



The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER MARCH 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 27 March at 19h15.

Programme:

- **Beginner's Corner:** "The international space station. Living and working in space." Recorded interview with a space station commander.
- **What's Up?** by Johan Smit.
- 10 minute break — library will be open.
- **Main talk: Curiosity Mars rover. Recorded Von Karmann lecture by NASA and JPL.**
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Pat Kühn.



Next observing evening

★ Friday 22 March 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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Report of observing evening on Friday 22 February 2013
by Michael Poll

At last, a clear cloudless evening for our observing. There were up to 10 telescopes and perhaps 20 – 30 people. We spread out in the avenue by the dome, and some moved on to the higher field behind the dome and pavilion. This spreading out was in order to avoid the tower lights at the N1 N4 interchange, but in the event the lights were not on! Perhaps someone read our last month's observing report!

In spite of the clear sky, there was a 12 day old moon in the north east, which hampered observing. We looked at the moon, noting amongst others, the craters Copernicus, Aristarchus, Tycho, and Plato. Not much detail was visible because of the high sun angle and consequent short shadows, but we did notice the central peak in Tycho. This was pointed out to some visitors as evidence of impact, and they put two and two together with reference to the Vredefort Dome.

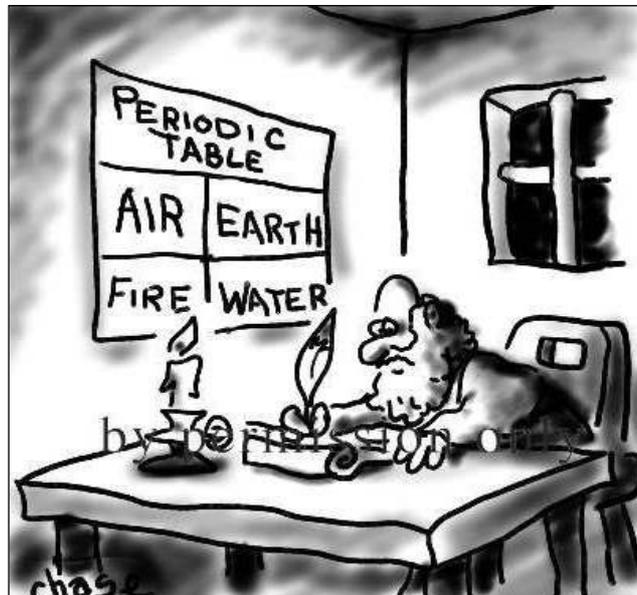
Jupiter had three satellites on show, and there was a sprinkling of background stars in the field which added value to the scene. The stars were about as bright as the satellites,.

Some visitors were introduced to the Sky Map star charts, and we did a naked eye tour of the sky, noting Orion and its retinue, and also noted were the crosses – the False Cross, the Diamond Cross, and the Southern Cross which was just rising above the trees to the south. Visitors were shown IC 2602, (the "Southern Pleiades"), which include and surround Theta Carinae in the Diamond Cross. A bit later on we were able to see Alpha and Beta Centauri when they rose above the trees. We also noted Achernar in the south west, looking very isolated as there were no other bright stars near.

Michael has for "ages" been meaning to pin down the three Messier objects M36, M37 and M38 in Auriga. The constellation was at its highest on this evening, Michael did find one of them, presumed to be M36, but the identification needs to be confirmed in the absence of moonlight. Ω

A note about our chairman

Our chairman, Bosman Olivier, is lying in Unitas Hospital in Centurion with a broken hip and a broken wrist. We wish him a speedy recovery. Members can wish him well on his cell phone at 082 883 1869.



Basics: The interplanetary medium - by Pierre Lourens

There is not just vacuum in interplanetary space. The interplanetary medium is the material which fills the solar system. Through it move all the larger solar system bodies, such as planets, their moons, asteroids, and comets.

First, there are **dust particles** orbiting the Sun. Their sizes range from 0.5 to 50 microns. Their general motion is in the same sense as the movement of the planets around the Sun. The dust particles are thought to originate from different sources:

- Dust is swept up from interstellar space as the Sun and its retinue of orbiting bodies orbit around the centre of the Galaxy.
- When a comet comes near the Sun, frozen gas on its surface, with dust particles frozen into it, sublimates and the comet releases a dust trail.
- Very occasionally, asteroids collide and are pulverized, thus forming new dust.

The main constituents of the Sun are hydrogen and helium. At the high temperatures in the Sun, the atoms of these two elements are completely ionized, i.e. the electrons are stripped from the atomic nuclei. What results is a plasma, in this case a mixture of hydrogen nuclei (protons), helium nuclei (alpha particles) and free electrons. There is a perpetual (but not constant) flow of this plasma away from the Sun. This is termed **the solar wind**. (Extremely small amounts of neutral (non-ionized) hydrogen atoms have also been detected in the solar wind throughout much of interplanetary space.)

Cosmic rays are also found in the solar system. They are very high-energy particles, mainly originating outside it. They may produce showers of secondary particles that penetrate and impact Earth's atmosphere and sometimes even surface. They are comprised primarily of high-energy protons and atomic nuclei. A lot of research has been done about them.

Electromagnetic radiation, which is mainly in the visible region, also streams perpetually from the Sun out into interplanetary space.

The Sun has a **magnetic field** that permeates interplanetary space. The Sun rotates with a period of about 27 days and the magnetic field also rotates with it.

The subject is actually complicated. The radiation from the Sun exerts radiation pressure on the solar wind and the dust particles in interplanetary space. The solar wind, in turn, exerts pressure on dust particles. (The dust particles that formed from the same nebula at the same time as the planets and the Sun, are long gone, blown out of the solar system by the solar wind and radiation pressure.) Magnetohydrodynamics (MHD) entails the dynamics of an electrically conducting fluid in a magnetic field. MHD is used to describe the dynamics of the solar wind in the interplanetary magnetic field. It is also thought that some of the dust particles are charged. Because they move relative to the interplanetary magnetic field, it exerts forces on them also. Ω

What's up in March & April

Some sources of information on what there is to observe are:

- <http://www.skyandtelescope.com/observing/ataglance>
- <http://www.heavens-above.com/>
- <http://skymaps.com/>
- <http://spaceweather.com/>
- <http://spaceweather.co.za/>
- <http://www.sao.ac.za/public-info/sun-moon-stars/>
- <http://www2.jpl.nasa.gov/calendar/>
- Sky Guide Africa South 2013.

Chairman's report of meeting held on 27 February 2013 by Pierre Lourens

The evening was started off by Percy Jacobs, who gave us a presentation on observational astronomy in "**Beginner's Corner**". He talked about optical astronomy, i.e., observations in the visible region with wavelengths between 400 and 700 nanometres.

1. He first talked about **observing methods**. These are:

- Wandering around the sky.
- A quick look to learn the sky.
- Planned observing session.
- Searching for something specific.

2. He then talked about **observing types**. These are:

- Unaided eye observing.
- Binocular observing.
- Telescope observing.
- Astro imaging.

3. Next was **observing conditions**. Things of importance here are:

- Cloud cover.
- Transparency.
- Seeing.
- Darkness.
- Wind.
- Humidity.
- Temperature.

4. Then he talked about **basic observing etiquette**. This can be summarized as:

- Come prepared.
- Be polite.
- Be considerate.
- No white light – only very dim red light.
- No load noise.

5. He then explained **what to fill in on the "Observing Log Sheet"**. This can be found in the newsletter for October 2011, page 7.

6. He then stressed that **observing is a skill**.

7. He discussed **averted vision**.

8. He discussed **night vision**.

9. Next was **eye placement at the telescope**.

10. **Perceptual blindness** was then discussed.

11. **Relaxation when observing** was next.

12. Finally, he said that **the factors of time and patience** are important in observing.

"**What's Up?**" was also presented by him. He highlighted the various objects to be on the lookout for during the month of March. He discussed the phases of the moon, the planets, the comets and the constellations to watch during March.

The main talk of the evening was presented by Tim Cooper, a well-known figure in astronomy circles in South Africa. It was titled "**A few comets to observe, and how to observe them**".

He first discussed the origins and composition of comets. He showed images of the cocoons of dust that surround nascent stars in the Orion nebula. In these cocoons grow planets, asteroids and comet nuclei. He showed diagrams of the disk-shaped Kuiper belt with its estimated 200 million comet nuclei, and of the roughly spherical Oort cloud much further out, containing estimated billions of comet nuclei. He showed actual photographs of two comet nuclei taken from spacecraft. They showed oblong bodies with streaks of light coming from them. He mentioned the dirty snowball theory of comet nuclei: they are composed of rock, dust, water ice,

frozen gases and a soup of organic compounds. The complete inventory of the gases and organic compounds in comet Hale-Bopp is a very long list.

He then discussed comet orbits. There are six orbital elements that specify a comet's orbit completely. The values of these elements become more accurately known as more observations over a larger part of its orbit are made and used in calculating them. These elements can be used to calculate where the comet will be at a certain time for observing it. Comets to focus on at present are: C/2012 F6 Lemmon; C/2011 L4 PanSTARRS; C/201 S1 ISON. All three of them have eccentricity ϵ (one of the orbital elements) ≈ 1 , which means their orbits are near parabolic. The planes of their orbits are also highly inclined. These two features of their orbits mean that they originate from the Oort cloud.

He then discussed how to observe comets visually and do scientific work about them. He showed graphs of the brightness of comets as function of date as they move near the Sun. It changes as different frozen gases on its surface sublimate as its distance to the Sun changes. He also gave a formula for the brightness of comets as function of distance from the Sun. The brightness increases as it approaches the Sun and decreases as it recedes from the Sun. Brightness estimations of observed comets are made using the "step method of Argelander." The degree of condensation of the image of a comet is graded on a scale of 1 to 9. 0 means no sign of condensation at all. 1 means slight condensation. 9 means the highest degree of condensation: a sharp, star-like disk. He showed images to illustrate the different degrees of condensation. These can be found by comparing the image with one of a list of standard objects. The length of the tail and the angle of orientation of the tail should be measured. The latter should be measured at the comet nucleus, as it changes while the comet moves. He discussed some of the colours seen in comets.

He then gave us some observational details and paths of the abovementioned three comets. (These details can be found on the Internet, so I won't write about these here.)

It was a very informative talk. It is a pleasure to listen to a talk by someone who knows what he is talking about!

We ended the evening as usual over tea, coffee and cookies, for which we have to thank Michael Poll. He is the one who ensures that it is always available at the end of our monthly meetings.



Meteor flash over Chelyabinsk in Russia. See article on next page.

Asteroid 2012 DA14 and the meteorite explosion over Russia by Neville Young

Asteroid 2012 DA14 has passed us by. I drove to find a good south-eastern horizon on Friday night 14 February, then waited an hour in the hopes that the clouds would clear - which they did not. So I got home in time to watch the asteroid on a NASA video link. Quite coincidentally, about 15 hours before the closest approach of DA14, a meteorite exploded 20 km up in the atmosphere over Russia. Yes, it is coincidentally, because the trajectory roughly determined for the meteorite was nowhere near that of DA14.

- <http://www.skyandtelescope.com/community/skyblog/newsblog/Meteorite-Explodes-Over-Russia-191379871.html>
- Plenty of videos to be found at: <http://say26.com/meteorite-in-russia-all-videos-in-one-place>
- http://www.esa.int/Our_Activities/Operations/Russia_asteroid_impact_ESA_update_and_assessment

The Russian meteorite emphasises more and more how Earthlings are becoming Spacelings. We are more aware of the far side of our fragile atmosphere than ever before. We have identified many tiny but potentially dangerous rocky neighbours, have started to think how we may possibly deflect them and are able to understand the nature and origins of most unannounced gate-crashers from space.

This meteorite over Russia was the first celestial event of this magnitude since the digital camera came of age. The previous event of similar significance was the Tunguska impact in 1908 when there were few film cameras, no digital cameras and almost no humans in the locality to wonder what had hit them.

I have combined a number of video clips into one video showing the smoke trail, the brilliant flash of light, the intense sound of the shock wave, the shattering of window panes, the panic-stricken screams of school children and office workers being thrown to the floor from the force of the blast.

Acknowledgements and thanks go to those who were lucky enough to witness the sensational event, for having the presence of mind to capture the visuals and for sharing them with their fellow Earthlings. The video can be viewed at <http://youtu.be/EOUNUlblado>.

See also:

- “**Feature of the month: Asteroid 2012 LZ1**” in the newsletter for July 2012, page 2.
- “**Comment on asteroid 4179 Toutatis**” in the newsletter for October 2004, pp. 4 & 5.
- “**Feature of the month: Asteroid Apophis**” in the newsletter for July 2011, p. 7.

Ω

Right: An artist's depiction of a large asteroid striking Earth. The question is not IF this will happen, but WHEN this will happen.



Noteworthy items

Solar system

- **Images of the solar system.** Collected here are 32 recent images gathered from around our solar system, at scales ranging from mere centimeters to millions of kilometers.
http://www.boston.com/bigpicture/2010/09/around_the_solar_system.html
- **Image of the Ganges delta.** Largest delta and largest mangrove forest on planet Earth as seen from a satellite.
http://www.esa.int/Our_Activities/Observing_the_Earth/Highlights/An_awesome_wave
- **Image made by spacecraft Rosetta of asteroid Stein.**
http://www.esa.int/Our_Activities/Space_Science/Asteroid_Steins_hidden_gems
- **ESA chooses instruments for JUICE.** The **JU**piter **IC**y moons **E**xplorer mission (**JUICE**) will carry a total of 11 scientific experiments to study the gas giant planet and its large ocean-bearing moons.
http://www.esa.int/Our_Activities/Space_Science/ESA_chooses_instruments_for_its_Jupiter_icy_moons_explorer
- **Asteroid 2012 DA14 passes Earth.** See a video clip of it as it zipped past Earth on 15 February in front of background stars.
<http://apod.nasa.gov/apod/ap130217.html>

Computers in astronomy

- **A supercomputer fit to dominate the cosmos.** Say hello to the correlator (i.e. computer) for the Atacama Large Millimeter/Submillimeter Array (ALMA).
<http://news.discovery.com/space/astronomy/a-supercomputer-comes-to-life-in-chile-130117.htm#mkcpgn=emnws1>

Exoplanets

- **NASA's Kepler mission discovers tiny planet system.** The first exoplanets found to orbit a normal star were giants. As observing technologies have advanced, smaller and smaller planets have been found, like these ones.
http://www.nasa.gov/home/hqnews/2013/feb/HQ_13-057_Kepler_Tiny_Planet.html

Our Galaxy

- **Stellar motions in outer halo shed new light on Milky Way evolution.** Peering deep into the vast stellar halo that envelops our Milky Way galaxy, astronomers using NASA's Hubble Space Telescope have uncovered tantalizing evidence for the existence of a shell of stars that are a relic of cannibalism by our Milky Way.
<http://hubblesite.org/newscenter/archive/releases/2013/07/full/>
- **NASA's Chandra suggests rare explosion created our Galaxy's youngest black hole.** New data from NASA's Chandra X-ray Observatory suggest a highly distorted supernova remnant may contain the most recent black hole formed in the Milky Way galaxy. The remnant appears to be the product of a rare explosion in which matter is ejected at high speeds along the poles of a rotating star.
http://www.nasa.gov/home/hqnews/2013/feb/HQ_13_045_Chandra_Black_Hole.html

Extragalactic astronomy

- **Speedy black hole holds galaxy's history.** A rapidly rotating supermassive black hole has been found in the heart of a spiral galaxy by ESA's XMM-Newton and NASA's NuSTAR space observatories, opening a new window into how galaxies grow.
http://www.esa.int/Our_Activities/Space_Science/Speedy_black_hole_holds_galaxy_s_history
- **NASA'S NuSTAR helps solve riddle of black hole spin.** Two X-ray space observatories have teamed up to measure definitively, for the first time, the spin rate of a black hole with a mass 2 million times that of our Sun.
http://www.nasa.gov/home/hqnews/2013/feb/HQ_13-063_NuSTAR_Black_Hole_Spin.html

Comet Lemmon near the South Celestial Pole



Feature of the month: Citizen Science - discover something

An invitation from HubbleSite: Do you want to contribute to the study of the cosmos, but don't have an astronomy degree or even a telescope? Well, we've got a solution for you. Use your free time and your computer to analyze real data from the Hubble Space Telescope and other space telescopes. Visit our new **citizen science portal** to find active astronomy projects that you can get involved in today. http://hubblesite.org/explore_astronomy/citizen_science/

Pretoria Centre committee

Chairman	Bosman Olivier	082 883 1869
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Newsletter Editor	Pierre Lourens	072 207 1403
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Assistant Treasurer	Michelle Ferreira	073 173 0168
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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
Member	Michael Poll	074 473 4785

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.