“The Southern Cross”

HERMANUS ASTRONOMY CENTRE NEWSLETTER
AUGUST 2010

Welcome to this month’s newsletter, and also to new members Barbara and Rodney Henwood, and Sheraine and Frances van Wyk (9 year old Frances is our youngest member). We hope you enjoy the newsletter, and the attached conversation about the meteorite sighting over Hermanus, and articles on the Hayabusa space probe and space weather, the latter related to the items in the ‘Astronomy news’ section.

The next Beginners Astronomy meeting will be held on Monday 9 August from 7.00 pm at the Hermanus Magnetic Observatory. A new 3-part format, looking at different topics, is being adopted. This will take place across 3 consecutive meetings, the first set as follows:

- Part 1 Mon 9 August – ‘The Solar System’,
- Part 2 Mon 11 October - ‘The Life & Death of Stars’, and
- Part 3 Mon 13 December – ‘Milky Way, other galaxies & the universe’.

The remainder of each evening will be taken up by stargazing (weather permitting). Attendance is free for Centre members, while, for non-members, the entrance fee will be R20 per person or R50 for all three evenings. If you wish to come along, please contact John Saunders - 028 314 0543 e-mail shearwater@hermanus.co.za by the Friday before each meeting.

A list of the named stars contains a large number starting with the letter ‘A’. Within the As, many start with ‘Al…’, illustrating how many of the stars have Arabic names. One is Altair, visible, at present, in the north-east in the Aquila (the Eagle). The constellation looks like a bird, with its rhomboid shaped open wings and long neck. Altair, the brightest star in Aquila (Alpha

Aquliae) can be seen near the rear end of the 'bird'. Altair's name, appropriately, means 'the flying one'. 16.8 light years away, it is the 12^{th} brightest star in the night sky. Its most notable physical characteristic is its very high speed of rotation (9 hrs versus the Sun's 25 days).

LAST MONTH'S CENTRE MEETING

In a fascinating presentation, Ed Foster took an unusual approach to illustrating the massive size of the universe and the enormous times taken for light from both far and, apparently, near to reach us. He mapped the time at which light left different galaxies or stars against geological and palaeontological events on Earth, starting with 2.1 billion years ago when the Vredefort dome is calculated to have been created, probably by a large asteroid. Focusing on South Africa, he worked his way through events in Earth's geological history, finishing at 4.3 years ago, when the light we see today from 'nearby' Alpha Centauri (one of the Pointers) first left the star.

MONTHLY CENTRE EVENINGS 2010

These take place at 7 pm at the **Hermanus Magnetic Observatory.**

12 August	'Tracking satellites and astronomical objects' by Greg Roberts, retired astronomer and amateur satellite detective
9 September	'SALT: construction and eye surgery' by Case Rijsdijk, scientist and amateur astronomer
7 October	'Comets: the trailblazers' by John Saunders (chairman)
11 November	Presenter: Amanda Gulbis, Astronomer, SAAO, Cape Town Topic to be confirmed
9 December	Christmas party

ACTIVITIES

Cosmology interest group Fifteen people attended the presentation and discussion of the Big bang theory and lambda CDM model held on 19 July.

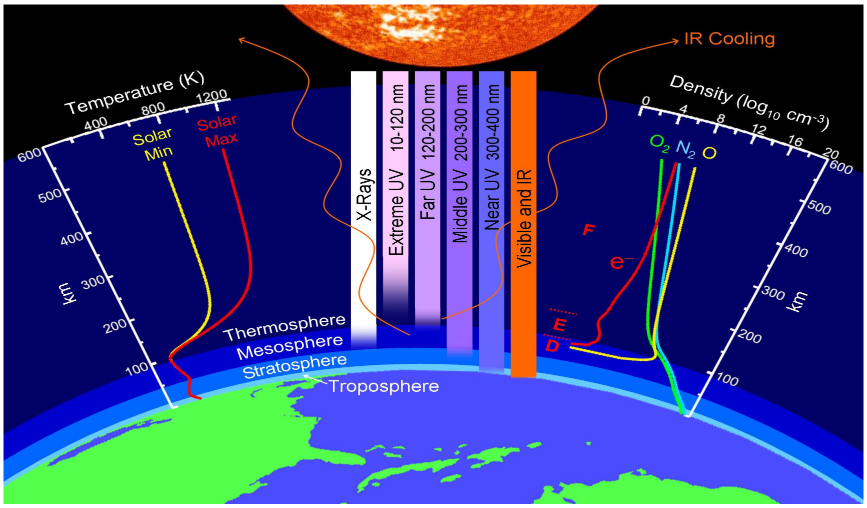
OBSERVATORY NEWS

Good news is on the horizon. Fingers crossed, we are on the brink of receiving the R85,000 needed to complete the Environmental Impact Assessment. More news will be sent out once the deal as been secured.

We have also been having important meetings with a wine estate in the Hemel & Aarde Valley concerning their interest in the project. There are positive vibes coming out, but, once again, until an agreement has been secured, we will hold back on the celebrations. Members will be advised on the outcome of the discussions as soon as possible.

ASTRONOMY NEWS FROM STEVE KLEYN

1 A puzzling collapse of Earth's upper atmosphere High above Earth's surface where the atmosphere meets space, a rarefied layer of gas, the 'thermosphere', recently collapsed and now rebounding.



Layers of Earth's upper atmosphere. Credit: John Emmert/NRL.

'This is the biggest contraction of the thermosphere in at least 43 years,' says John Emmert of the Naval Research Laboratory. The collapse happened during the deep solar minimum of 2008-2009, a time when the thermosphere cools and contracts when solar activity is low. In this case, however, the magnitude of the collapse was 2-3x more than low solar activity could explain.

The thermosphere ranges in altitude from 90 km to 600+ km. It is a realm of meteors, auroras and satellites, which skim through the thermosphere as they circle Earth. It is also where solar radiation makes first contact with our planet. The thermosphere intercepts extreme ultraviolet (EUV) photons from the sun before they can reach the ground. When solar activity is high, solar EUV warms the thermosphere, causing it to puff up like a marshmallow held over a camp fire. Temperatures can be as high as 1400 K—hence the name thermo-sphere. When solar activity is low, the opposite happens. In 2008 and 2009, the sun plunged into a century-class solar minimum. Sunspots were scarce, solar flares almost non-existent, and solar EUV radiation low.

We know what's happening up in the thermosphere because satellites feel aerodynamic drag when they move through the thermosphere, and it is possible to monitor conditions there by watching satellites decay. Emmert analysed the decay rates, from 1967 – 2010, of > 5000 satellites at altitudes of 200 - 600 km., providing a unique sampling of thermospheric density, temperature, and pressure across much of the Space Age. He found that the 2008-2009 thermospheric collapse was bigger than any past collapse, and bigger than the Sun alone could explain.

One possibility is carbon dioxide (CO_2). CO_2 in the thermosphere acts as a coolant, shedding heat via infrared radiation. Increasing CO_2 levels in the atmosphere, including the thermosphere, could have magnified the cooling action of solar minimum. 'However, even when we take CO_2 into account, using our best understanding of how it operates as a coolant, we cannot fully explain the thermosphere's collapse,' says Emmert.

According to Emmert, low solar EUV accounts for about 30% of the collapse. Extra CO_2 accounts for at least another 10%., leaving up to 60% unaccounted for. Scientists acknowledge that the situation is complicated, with more to it than just solar EUV and terrestrial CO_2. For instance, trends in global climate could alter the composition of the thermosphere, changing its thermal properties and the way it responds to external stimuli. The overall sensitivity of the thermosphere to solar radiation could actually be increasing. Important clues may be found in the way the thermosphere rebounds. Solar minimum is now coming to an end, EUV radiation is on the rise, and the thermosphere is puffing up again. Exactly how the recovery proceeds could unravel the contributions of solar vs. terrestrial sources.

2 Solar storms – an international problem That's the message scientists delivered at the International Living with a Star (ILWS) meeting held on 16 July in Germany, to representatives from more than 25 of the world's technologically-advanced nations. 'The problem is solar storms—figuring out how to predict them and stay safe from their effects,' says ILWS Chairperson Lika Guhathakurta of NASA headquarters. 'We need to make progress on this before the next solar maximum arrives around 2013.'

The Sun and Earth are separated by 93 million miles of space—a seemingly safe distance. However, since the Space Age began, there has been a growing realisation that 93m miles really are not so far. Spacecraft and ground-based observatories show that Earth is located in the Sun's outer atmosphere, buffeted by solar winds and pelted by hail storms of energetic particles. Moreover, the two bodies are actually connected by invisible threads of magnetism. During 'reconnection events', which typically happen several times a day, you can trace invisible lines of force all the way from Earth's poles to the surface of the Sun. Predicting solar activity is a complicated problem, akin in some ways to terrestrial weather forecasting but multiplied in difficulty by the thorny physics of solar plasma and magnetism. Predicting the Sun is only half the problem; the other half is Earth. How our planet's magnetic field and atmosphere respond to any solar storm is a magneto-hydrodynamic riddle that top scientists struggle to understand, even with the aid of Earth's most powerful supercomputers. Therefore, it is often said that space weather forecasting lags 50 years behind its terrestrial counterpart. Another complication is volume. Heliophysics's stage is hundreds of millions of miles wide. Simply keeping track of what's going on is a significant challenge. NASA and other space agencies have dozens of spacecraft out there, but they are spread over an enormous volume.

A 2008 report by the National Academy of Sciences (NAS) details the possible consequences of solar storms. 'Imagine trying to monitor Earth's oceans with a small number of buoys. You'd miss a lot. That's the situation we're in now with the 'ocean of space,' says Guhathakurta. China is about to contribute a space-buoy known as 'KuaFu' which will sample the solar wind upstream from Earth. When KuaFu launches it will, join a growing fleet of spacecraft dedicated to heliophysics. NASA, the European Space Agency, the Russian Federal Space Agency, the Canadian Space Agency, JAXA and China are all making significant contributions.

The solar cycle is predicted to peak during the years around 2013. While probably not the biggest peak on record, human society has never been more vulnerable. The basics of daily life—from communications to weather forecasting to financial services—depend on satellites and high-tech electronics. A 2008 report by the NAS warned that a century-class solar storm could cause billions in economic damage.

DID YOU KNOW?

This month, we begin a series on what Scientific American suggests are 8 wonders of the solar system. Characteristics include the biggest, highest, deepest, largest, strangest, unique-est..... We start with the largest known meteorological feature in the solar system, the largest hurricane.

Jupiter's great red spot (GRS) is a persistent anti-cyclonic (high pressure) storm located 22 deg South of the equator. It is 2-3 times larger than Earth and has been definitely known to have been in existence since 1831, and possibly since 1665 when Galileo first observed Jupiter through a telescope. Of course, it could have existed for much longer than around 400 years.

The spot is oval shaped, rotating anti-clockwise with a full rotation taking 6-7 days. Its dimensions are massive: 24,000-40,000 km x 12,000-14,000 km, with a maximum altitude above the cloud tops reaching 8 km. Winds at the outer edge of the storm blow at more than 400 km an hour and huge lightning bolts crackle at the base of the clouds.

The GRS rotates differentially from the rest of the atmosphere, sometimes more slowly, sometimes more quickly. During its recorded history it has travelled several times round the planet. Mathematical models suggest that the storm is stable and may be a permanent feature.

Storms like this are common in the turbulent atmosphere of gas giants. They can last for as little as hours and as long as centuries. Jupiter also has white and brown ovals which are lesser, unnamed storms. White ovals usually have relatively cool clouds in their upper atmosphere, while brown ovals are warmer and located within the normal cloud layer.

Red Spot Junior is a feature which formed in the southern hemisphere in 2000. Similar in appearance to the GRS, it is smaller and was created when several smaller while oval-shaped storms merged into a single feature. Since merging, it has increased in intensity and changed colour from white to red.

Sources New Scientist magazine, Wikipedia, plus other Internet and printed sources

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