

"The Southern Cross"



HERMANUS ASTRONOMY CENTRE NEWSLETTER

MARCH 2011

Welcome to this month's newsletter and the article on sunspots, this time from NASA. We also welcome new member Rita White.

Advance information for later in the year. Presentation of the very successful 2010 5-part BBC DVD series entitled 'Wonders of the solar system' by Prof Brian Cox is planned, subject to confirmation of room availability by HMO, for **Beginners astronomy group** meetings on Monday evenings in July and August. Details of each 1 hour part are as follows:

- 4 July Empire of the Sun
- 18 July Order out of chaos
- 8 Aug The thin blue line
- 22 Aug Dead or alive
- 29 Aug Aliens

In addition to the trip to the Cederberg in April, which is already fully booked, other trips are also being considered this year, if there is sufficient interest. Possibilities include:

- **Sutherland** Possible dates for these 2 night visits are the weekends of 7-9 October, 21-23 October or 4-6 November. Activities would include a night tour of SALT, including star-gazing through 2 dedicated visitor 14" and 16" telescopes, a daytime technical tour of SALT, and star-gazing at a dedicated telescope site in Sutherland. And/or
- **Carnarvon** Again, this would be a 2 night visit with the same possible dates as those for Sutherland. Activities would include a daytime tour of MeerKat and an overview of the SKA (square kilometer array), and night time star-gazing. It would be possible to include an additional overnight stay in Fraserburg and visit the Fossil Museum. Note that

this trip would involve somewhat longer traveling distances than Sutherland. And/or

- **Cape Town** A Saturday trip, this would include a view of the midday gun on Signal Hill, an afternoon show at the Planetarium, and a tour of the SAAO in Observatory with night viewing using the McLean telescope from 8 - 9 pm.

The Sutherland and/or Carnarvon trips would need sufficient numbers, with a maximum of 20. If you are interested in any of these trips, please contact John Saunders at shearwater@hermanus.co.za for more information and/or to have your name added to the list(s).

WHAT'S UP?

The hazy irregular galaxy which forms the Large Magellanic Cloud (LMC) can be seen, with the naked eye, forming an obtuse angle of around 110° with Canopus and Achernar, high in the southern sky. Located partially in the constellations of Dorado (the goldfish) and Mensa (named for Table Mountain), it is described as forming the astronomical 'cloud' over the mountain. 160,000 ly away, the LMC contains some weak features of a spiral galaxy eg. a central bar shape and a spiral arm. It might previously have been a spiral galaxy whose arrangement was disturbed by the gravitational effects of the Milky Way and the Small Magellanic Cloud. Rich in gas and dust, it contains old as well as new stars, including the Tarantula Nebula (NGC 2070), the most active star-forming region on the Local Group of galaxies, which is visible to the named eye. Binoculars reveal numerous clusters of stars within the LMC.

LAST MONTH'S ACTIVITIES

Monthly centre meeting Details of the AGM, held on 3 February, were summarised in the February newsletter.

Interest groups The **cosmology** group met on 7 and 21 February for screening of parts 9 - 12 of the ongoing DVD series on cosmology. The series continues to be popular with both members and visitors, with 31 and 21 people, respectively, attending each meeting.

Other activities The February/March edition of **Whale Talk** magazine contains an article by John Saunders entitled 'William Herschel, the planet Uranus and Voyager 2 spacecraft'.

THIS MONTH'S ACTIVITIES

Monthly centre meeting The scheduled presentation on solar activity by Pieter Kotze has had to be cancelled. In its place, an excellent DVD entitled 'Hubble - 15 years of discovery' will be shown. The 75 minute presentation describes and illustrates the huge impact which Hubble has had on furthering our knowledge and understanding of the universe.

As usual, tea and coffee will be available after the presentation and, weather permitting, there will be an opportunity for star-gazing. Non-members are welcome for a fee of R20 (R10 for students and children).

Interest group meetings

The next **Beginners astronomy** group meeting will take place on Monday, 14 March, at the HMO, at 7.00 pm. The presentation by John Saunders will be followed, weather permitting, by star-gazing from the HMO car park. Non-members are welcome for a fee of R20 (R10 for students and children). For more information and/or to book a place, please contact John at shearwater@hermanus.co.za

The **cosmology** group's series of DVD viewings will continue to take place on the 1st and 3rd Monday of each month, at the HMO at 7.30 pm. The topics for March are: 7 March - Parts 13 'The cosmic microwave background' and 14 'Conditions during the first million years', and 21 March - Parts 15 'Primordial sound - Big Bang acoustics' and 16 'Using sound as cosmic diagnostic'.

Visitors who attend for one evening are welcome for free, but will need to join the Centre if they wish to attend further meetings. For further information on the 7 March meeting please contact John Heyns at jheyns@hermanus.co.za or on 028 314 1480. Otherwise, for more information on the 21 March meeting, or any of the group's activities, please contact Pierre Hugo at pierre@hermanus.co.za

Educational outreach Access to the MONET telescope is not available in March, for maintenance reasons. However, Sundays from 0700-1400 Universal Time have been reserved for the following dates: 10 April, 1 May, 8 May and 29 May. HAC members will be working with learners in local schools. Please contact John Saunders at shearwater@hermanus.co.za or Pierre de Villiers at pierredev@hermanus.co.za for more information about the project.

2011 MONTHLY CENTRE MEETING SCHEDULE

These will take place at 7 pm at Hermanus Magnetic Observatory.

10 March 'Hubble - 15 years of discovery' DVD

- 7 April 'Astronomy of the Pyramids' by Wayne Trow, scientist and amateur astronomer, ASSA
- 5 May 'Nicholas de LaCaille's work in South Africa' by Dr Ian Glass, senior astronomer, SAAO, Cape Town
- 2 June 'SETI, METI and little green men' by Johan Retief, committee member
- 7 July 'The story of CERN: a fifty year journey into the heart of the matter' by David Kershaw, centre member
- 4 August 'Useful observations that can be done by amateurs; by Cliff Turk, ASSA, Cape Town
- 1 September 'The ionosphere' by Dr Lee-Ann McKinnel, MD of the HMO
- 6 October 'The southern constellations using radio astronomy, and SKA' by Dr Debra Shepherd, Director, educational outreach, SKA
- 3 November 'Sir John Herschel' by Auke Slotegraaf, psychohistorian and amateur astronomer
- 8 December Christmas party

OBSERVATORY NEWS

A decision on the proposal submitted to the Dept of Environmental Affairs and Development Planning at the Western Cape Provincial Administration in January is still awaited. In the meantime, acting on responses and feedback on the plans presented at the AGM, the committee is continuing to work with the architect on the design for the observatory.

ASTRONOMY NEWS FROM STEVE KLEYN

Largest galaxies grow up gradually like snowflakes They may be monsters of the universe, but elliptical galaxies can start life in the same way as snowflakes. It has long been assumed that these most massive of galaxies form when two smaller spiral-shaped galaxies collide. However, there is an alternative theory, in which a cloud of gas collapses in on itself to form a dense core of stars which then grows larger by assimilating smaller galaxies over time. This is similar to how ice crystals build up around a microscopic dust grain as it falls to Earth, forming a snowflake.

Evidence suggests that the massive elliptical galaxy NGC 1407 formed in this way. Duncan Forbes of Swinburne University of Technology in Hawthorn, Victoria, Australia, and colleagues, used the colours of the star clusters in NGC 1407 to estimate its chemical composition. They found the concentration of heavy elements was highest at the core's centre, decreasing towards its edges, which tallies with the gas cloud collapse theory. Gravity at the cloud's centre would be stronger than at its edges, concentrating the

heavy elements produced in stars there. That the heavy element gradient did not extend to the galaxy's outer regions is consistent with a gradual assimilation of star clusters from already formed, smaller galaxies.

Is gravity left-handed? An answer could provide a clue to a long-sought theory of quantum gravity - and might be within our grasp by 2013. General relativity describes gravity's actions at large scales. For tiny scales however, a theory of quantum gravity, incorporating quantum mechanics, is needed. However, first physicists need to understand gravitons, hypothetical quantum particles that mediate the gravitational force. These likely come in left and right-handed varieties: in the former, the particle's spin would be aligned with the direction of its motion; in the latter, the spin would be the opposite.

General relativity does not distinguish between right and left, so you might expect gravity to be transmitted by both varieties, but the quantum world may play favourites. When it comes to the ghostly particles known as neutrinos, for example, the weak force only interacts with the left-handed variety.

To find out whether gravitons fall into the "ambidextrous" camp of general relativity or exhibit quantum asymmetry much like a neutrino, João Magueijo and Dionigi Benincasa of Imperial College London suggest looking to the cosmic microwave background (CMB), relic radiation from the big bang. During inflation, the faster-than-light expansion of the nascent universe, powerful gravitational waves might have rippled through space-time, polarising the CMB's photons in a telltale pattern.

The pair calculates that, if gravity depended on just left or right-handed gravitons, this would have skewed the polarisation pattern in an obvious way. What is more, inflation would have stretched these effects to astronomical proportions, making them easily visible to astronomers. The European Space Agency's Planck telescope will image the CMB's polarisation and will release the data in 2013.

A theory called loop quantum gravity, an attempt to unite quantum mechanics and general relativity, already suggests that an asymmetry might be embedded deep into the laws of the universe and that this should render gravity left-handed. Evidence of left-handed gravitons in the CMB would be "a triple discovery", says Lee Smolin of the Perimeter Institute in Waterloo, Ontario, Canada, who has worked with Magueijo and Benincasa on the subject. "It would confirm inflation, that gravity is quantum mechanical, and that there is left-right asymmetry in quantum gravity."

Hot Pixels Something strange is killing off pixels at an alarming rate in the detectors of a multi-billion dollar space telescope scheduled to launch in 2014. The problem is just the latest blow for NASA's ultra-sensitive James Webb Space Telescope (JWST), which is expected to launch late, and run over-budget.

JWST has a 6.5-metre mirror, which is nearly three times as wide as the mirror on the Hubble Space Telescope. The telescope could glimpse the universe's first stars and galaxies. However, in December 2010, Marcia Rieke of the University of Arizona in Tucson, and colleagues, found that roughly 2 per cent of pixels in a detector destined for JWST's Near Infrared Camera (NIRCam) were transmitting signals although no light was hitting them. That's four times as many "hot pixels" as were found when the detector was analysed in 2008.

The researchers later found that the problem affects four of the camera's five long-wavelength detector arrays. "We don't know what is happening, and we don't know if there's a way to reverse it or slow it down," says Rieke, principal investigator for the NIRCam. "Until we understand the root cause, I think we're all going to be quite nervous." NASA allows no more than 5 per cent of a detector's pixels to be hot by the end of the telescope's five-year space mission. At this rate, the detectors may exceed this limit before the telescope even leaves the ground, says Rieke.

The pixel problem follows a series of setbacks for JWST. In November 2010, an independent review panel predicted that JWST is unlikely to launch before September 2015, more than a year later than planned, and will cost \$1.5 billion more than expected. NASA has set up a review board to analyse the detector problem and discuss solutions. "It's too early to speculate on what the root cause is or what we're going to do to fix it," says JWST programme director Rick Howard. He says it may be a month or more before the expert board comes to a conclusion.

DID YOU KNOW?

Minas, one of Saturn's many moons, boasts the 7th wonder of the solar system, the highest crater peak.



Named after a character in Greek mythology, this moon of Saturn was discovered by William Herschel in 1789. It is the

20th largest moon in the solar system, and is the smallest known astronomical body thought to be rounded in shape due to self-gravitation. Its density indicates it is formed mostly of water ice, with only a small amount of rock. Tidal forces acting on it by Saturn means it is not perfectly spherical, its longest axis being about 10% longer than the shortest.

Its most distinct feature is a huge impact crater 130 km across, named Herschel, after the moon's discoverer. The crater's diameter is almost a third of the whole moon's diameter. The walls are approximately 5 km high, parts of the floor are 10 km deep, and its central peak rises 6-8 km above the crater floor. An equivalent crater on Earth would be 4,000 km in diameter, wider than Canada.

The impact producing the crater must have nearly destroyed Mimas and fractures can be seen on the opposite side of the moon, possibly created by shock waves from the impact travelling through the moon. The moon's surface is saturated with smaller craters, but none anything like the size of Herschel.

Mimas maintains the Cassini Division, the gap between Saturn's two widest rings (A and B). The pull of Mimas on particles in the division, always in the same direction in space, forces them into orbits outside the gap.

From certain angles, Mimas closely resembles the Death Star space station in the Star Wars films. This is coincidental, as the first film was made three years before the first close-up photographs of Mimas were taken.

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

For more information on the Hermanus Astronomy Centre, visit our website at www.hermanusastronomy.co.za

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