“The Southern Cross”

HERMANUS ASTRONOMY CENTRE NEWSLETTER

JANUARY 2010

Welcome to the first newsletter of the New Year. We wish you all the best for 2010, and hope that you continue to enjoy learning about astronomy and exploring the night skies.

Membership fees for 2010 are now due. If you have not yet renewed your subscription, we urge you to do so as soon as possible. We promise another interesting and exciting year and have several guest speakers lined up. The membership fee for a single person is R80 plus R50 for a second family member and/or students.

Our Bank Details are as follows:-
Name of ABSA Account - Hermanus Astronomy Centre
Account number - 9230163786
Branch code - 632005
NB. Please also include ‘2010’ and <u>most importantly</u>, your name eg. 2010 2 Saunders

A copy of the membership form, including bank and other payment options is attached with the newsletter.

‘Exotic stars’ are the focus of the attached New Scientist article.

The constellation of Taurus can be easily located to the left of Orion. The red ‘eye’, found just below a line continued left from the line of Orion’s belt, is the red giant Aldebaran. Aldebaran forms the tip of a distinctive upside down V, the large star cluster the Hyades. Further left is another easily identifiable star cluster, the Pleides, with six of its 'Seven sisters' clearly visible to the naked eye.

CENTRE MEETING – 11 DECEMBER 2009

This took the form of a very enjoyable Christmas meal held at the Baleen Auberge in Voelklip. 42 members and partners enjoyed a full Christmas dinner, crackers and party poppers, an astronomical musical quiz led by John Saunders, and a raffle.

MONTHLY CENTRE EVENINGS 2010

Centre meetings will take place at 7 pm at the **Hermanus Magnetic Observatory.**

21 January	AGM and presentation on using the astronomical website 'Stellarium' by Derek Duckitt.
18 February	'Looking down, not up – planet Earth' by Izak Rust, Consultant geologist
18 March	'Galaxies: cosmic collisions' by Petri Vaisanen, SAAO, Cape Town

ACTIVITIES

Cosmology interest group Twelve people attended the meeting on 7 December. The topic of 'relativity' raised questions and discussion which illustrated the complexities of this challenging subject.

Educational outreach On 10 December, Jenny Morris gave a presentation on 'An introduction to astronomy' to the senior primary learners at the Waldorf School. On 18 December, the audience was people attending the Mirror Word Missionary youth camp in Voelklip. Pierre de Villiers led the introductory astronomy presentation, and Johan Retief talked on the Moon.

Whale Talk article An article on the Star of Bethlehem by John Saunders, based on the presentation given to the Centre earlier in the year by Case Rijsdijk, was published in the Nov/Dec issue.

OBSERVATORY NEWS

As part of the Environmental Impact Study (EIS), a study of the volume of traffic on Rotary Way will be undertaken shortly. A meeting will also be held in the near future with PHS Consultancy, which is undertaking the EIS, to discuss ways forward. Funding applications to the Shuttleworth Foundation and the National Lottery are being finalised for submission by 29 January, the deadline for both.

ASTRONOMY NEWS FROM STEVE KLEYN

1 Mars rovers NASA's Mars rover Spirit has now done six years of unprecedented science exploration. However, the upcoming Martian winter could end the roving career of the beloved, scrappy robot. Spirit landed on 3 January 2004, and its twin, Opportunity, on 24 January 2004. The rovers began missions intended to last three months, but which have lasted six Earth, or 3.2 Mars, years. A sand trap and balky wheels could prevent NASA's rover team from using a key survival strategy for Spirit. They may not be able to tilt the robot's solar panels toward the Sun to collect power for heat to survive the extreme Martian winter.

2 NASA's Wide-field Infrared Survey Explorer All systems are behaving as expected on WISE, which was launched on 14 December from Vandenberg Air Force Base in California. Following a one-month checkout, the most detailed survey yet of the entire sky in infrared light begins. 100s of millions of objects will populate its vast catalogue, including dark asteroids, the closest "failed" stars and tremendously energetic galaxies.

After acquiring the Sun's position and lining up its solar panels facing the Sun, scientists checked out the spacecraft's pointing-control system in preparation for jettisoning the instrument's cover on 29 December, enabling WISE to get its first look at the sky. The instrument consists of a 40cm (16-inch) telescope and four detectors, each with one million pixels.

The WISE team has verified that the instrument is as cold as planned. The cryostat's outer shell is slightly below the planned 190 Kelvin (minus 83°C), and the coldest of the detectors is less than 8 Kelvin (minus 265°C). WISE's first images will be released within one month after its one-month checkout.

3. Fluff? Voyager Makes an Interstellar Discovery NASA's two Voyager probes have been racing out of the solar system for over 30 years. They are now beyond the orbit of Pluto and on the verge of entering interstellar space—but they are not there yet. The solar system is passing through an interstellar cloud that physics says should not exist. "Using data from Voyager, we have discovered a strong magnetic field just outside the solar system," explains Merav Opher, a NASA Heliophysics Guest Investigator at George Mason University. "This magnetic field holds the interstellar cloud together and solves the long-standing puzzle of how it can exist at all." The discovery has implications for the future when the solar system will eventually bump into other, similar clouds in our arm of the Milky Way.

Astronomers call the cloud we're running into now the Local Interstellar Cloud or "Local Fluff" for short. It's about 30 light years wide and contains a wispy mixture of hydrogen and helium atoms at a temperature of 6000°C. The existential mystery of the Fluff has to do with its surroundings. About 10 million years ago, a cluster of supernovas exploded nearby, creating a giant bubble of million-degree gas. The Fluff is surrounded by this high-pressure supernova exhaust and should be crushed or dispersed by it.

"The observed temperature and density of the local cloud do not provide enough pressure to resist the 'crushing action' of the hot gas around it," says Opher. So how does the Fluff survive? The Voyagers have found an answer. The Fluff is much more strongly magnetized than anyone had previously suspected—between 4 and 5 microgauss*," says Opher. "This magnetic field can provide the extra pressure required to resist destruction."

The Fluff is held at bay just beyond the edge of the solar system by the Sun's magnetic field, which is inflated by solar wind into a magnetic bubble more than 10 billion km wide. Called the "heliosphere," this bubble acts as a shield that helps protect the inner solar system from galactic cosmic rays and interstellar clouds. The two Voyagers are located in the outermost layer of the heliosphere, the "heliosheath," where the solar wind is slowed by pressure of interstellar gas.

Voyager 1 entered the heliosheath in December 2004 and Voyager 2 followed later in August 2007. These crossings were key to Opher et al's discovery. The size of the heliosphere is determined by a balance of forces: Solar wind inflates the bubble from the inside while the Local Fluff compresses it from the outside. Voyager's crossings into the heliosheath revealed the approximate size of the heliosphere and, thus, how much pressure the Local Fluff exerts. A portion of that pressure is magnetic and corresponds to the ~5 microgauss Opher's team has reported.

The fact that the Fluff is strongly magnetized means that other clouds in the galactic neighborhood could be, too. Eventually, the solar system will run into some of them, and their strong magnetic fields could compress the heliosphere even more so than now. Additional compression could allow more cosmic rays to reach the inner solar system, possibly affecting terrestrial climate and the ability of astronauts to travel safely through space. On the other hand, astronauts wouldn't have to travel so far because interstellar space would be closer than ever. These events would play out on time scales of 10s to 100s of thousands of years, the time it takes for the solar system to move from one cloud to the next.

DID YOU KNOW?

This month, we focus on Vega, the fifth brightest star in the night sky, and also consider the characteristics of main sequence stars.

Vega (Alpha Lyrae, the harp)

The name means 'swooping eagle' or 'vulture' (Arabic). It is the second brightest star in the northern hemisphere after Arcturus and is visible north of 51 deg South. With Altair (Aquila) and Deneb (Cygnus), it forms the 'summer triangle' in the northern hemisphere.

It is the most extensively studied star after the Sun. Features in the dust round Vega may be signatures for a planetary system. Because the Earth's pole 'wobbles' over time, Vega will replace Polaris as the North Star around 14,000 CE.

Vital statistics

- 1.5x the mass and 37x the luminosity of the Sun
- 25 ly away
- m = 0.03 – Vega is the 'calibration candle' for defining apparent magnitude, regarded as m = 0. M = 0.58

A blue-tinged white **main sequence** star, it will become a red giant, then a white dwarf. Although younger, like the Sun, it is made of mostly hydrogen and helium.

The Sun rotates in 27 days, but, although larger, Vega rotates every 12.5 hrs. This high speed of rotation means than it bulges significantly at its equator, making the star 23% wider than it is tall. This elliptical shapes means that the star's gravity is not evenly distributed across the surface. Because the equator is further away from the centre of mass, gravity is lower in that region, making temperatures at the equator lower than at the poles.

Main sequence stars

After a star has formed, it creates energy in the hot, dense core through nuclear fusion of hydrogen into helium. During this time, it is said to be a main sequence star (equivalent to the long span of adulthood in humans). Examples: Sun, Sirius, Alpha Centauri A&B.

Stars spend most of the their lives in the main sequence eg the Sun took about 20 million years to form, but will spend about 10 billion years as a main sequence star before evolving into a red giant. Main sequence stars are in hydrostatic equilibrium, where the outward thermal pressure from the hot core is balanced by the inward gravitational pressure from the outer layers. Energy created at the core makes its way to the surface by either radiation or convection, and is radiated away at the photosphere, the region located on the outer part of the star from which externally perceived light originates.

Once a significant amount of hydrogen has been consumed, the star begins to move out of the main sequence part of its life and change its size and other characteristics as the means of energy production alter in response to the reduction of available hydrogen. These changes signify onset of its old age.

The lifespan of a main sequence star is determined by its mass. In general, the more massive a star, the shorter its lifespan in the main sequence. More massive stars have more fuel and might be expected to last longer. However, their larger mass means they have a stronger gravitational force. This increases the temperature of the core, making the nuclear reaction occur at a greater rate, using up the fuel more quickly than in smaller stars. Massive stars may only stay in the main sequence for a few million years, while smaller mass stars may last for billions of years.

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