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

NEWSLETTER APRIL 2007

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

Date and time	Wednesday 25 April at 19h15
Chairperson	Fred Oosthuizen
Beginner's Corner	"Caustic Testing of Mirrors" by Fred Oosthuizen
What's Up	by Dirk Wolmarans

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

MAIN TALK

Cubewanos, Alindas, Atens and Centaurs*

by

Ad Sparrius

The meeting will be followed by tea/coffee and biscuits as usual.
The next social/practical evening will be held on Friday 20 April at the Pretoria Centre Observatory, which is also situated at CBC. Arrive anytime from 18h30 onwards.

*See page 5

INSIDE THIS NEWSLETTER

Last month's meeting — Michael Poll

More than 50 people attended the March meeting, which was chaired by Michael Poll.

Karl Crous presented Beginner's Corner, a talk entitled "Webcam Astrophotography". Relatively cheap cameras that enable people to see each other on the web have been found to be eminently suitable for astrophotography. The two types of camera available are CMOS and CCD, and the advantages and disadvantages of each were noted. Carl showed how the cameras can be adapted to interface with a telescope, and showed how focusing could be done - either by eyepiece projection or at the prime focus. Focusing is a critical aspect of webcam photography, and it requires much patience and testing. It is advisable to keep records of all settings used.

Next Carl detailed the software that is available to process the raw images. There are programmes for processing (e.g Registax 4.1,which is free) and then for fine tuning ("tweaking") of the images Adobe Ulead or Photoexpress can be used.
Carl showed some nice examples of his results, including comparison of his early efforts with later (better) images.

"What's up?" was presented by Tony Viljoen. Tony noted the changing times of sunrise and sunset. At this time of year the sun rises later and sets earlier with a comparatively large time difference during the month. Also at this time of year the Milky Way arches overhead from south east to north west, and Orion is setting when Scorpius rises. Comet McNaught is now circumpolar, though below naked eye visibility, and Comet Lovejoy is in Indus. Lovejoy is the first comet to be found with a survey done with a digital camera. Asteroid VV2 is a near Earth asteroid and could be found moving through Leo on March 31st.

The main topic of the evening was presented by Cor Rademeyer, and was entitled "Spectroscopy". Cor introduced the subject with a description of atomic structure and explained how absorption and emission spectra are created by electrons jumping to a higher orbital with the absorption of energy and with the release of energy as they fall back. Changes in orbitals of electrons which occur at high temperatures involve atoms and ions, and some stable molecules. Molecules can be affected at lower temperatures.

Cor described the various instruments that are used to obtain spectra, (the incoming light waves are split into the various wavelengths either with a prism or a diffraction grating, and spread out into a spectrum), and he showed some examples of spectra of single elements. There are many properties of an object that can been shown by its spectrum : chemical composition, temperature, velocities can be measured, and double stars can be identified even if they are too close together to be split optically. Stars are classified by their spectral types, and the process of stellar evolution could not have been established without spectroscopy. The composition of clouds of gas (e.g the solar corona, planetary nebulae, molecular clouds) can be established. Other uses are determining the composition of the atmospheres of the planets in the solar system and of the gases sublimed by comets.

This excellent presentation was much appreciated by all present.

Last month's observing evening — Michael Poll & Johan Smit

The sky was clear early on, but cloud crept in later. Between 10 and 20 people did get some observing done. Saturn was high in the north, and was duly scrutinised. It was well placed in a pretty star field, and in one case there was a debate as to whether one of the objects was a star or a moon. Saturn is on the border between Cancer and Leo, and nearby is Regulus, the brightest star in Leo. In the sickle of Leo is gamma Leonis, a double star which was nicely split in a 6 inch reflector. One component is slightly brighter than the other. One other nice double in the north now is Castor, (alpha Geminorum), and this was also noted.

We took a long look at a few of the southern delights with a splendid zoom eyepiece brought by Andrie. The Jewel Box (NGC 4755), the triple star alpha Crucis were particularly good. Before the clouds came in we were also able to get a look at Omega Centauri (NGC 5139)

Zeta Leporis circumstellar disk

New mid-infrared images of the Zeta Leporis circumstellar disk obtained with T-ReCS on Gemini South have for the first time revealed what researchers are calling an "exo-asteroid belt" around another star. Far from a passive dust disk, the new data show that there must be some sort of ongoing collisional activity within a few astronomical units (AU) of the star. These collisions sustain the replenishment of the small dust grains detected in the T-ReCS images. The results also lend support to the theory that the Zeta Leporis system contains a large reservoir of asteroid-sized bodies as well as the possibility of rocky planets.

Website: **http://www.gemini.edu/index.php?option=content&task=view&id=222**

An abstract as well as a preprint of the complete paper can be found at website **http://arxiv.org/abs/astro-ph/0612550**

Left: Artist's conception of an asteroid belt around Zeta Leporis. Collisions between such bodies are likely the source of the small dust grains detected by T-ReCS.

Telescopes for sale

TELESCOPE S.A is receiving an exciting new range of GOTO telescopes as well as upgrade kits for existing EQ3 and EQ5 tripods. We are also approved agents for Celestron and stock the new Celestron "SKY SCOUT".

Place your orders now and be ready for the winter sky! Contact Wayne Mitchell, librarian, 072 465 7739 or visit our website:

www.telescopesa.za.org

Jack Bennett Award 2006 – 2007 : Preliminary Notice

The Jack Bennett Award is given annually to the person considered to have done the most for the Pretoria Centre of ASSA and / or Astronomy in the past year.

A form will be circulated in the May 2007 newsletter inviting nominations for the 2006 – 2007 Award. Details of where to submit the nominations and the closing date will be noted on the form.

Scope-X

Download pamphlets in Afrikaans or English with date, time & venue of Scope-X in Johannesburg on 21 April 2007 from websites

http://assa.saao.ac.za/resource/scopex-2007-afr.pdf

http://assa.saao.ac.za/resource/scopex-2007-eng.pdf

Solar Atmosphere Anatomy—by Michael Poll

The visible "surface" of the sun's disc is called the **photosphere.** It is a glowing gas about 500 km thick that marks the tops of currents of hot opaque gas rising from the interior. At the photosphere the gas becomes transparent, allowing light to escape into space.

Active regions of the photosphere – Compared with the earth's magnetic field, which is like a single bar magnet (a magnetic dipole), the sun's magnetic field is made up of numerous such dipoles ("multiple bar magnets") each forming an active region. The active regions emerge from deep within the solar interior and break through the photosphere at unpredictable locations, often forming sunspots where they emerge.

The sun's atmosphere has two distinct components – the Chromosphere and the Corona.

The **Chromosphere** is the lower component. It is about 4000 km thick, has a temperature of about 10 000℃ and shines with the reddish light of hydrogen atoms. It can be seen just above the moon's limb during a total eclipse.

The **Corona** is the grandest part of the sun's atmosphere that is seen during a total eclipse. The corona cannot be seen normally because the photosphere outshines it - it is only about 1 000 000th as bright as the sun and even less bright than the full moon. The corona is as faint as it is because it is an extremely rarefied gas - even its thickest part at the base is billions of times less dense than the earth's atmosphere at sea level – so that much of the light we see during totality is not from the corona but light from the photosphere, which has been scattered towards us by free electrons in the corona. Nevertheless the corona occupies a huge volume of space, and is extremely dynamic. The temperature is in the order of millions of degrees, and it shows structural changes on a time scale of hours. The structure is frequently rocked by explosions that throw material into interplanetary space in the form of the solar wind, which is a stream of electrons, protons, and partially ionised atoms that emanates from deep within the corona and extends past the planets to the heliopause.

Plasma : The gas in the corona is what is called a plasma, which is an electrically conducting gas created when atomic nuclei at high temperatures have been almost entirely stripped of their electrons. The charged particles in the plasma are easily deflected by magnetic fields, and because the gas is so rarefied, the shape of the corona is determined by magnetism rather than gravity, and the corona is at its hottest and brightest where the magnetic fields are strongest.
The source of energy that heats the corona to such an extreme temperature has not been precisely determined. Large numbers of small scale explosions contribute, which occur when strong winds are created as coronal gases adjust to the field lines. However, observations by the SOHO and TRACE satellites suggest that the corona is heated primarily by electric currents generated in convective bubbles below the photosphere. The currents course through coronal loops.

Coronal loops are thin bright strands, embedded in the photosphere, but which arch into the corona. The embedded ends connect two photospheric regions with opposite polarities. Hot coronal gases are trapped in the magnetic field lines of the loops, and can therefore only flow from one end of the loop to the other, losing energy in the form of X- rays or extreme ultra violet (EUV) light. The loops are seen as prominences during totality.

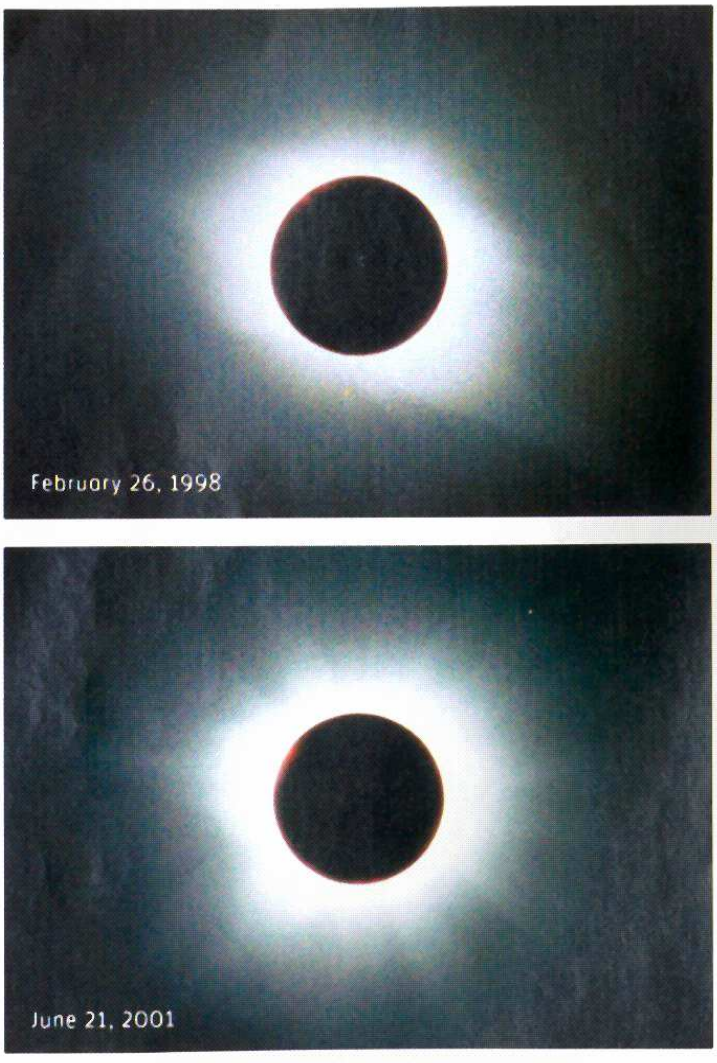
Solar flares are giant explosions that can outshine the entire X ray corona by a factor of 1000. They occur when the immense current flowing through the coronal loops becomes unstable. The largest flares generally occur in regions where new, twisted, magnetic field lines ("new loops") are emerging from below the photosphere. Most of the flare's energy goes into generating large numbers of ions and electrons, which are accelerated to a large fraction of the speed of light. These charged particles move rapidly away from the flare initiation sites, and hit the upper layers of the chromosphere, forming bright ribbons visible in hydrogen alpha and UV light. Their kinetic energy is transformed into heat, and the heated chromospheric matter evaporates into the corona, where it can increase the gas density in a loop by a thousandfold. Since dense gas radiates more efficiently than rarefied gas, the heat is quickly lost into space in the form of bright X ray radiation. This radiation from flares can affect earth – it puffs out the outer layers (ionosphere) of the atmosphere, affecting long range communications, and increasing drag on satellites in low earth orbit.

Streamers – hot coronal gases above an active region of the photosphere are permeated by waves of energy that exert pressure on the magnetic fields in the coronal loops. Generally the field lines in the loops are strong enough to resist this pressure, and the coronal gases remain trapped within the closed

loops. However, if the field is weak it can be dragged into interplanetary space. The parts of the field that manage to remain unbroken become stretched like toffee into the shapes we see as streamers in the corona during a total eclipse. They extend radially outwards from the sun, and their pattern depends on how magnetic the sun is at the time. When there is low magnetic activity, and few sunspots, the streamers are relatively featureless and extend on opposite sides of sun's equatorial belt, whereas during sunspot maximum they extend all around the sun.

Coronal mass ejections – a few times a day the pressure of the waves in the hot coronal gases cause the magnetic field lines in the coronal loops to snap open above as much as 10% of the upper corona, causing an "eruption" known as a coronal mass ejection (CME). The CME propels perhaps as much as a billion tons (hence the "coronal mass"!) of charged particles into interplanetary space, and the open ended magnetic field lines may direct them towards the earth. During the initial eruption some particles are accelerated to near light speeds. However most of the matter ejected travels at about 500 km per second. Although relatively sluggish, this matter can carry plasma and magnetic field lines past the earth, causing damage to power installations, and damage to satellites.

References : Carolus J Schrijver. "The Science Behind the Solar Corona." Sky & Telescope April 2006 p 28
Heather Couper & Nigel Henbest. "Encyclopaedia of Space." Dorling Kindersley Books.



Above: Each of these photographs by eclipse aficionado Fred Espenak is a 2-second exposure on Kodak Royal Gold 100 film with a 90-mm refractor at f/8. The February 26, 1998, view reflects the corona's typical appearance during solar minimum, when sunspots are few or absent: the longest streamers extend along an axis defined by the Sun's equator. By contrast, the June 21, 2001, view typifies the solar maximum corona, with streamers radiating in all directions.

This month's main topic

The talk will be about the broad field of new developments in asteroids, especially the new discovery of Trans-Neptunian Objects (Kuiper Belt Objects), including the re-classification of Pluto as a dwarf planet, as well as some of the strange asteroid families from the main asteroid belt.

Nylsvley excursions

All excursions to Nylsvley have been postponed until further notice due to renovations being done to the dormitory there.

Earth at night

Rosetta

Recently, ESA's Rosetta spacecraft had a first look at asteroid 21-Lutetia, one of the targets of its long mission. The onboard camera OSIRIS imaged the asteroid passing through its field of view during the spacecraft's gradual approach to Mars. The planet was reached on 25 February 2007 for the mission's next gravity assist.

During its long trek to final destination (comet 67P Churyumov-Gerasimenko), Rosetta is planned to study two asteroids—2867-Steins and 21-Lutetia, both lying in the asteroid belt between the orbits of Mars and Jupiter. Asteroids, as well as comets, carry important information about the origin of the Solar System - a better understanding of which is one of the primary goals of Rosetta.

The image below left shows Mars and the Milky Way as seen by Rosetta.

Read more on website **http://www.esa.int/esaSC/SEMNRESMTWE_index_0.html**

Below: An artist's representation of an exoplanet orbiting its parent star.

An Atmosphere around an Exoplanet?

NASA's Spitzer Space Telescope has captured for the first time enough light from planets outside our solar system, known as exoplanets, to identify molecules in their atmospheres. It was done using spectrum analysis. This surprise achievement is a significant step toward being able to detect possible life on rocky exoplanets in the future and comes years before astronomers had anticipated. So far, most exoplanets found are similar to the gas giant Jupiter, but dubbed "hot Jupiters" as they orbit very close to their parent stars.

The data indicate the two planets studied are drier and cloudier than predicted. Theorists thought "hot Jupiters" would have lots of water in their atmospheres, but surprisingly none was found around HD 209458b and HD 189733b. According to astronomers, the water might be present but buried under a thick blanket of high, waterless clouds.

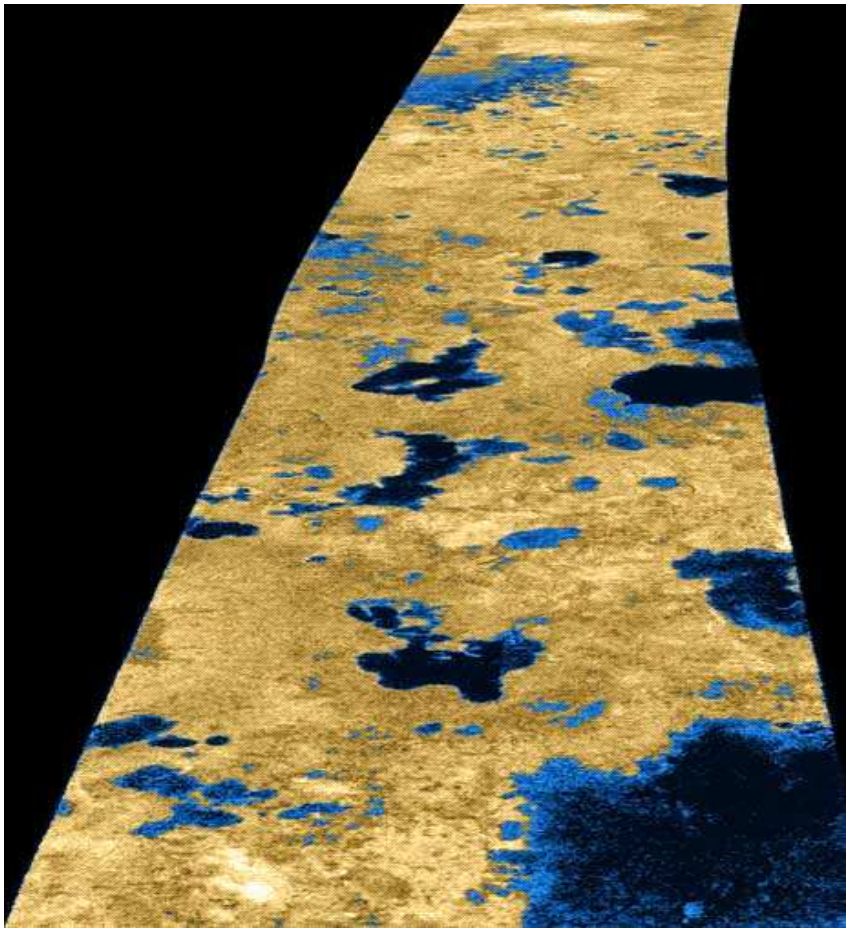
Website for article: **http://www.spitzer.caltech.edu/Media/releases/ssc2007-04/release.shtml**

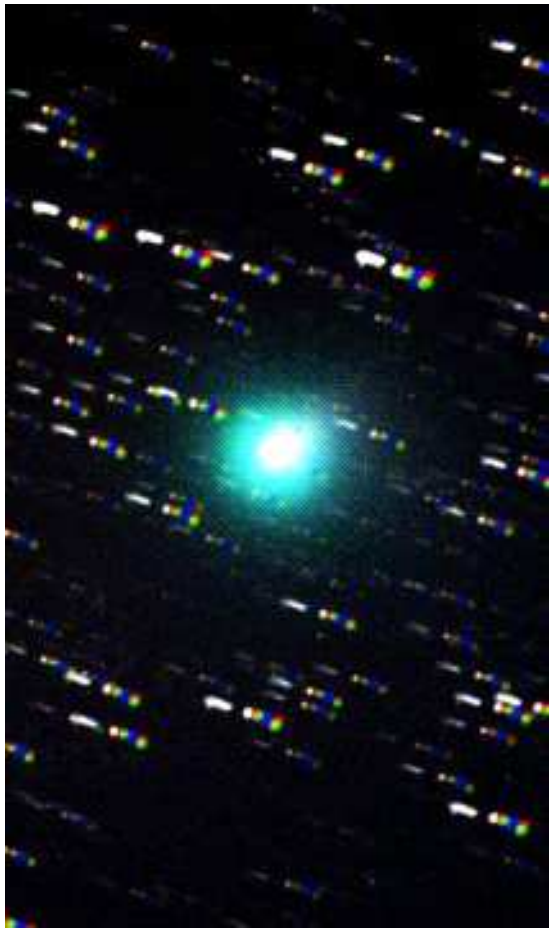
Website for Spitzer Space Telescope: **http://www.spitzer.caltech.edu/spitzer/index.shtml**

Titan

Radar-imaging data from the Cassini spacecraft has revealed that Saturn's giant moon Titan likely has lakes of methane on its surface, indicated by the darker colouring in the image below left. What's more, the flyby also provided evidence that Titan has a hydrological cycle remarkably similar to that of Earth's, though with methane as the key component, not water.

Website: **http://news.nationalgeographic.com/news/2007/01/070105-saturn-titan.html**





Comet Lovejoy

On March 15th, Terry Lovejoy of Thornlands, Australia, discovered a new comet (C/2007 E2) in the southern constellation Indus. Remarkably, to make the find he used not a telescope but just an off-the-shelf digital camera - a Canon 350 D. The photo at top right was taken through a 0.41-m (16") reflector.

The new comet is green and shines like a 9th magnitude star, too dim for the unaided eye but an easy target for large backyard telescopes in the southern hemisphere.

Comet Lovejoy's orbit is cockeyed, almost perpendicular to the plane of the solar system. At the moment the comet is swooping up from below this plane, moving from southern to northern skies. At closest approach to Earth (0.44 AU) in late April, Comet Lovejoy is expected to brighten to 7th magnitude, still not a naked-eye comet but easy to see through small telescopes.

Web links: Go to website **http://spaceweather.com** then go to newsletter for 20 March 2007.

Image of light pollution in South Africa

View an image of light pollution in South Africa compiled from NASA pictures and GPS software by Mauritz Geyser, one of our committee members. See website

http://assa.saao.ac.za/assets/buttons/darkskies_All_SA_Night_Sky.jpg

Space Shuttle launch seen from ISS

The Space Shuttle launch on 9 September 2006 as seen from the International Space Station.

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