“The Southern Cross”

HERMANUS ASTRONOMY CENTRE NEWSLETTER
FEBRUARY 2010

Welcome to the newsletter, and also to new member Ingrid Spitze. The four attached New Scientist articles cover a range of topics.

Two changes are being made to the interest groups. Future **Absolute beginners astronomy** meetings will be held bi-monthly at the Magnetic Observatory. The next meeting will be on 15 February at 8 pm, and then in April. The design of the **Telescope skills** group has been changed to an Internet and e-mail-based process involving members with access to a telescope undertaking small monthly projects. Please contact Johan Retief for further details.

Two dogs are easy to spot in the night sky during the summer months. Canis Major and Minor can be found following Orion, the hunter. To the right of Orion, Canis Major (the greater dog) contains Sirius, the brightest star. Procyon, the brighter of the two main stars in Canis Minor, forms the third point of the ‘summer triangle’, a large equilateral triangle, the others being Sirius and Betelgeuse (Orion).

CENTRE MEETING – 21 JANUARY 2010

The first centre meeting to be held at the Magnetic Observatory, the AGM, was well attended. John Saunders gave a comprehensive summary of the wide range and number of activities undertaken in 2009. Following completion of the formal agenda, Derek Duckitt gave a demonstration of the amazing amount of information offered by the software programme ‘Stellarium’, a free download.

MONTHLY CENTRE EVENINGS 2010 – schedule for early 2010

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

18 February	'Looking down, not up – planet Earth' by Izak Rust, Consultant geologist
18 March	'Galaxies: cosmic collisions' by Petri Vaisanen, SAAO, Cape Town
15 April	'My son's journey into space' by Dr Rick Shuttleworth
20 May	'Twinkle, twinkle, little star: How astronomers determine what you are' by Pierre de Villiers

ACTIVITIES

Absolute beginner's group The fifteen people who attended the meeting on 18 January were able to watch the presentation, but, unfortunately, cloudy skies prevented any stargazing. Bad weather also led to cancellation of the meeting scheduled for 19 January.

Cosmology interest group Nine of the sub-group involved in learning about Pierre Hugo's homeostatic model met on 11 January. The challenging topic of relativity was further discussed by twelve members at the general meeting on 25 January.

Educational outreach John Saunders and Pierre de Villiers met Kevin Govender of the SAAO to discuss arrangements for Overstrand schools to have live access to the Monet telescope in Texas.

OBSERVATORY NEWS

The project is on hold until further funds can be raised to enable the environmental impact study to continue. To this end, we continue to encourage members to consider becoming Friends of the Observatory

An application for funding for building of the observatory has been submitted to the Lotteries Board. It is unclear how long the decision-making process will take, but we hope it will be a positive one.

ASTRONOMY NEWS FROM STEVE KLEYN

1 Smashing Asteroids On 6 January, a LINEAR (Lincoln Near Earth Asteroid Research) telescope spotted a long dust trail, named P/2010A2. The dust trail resembles a comet's tail, but it resides in the asteroid belt between Mars and Jupiter. The trail may be the debris of a collision between two large asteroids, the pressure from sunlight having blown the resulting debris cloud into a long tail. The impact might have occurred only a few weeks ago and would be the most recent evidence of an asteroidal pileup.

Hopefully, time will be found for Hubble to look at this dust trail and prove what it is.

2 Another near miss On 13 January, a 10m wide asteroid named 2010AL30 zoomed past Earth at only 1/3 of the distance to the Moon. Had it had been on collision course it is unlikely that it would have reached the ground as it would have burned up very quickly. However, in doing so it would have caused a huge fireball which would have been world headlines. Spotted only three days earlier, it highlights our vulnerability to many objects with unknown peculiar orbits. There may be some large enough to cause harm.

Whereas large asteroids are easy to spot as they reflect enough sunlight, smaller asteroids of 30 to 50 metres in size (which can wreak havoc should they hit us), are usually too dim to be seen early. 2010AL30 had a solar orbit of just 366 days, nearly "in sync" with Earth and, thus, was able to stay invisible for nearly 100 years.

3 MARS up close Mars is the most Earthlike world we know; backyard telescopes can sometimes show polar caps, surface markings, seasonal white clouds, and windblown dust. Mars also behaves uniquely in our sky, spending most of its time far away as a tiny blob in a telescope, then every 2.1 years, swinging much closer for just a few months around opposition.

Mars comes almost twice as close at some oppositions than at others (it has a significantly elliptical orbit that is also near Earth's orbit). The near and far oppositions occur in a 16-year cycle. We are now near the bottom of that cycle. Mars reaches opposition and made its closest approach to Earth in late January 2010, appearing only 14.1 arcseconds in diameter. It will peak again in July 2018, at 24.3".

In at least a 4" telescope on a night of steady air, the bright north polar cap may be visible. In February or March, you may notice the cap shrinking in the Martian northern spring. Dark surface markings may be harder to discern, depending on which side of Mars is facing Earth. Watch also for bright limb hazes, occasional white clouds, and the obscuring bright patch of a large, moving dust storm.

4 Firefly mission High-energy bursts of gamma rays typically occur far out in space, perhaps near black holes or other high-energy cosmic phenomena. Scientists were surprised in the mid-1990s when they found these powerful gamma ray flashes happening on Earth, in the skies overhead. Called Terrestrial Gamma-ray Flashes, or TGFs, very little is known about them. They seem to have a connection with lightning, but TGFs themselves are entirely different. "They're the most potent natural particle accelerators on Earth," says Doug Rowland of NASA's Goddard Space Flight Centre.

Individual particles in a TGF acquire high levels of energy, sometimes in excess of 20 mega-electron volts (MeV). In contrast, the auroras visible at high latitudes are powered by particles with < 1,000th as much energy. There are many questions about TGFs. What causes these high-energy flashes? Do they help trigger lightning--or does lightning trigger them? Are they responsible for high-energy particles in the Van Allen radiation belts which can damage satellites?

Scientists are planning to launch a tiny, football-sized satellite called Firefly in 2010 or 2011. If successful, Firefly will return the first simultaneous measurements of TGFs and lightning. Most of what's known about TGFs to date has been learned from missions meant to observe gamma rays coming from deep space, such as the Compton Gamma Ray Observatory, which discovered TGFs in 1994 when it caught fleeting glimpses of gamma rays out of the corner of its eye. The powerful flashes were coming from Earth's atmosphere!

Subsequent data from Compton and other space telescopes have provided a tantalizingly incomplete picture of how TGFs occur: In the skies above a thunderstorm, powerful electric fields generated by the storm stretch upward for many miles into the upper atmosphere. These electric fields accelerate free electrons to speeds nearing the speed of light. When these ultra-high speed electrons collide with molecules in the air, the collisions release high-energy gamma rays as well as more electrons, setting up a cascade of collisions and, perhaps, more TGFs. Unlike lightning, most of a TGF's energy is released as invisible gamma rays, not visible light. They do not produce bursts of light like sprites and other such phenomena, but these unseen eruptions could help explain brilliant lightning strikes.

A longstanding mystery about lightning is how a strike gets started. Scientists know that the turbulence inside a thundercloud separates electric charge, building up enormous voltages. However, the voltage needed to ionize air and generate a spark is about 10 times greater than the voltage typically found inside storm clouds. TGFs could provide that spark. By generating a quick burst of electron flow, TGFs might help lightning strikes get started, Rowland suggests.

If so, there ought to be many more TGFs each day than currently known. Observations by Compton and other space telescopes indicate that there may be fewer than 100 TGFs worldwide each day. Lightning strikes millions of times per day worldwide. That is quite a gap. Then again, Compton and other space telescopes before Firefly were not actually looking for TGFs. So, perhaps, it is not surprising that they did not find many. Firefly will specifically look for gamma ray flashes coming from the atmosphere, not space, conducting the first focused survey of TGF activity. Firefly's sensors will even be able to detect flashes that are mostly obscured by the intervening air, which is a strong absorber of gamma rays (a fact that protects people on the ground from the energy in these flashes). Firefly's survey will give scientists much better estimates of the number of TGFs worldwide and help determine if the link to lightning is real.

DID YOU KNOW?

Finding out about Capella, the sixth brightest star in the night sky, also enables us to learn more about dwarf stars.

Capella (Alpha Aurigae, (the charioteer))

The name means 'small female goat' (Latin). In the northern hemisphere, it forms the left shoulder of the charioteer and is the third brightest star after Arcturus and Vega.

Yellow in colour, it is, in fact, a 4 star system in 2 binary pairs:

- 2 large, non-eclipsing, bright giant stars, Aa and Ab, with radii 11x the Sun, orbiting in 104 days about 100,000 km apart.
- 2 small, faint, cool **red dwarfs**, 10,000 AU from the other pair.

Vital statistics

- 42 ly away, m = 0.8, M = - 0.48 (average of large pair)
- 79 x brighter than the Sun (average of large pair)
- 0.05 brightness of the Sun (average of small pair)
- 2.6 x mass of the Sun (average of large pair)

Red dwarfs

These are small stars found at the cool end of the main sequence. Their mass is ≤ 40% of the Sun and surface temperatures are ≤ 3,500 K. They make up the majority of stars, but their low energy levels mean than they are difficult to observe, with none being visible to the naked eye. Examples: Proxima Centauri, Barnard's star.

Low temperatures mean that energy is generated at a slow rate. Energy is transported from the core to the surface by convection, rather than radiation, as in the Sun. They emit little light, as little as 1/10,000th and no more than 10% of that of the Sun. Helium does not accumulate at the core and they can burn a larger proportion of their hydrogen than larger stars before leaving the main sequence, meaning that red dwarfs have very long life-spans, some longer than the estimated age of the universe. Some red dwarfs have been found to have extra-solar planets in orbit around them.

White dwarfs

Also known as degenerate dwarfs, these are very dense, small stars with a mass similar to the Sun, and volume similar to Earth. They are the end product of the evolution of all but the most massive stars ie. low-mass stars like the Sun. Examples: Sirius B, Procyon B.

They are the end result of a red giant which has shed its outer layers to form a planetary nebula, which then diffuses, leaving the small core. Their faint luminosity comes from emission of stored thermal energy. White dwarfs are very hot when they are formed, as they no longer radiate energy. Over time, they do gradually lose their energy and cool down. The colour changes from white to red as they cool, eventually becoming cold black dwarfs. However, as insufficient time has passed since the universe was formed, even the oldest white dwarfs still radiate energy and no black dwarfs are thought to exist.

Sources http://en.wikipedia.org, www.space.com/scienceastronomy, Oxford dictionary of astronomy, Astronomy (Dorling Kindersley Eyewitness companions)

COMMITTEE MEMBERS

John Saunders (Chairman)	028 314 0543
Steve Kleyn (Technical Advisor)	028 312 2802
Pierre de Villiers (Treasurer)	028 313 0109
Irene Saunders (Secretary)	028 314 0543
Jenny Morris (Newsletter editor)	071 350 5560
Derek Duckitt (IT & website co-ordinator)	082 414 4024
Johan Retief (Monthly sky maps)	028 315 1132
Piet Daneel (Auditor)	028 314 0947