"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER

APRIL 2010

We hope you find this month's newsletter and the attached New Scientist articles on 'comet swarms', 'moon water' and 'lonely stars' interesting and informative. Remember that a lot of information on particular visible features and notable events is also sent out by Johan Retief with his monthly Sky maps. We welcome new members Patricia Blignaut and Tom van Dyk.

Three stars visible, to us, at this time of year to the north and north-east have been claimed, by some, to be 'mirrored' in the location of three important buildings in Washington DC, as part of an alleged Masonic influence on the design of that city. Regulus (Leo), Spica (Virgo) and Arcturus (Bootes), form a right angled triangle, with Spica at the corner. This arrangement, some argue, has been copied in the similar shaped triangle formed by the Capitol building (Regulus), the Washington Monument (Spica) and the White House (Arcturus).

CENTRE MEETING – 18 MARCH 2010

Petri Vaisanen, from the SAAO in Cape Town, gave a fascinating presentation on galaxies, including his work on colliding galaxies. After summarising the history of discovery of galaxies, he explained the methods used to calculate their distances, the processes which inform their shape and characteristics, and the events predicted when the Milky Way and Andromeda galaxy collide.

MONTHLY CENTRE EVENINGS 2010

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

15 April 'Our Russian space adventure' by Dr Rick Shuttleworth on his son Mark's preparation for his trip into space

20 May	'Twinkle, twinkle, little star: How astronomers determine what you are' by Pierre de Villiers
17 June	'19th Century astronomy at the Cape' by Johan Retief
17 July	'Deep space and deep time: related or not?' by Ed Foster, biochemist and amateur astronomer

ACTIVITIES

Cosmology interest group Galaxies were also the topic addressed by the ten people attending the meeting on 22 March. The development of galaxies within the Big Bang model raised a number of areas of discussion. The cosmic microwave background is the topic for the next meeting. Eleven members attended the final session on Pierre Hugo's homeostatic model on 5 April. At the next session, Derek Duckitt will present his thoughts on gravitation.
Educational outreach On 24 March, John Saunders gave the 'Introduction to astronomy' presentation to 98 Grade 10 learners from Hermanus High School at the Wortelgat Outreach Trust.
'Whale Talk' article 'The Easter full moon', with its topical 'bunny' visible on the moon in the southern hemisphere, was the title of the article by John Saunders published in the March/April issue of the magazine.

OBSERVATORY NEWS

Although the Environmental Impact Assessment for the observatory project is currently still on hold due to the need for more funding, there are one or two areas of progress. Firstly, an assessment of the preferred site plus other alternatives is being investigated by two knowledgeable experts. Both are members of the ASSA and have vast experience in the field of preparation and building of observatories in South Africa. Together with PHS Consultants, they will prepare a report detailing the positive and negative aspects of all sites currently being suggested. Secondly, we plan to have an expert botanist complete a report on the different sites in the near future. We hope that funding for the completion of the report will be forthcoming in the next month or so.

The "Friends of the Observatory" pledge project continues for those wishing to make a donation to support development of the observatory.

ASTRONOMY NEWS FROM STEVE KLEYN

1 WISE NASA's Wide-field Infrared Survey Explorer, searches for 'dark' objects in space like brown dwarf stars, vast dust clouds, and Earth-approaching asteroids. WISE finds them by sensing their heat in the form of

infrared light which most other telescopes cannot pick up. "Our instrument is finding [dozens] of asteroids every day that were never detected before," says Ned Wright, principal WISE investigator and physicist at the University of California in Los Angeles. "WISE is very good at this kind of work."

Most of the asteroids WISE is finding are in the main asteroid belt between Mars and Jupiter, but a fraction of them are different—they're the kind of Earth-approaching asteroids that send shivers all the way down a Brontosaurus' spine. "WISE has only been in orbit for about three months, but we've already found a handful of asteroids classified as 'potentially hazardous,' including one seen in 1996 but lost until re-observed by WISE. To be named 'potentially hazardous,' an asteroid's orbit has to pass within about 5 million miles of Earth's orbit. One of our discoveries' orbits will cross Earth's orbit less than 700,000 miles away," Bright stated.

2 Runaway Star formed our solar system The solar system may have been born inside the remains of a single star that ran away from its family. Meteorites that contain bits of rock called calcium-aluminium-rich inclusions suggest that the solar system may have formed very quickly from the ashes of other stars. That is because the inclusions formed with the radioactive isotope aluminium-26, which is forged inside stars tens of times as massive as the sun and decays with a half-life of only 720,000 years. The solar system could have sprung from a solitary star's ashes, which could have cooled more quickly. To account for the amount of Al-26 observed in meteorites, the star would still have had to be massive, probably forming in a group of other stars.

At some point, it may have been flung out of its birth cluster by gravitational tussles with its siblings or the explosion of a companion. As it zipped through interstellar space, the star would have released Al-26 in winds, forming a shell of material around it. When the star later exploded, its remains would have slammed into this shell, creating a turbulent region with areas dense enough for the sun to form. Most of the galaxy's planetary systems may not have formed as quickly as ours, since many probably arose from clusters. This makes them likely to have lower levels of Al-26, which generates heat as it decays. The cooler temperatures may have led rocky planets to take a different evolutionary path to Earth, perhaps becoming ocean worlds.

3 Nanosatellite sets sail The first spacecraft designed to do away with itself has been unveiled. It will try out an idea that could stop space getting clogged up with junk orbiting the Earth. The debris of abandoned spacecraft

and satellites is building up in low Earth orbit. This zero-g scrapheap has grown by 40 per cent in the past four years alone, with the US Air Force now tracking 19,000 orbiting objects larger than 10 cm across. And as chunks of debris strike each other, they fragment further – presenting still more threat of collision to working spacecraft.

The tiny CubeSail craft, measuring 30 x 10 x 10 cm and weighing just 3 kg, was designed at the Surrey Space Centre at the University of Surrey, UK. It has a solar sail to use for propulsion – harnessing the pressure of sunlight, like a boat's sail harnesses the pressure of the wind, but it can also use the sail as an "orbital brake" to help it fall to a fiery death in the atmosphere.

CubeSail, funded by the pan-European aerospace company EADS Astrium, will be launched into low Earth orbit late next year. At an altitude of 700 km, the "nanosatellite" will unfurl its 5 x 5 m sail, initially to test its usefulness for propulsion. After that experiment is complete, says Surrey Space Centre's project chief Vaios Lappas, the solar sail will be turned away from the sun and its efficiency as an orbital brake will be tested. Even at this high altitude there are rarefied molecules of the Earth's atmosphere, and drag from those molecules eventually slows satellites in low Earth orbit enough to bring them to destruction in a blazing re-entry through the thicker layers of the atmosphere below. The sail should increase that drag and send the craft to its doom sooner: instead of taking decades, it could take just a few years.

If CubeSail works, future satellites could be fitted with similar sails that would be deployed when their useful life ends and they become space junk, or swarms of CubeSails could be flown into orbit, attach themselves to space junk and help de-orbit it faster. However, the history of spacecraft that unfurl or inflate devices in orbit is not a happy one: components often fail or get stuck. Setting sail into space is not an easy task.

4 Neptune a cannibal? Neptune might have polished off a super-Earth that once roamed the outer solar system and stolen its moon to boot. The brutal deed could explain mysterious heat radiating from the icy planet and the odd orbit of its moon Triton. Neptune's own existence was a puzzle until recently. The dusty cloud that gave birth to the planets probably thinned out further from the Sun. With building material so scarce, it is hard to understand how Uranus and Neptune, the two outermost planets, managed to become so big. What if they actually formed closer in? In this scenario,

Uranus and Neptune formed much closer to the sun and migrated outwards, possibly swapping places in the process.

That would have left behind enough material just beyond their birthplace to form a planet with twice the Earth's mass, according to calculations published in 2008 by Steven Desch of Arizona State University in Tempe. Neptune's peculiar moon Triton may once have been paired with this hypothetical super-Earth. Triton's orbit in the opposite direction to Neptune's rotation, suggests that it did not form there but was captured instead. For this to occur, Triton would have had to slow down drastically. One way to do this is for Triton to have had a partner. In 2006 researchers argued that Triton was initially paired with another object of similar size that wound up being gravitationally slung into space after the pair ventured near Neptune. However, Triton could have slowed if its former partner were a heavy super-Earth because a more massive body could carry away more of the pair's kinetic energy. Neptune may have engulfed the super-Earth and leaving Triton to start orbiting its new host. Heat left over from the impact could explain why the planet radiates much more heat than its cousin Uranus, which is similar in mass and composition.

DID YOU KNOW?

This month we look at the **blue supergiant** Rigel, the 7th brightest star.

Rigel (Beta Orion)

The name means 'foot of the great/giant one' (Arabic) – the left foot of Orion. In mythology, it is the spot where Scorpio stung Orion after a battle. It is actually the brightest star in Orion (the label 'alpha' was mistakenly given to Betelgeuse whose variability makes it appear brighter, at times). It is an important navigation star.

It is a multiple star system of 3 stars, 1 very large and 2 small:

- Rigel A – a **blue supergiant**
  - 17-20x the mass, and 40,000x brighter than the Sun
  - 775 ly away, m = 0.12
  - 500x brighter than Rigel B
  - in the process of dying, probably fusing helium into carbon and oxygen, having exhausted its hydrogen
  - because of its large size, it is likely to explode as a supernova
  - its great luminosity and location makes it light up several nebulae
- Rigel B – a binary system of 2 main sequence stars,

orbiting each other in 9.8 days
    - 2,200 (astronomical units AU) from Rigel A
    - m = 6.7, outshone by Rigel A

Average combined magnitudes: m = 0.18, M = - 6.69

Blue-white supergiant stars (BSGs) Examples: Rigel, Deneb (Cygnus)

- They are extremely hot and bright, with surface temperatures of 20,000 – 50,000 K and, typically, 10 – 50x more massive than the Sun
- Their radii can be up to 25x that of the Sun
- They are commonly smaller than their red counterparts
- Their extreme mass means they have relatively short lifespans and are mainly found in cosmic structures containing younger stars
- Although relatively rare and short-lived, their brightness means that they are among the most visible stars
- They represent a slower burning phase in the death of a massive star. Due to their core reactions being slower than in red supergiants, (RSGs), the star contracts. Because similar energy is coming from a smaller area, the star's surface is much hotter than that of a RSG
- If their core reactions increase, they can become RSGs, and vice versa, if core reactions slow
- Stellar winds from RSGs are dense and slow, but those from BSGs are fast but sparse. If a RSG becomes a BSG, the faster wind impacts the already emitted slower wind, causing the out-flowing materials to condense into a thin shell. Almost all BSGs have a shell, suggesting they were once RSGs
- BSGs are likely to end their lives as supernovas, although a very small number become rare oxygen-rich white dwarfs, for unknown reasons

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

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