"The Southern Cross"

HERMANUS ASTRONOMY CENTRE NEWSLETTER
OCTOBR 2009

Welcome to the latest newsletter, and also to new members Peter and Lynn Krafft. A New Scientist articles on dark holes is attached.

Two exciting developments within the Centre are set to add to the opportunities available to members and the wider community. First, building of the observatory (see 'observatory news' for details). Second, our educational outreach role in local schools will be strongly enhanced by recently agreed access to the remotely controlled Monet telescope at the McDonald Observatory at Austin in Texas. This will enable learners to make live observations of the night sky during South African daytime. Development of this project will take place in liaison with the SAAO in Cape Town.

The brightest non-lunar object visible in the night sky until around 1 am is Jupiter. It is moving in Capricornus, smallest of the 'zodiac' constellations, and 40th biggest of the 88 constellations. It represents the god Pan, having a goat's body and fish-like tail.

CENTRE MEETING – 24 SEPTEMBER

Auke Slotegraaf, a psychohistorian, led 3 informative and entertaining sessions. At the centre meeting, he gave a presentation on three early astronomers – Tycho, Kepler and Galileo, all brilliant, dedicated scientists who also recognised the need to secure necessary financial support from powerful patrons, including kings. On 25 September, Auke ran a practical workshop on making low-cost planispheres, and demonstrated the large amount of information built into this tool. His final session on 26 September focused on the attributes and attitudes needed for successful and rewarding deep sky observation. Auke's informative website is www.psychohistorian.org

FUTURE MONTHLY CENTRE EVENINGS 2009

The Thursday meetings will be held at 19.00 on the following days:

22 October	'All about Sundials' by Steve Kleyn (member)
19 November	"Moons and Asteroids of the Solar System' by John Saunders (Centre chairman)
17 December	Christmas Party

ACTIVITIES

Visit to Cape Town Planetarium and the Royal Observatory On 19 September, 17 members spent a fascinating time watching a show at the Planetarium and touring the observatory, including the museum. Following a meal at the nearby River Club, they were afforded wonderful views of Jupiter and the Galilean moons through the 18" visual part of the McLean refractor telescope. Members particularly enjoyed the hydraulic floor, which can be raised and lowered to enable observations at different angles.

Cosmology interest group. Gravitation proved to be a challenging and lively topic for discussion by the 10 members who attended the meeting on 28 September.

Educational outreach On 2 October, Pierre de Villiers, Frans Marais and Jenny Morris met representatives of the Overstrand Education Department as part of the process of enabling members to give educational presentations to learners in schools in the Overstrand.

OBSERVATORY NEWS

A **pledge scheme** has been established in order to assist with the costs currently being incurred during the planning stage. Members are invited to make a pledge, of anything from R50 upwards, using the attached **pledge form.** The completed form can be posted confidentially into the pledges box at the back of the hall at meetings.

Committee members have approached a number of possible sources of funding for construction of the observatory, but would welcome any suggestions on individuals or organisations who may be interested in 'buying a brick' or making an interest free loan. Please contact John Saunders with any suggestions.

ASTRONOMY NEWS FROM STEVE KLEYN

1 Mercury NASA's MESSENGER spacecraft flew by Mercury for the third and final time on 29 September, less than 142 miles above the planet's rocky surface, for a final gravity assist required to enter Mercury's orbit in 2011. Cameras will photograph previously unseen terrain, and, as the spacecraft departs, it will take high-resolution images of the southern hemisphere. Scientists expect the spacecraft's imaging system to take more than 1,500 pictures. So far, more than 90% of the planet's surface has been photographed. The new pictures will fill in some of the gaps, and provide high-resolution imagery of targets of interest.

The spacecraft may also observe how the planet interacts with the solar wind. During this encounter, high spectral- and high spatial-resolution measurements will be taken of Mercury's super-thin atmosphere and comet-like tail, which may be strongly influenced by solar activity. Scans of the tail will provide important clues regarding the processes that maintain Mercury's fascinating atmosphere.

An altimeter will make a topographic profile of Mercury's surface along the instrument ground track which will extend scientists' equatorial view of Mercury's global shape and allow them to confirm the discovery made during the first and second flyby that Mercury's equatorial region is slightly elliptical.

Spitzer space telescope. The infrared telescope ran out of coolant 15 May, more than 5½ years after launch. It has since warmed to a still-frosty 30° Kelvin (about - 406° F). However, new images taken with two of Spitzer's infrared detector channels (two that work at the new, warmer temperature) demonstrate the observatory remains a powerful tool for probing the dusty universe.

Since its launch from Cape Canaveral on 25 Aug. 2003, Spitzer has made many discoveries, including planet-forming disks around stars, the composition of the material making up comets, hidden black holes, galaxies billions of light-years away and more. Perhaps the most revolutionary and surprising Spitzer finds involve planets around other stars, called exoplanets. In 2005, Spitzer detected the first photons of light from an exoplanet. In a clever technique, now referred to as the secondary-eclipse method, Spitzer was able to collect the light of a hot, gaseous exoplanet and learn about its temperature. Later, detailed studies revealed more about the composition and structure of the atmospheres of these exotic worlds. Recently, astronomers have witnessed odd behavior around a young star. Something, perhaps another star or a planet, appears to be pushing a clump of planet-forming material around. The observations offer a rare look into the early stages of planet formation.

Herschel Observatory on line During the recent Herschel performance verification phase, the SPIRE and PACS photometers were used in 'parallel mode' to observe a 2 x 2 degree field in an area near the galactic plane, 60° from the galactic centre, in the Southern Cross constellation. This region is considered valuable for demonstration purposes as it typifies crowded fields with, potentially, many molecular clouds along the line-of-sight. The ability of the SPIRE and PACS cameras to map regions of massive cloud complexes provides the capability to detect stages of star formation which have not been found with previous infrared missions.

The resulting images reveal an extremely rich reservoir of cold material in the galactic plane, seen to be in unsuspected turmoil. Interstellar material appears to be condensing in a continuous and interconnected maze of filaments and strings of newly-forming stars in all stages of development. The observations yield additional information about this cold material - how much there is, its mass, temperature and composition, and whether or not some of it is collapsing to form new stars. Observations like these are key to addressing Herschel's primary: the study of star formation and the interstellar medium in the Milky Way and nearby galaxies, and the detection and investigation of galaxies in the distant universe.

Herschel is a versatile space observatory with a range of capabilities covering point-source photometry, imaging, large area mapping and spectroscopy. Different observing modes exist to optimise the scientific return of the mission. The 'SPIRE/PACS parallel mode' is one of its most powerful modes, the cameras observing simultaneously while the telescope scans across the sky. Using both instruments together produces 5 images simultaneously in different wavelengths, making optimal use of the superfluid helium cryogen that ultimately defines the lifetime of the Herschel mission. Since the fields-of-view of the two instruments are almost 20 arcmin offset from each other, this mode is particularly useful for imaging large areas in survey-type observing programmes. Large areas of the Milky Way will be surveyed systematically, exploring astronomical 'terra incognita' and providing new insight into the mechanisms of star formation. The parallel mode will also enable observation of 'blank fields', particularly relevant to understanding star formation throughout cosmic history.

DID YOU KNOW?

The focus, this month, is on Canopus, the second brightest star. We will also look at ways in which stellar distance relates to magnitude.

Canopus (Carinae (the keel of the ship of the Argonauts))
The origin of the name is uncertain, with possible Greek, Egyptian, Semitic and Arabic origins. It is possibly the name of a ship's captain from the Torjan War, or may mean 'golden earth' from ancient Egypt, a description of its appearance when seen through atmospheric haze.

Some spacecraft use the light from Canopus to orient themselves in space because of its brightness and angular distance from the Sun.
It is only visible south of 37 degrees North.
Distance: 310 **ly,** m (apparent magnitude): -0.62, M (absolute magnitude): -5.53.
A very hot star, 14,000x more luminous than the Sun, with an extremely hot (10x the Sun's corona) magnetically heated corona extending far beyond the surface.
Although Canopus appears to be half as bright as Sirius from Earth (apparent magnitude), it is much more luminous than Sirius and has a much greater absolute magnitude. This apparent contradiction is explained by the effect of **distance** on the visual brightness of stars.
It is a yellow-white supergiant, 65x size of the Sun. Slowly dying, it has stopped hydrogen fusion, and is now converting helium into carbon.

Relationships between distance and magnitude
The unit used to describe the distance of planetary objects from Earth is the light year (ly), which is defined as the distance travelled in one year by light. One light year equals 9.5×10^{12} km (9,500,000,000,000 km), with light travelling at 300,000 km/second.

There is a three-way inter-relationship between apparent magnitude, absolute magnitude and distance, which is clearly illustrated by the two brightest stars, Sirius and Canopus:

Sirius	m = -1.46	M = 1.4	d = 8.6 ly
Canopus	m = - 0.62	M = - 5.53	d = 310 ly

These values identify that, although Canopus is an inherently brighter star than Sirius ie. has a much higher absolute magnitude (M), because of its much greater distance (d) from Earth, its apparent magnitude (m) is about half that of Sirius. In other words, the brightness of Canopus is more a result of its luminosity than its proximity to Earth, while, for Sirius, proximity plays a greater role in its brightness than its inherent luminosity. This illustrates the basic premise that a dim nearby star will look brighter than a very bright, distant star.

The relationship between apparent magnitude and distance is not a linear one ie. twice the distance does not mean half the amount of light perceived. Instead, apparent magnitude is related to distance by the inverse square law, which means that a source of light twice as far away from a closer one appears a quarter as bright. Conversely, if the distance from a light source is halved, the brightness of the light is quadrupled. Distance, apparent and absolute magnitude are also interrelated mathematically in that, if the values of either three is known, the third can be calculated. If m and d are known, M can be calculated, and, if m and M are known, d can be calculated.

Constellations often hide differences in distance among the stars which they include. Although they appear two-dimensional, constellations are not physical groupings, and there can be large differences between the distances of stars in a constellation and the apparent groupings seen from Earth. For example, the four brightest stars in the Southern Cross are the following distances from us:

α crux - 320 ly, β crux - 350 ly, γ crux - 88 ly, δ crux - 360 ly.

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

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