyen 011 441 3458 (w) 083 654 1862
Centre Representative :	Michael Poll 012 331 1615 (h)
Public Relations Officer and Deputy Treasurer :	Lorna Higgs 012 333 9366 (h)
Librarian :	Wayne Mitchell 012 719 9065 (w) 072 465 7739
Curator of Instruments :	Johan Smit 083 306 1199
Member :	Peet van der Walt 0829203978
Member :	Fred Oosthuizen 072 373 2865