

CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for December 1999

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**The Sir Herbert Baker Library, 18a Gill Street, Observatory, Johannesburg
P.O.Box 93145, Yeoville, 2143**

Editorial

December (already???) - we're halfway through the ASSA Jo'burg Centre's year and it feels like just a couple of months ago, we were gathered at Tom's farm enjoying the 1998 Star Party, and within a couple of weeks we'll be there again celebrating the end of 1999...and just around the corner, 2000 - the last year of the 2nd millenium.

The bright planets are still putting on a good show for us - Jupiter (a good sight in a moderate sized telescope and quite awesome in a large one) and Venus are very bright and unmistakable and Saturn is also there though less spectacular to the naked eye.

We've managed to put together a bumper Year-end issue with many varied and interesting articles.

Eben van Zyl continues his interesting series on Galaxies by introducing us to Globular Clusters and Trevor Gould has submitted a couple of articles, one of which is of special interest to those who are involved in, or who want to become involved in, the recovery of meteorites.

Brian has supplied us with the Astronomical calendar for December and January and your editor will be applying a little arm-twisting to get an article from the Frasers about their Leonid viewing trip to the Kalahari, for our next (January) issue.

There have been several reports of good Leonid sightings and any of you out there who have something to share with us, please do so for the January issue. Your editor has received several emails covering a wide range of Astro-topics and has included a couple for your perusal.

The December and January issues will, unfortunately, be published without the always excellent and interesting articles on JPL and NASA from Bill Wheaton, who undergoes major surgery on the 30th November. The good wishes of Committee and Members are directed to you Bill and we look forward to hearing from you once you regain your mobility.

Lastly, we wish all members well over the Festive Season.

The Editor,

Chris chris@aqua.co.za

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The Year End Star Party

Tom has once again graciously opened his home to us as a venue for our annual Year End Star Party. Those of you who attended last year's blast will remember the lethal concoction (I think it was some highly-secret rocket fuel) that Tom served up to the bold and brave amongst you. He has assured me that there is more of this medicinal anomaly available to be consumed by any of you courageous enough to say YES! Well even if you don't try the brew - the fires will be available for you to braai your own consumables.....

PLEASE REMEMBER THAT THIS IS A BRING 'N BRAAI

.....so bring along anything you wish to consume - both food and beverages. Come along from late afternoon (16:00ish) onward.

A map to navigate to Tom's farm is printed on the next page and if you follow the straightforward directions thereon, you won't have any problems getting there.

.....and for those of you who wish to take your telescopes along, the view is magnificent and the stars look as though they are almost within reach!!!

Future Meetings

January 12 th	Computers in Astronomy	Chris ²
February 9 th	METSOC 1999	Trevor Gould
March 8 th	Marconi	Tony Voorvelt
April 12 th	Planetarium Meeting	T.B.A.

We will be asking Dr Nicholson of HartRAO to present a lecture at one of our meetings.

Dark Sky Viewing

On the Saturday nearest New Moon at Tom Budge's Farm in the Magaliesberg. Remember that this is by arrangement only as most observers will be following specific viewing programmes and if you don't have your own 'scope, you should contact one of the observers (e.g. at the monthly meeting) to arrange some viewing time with them.

8 th January	3 rd June	25 th November
5 th February	1 st July	
4 th March	26 th August	Year End Star Party
1 st April	23 rd September	<i>"Under the Full Moon"</i>
6 th May	28 th October	9 th December

Jo'burg Centre Outings for 2000

Your Committee is making arrangements for several outings during the year. Amongst these are some old favourites as well as a couple of new ones which should prove interesting. The annual jaunt to Swinburne in August will be replaced this coming year with a jaunt to Nylsvlei which should be more Astronomically beneficial and less of a financial burden. We will also be trying to arrange 2 trips to Boyden as well as trips to Hartebeeshoek, the Tswaing Crater and the Science & Technology Museum.

Thanks

A great vote of thanks to our hard-working Curator of Instruments for all the non-Astronomical work he has accomplished during the last couple of months. This includes items such as Lights and Drains.

Thanks Frans.

1999 Star Party - Map to Tom's Farm

Thomas W. E. Budge

Protea Ranch, Vlakplaats, 354JR, Gauteng

	Box 72229, Parkview, 2122 South Africa
	
	
	Office: (011)484-4740
	
	Facsimile: (011)484-3327

Directions

Distances not to scale. Minor roads not shown.

Turn onto the Henopsrivier gravel road and travel for almost exactly one kilometer. Turn right onto a private tar road, following Highveld Taxidermist and Shona Langa signs. Travel the entire length of the tar road, continuing on the gravel for another 150 meters. Take the left fork at the Y-junction, following the strip road over the hill to Protea Ranch. The strip road is rough

VARIABLE OF THE MONTH: A CHRISTMAS HAMPER

This month, Canopus readers are treated to not one, not two but no less than nine variables. They are the probable eclipsing binaries DG Cet, DS Cet, AL Ari, FU Eri, V1125 Tau, V1366 Ori, UZ Vol, V365 Pup and V366 Pup. Full details and charts can be found in "A Treasure Trove of Variable Stars" on page 108 of the December Sky and Telescope.

The article explains how beginners can make the observations and what to do with them.

Here is a good opportunity to do some real science without having to be experienced, super accurate vs observers. I have been trying for 18 years to interest SA amateurs in eclipsing binary programmes without having much success. PEP specialists like Hugh Lund, Andre van Staden and Luciano Pazzi have done some work but a vast field is open to observers equipped with ordinary eyeball photometers.

Let me end by repeating that you only have to ask, in order to be given help in starting and by quoting the closing paragraph of the Sky and Telescope article: "Eclipsing binaries have played a crucial role in astronomers' understanding of the Universe. For example, the revolution period revealed by eclipses can be compared to the radial velocities of the components determined by spectroscopy. This information often makes it possible to deduce the diameters, masses and densities of the individual stars, even without necessarily knowing how far they are."

Have a happy Christmas and make this old curmudgeon happy by embarking on some serious scientific work.

Danie Overbeek.

Speed of Light May Not be Constant, Physicist Suggests

A U of T professor believes that one of the most sacrosanct rules of 20th-century science -- that the speed of light has always been the same -- is wrong.

Ever since Einstein proposed his special theory of relativity in 1905, physicists have accepted as fundamental principle that the speed of light -- 300 million metres per second -- is a constant and that nothing has, or can, travel faster. John Moffat of the physics department disagrees -- light once travelled much faster than it does today, he believes.

Recent theory and observations about the origins of the universe would appear to back up his belief. For instance, theories of the origin of the universe -- the "Big Bang"-- suggest that very early in the universe's development, its edges were farther apart than light, moving at a constant speed, could possibly have travelled in that time. To explain this, scientists have focused on strange, unknown and as-yet-undiscovered forms of matter that produce gravity that repulses objects.

Moffat's theory -- that the speed of light at the beginning of time was Much faster than it is now -- provides an answer to some of these cosmology problems. "It is easier for me to question Einstein's theory than it is to assume there is some kind of strange, exotic matter around me in my kitchen." His theory could also help explain astronomers' discovery last year that the universe's expansion is accelerating. Moffat's paper, co-authored with former U of T researcher Michael Clayton, appeared in a recent edition of the journal Physics Letters.

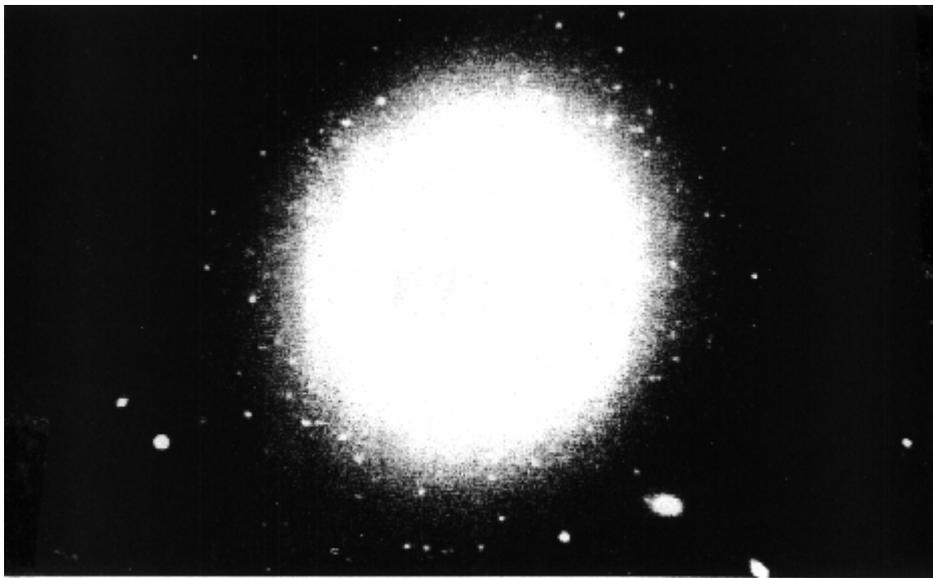
Andrew Yee

ayee@nova.astro.utoronto.ca

THE GLOBULAR CLUSTERS

While the galaxies were condensing from gasclouds of size 10^7 to 10^{11} solarmasses, smaller aggregations of stars were formed on the outskirts of the galaxies from 10^5 to 10^6 solarmasses of hydrogen and helium, the latter constituting about 20%. These condensations formed the globular clusters that remained in the gravitational sway of the galaxies, very much like "islands" around continents. They contain 100 000 to 1 000 000 stars each. Since they were formed from the primeval gas of the cosmo-genesis, the stars of the clusters contain very little by way of elements heavier than hydrogen and helium. The fact that their stars are poor in heavier atoms, is borne out by spectroscopic analysis. The clusters also contain very little dust which consists largely of heavier elements. The absence of dust shows that the globular clusters could not, in the past, have produced any supernovae which would have enriched the clusters with dust.

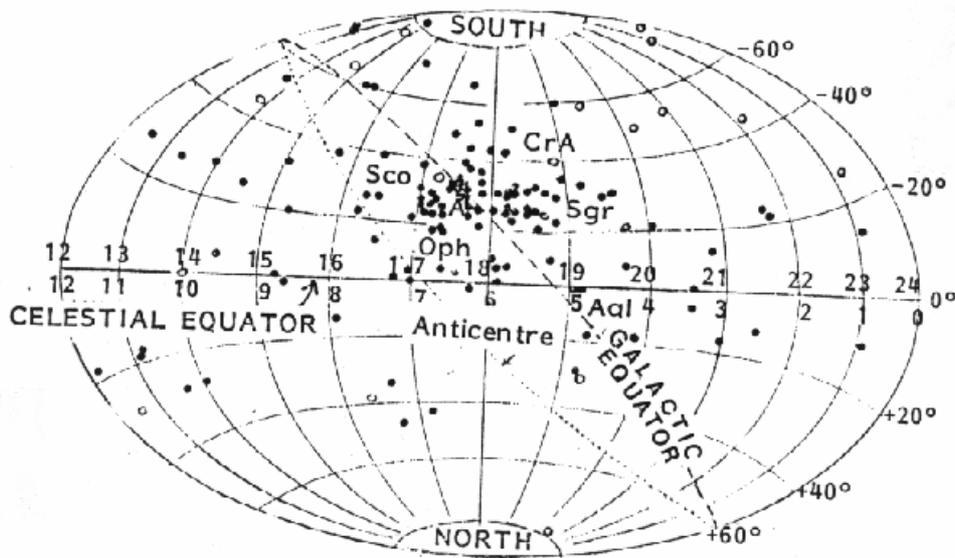
A photograph of the massive E0-elliptical galaxy M87, NGC 4486, situated at 12h 30m North $12^\circ 27'$ in the constellation of Virgo, shows many bright spots on the periphery of the galaxy.



Hundreds of globular clusters appear as fuzzy dots in this photograph of M87

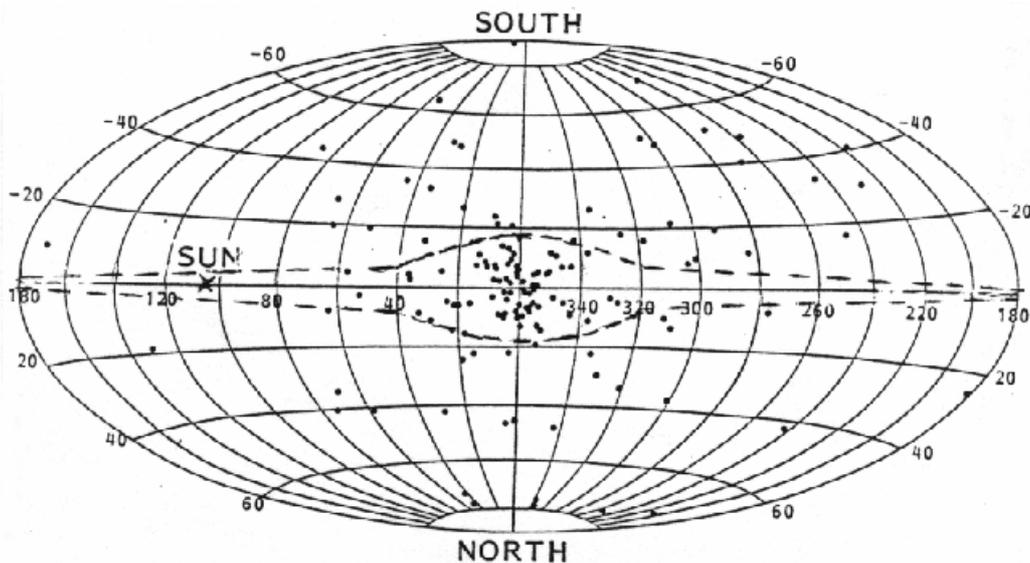
These bright spots must be globular clusters, because not even the very brightest stars would be visible at that distance of 24 to 30 million light years. Some 1000 globular clusters have been counted around M87. It is estimated that there must be many more thousands of globular clusters, hidden in the glare of the galaxy. The clusters are very evenly distributed around the galaxy, and they show how the clusters move in orbits around the galaxy, proving that they are bound in the gravitational field of the galaxy.

When we look at the globular clusters of the Milky Way, we see that things are very different. Here the globular clusters seem to be mostly located in one part of the sky, between right ascension 17h and 19h and between declinations 20° and 40° South, as shown in Diag 1. They are clustered about the point RA 17h 42m, declination $-28^\circ 55'$, which is very close to the centre of the Milky Way galaxy. If they are clustered around the centre of the Milky Way, why are they located to one side of the sky?



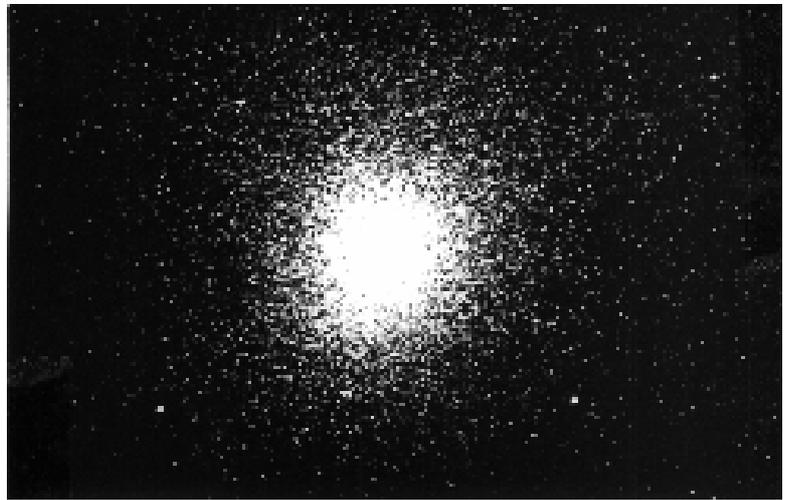
Diag 1. Locations of globular clusters around the point 17 42 -28 55

This must obviously be an illusion and it must be due to the fact that the Sun (where our vantage point is located) is not centrally placed in the Milky Way. If we convert the coordinates of the clusters to galactic longitude and latitude we get the plot as shown in Diag. 2. Here the globulars are evenly spaced around the centre of the Milky Way, as the case would be if they are held in the gravitational field of the Milky Way. The outer confines of the Milky Way are shown by dotted lines and the most likely position of the Sun is indicated at three-fifths of the distance from the centre towards the outer rim, ie about 30 to 32 thousand light years from the centre. In this diagram we see that almost all the globulars are located towards one side of the sky as we observe in actual fact. Thus, working out the real galactic locations of the globulars provided astronomers with the key which enabled them to locate the position of the Sun as being three-fifths from the centre of the Milky Way galaxy! The Sun finds itself between the Orion Arm and the Perseus Spur of the spiral arms of the Milky Way and 30 to 32 thousand light years from the centre. Don't be downhearted, the Sun is still 20 thousand light years inside the outer edge of the spiral arms of the Galaxy!

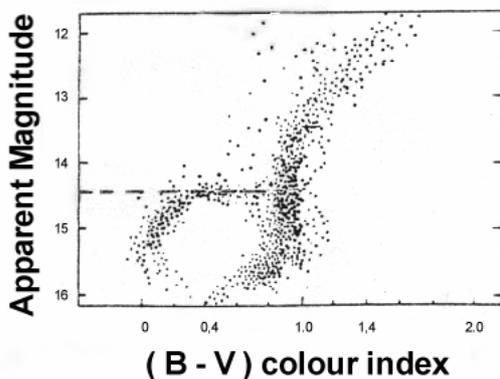


Diag 2. Distribution of globular clusters around the Milky Way.

We can now see why the Milky Way seems to spread in a thin strip right around the sky, because the Sun is situated right inside the spiral arms. There is a concentration, a hump, in the direction of Sagittarius, which is the direction of the centre of our Galaxy. The point Sagittarius A is the point from which radio waves were picked up by Karl Jansky in 1931-32. Every 23h 56m (sidereal day) the radio waves were heard. This was the birth of radio astronomy, but it was only after World War II that radio astronomy really took off and radio telescope dishes popped up all over the place. The largest of all the globulars is Omega Centauri, NGC 5139, which is barely visible to the naked eye at 13h 26m -47° 25', north-east of the Southern Cross. It spans at least 30', as large as the full moon. It contains at least 1 000 000 stars. The largest telescopes show that it actually spreads over 65 minutes of arc and may contain as many as 1 500 000 stars. Its distance from the Sun is 17 000 light years. Since the stars in Omega Centauri are all equally far from the Earth, on account of the great distance, we do not need to know the



absolute magnitudes of the stars in order to draw a Hertzsprung-Russel diagram of absolute magnitude against spectral types. We can use the apparent visual magnitudes against their (B - V) colour indices, colour index being the difference between the magnitude through a blue filter (B) and the magnitude through a yellow filter (V). This is shown in Diag 3. We can see at a glance that many of the stars have left the main sequence and moved to the giant and supergiant areas (to the upper right) of the graph. There are also many stars in the horizontal branch (dotted line). These are the RR Lyrae variables of which we know that they all have the same absolute magnitude of 0,8 and



Diag 3 Colour index H - R diagram of Omega Centauri

are of spectral type A. The mean apparent magnitude of the RR Lyrae variables, is indicated by the dotted line. It cuts the Y-axis at 14,4 which can be taken as the mean apparent magnitude of the RR Lyrae variables in the cluster, We thus know the absolute magnitude and the apparent magnitude m and can therefore calculate the distance of Omega Centauri from the formula:

$$M = m + 5 - 5\log D,$$

where the only unknown is D the distance in parsecs,

Let's do it.....

$$0,8 = 14,4 + 5 - 5 \log D$$

$$\therefore \log D = (14,4 + 5 - 0,8) \div 5$$

$$= 18,6 \div 5 = 3,72$$

$$\therefore D = \text{antilog } 3,72 = 5241,8 \text{ parsecs}$$

$$= 5241,8 \times 3,26 = 17088 \text{ light years}$$

Any amateur astronomer can select a globular cluster of his/her heart's desire and determine the apparent visual magnitudes of several of its RR Lyrae variables. They are easily earmarked because they have very short periods of variability of less than 1½ days. The mean of his magnitudes so obtained is the value of **m**. Using 0,8 for **M** he can then calculate the distance of the globular cluster.

Five to choose from are listed here:

Omega Centauri	NGC 5139	30' 13h 26	-47° 25'
47 Tucanae	NGC 104	25' 00h 24	-72° 08'
M4 in Sco	NGC 6121	20' 16h 23	-26° 30'
Ara	NGC 6397	19' 17h 40	-53° 40'
Pavonis	NGC 6752	15' 19h 10	-60° 00'

NGC 6397 in Ara is probably the nearest of all the globulars. Let's see what value you find for its distance.

If the amateur also measures the blue and yellow magnitudes of the other stars in the cluster, he will be able to draw a Colour Index Hertzsprung-Russell diagram of apparent magnitude against colour index for the whole cluster. He will then be able to see what percentage of the stars have left the main sequence to move to the giant and supergiant areas and thus be able to estimate the age of the cluster. If he finds an age of 10 thousand million years, it means that the Hubble constant must be close to 100 km s⁻¹ Mpc⁻¹. If he finds an age of 13 milliard years, the Hubble constant will be closer to 55..

Such a project will keep an enthusiast busy for several years.

Globular clusters have been found that are very far from the Milky Way, eg, PAL 2 which is 493 milliard light years away; PAL 3, 326 milliard Light Years: PAL 4, 304 milliard light years and NGC 2419, 311 milliard light years. The first three were discovered by the 5-metre Mt Palomar telescope. These globulars obviously belong to the intergalactic space and they probably roam from galaxy to galaxy through the depths of space

Jan Eben van Zyl

For Sale

Telescope Pier 1170mm high
10" grey painted steel tube

on a 500mm circular base 10mm thick.

The top mounting area is 8mm x 10" diameter steel plate w/mounting holes.
There is a 4" access hole on one side to facilitate the fitment of bolts and nuts.

The tube is braced by 5 triangular flanges plus 2 steel tubes at the rear.

Asking only R200-00

Contact Bill Lockhart on (011) 896-2395

THE SEASONS

“Spring has arrived” - (Editorial. CANOPUS Sept 1999). Arguments about when the Seasons begin and end are often more emotional than logical, but there is more to the subject than one might think. The mathematical treatment of it is given in “*GENERAL ASTRONOMY*” by Sir Harold Spencer Jones, late Astronomer Royal. The main factors concerned are:

1. The Earth moves around the Sun in an elliptical orbit at a varying velocity, greatest at Perihelion (about 2 January), when it is closest to the Sun and slowest at Aphelion, when it is furthest from the Sun (about 4 July).
2. The Earth’s axis is tilted at 23,5 degrees so the Southern Hemisphere faces towards the Sun in summer, when the Earth is near Perihelion and travelling fastest. In winter the Southern Hemisphere faces away from the Sun and the Earth is near Aphelion and travelling slowest.
3. The result is that, *THEORETICALLY*, the Southern Hemisphere has short hot summers and long cold winters as follows:

Spring	lasts for approximately	90 days
Summer	do. do.	89 days
Autumn	do. do.	92 days
Winter	do. do.	94 days

So if we assume that the Equinoxes and Solstices mark the midpoints of the Seasons and the above Periods be equally divided about them, then we can say that *THEORETICALLY*:

Spring begins on	8Aug, mid-Spring	=21Sep (Equinox),	ends on	5 Nov
Summer	6Nov, mid-Summer	=21Dec (Solstice),		2 Feb
Autumn	3Feb, mid-Autumn	=21Mar (Equinox),		5 May
Winter	6May, mid-winter	=21Jun (Solstice),		7 Aug

However, another factor is that there is a delay in the time that the Earth absorbs heat from the Sun in Summer and radiates it out in Winter. But the ruling factor is climatic conditions, which are generally unpredictable and often overrule all the above.

It must be remembered that the Equinoxes and Solstices do not always fall on the 21st of the month and can vary between the 20th and the 23rd of the month from year to Year.

Incidentally, the above dates agree very closely with those given in the Chinese Calendar which has been in use for some 3 400 years. The beginnings of the seasons are marked by specific names and dates (for the Northern Hemisphere) viz:

Lichun	beginning of Spring:	4 February
Lixia	beginning of Summer:	6 May
Liqiu	beginning of Autumn:	6 August
Lidong	beginning of Winter:	6 November

Richard Overy

Minor Planet Occultation - 14th October 1999

At the October meeting on the 13th October, Danie Overbeek showed that there was a good possibility of the occultation of an 8th magnitude star by the minor planet 48 Doris being visible from the Gauteng area. Danie had received last-minute predictions that put the shadow track of the 190 km wide asteroid right over the Johannesburg area. He was so confident of the path that he decided to go down to the Vaal river at Villiers to get a better spread of observers.

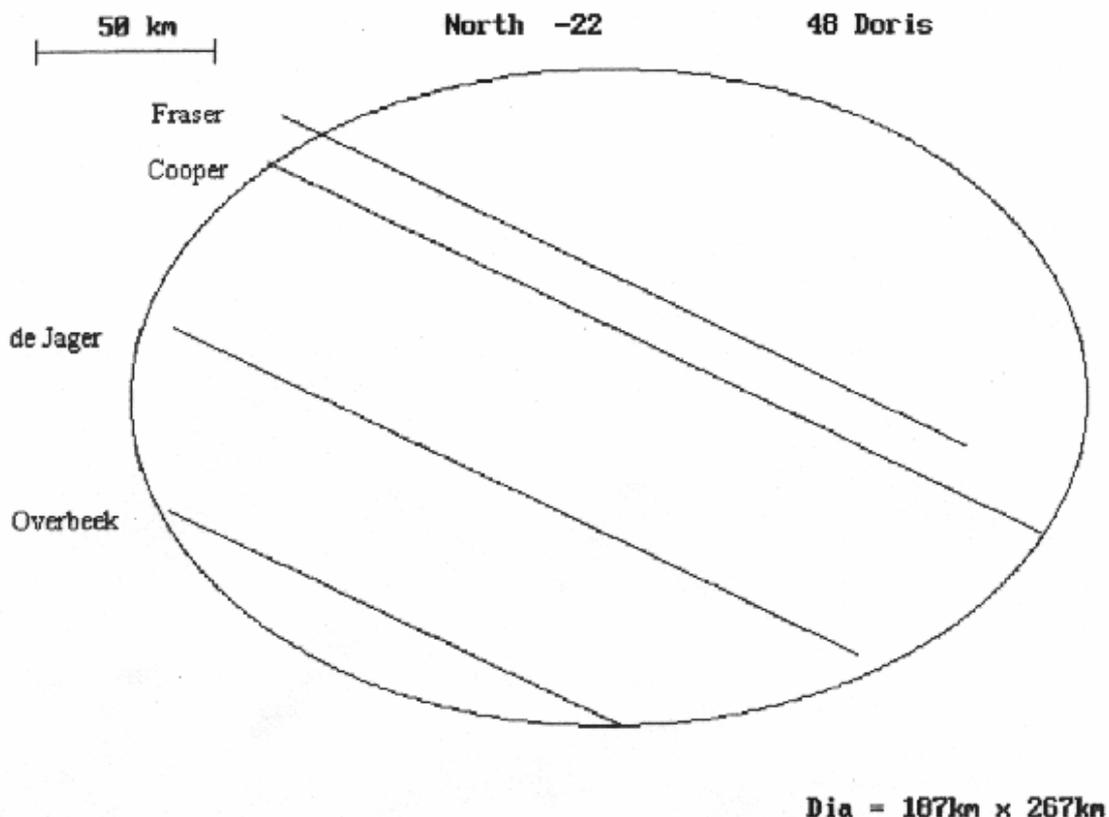
His enthusiasm worked, sort of, because about 10 or 11 observers attempted the observation. Not all of them, however, obtained successful results.

For one observer the star moved behind his neighbour's tree and so could not be observed from his fixed telescope. Another observer bumped his telescope just at the wrong time and so missed seeing the event. Then, because the event occurred about 5 minutes later than the original prediction and not everyone knew about this, one observer stopped looking about 2 minutes before the event and so missed it. Three people were looking at the wrong star or were a bit late and did not find the star. In the end five observers saw the event, two from the same location. Still, a very good result, which, but for the above sad tales, might have been the all-time best-observed occultation from the Southern hemisphere!!

It was a very good learning exercise for all. Some of those who missed will get good observations next time. We have realised that the procedure that we have been using to get a time signal is not totally reliable and are probably going to switch to a different method in future. Don't think that the Telkom time service and/or the SABC 6 "pips" are accurate!! They may not be. The CSIR have a PC-based time service, but this is not very helpful out in the country. They have advised that they are looking at a voice linked time service, which would solve all our problems.

The attached diagram shows the cords obtained by the four stations, as well as a possible outline of the shadow as it passed over our part of the Earth. This profile can be juggled around and altered in a number of ways and the suggested figure shown may differ from the real shadow somewhat. But it does show how you can work out the shape and size of a piece of rock that was 495,000,000 kms away at the time, with just a small telescope in your backyard. One observer saw a "blink" that certainly suggests that Doris has a small moon. And that is why we do these observations. Its all in the pursuit of serious science. But fun too.

Brian Fraser



HARTRAO needs you!

The Hartebeeshoek Radio Astronomy Observatory now has a busy public outreach program, and on many evening hosts groups, some of whom sleep overnight.

The evening groups are treated to a magnificent view of the night sky and binoculars are made available to them, as is a 14 inch Celestron, which is operated by a professional astronomer.

The already busy astronomers are therefore now also doing night shift, catering for the groups. They could use some help from us amateurs.

Amateurs could help in two ways:

[1] Amateurs have a hard earned knack of finding objects in the sky at short notice, completely without help from star charts or

Trevor Gould

computers. They could show the professional radio astronomers where the visual objects are.

[2] Amateurs could assist in running the evening groups: there may be some compensation for travel costs involved. Certainly if we could spare an evening once every, say six weeks, the task would not be onerous and it would be a great pleasure to view the sky from out of town, in a safe locality, and through a 14" 'scope.

If anyone is interested in helping out, please contact the writer.

For a long time now, HARTRAO has freely advertised the Johannesburg Centre as a place for interested amateurs to gather: let's help them to help us!

Central Bureau for Astronomical Telegrams

Hi Chris

Please mention in CANOPUS that Professor Derck Smits of UNISA offers an e-mail service to interested amateurs who would like to receive CBAT e-mail announcements. This works on an automatic basis, such that the amateurs e-mail address is added to the list of those who presently receive this regular data.

Interested amateurs may contact me, quoting the address to which they would like the e-mail to be sent.

Regards!

Trevor Gould

Trevor Gould + Associates

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+27-83-212-8945 [Mobile]

+27-11-886-5602 [Home and Voice Mail]

+27-11-359-2290 [Fax]

As Large as.....

Looking at the world from space it is just baseball-sized. On the site of the Swiss Fourmilab you can start enlarging it...again...and again...and again. Go to 'Astronomy and Space', then to 'Earth and Moon Viewer' and then to 'Map of the Earth'

<http://www.fourmilab.ch>

The moon stuff is interesting

Chris Stewart

FOR SALE

Meade ETX-90EC Maksutov-Cassegrain Astro Telescope(F=1250mm f/13.8)
Meade Auostar Computer Controller
Deluxe Field Tripod for ETX-90EC
26mm & 15mm Super Plössl eyepiece(1.25")
45° Erecting Prism
8x25mm Right-Angle Viewfinder

Price: R10 000.00

Reason for selling:

Used the scope once to look at the Moon and want to buy a 12" LX200 telescope.

Contact person: Renette Pretorius
Tel: 082 651 1960

FOR SALE

Charles Frank Equatorial mount with manual advance mechanism
3" Reflector
20mm Eyepiece
No Viewfinder

Price: R700.00 or nearest offer as it stands.

Contact Person: Mr. Seth Abrahams
Tel: (011) 487 1753 (h) Sunday - Thursday
Tel: (011) 640 5187 (w)

Friday Nights at the Observatory

Late in September, Ed asked me to take my 'scope up to the observatory to assist with any viewing that might take place. The reason being that Tony Voorvelt was having a public lecture in the auditorium next to the 26½ inch telescope. and if the weather was kind, then the 26½" and our own 'scopes would be opened for the audience to look through, and I would provide another 'scope.

Tony's lecture was on the development of radio by Marconi, with practical demonstrations with the sort of equipment Marconi would have had access to. The lecture was well received, as were the demonstrations, especially by the younger members of the audience, who were asked to assist. Viewing was done through the 26½" and our society instruments.

Tony's plan is to hold a monthly lecture on some event or person or development, that has shaped our society. The talks are to be of an informal nature, aimed at providing entertainment, as well as informing the audience, and should be understandable to all ages, and must have practical demonstrations, with "period equipment".

The second lecture was about the development of X-rays. The audience was larger, so the word is spreading. However the weather was overcast, which was fortunate, as I'd not taken my scope, and there was no-one able to drive our 'scopes.

The next lecture will be on the 26th November. Regrettably I will not be able to attend. So far the subjects have been of a scientific nature, due to Tony's position in the physics world, but if these lectures develop as he would like, then the subject matter will diversify.

Tony is to be congratulated in setting up these lectures, and I will support them as often as I can. I do suggest that all who can, should set aside the last Friday of each month, for an entertaining and informative event. Children are especially welcome, as they are the brains of tomorrow.

Melvyn Hannibal

From: NASA News@hq.nasa.gov

RELEASE: 99-127

ASTRONOMERS FIND EVIDENCE OF FIRST PLANET ORBITING A PAIR OF STARS

Astronomers have found evidence of the first known planet orbiting a pair of stars. Previously, planets have been found circling only single stars.

The Microlensing Planet Search (MPS) project, led by David Bennett and Sun Hong Rhie of the University of Notre Dame, South Bend, IN, used a technique called gravitational microlensing that may have revealed a planet about three times the mass of Jupiter orbiting a binary star system. The researchers, who are supported by NASA's Astronomical Search for Origins Program, the National Science Foundation (NSF) and the Research Corporation, report their results in the November 4 issue of *Nature*.

"Between half and two-thirds of the stars in our solar neighborhood are known to be members of binary or multiple star systems," said Morris Aizenman of NSF's Astronomical Sciences Division. "To find evidence of a planet orbiting a pair of stars means there could be more planetary systems than we previously thought." Astronomers have detected only about 20 planets outside our solar system, all orbiting single stars, although some of those stars are in binary systems.

Gravitational lensing is based on a property first noted by Albert Einstein in the 1930s. When an object such as a star or planet moves in front of a more distant star, the gravity of this star or planet serves as a "lens," magnifying the light from the distant star and making it appear brighter. The Microlensing Planet Search astronomers analyzed data from such an event that occurred in 1997, referred to as MACHO-97-BLG-41 -- the 41st microlensing event discovered by the Massive Compact Halo Objects (MACHO) collaboration that year. During this 100-day

event, the pattern of brightness appeared too complex to be produced by a single-star lens.

While Bennett and his colleagues believe the best model for explaining this microlensing event is a planet orbiting a binary star system, other astronomers have proposed alternative models they believe could also fit the data. One possibility is that the orbital motion of the binary star system itself could have caused the change in the observed brightness of the distant star. Another possibility is that the distant star may itself be part of a binary system. These scenarios will be tested in future observations.

The MACHO project, which is supported by NSF as part of the National Science and Technology Center for Particle Astrophysics at the University of California at Berkeley, routinely makes data

on microlensing events available to other astronomers. MACHO is using microlensing to explore tens of millions of stars in a search for the "dark matter" that dominates the mass of our galaxy. Dark matter is believed to exist because the combined gravity of the known matter in the universe is not enough to account for the observed gravitational effects.

The MPS astronomers are using the microlensing technique to search for planets orbiting stars other than our Sun. For this analysis, they used observations from telescopes at the Mount Stromlo Observatory in Australia and the Wise Observatory in Israel as well as data from the NSF's Cerro-Tololo Inter-American Observatory in Chile. Astronomers at the Wise Observatory co-authored the *Nature* report.

More information on MPS can be found on the Internet at:

<http://bustard.phys.nd.edu/MPS/>

Meteorite Recovery in Southern Africa

We have all seen and enjoyed watching meteors rushing dramatically across the night sky. If we have been fortunate and observant [I haven't], we may have seen a daylight meteor.

Once a small chunk of interplanetary rock reaches the surface of the Earth it ceases to be a meteor and becomes a meteorite.

The recovery, preservation and study of meteorites is an important prelude to assembling the early the history of the Solar System.

I'm not going to write about meteors, because Tim Cooper does that excellently.

I'm also not going to write about the history of the Solar System, despite it being one of my major interests.

I intend to write to write about the recovery of meteorites in Southern Africa, but if I wander off the subject a little, I hope you will forgive me.

In July 1999, South Africa hosted the 62nd Annual Meeting of the Meteoritical Society, an international interdisciplinary body [see my other article in MNASSA] dedicated to a fairly range of planetary sciences, including the recovery and study of meteorites.

Up to now, the recovery of meteorites has been either a serendipitous process, resulting from seeing a fall, finding a large and unmistakable meteorite, or a short term project to find anything that may have fallen in a likely spot.

Following the 62nd Meeting of the Meteoritical Society at University of the Witwatersrand in July 1999, I got to thinking about the role of amateurs and the recovery of meteorites.

I also did some initial enquiries and put together an informal proposal which I sent off to Professor Wolf Uwe Reimold at the Department of Geology, U Wits. I considered that this could be an ideal activity for amateurs to be involved in, and that the Johannesburg Centre would be an ideal body to run with the concept.

The initial proposal, rushed off before the results of the first enquiries were available was a little off the mark, but, nevertheless, here it is:

Notes on Proposed Meteorite Recovery Program for Southern Africa

Abstract

Meteorites have been recovered in Southern Africa chiefly in those rare instances where they were seen to fall, or where the size of the meteorite was such that it was difficult to overlook.

No concerted effort has been directed to study the feasibility of recovering less obvious falls.

Obviously the viability of recovery varies inversely with rainfall and vegetation and in Southern Africa, this means an increasing recovery probability as one travels westwards.

The recovery exercise is an ideal project for amateurs to contribute directly to planetary science.

All recoveries will be handed in to Professor W U Reimold of the Geology Department of the University of the Witwatersrand, in accordance with the provisions of the National Monuments Act.

Scope

This project intends to recover meteorites from:

[1] seasonal playa lakes, which dry up in the low rainfall months;

[2] erg surfaces in sandy deserts, where the meteorite impacts a sand dune, and settles with sand movement to a basal layer. The basal layer is exposed as the dune migrates.

Exclusions:

- [a] The project does not have resources to follow up legends of falls;
- [b] micrometeorite recoveries; i.e. rain gauge collections
- [c] witnessed falls; [through triangulation].
- [d] fossil meteorite recoveries [magnetic recovery of material from mining operations].

Recovery Strategy

Playa Lakes

Playa lakes represent an opportunity to test recoveries strategies and in particular offer a monochrome surface, against some fresh falls will stand out in contrast.

However, older falls will assume the monochromaticity of the lake bed, owing to deposits of clay minerals stirred up during seasonal filling of the lake. These older falls MAY be found as a bump on the dry lake surface. Since the bed is usually one of very low relief, these items should also stand out.

Target sites will be obtained from progressively smaller scale maps. Ownership of the farms will be provided through the auspices of the Geology Department, University of the Witwatersrand. Owners will be contacted in advance for permission to conduct a research and recovery operation from the lake beds on their farms.

Once permission has been received, detailed mapping, preferably from aerial mapping, will be done. Grids will be set up along easy compass directions and team members will each be given one grid line [separated from the next by 10m] to walk.

A collector will walk behind the team with a cart. Once a likely piece has been found, the collector will bag and document it and place it on the cart.

A small team will test the viability of the procedures in advance of a full operation.

It is proposed to collect all suitable material using tongs [untouched by human hands], place them in plastic bags and seal them on the spot. A sticker on the bag will identify the collector, the lake bed name, the date and a gps location and a sample number.

In due course each sample number will be plotted on the map.

Recovery Strategy

Erg surfaces

Owing to the temporary nature of these surfaces, maps will provide only limited use: to identify areas where these surfaces exist.

Recent aerial maps, or local knowledge must be used to pinpoint suitable candidates.

As meteorites fall into sand dunes, the impact is cushioned to some degree. As saltation proceeds, the meteorites are left behind and gradually fall to a hard surface, where they accumulate together with other rock fragments.

Each field officer will be given one erg to walk along. For each recovery

[estimated at a few per day] , the officer places a stick in the ground. A sticker is stuck to the stick to identify the sample number, which is bagged and labelled. Later, A GPS co-ordinate is obtained for each stick and noted on the sample bag.

It is estimated that erg surfaces [Namib Desert] will lie further afield than playa lakes [Karoo] and therefore playa lakes will enjoy priority, purely as a function of logistics.

Formal
Approval
Process

Initial concept approval will be obtained from Professor W U Reimold of the Geology Department of the University of the Witwatersrand.

On modification, a pilot plan will be set up. The results of the pilot will ultimately further modify the concept.

Approval includes acceptance of recoveries by the Department of Geology, together with an assurance of communication of research papers to the team i.r.o. their recoveries.

The Department of Geology will be free to disseminate recoveries to any person doing research in this area, regardless of which country the research will be conducted in.

Pilot Project- Silver Streams

Professor Reimold accepted the proposal, and we set up a pilot project to test the concept feasibility.

Without using anything more high tech than a road map which showed a pan close to the road near Silver Streams, I managed to obtain the names and contact details for farmers who owned pieces of pan, and obtained permission to conduct a recovery operation on those parts [one farmer refused to grant permission over the weekend, another two accepted and one of those offered overnight accommodation].

Brian and Val Fraser and I conducted a search in September. We had considered that the chief problem may be heat and sun and we were indeed fortunate not to have to deal with that problem at all, as it had snowed in the vicinity overnight and the temperature was, taking wind chill into account, only just above freezing.

Just as I had hoped, a fair area of pan was free of vegetation, although much was covered with a short grass. Additionally, the bare area consisted of a light coloured calcrete, against which it was hoped that the black fusion crusts of meteorites would stand out in profusion.

Sure enough, a large number of black objects did stand out in profusion, but they all turned out to be the weathered remains of loose pieces of the underlying Transvaal Dolomite, which weathers to a black colour.

With such a low signal to noise ratio, no meteorites were recovered.

Subsequent Progress

A number of meteoriticists have provided useful information:

Dr Mike Zolensky [JSC, NASA] has advised that many meteorites in the Namib weather to a red/brown, not black.

Dr Sara Russell of the Natural History museum in London has also advised on legalities of collecting in Namibia, and also likely areas.

Dr Alex Bevan, curator of meteorites in Western Australia, has also helped with information on the 15 years of recovery operations he conducted in the deserts of Western Australia. In addition, he advised that in Australia searches are successfully conducted amongst the piles of stones farmers gather at the edge of fields.

They all wish us well.

Professor Reimold is concerned that we need to be less random in the selection of likely locations and to this end has suggested a meeting with a sedimentologist, Dion Brandt, of Wits Geology. This meeting identified bare areas of low sedimentation and high ablation that should multiply our chances of recovery.

The low sedimentation principle means that meteorite falls will not be covered rapidly by sand/ mud etc., and will remain exposed longer. The high ablation principle suggests that if a meteorite did become buried [and some meteorite are quite capable of digging holes!] the covering material will be blown away by wind [or washed away] to expose the underlying meteorite. The longer the time interval [the Kalahari is some 80 million years old], the more meteorites it will have soaked up, and the better the chances of recovering one or more.

The improved chances are however, offset by the high rate of weathering of meteorites, which, for stony meteorites makes them unidentifiable within a year.

Professor Reimold is also willing to conduct a training course for interested people who do not know how to identify a meteorite.

Team Members

Initially, we will restrict recovery team members to members of the Johannesburg Centre, but hopefully as the operation grows, we can include members of other centres, students and interested members of the general public.

If the operation does take off, it may provide a source of new members.

There are some costs, and these can be quite considerable. The first cost is transportation to the remote site [meteorites seldom fall conveniently close to home], and the second is accommodation [we cannot rely on the goodwill of farmers].

Basic equipment is more than likely to hand anyway.

Team member functions include organisation [setting up an expedition], site selection, obtaining the names of owners of the site and obtaining permission from them to recover meteorites, photography of the meteorite before it is recovered, administration [assigning an initial unique identifier to the recovery], provision of transport, finding accommodation locally, handing the finds over to the University for study, obtaining feedback etc., catering on site, etc. We also need someone with knowledge of first aid. Whatever you can contribute will be used in some way and will be most welcomed. Here is another unusual opportunity for we amateurs to contribute to science.

If anyone would like the opportunity to get out of the city into the country for, probably, a weekend [the distance one can go is limited by the length of the weekend and the balance between search time and travel time], please contact:

Trevor Gould
Home: 011-886-5602
Mobile: 083-212-8945
E-mail: trevorgo@tnet.co.za

How do you count?

So much has been written and spoken about the coming Millenium that many are - quite understandingly - more confused than ever. Is it mainly a computer problem, or does it perhaps have some deep cosmic significance? In the meantime those people who like to play games with numbers are having a great time and they can probably derive some wonderful and exciting predictions from their calculations.

But of course there are certain difficulties.. A priori it is difficult to accept that the number of revolutions of a relatively small planet around a very average star, just one of the many billions in the universe, should be of any consequence. But we shall just let that pass and accept that the beginning of our counting period was meant to coincide with birth of Jesus, at the same time noting in passing that it is now generally agreed that this birth happened around 6 BC. And as regards the precise date and the season of the year, it is very hard to believe that there were shepherds watching their flocks by night in the bleak midwinter. Then there is the vexed question whether the true millenium should be considered to end when the numbers change from 1999 to 2000, or when a thousand years have elapsed? Here we can fortunately at least agree that 1000 years have elapsed since the numbers changed from 999 to 1000. But to confuse the matter further, there are a number of countries and religious groups which have for centuries used different calenders, and which will almost certainly continue to do so.

But all these problems are relatively minor ones. There is in fact a far more important question, and it

seems strange that scarcely anyone appears to have given it a thought.

From the time we were born we we taught to count in tens, a method which is known as a denary or decimal system. Ten tens make one hundred, ten hundreds one thousand, and so on.

It just seemed to be the natural thing to do. One always had the feeling that it must have been based on some very fundamental law of nature. But is it? If we look at it carefully, the only clear connection with nature that we can find is the fact that all human beings were, are, and probably always will be born with ten fingers, five on each hand. From the very earliest times man must have been using his fingers to count. The Roman numerals give a very neat illustration of this. Numbers one, two, three and four are indicated by one to four fingers, I, II, III or IIII, while five is indicated by a V, a symbolic representation of an open hand. Two V's joined together make an X, which equals ten. For mathematical and general scientific use the Roman numerals are not very practical, and they have therefore been generally discarded, but counting in tens has remained with us ever since the very early days.

However, there is no law in nature which says that it must necessarily be like that. Had we been born with four fingers on each hand, it is more than likely that we would now be counting in eights, i.e. using an octal scale, which incidentally would have been an advantage for computer programming. There is basically no objection at all to counting in eights - or twelves, for that matter.

When counting in eights, 10 would represent what we now call 8, 100 would stand for our present 64, and a millenium would contain 512 years by our present reckoning. It is clear from this that the present "millenium" is altogether a man-made concept, and that it has no special "cosmic" or any other significance whatever.

And thus, having been made by man, it is up to mankind - which really means you and me - to make the very best use of it.

Jan Hers.

In the Sky this Month

December 1999

dd hh

2 22 Pluto in conj. with Sun
 3 05 Mercury greatest elong. W(20)
 3 21 Venus 3.1 S of Moon
 6 02 Mercury 2.9 S of Moon
 7 23 NEW MOON
 8 14 Moon at apogee
 11 22 Neptune 0.1 N of Moon Occn.
 12 19 Mars 0.6 S of Moon Occn.
 12 21 Uranus 0.2 N of Moon Occn.
 14 05 Mars 0.7 S of Uranus
 16 01 FIRST QUARTER

dd hh

17 08 Mercury 5.5 N of Antares
 18 06 Jupiter 4.1 N of Moon
 19 09 Saturn 2.9 N of Moon
 19 14 Mercury 10.6 S of Pluto
 21 05 Jupiter stationary
 21 09 Aldebaran 1.3 S of Moon Occn
 22 08 Solstice
 22 11 Moon at perigee
 22 18 FULL MOON
 29 14 LAST QUARTER

January 2000

dd hh

3 04 Venus 2.7 S of Moon
 4 01 Earth at Perihelion
 4 12 Moon at apogee
 6 06 Mercury 3.7 S of Moon
 6 18 NEW MOON
 7 10 Venus 6.6 N of Antares
 8 05 Neptune 0.1 N of Moon Occn.
 9 05 Uranus 0.4 N of Moon Occn.
 10 18 Mars 1.9 N of Moon
 10 19 Venus 9.3 S of Pluto
 13 01 Saturn stationary

dd hh

14 13 FIRST QUARTER
 14 15 Jupiter 4.4 N of Moon
 15 16 Saturn 3.1 N of Moon
 16 00 Mercury in superior conjn.
 19 21 Moon at perigee
 20 22 Mercury 2.4 S of Neptune
 21 04 FULL MOON Eclipse
 24 18 Neptune in conj. with Sun
 28 05 Mercury 1.3 S of Uranus
 28 08 LAST QUARTER

Here are some ASSA web sites as printed in MNASSA

Durban Centre:	http://www.astronomical.lia.net
Harare Centre:	http://www.samara.co.zw/peschool/astronomy/assa.html
Johannesburg :	http://www.aqua.co.za/assa_jhb/assa001q.htm
Natal Midlands:	http://www.botany.unp.ac.za/nmc/nmc.html
Pretoria Centre:	http://mafadi.aero.csir.co.za/assa/index.html
Deepsky section:	http://members.xoom.com/auke/index.htm http://home.global.co.za/~auke/
Computing Section:	http://www.icon.co.za/~hilton/assa/Welcome.html