The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER, FEBRUARY 2005

The next meeting of the Pretoria Centre will take place at Christian Brothers College, Pretoria Road, Silverton, Pretoria

Date and time	Wednesday 23 February at 19h15
Chairperson	Mike Haslam
Beginner's Corner	by Neville Young
What's Up	by Pierre Lourens

++++++++++ LEG BREAK - Library open ++++++++++++

Main Topic

Claire Flanagan - the energetic director of the Johannesburg Planetarium -with her talk entitled "What Every South African Needs to Know about Pulsars and the Square Kilometer Array"

The meeting will be followed by tea/coffee and biscuits as usual. The next social/practical evening will be held on Friday 18 February at the Pretoria Centre Observatory, which is also situated at CBC. Arrive

INSIDE THIS NEWSLETTER

Last month's meeting - by Johan Smit

The meeting was well attended, but due to some confusion regarding the whereabouts of the attendance register an exact attendance figure was not obtained.

Beginners corner:
Michael Poll introduced us to a constellation primer project that he is busy working on. This will be published in the foreseeable future.
There is definitely a need to make Michael's vast knowledge and experience available to the community. He explained how to observe and identify constellations and rated them according to ease or difficulty of finding and identifying. I will be the first buyer of that book.

What's up:
Wayne Mitchell showed us what to look for in February, both easy and knowing Wayne, also some challenging objects. He also advised us on a starry show for our loved ones at Valentines day. We are looking forward to feedback on that.
Both Michael and Wayne make regular appearances at the practical evenings and everyone is invited to come and learn from them.

Main Topic:
It was presented by Lorna Higgs.
A very innocently named topic, Bright stars, turned out to be a very thought-provoking and interesting subject.
In a presentation by such an interesting speaker it is very difficult to find outstanding instances, but Lorna's imaginative use of very simple presentation tools was definitely a highlight. High-tech is not always best. Content and presenting it properly is King and Lorna definitely rules in that field.
Well done Lorna, and she made me think when I now look up at the stars and wonder what happened when the light I see left them. Lorna has "built" a cheap time travel machine for me.

During the after-meeting talk around coffee and tea every-one agreed that the 3 speakers have set a high standard for 2005. To match that, speakers for the next meetings have their work cut out.
We look forward to an entertaining and learning-rich year.

Last month's observing evening—by Michael Poll

Jan 21st 2005

Cloud again - only 4 of us were there. We caught a glimpse of the moon but otherwise chatted. This month amongst other things, Saturn and the southern Milky Way will be available for observing.

The Brightest Stars – Past And Future :
1. From Hipparchus to Hipparcos – by Michael Poll

Hipparchus, mathematician and astronomer, lived in the second century BC. He was born in Nicaea, now Iznik, in Turkey, in about 190BC and died in about 120 BC, probably in Rhodes in Greece.

Hipparchus made a number of measurements of importance in astronomy. Possibly his most fundamental discovery was that of the precession of the equinoxes. Precession is due to the slow change in the direction of the Earth's axis of rotation. The discovery was a consequence of Hipparchus' measurement of the length of the year, when he found that there was a difference in the length of the sidereal year and the tropical year. The sidereal year is the time that the sun takes to return to the same place amongst the fixed stars, and the tropical year is the length of time that the sun takes to return to the same equinox. The tropical year is about 20 minutes shorter than the sidereal year. Our calendars use the tropical year, which synchronises the seasons with the calendar, meaning that the seasons repeat at the same time of year.

The data needed by Hipparchus to calculate the length of these two different years was not something that he could have found over a few years of observations. It has been suggested that he calculated the length of the tropical year using Babylonian data, and then checked this against observations of equinoxes and solstices, including his own data, and those of Aristarchus in 280 BC and Meton in 432 BC. Hipparchus probably also calculated the length of the sidereal year using older Babylonian data. He calculated the length of the year to within 6.5 minutes, and his value of 46" of arc for the annual precession compares with the modern value of 50.26".

Hipparchus discovered the variation in the apparent diameters of the sun and moon, and concluded that their distances from the Earth must therefore also vary. He calculated the distance of the moon as being between 59 and 67 earth radii : the modern value is 60 Earth radii.

In 134 BC Hipparchus classified stars into six magnitude classes according to their brightness: he assigned the value of 1 to the 20 brightest stars, to "weaker" ones a value of 2, and so on to the stars with a class of 6, which can be barely seen with the naked eye. He used terms such as "bright" and "small" to describe the stars. This magnitude scheme was later adopted by Ptolemy.

Hipparchus created the first star catalogue. He saw a nova in Scorpius in about 135 BC, (the first nova to be recorded), after which a contemporary wrote "…therefore he began a blasphemous undertaking, namely, to count the stars and measure their positions …." Using an armillary

sphere (a forerunner of the astrolabe) he measured the co-ordinates of about 850 stars, although some sources say the catalogue comprised 1080 stars. The catalogue was probably completed around 129 BC, but the original has not survived. It may have been lost in the fire at the great library in Alexandria.

In his star map Hipparchus may not have used a systematic coordinate system but used various different ways to designate the position of a star. He used ecliptic co-ordinates (by designating the position of a star on the basis of its angular distance from the plane of the ecliptic, and its celestial longitude, which is its angular distance from a zero point on the ecliptic, such as the vernal equinox), and he also used other co-ordinate systems, including some equatorial coordinates.

It has recently been announced (January 2005) that Bradley Schaefer (Professor of physics at Louisiana State University) may have discovered a pictorial representation of Hipparchus' catalogue. The representation is on a Roman statue called the Farnese Atlas. The statue, currently housed in Naples, Italy, dates back to the second century, and depicts Atlas, one of the Titans, holding a sky globe on his shoulder. The statue's sky globe, which is 66 cm (26 inches) in diameter, shows 41 Greek constellations, as well as the celestial equator, the tropics and the ecliptic. Schaefer states that the constellations are accurately depicted, so the sculptor must have based his work on some specific astronomical observations. After measuring 70 positions on the globe Schaefer concluded that the Farnese Atlas best matches the sky of 125 B.C., within about 55 years either way. This is too early for Ptolemy, too late for Aratus of Soli, but almost a perfect match for Hipparchus, and so Schaefer suggests Hipparchus' catalogue as the original observational source. The discovery may lead to the solution of two long-standing questions : what did Hipparchus use as a co-ordinate system and what fraction of Hipparchus' star catalog was incorporated into Ptolemy's "Almagest" ?

The measuring of star positions is called "astrometry". With the instruments available, Hipparchus was able to determine star positions to within about one third of a degree. Positional measurements have become more and more accurate over the centuries since Hipparcus, improving by nearly 100 000 times. The Hipparcos satellite, (***Hi***gh ***P***recision ***Pa***rallax ***Co***llecting ***S***atellite) launched in 1989 and operational from then until 1993, provided the most accurate star positions yet. The satellite measured angles as small as 2 milliarcseconds. One arc second is $1/3600^{th}$ of a degree, and one milliarcsecond is $1/1000^{th}$ of that, so a milliarcsecond is 0.00000028 of a degree. For a person standing one metre away from you, the hair on the persons head would grow that much in a half second of time…..

Star brightness measurements

For a century, doing them one by one, this has been a staple of amateur astronomers. However, the SuperWASP system, that is being developed at an observatory on La Palma in the Canary Islands, will be capable of making up to **50 million** star brightness measurements **in one night**. What is more, similar systems are being developed at over 20 other centres. See Sky & Telescope, August 2004, p 30.

Sterrewag te koop

Ek wil my sterrewag verkoop. Prys: R2000. Nog foto's beskikbaar. Kontak Dewald van Vuuren by:
Tel. 012 674 1013
Fax. 012 664 2729
Sel 082 726 8903
E-pos Dewald.JVVuuren@kumbaresources.com

Asteroid

An asteroid that has an orbit entirely within that of Earth, was discovered recently. See Sky & Telescope, September 2004, p 18.

Water on Mars

The two robot rovers on Mars, named "Spirit" and "Opportunity", have found convincing evidence that liquid water once flowed on the surface of Mars. See Sky & Telescope, June 2004, p 20 & October 2004, p 16.

Astronomy on radio

There is a short talk on astronomy on SAfm just before the 8 a.m. news on Saturday mornings. It is given by Case Rijsdijk, former president of ASSA.

Future talks

March – "Titan" by Neville Young & Mike Haslam.

April – "Making observing a pleas ure" by Wayne Mitchell.

April/May – "Gamma-ray Astronomy" by prof de Jager.

May – "TV – Beating the Seeing".

Astronomical website addresses

The Extrasolar Planets Encyclopedia: http://www.obspm.fr/encycl/encycl.html

Extrasolar Visions - An Extrasolar Planets Guide: http://www.extrasolar.net

Terrestrial Planet Finder: http://www.terrestrial-planet-finder.com/

SETI

As NASA pursues unmanned missions throughout the solar system, the quest for signs of life on distant planets -- more likely in the past than in the present -- is gaining increased attention from space agency planners.

The problems are formidable: They must increase their understanding of how life originated and evolved on Earth; they must deduce the most likely places where water could have existed on planets like Mars; and they must develop new techniques for drilling many yards, and later many miles, beneath the surface of such planets.

Finally, the scientists must be scrupulously careful with every spacecraft and every tool that lands on any planet to make sure they do not carry microbes from Earth that would contaminate whatever extraterrestrial life might conceivably exist now or in the past.

At a recent annual meeting of the American Geophysical Union in San Francisco, NASA-sponsored scientists from many research institutions called their search for life on other planets and their moons "a unifying theme" for solar system exploration.

"Astrobiology is now the intellectual centerpiece of NASA's efforts in space exploration," said Bruce M. Jakosky, professor of geology at the University of Colorado, referring to the new field that integrates astronomy with the study of life.

Mars and Europa, the ice-covered moon of Jupiter, "appear as potentially habitable worlds, either today or in the past," he said. "And the smoggy atmosphere of Saturn's moon Titan may well cover a surface where intermittent water and organic chemicals might have encouraged the evolution of living organisms."

As a result of recent discoveries of microbes living in freezing cold, with no oxygen or light, and the profound pressures of deep underground mines, Jakosky noted, the extreme diversity of life on Earth makes it quite likely that life could be or have been widespread in our solar system.

"We could probably pick up some bugs right now on Earth that would find themselves quite happy in a Martian environment," he said.

For 30 years, scientists scanning images of Mars from spacecraft have been tantalized by giant channels, broad basins and sinuous valleys on the Martian surface that look exactly as if water had flooded and flowed there billions of years ago.

Three spacecrafts -- one stationary lander operated by the European Space Agency and two NASA rovers – are on the Red Planet and search for signs of past and present life, and water.

In an even more ambitious mission, astronomers and astrobiologists said at the AGU meeting that they have begun planning a voyage to Europa to study what must be deep oceans -- and possibly life -- beneath the icy crust of the Jovian moon.

They envision sending a 300-foot-long, nuclear-powered craft -- called JIMO, for Jupiter Icy Moons Orbiter -- to spend five years circling Europa, plus two others, Callisto and Ganymede. Scientists have not ruled out landing probes or instruments on the surface of Europa to aid the search.

The mission will fly no earlier than 2010 and could cost as much as $8 billion.

As the space agency pursues missions to other planets, a major focus is protecting those worlds and ourselves, said John D. Rummel, who bears a unique title as NASA's "planetary protection officer" in Washington. "As we discover life out there, we don't want to find that we've already killed it off."

International space treaties require space-faring nations to develop foolproof techniques for rigorously sterilizing every object -- spacecraft or instrument -- that is designed to approach or land on a planet, he said. Similarly, when spacecraft are planned to return to Earth, they must be built so there is no possibility of unknowingly bringing an alien organism back to Earth.

Back when the Apollo program was carrying astronauts to the moon, their samples of lunar rock were quarantined for months, and their instruments were sterilized. Because the job will be infinitely more difficult for the robotic planetary explorers, teams of scientists are already developing the crucial anti-contamination technology, Rummel said.

NASA has created a major "Astrobiology Institute" with its headquarters at the Ames Research Center in Mountain View, with some 20 universities and research institutions participating.

Geochemist David J. Des Marais, an astrobiology researcher at Ames, noted the importance of understanding the evolution of life on Earth if scientists are ever to understand how life might have developed on planets elsewhere.

His own research into how life developed suggests that water must have first rained down on the new-forming Earth from comets and meteors as much as 4.9 billion years ago and that more massive impacts introduced organic chemicals within an additional billion years.

"Proto-cells" then began to form on the warming Earth. And finally by 3.7 billion years ago, the first life appeared along the coasts of small, new continents in the form of "biofilms" and layers of microbial mats whose fossil forms have been discovered in recent years.

Within a few hundred million years, those microbes had learned to use sunlight for energy, growth and reproduction. After a few million years, more advanced life forms emerged. And after that, the pace of evolution and growth of diversity increased swiftly, he noted.

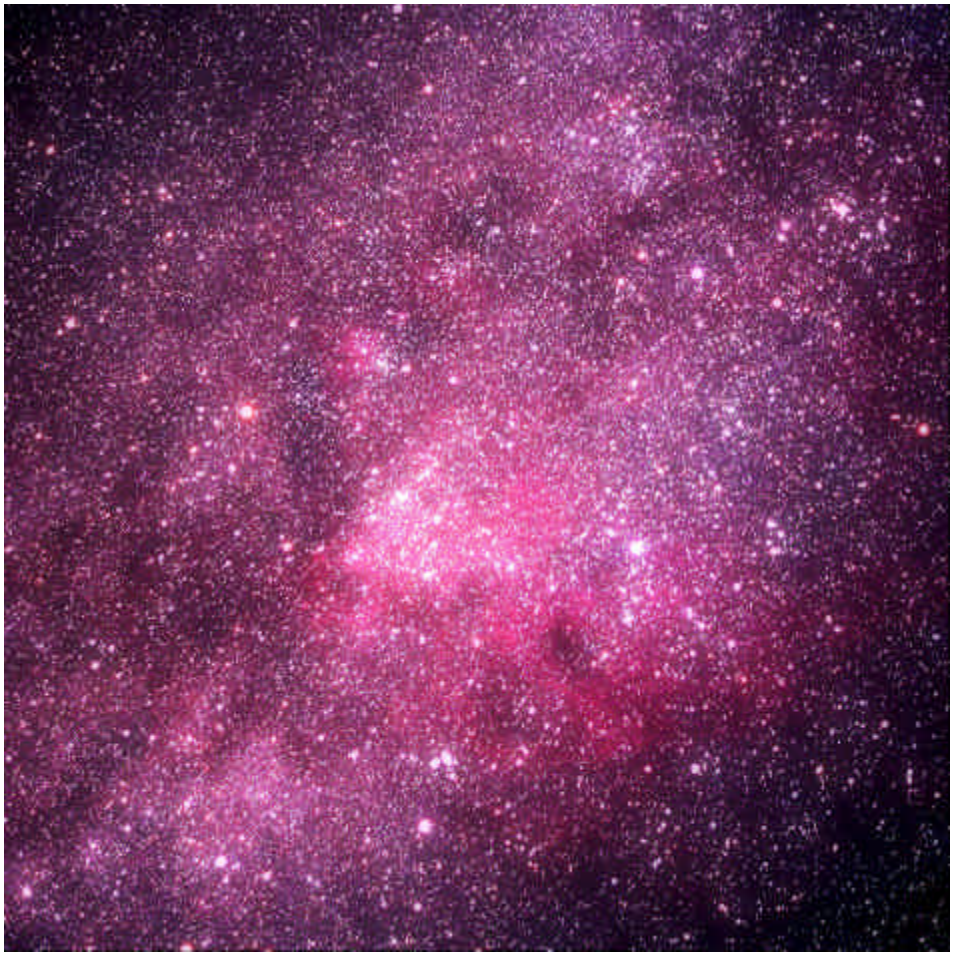
"Understanding the nature and timing of this ascent of life is crucial for discerning our own beginnings," Des Marais said. "This understanding also empowers our search for the origins, evolution and distribution of life elsewhere in our solar system and beyond."

Website: http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2003/12/15/MNGNV3NFRI1.DTL

David Perlman

San Francisco Chronicle Science Editor

Astrophotography



Gum Nebula

This processed photo of the Gum Nebula in the Vela constellation was taken on 5 January 2005 at the dark skies of Kagga Kamma Game Reserve, Western Cape. The exposure time was 20 minutes using a 50mm lens at f1.7 with Fuji Sensia 400 film.

Photo taken by Mauritz Geyser, one of the committee members of our Centre.

PRETORIA CENTRE COMMITTEE

Chairman	Neville Young	083 303 2840
Vice Chairman	Michael Poll	012 331 1615(h)
Treasurer & Mem Secretary	Rynhardt van Rooyen	011 441 3458(w) 083 654 1862
Secretary	Tony Viljoen	012 654 5783(h) 072 247 6648
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	Mike Haslam	012 667 4845 083 675 4984
	Lorna Higgs	012 333 9366(h)
	Wayne Mitchell	012 719 9065(w) 072 465 7739

Email addresses at www.pretoria-astronomy.co.za