

CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for August 1999

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The Sir Herbert Baker Library, 18a Gill Street, Observatory, Johannesburg

Editorial

Well another ASSA year has come and gone - the Johannesburg Centre's AGM and bring 'n braai was enjoyed by all attendees. The majority of your previous committee has been re-elected together with two stalwarts in the persons of Ed Finlay and Melvyn Hannibal both of whom have served on previous occasions. Welcome back to the committee and may this be a great year for the Jo'burg Centre.

Eric and Peter have submitted another SSSH article together with a useful loose insert which has the eyepiece views as well as general skymaps of the area(s) of interest. Eric has also secured permission to reprint an article from the Engineering News on Sir David Gill, whose name should be familiar to all of you who regularly attend meetings at the old Observatory. We thank that Publication and the Author of the article, Don Visser, for their kind permission.

Want to find out more about Hazardous Asteroid 1999 AN10? - well then, read Bill Wheaton's informative article which covers this and other topics of interest, plus news of some missions currently in progress at NASA. Brian, as always, informs us of pertinent overhead happenings in 'The Sky' which covers the August through September timeframe and Eben has tackled a controversial subject - the Evolution of the Galaxies. As he puts it - it is "*...an astronomical topic about which there is the least amount of agreement.*" We think he is being very kind with this polite understatement!!!

There are many Snippets of AstroInfo gleaned from the Astronomical media this month and wherever possible, we have supplied URLs (website addresses) where you may read a more detailed account of the news in question. The links will also be found on our own website.

As this is the start of a new ASSA Jo'burg Centre subscription year, a subscription form has been included with this copy of Canopus. More detail may be found in the notices section.

Here's wishing clear skies to all our members for the year ahead.

The Editor

Chris chris@aqua.co.za,

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Notice of Meeting

The **August** meeting of the Johannesburg Centre of the Astronomical Society will be held at the Sir Herbert Baker Library, 18a Gill Street, Observatory, on Wednesday the 14th of August, 1999.

Topic:

Test the Team

Future Meetings

September 8th Bird migration & navigation Wolf Lange

Dark Sky Viewing

On the Saturday nearest New Moon at Tom Budge's Farm in the Magaliesberg.

7 th August	9 th October	<i>Year End Star Party</i>
11 th September	6 th November	11 th December

Swinburne 1999

Our annual trip to Swinburne will be held on the long weekend of 7th to 9th August 1999. If you are interested in this trip (at the last moment), please contact Ed Finlay for further details. We will arrive on the afternoon of the 7th and leave after breakfast on the 9th.

Haartebeeshoek

Set aside Saturday the 23rd of October for a group visit to the Haartebeeshoek Radio Telescope Facility. Remember that there will be a small charge levied for this priviledge (R5 to R10), and please give your name to Constant so that the number of visitors can be communicated to the Haartebeeshoek admin people beforehand.

Annual Subscription Fees

At the AGM, some of changes to the structure of the annual subscription fees were introduced and passed by a majority vote. The joining fee has remained unchanged at R50-00, But the annual subscription fee has been raised to R100-00. However, to offset this increase in fee, we have introduced a family membership fee of R125-00. With a family membership, the main difference is that although all family members receive full rights as members of the Centre, only one copy of the monthly magazine, Canopus, will be posted to the family address. Also, family membership is restricted to a couple and their dependants. The Annual Subscription form has been included with this issue of Canopus, and we would like to urge members to pay their subs as early as possible to enable your committee to plan the projects for the year ahead.

Please post your subscription fee, or deposit/transfer it directly into the Society's bank account at **NEDBANK**. The Account information is as follows:-

Bank:		NEDBANK
Branch	Name:	Park Plaza
	Code:	19 21 42 44
Account	Type:	Current Account
	Number:	1921 013761
	Name:	<u>ASSA Johannesburg Centre</u>

Please remember to write your name on the deposit slip or to include your name as a reference on a direct transfer. Then fax the details to the Chairman to let him know that you have paid via direct deposit/transfer so that you will be kept on the Canopus mailing list.

Letters to the Editor

Hi Chris, Ray

In case you were aware of it www.astronomynow.com (the UK mag) is online and possibly may give some good pics of Mars plus other info.

Well I saw the website and tried to get info on our ASSA sections - in particular Variable Star section, as that is my interest. But to no avail.

The only one which moved me anywhere was the Hilton's site.

Any response - or am I just thick?

Cheers

Tony

Thanks for the comments Tony. Currently, the only section link that is working on our website is the one to Tony Hilton's Computing section. You may have noted some of the other pages that we had hoped already to have activated, are also still inactive - a situation that we will attempt to remedy in the not-too-distant future. We will need some input from the heads of the various sections in order to set up suitable pages for them - any section heads out there interested?.

If you are particularly interested in Variable Stars, allow us to recommend the AAVSO (American Association Of Variable Star Observers) website:- <http://www.aavso.org/>

Dear Editor,

I heartily agree with all the points mentioned by "Anon" in the article "Calling all Farmers" (July Canopus). My own "rain maker" is so effective, the mere mention of it by a friend, produced four days of cloud.

M. Hannibal

*Mojaje is an absolute amateur compared to **our** rainmakers - We wonder if the number of inches of rain that falls is directly proportional to the number of inches of aperture in the rainmaker?*

Hi there,

...(deleted)...By the way, while I was back home on holiday, I passed the observatory one evening when the sky was clear and thought to take a look at the nova through the Society's telescope. The guard at the gate was adamant that I could not go in, that I should come during the day (!) to see the people there, and could not understand that ASSA members should have access to their own facilities. A bizarre situation, I think. Are other people experiencing this problem?

Cheers,

Chris (Stewart)

Any other members out there experienced this same problem? Please let us know and the committee will follow up on this sort of situation.

JPL and NASA News

Bill Wheaton, IPAC 1999 August

I had expected to describe the Far Ultraviolet Explorer, FUSE, which was successfully launched on 1999 June 24. However, so much other news has come up that it will again have to wait for a future issue.

Chandra Launched at Last

The biggest news by far this month is the successful launch of Chandra, third of the NASA Great Observatory series, which I described a year ago when it was still known as AXAF, the "Advanced X-ray Astrophysics Facility". The Einstein Observatory, launched in 1978, was the first large focusing X-ray telescope in space, and resulted in a sensitivity improvement of about 1000 over its predecessors. Ever since Einstein's enormous success, X-ray astronomers have been yearning to follow up along the many alluring paths it first suggested. Now, after 21 years, the doors are finally open.

The Hazardous Asteroid 1999 AN10

A year or so ago, based on the experience with 1997 XF11, I predicted that many more asteroid impact false alarms would be forthcoming. This expectation was based partly on the obvious fact that the chances of an object passing "very close" (say 65,000 km, ~ 10 earth radii) to us, is much larger (~ 100 times) than the chance of our being actually hit. However it was also partly due to the details of the way in which poorly-known orbits are improved, inevitably giving us a little suspense in the midst of the process. This month we will study this process in more detail in a typical case, which also happens to be the current "threat champion" in the hazardous asteroid business.

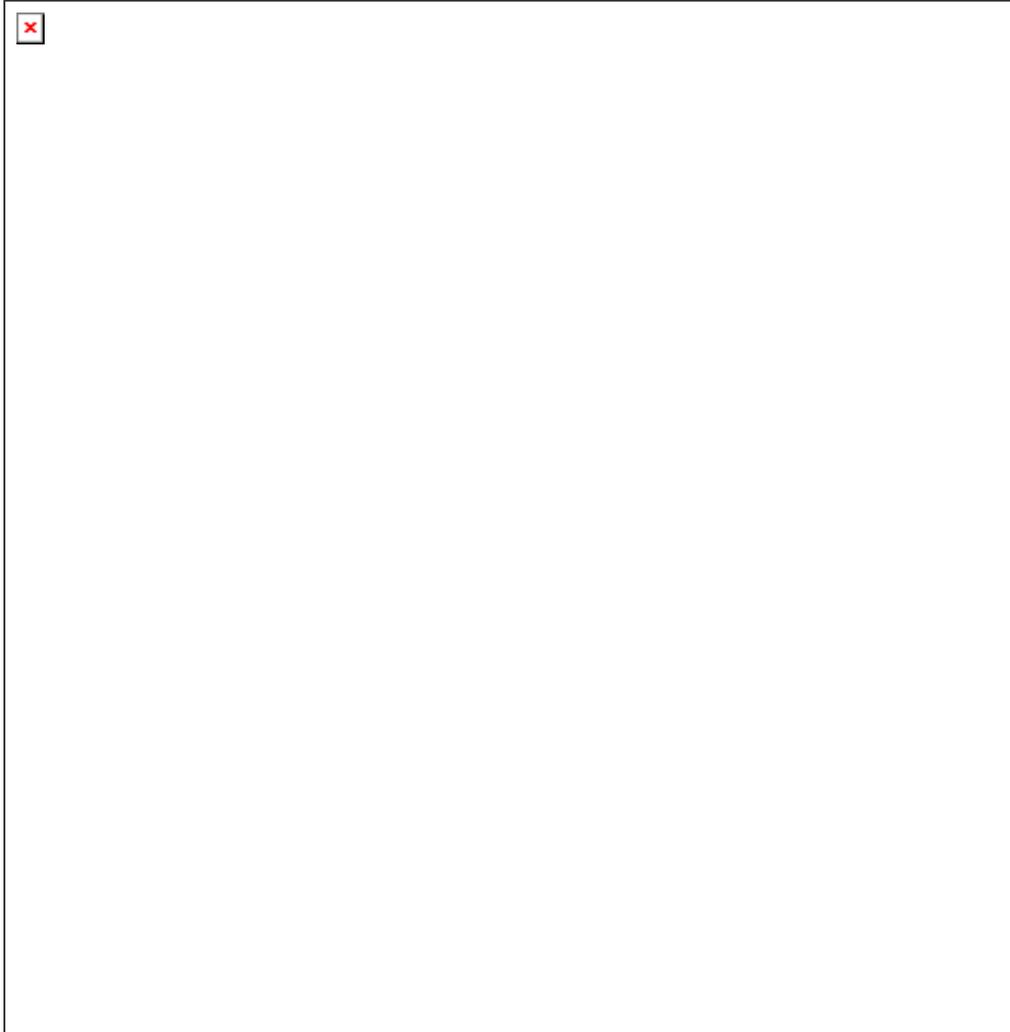
In the good old days we never noticed near passages, quietly happening all the time. Now that we can actually take action to affect the result if need be, we have a program to detect all the dangerous asteroids 1 km in size within the next decade, so that they can be monitored. So it is inevitable that lots of close calls are going to be detected, evaluated, and almost all eventually dismissed as more accurate measurements

become available showing no impact is possible.

Sure enough, two new potential impactors have turned up in the past few months. With the collection of more observations, and yet again (as for 1997 XF11) with the help of previously unrecognized historical observations, neither object now appears to pose any threat in the near term. Nevertheless, the situation for 1999 AN10 (size, about 1 km) as it appeared based on the data available in early June, was interesting. Since it is also likely to prove typical of many future alarms, I think it is worth study in some detail. The circumstances are illustrated in the figure below.

The "Impact Plane", so-called, is actually the plane through the center of the Earth, perpendicular to the velocity of 1999 AN10 in a co-ordinate frame in which the Earth is at rest, on 2027 August 7. The small circle at the origin (0,0) in the lower right is the "target": namely, us. The point at which 1999 AN10 will pass through the 2027 August 7 impact plane cannot (of course) be exactly known; yet because its orbit had been fairly well determined, we *did* know that it will pass somewhere within a small region in this plane. This region, even based on the observations available on June 1, does *not* include the Earth. So far so good, it seems.

It is characteristic of such possible regions that they are nearly elliptical in form, with the highest danger being at the center of the ellipse, and tapering away in all directions from that most hazardous point. The probability of 1999 AN10 passing through any given point, if plotted in proportion vertically above that point, generates a shape that looks like a smooth hill. It may not surprise you greatly that a cut through the center of the hill, perpendicular to either of the two ellipse axes, has the familiar bell-curve shape: the "normal curve" of probability.



The line labeled "uncertainty ellipse" is that region, based on the orbital solution of early June. It appeared to be a line rather than an ellipse simply because it was extremely long in one dimension, and very narrow in the perpendicular direction, so the width could not be ascertained by eye at the scale of the figure. Notice also that, since the normal curve does not ever return down completely to zero, we must be satisfied to plot a contour level 0 on the smooth hill, one chosen so low that the danger the asteroid will pass outside it is judged negligible. Any very small value can be chosen; 1% is a common choice. Fortunately, since the normal curve declines extremely rapidly to minuscule values, any reasonable choice does not affect the plotted size of the elliptical contour region too markedly.

Yet because the ellipse was so narrow, there was essentially no chance that it would strike us in 2027, for the possible region as it passed nearest the Earth was basically a long narrow strip, about 40,000 km away, but only a few hundred km wide.

Or, the asteroid might easily have passed much further than 40,000 km, for the tip of the ellipse as drawn is approximately at (-430,000; 150,000) km. This is about 450,000 km away, well beyond the Moon. It might seem odd at first that one could say only that the asteroid will pass at a nearly unknown distance, between 450,000 km and 40,000 km from the Earth, and still assert with great confidence that it will not impact. The geometry of the enormously elongated ellipse in the figure, which is the typical situation, should help to make this more clear in the many encounters of hazardous asteroids that are inevitable in the future.

But 2027 itself is only part of the story. Even in the event of a miss, it is clear that if 1999 AN10 were to pass near the Earth, its current orbit would be strongly perturbed, conceivably into a new path which might impact on some future date. Because an elliptical Keplerian orbit is, after all, periodic, retracing itself year after year, any new orbit would necessarily pass near the Earth's orbit in the future, barring perturbation by some third body in the

Solar System. The three points marked "keyholes" indicate such possible hazards, in that passage near those particular points might have changed the orbit to give a dangerous encounter in the three future years given. The details of an encounter following any of the "keyhole" passages would depend extremely sensitively on the precise position in the encounter plane in 2027. (The point for 2034 seems to be far outside the target ellipse, but because the ellipse falls off fairly slowly in the long dimension, given the inevitable arbitrariness in drawing the probability contours noted above, its probability still merited attention.)

The figure is based on the one set of data. Most sets of observations will result in some such ellipse; as more observations are added, the resulting new ellipses shrink, becoming successively smaller and smaller. But because any new data ought to be consistent with the old, addition of new observations should only reduce the size *within* the confines of previous ellipses, without moving it elsewhere in the impact plane. The result of continuing observations is therefore normally a set of nested ellipses of decreasing size, converging on the true point of passage through the impact plane. Early in the process, the error ellipse is so large that, even though it may contain the Earth, the likelihood of impact is negligible. Much later the ellipse shrinks until most likely, as here, the Earth is excluded. In between there is necessarily a period when the danger rises to a maximum. If this maximum is in the range above say, 0.1%, we have a false alarm likely to attract media attention.

For 1999 AN10, most recently, a pre-discovery observation on Palomar Sky Survey plates, found by A. Gnadig and A. Doppler and dating back to 1955, has shown that the 2027 encounter will in fact miss all of the keyholes in the diagram, passing Earth at 389,000 km. This removes the danger until an approach in 2076 February. Nevertheless, presuming a miss in 2076, it still seems that 1999 AN10 will remain a threat that needs monitoring for about the next 600 years, when the current series of close approaches should end. For now, it is the most hazardous earth-approaching asteroid known in the 1 km-or-above size class.

An especially good site for the most recent analyses of currently developing hazards is at the Space Mechanics Group of the University of Pisa: <http://newton.dm.unipi.it/neodys/> ; the figure

came from there. The standard repository for asteroid information is the IAU Minor Planet Center, at SAO; its URL is:

<http://cfa-www.harvard.edu/cfa/ps/mpc.html>

Unique Object 1998 KY26

Another remarkable object, 1998 KY26, was discovered last year passing at a distance of 800,000 km, or just twice that of the Moon. In the 1999 July 24 issue of "Science", Steve Ostro of JPL and an international team report it is unique in several regards:

- It is the smallest (30 m) solar system body ever studied in detail. It is believed that about 1,000,000 objects of this size are in Earth-crossing orbits, but 1998 KY26 is the first ever caught close enough for examination.
- It is rotating at the unheard-of rate of once every 10.7 min, meaning it must be a single solid object, since gravity is too weak to hold it together. An astronaut or a loose boulder on its equator would simply fly off into space.
- It is in an orbit making it the most accessible to spacecraft of all the 25,000 or so asteroids with reliable orbits.

Based on radar and optical observations, Ostro *et al.* suggest it is likely to be a carbonaceous chondrite, composed of complex organic compounds and, probably, several thousand tons of water bound chemically in the minerals.

Briefly Noted:

A large number of other events this month deserve mention, if only in passing. First, Deep Space 1, its technology demonstration objectives accomplished with near perfect success, will fly by the barely-known 1-2 km asteroid 1992 KD, on July 29 at approximately 04:46 UT, at a speed of 15.5 km/s and a distance of only 15 km. At the very least this should be exciting! Then, on July 31, Lunar Prospector -- its primary mission all complete -- is to be deliberately crashed into a likely ice-bearing polar crater, in the hope of raising a cloud of water vapor that will be illuminated by the Sun and observed by waiting telescopes on Earth. Finally, Cassini, having flown by Venus again in June, will fly by Earth on August 18, and then be on its way to Jupiter and the outer Solar System.

Variable of the Month:

by Danie Overbeek

EX Hydrae

This interesting dwarf nova is an ideal object for almost everyone using a 6" or larger telescope. The field is easily located without setting circles, between the small but prominent constellations Crux and Corvus.

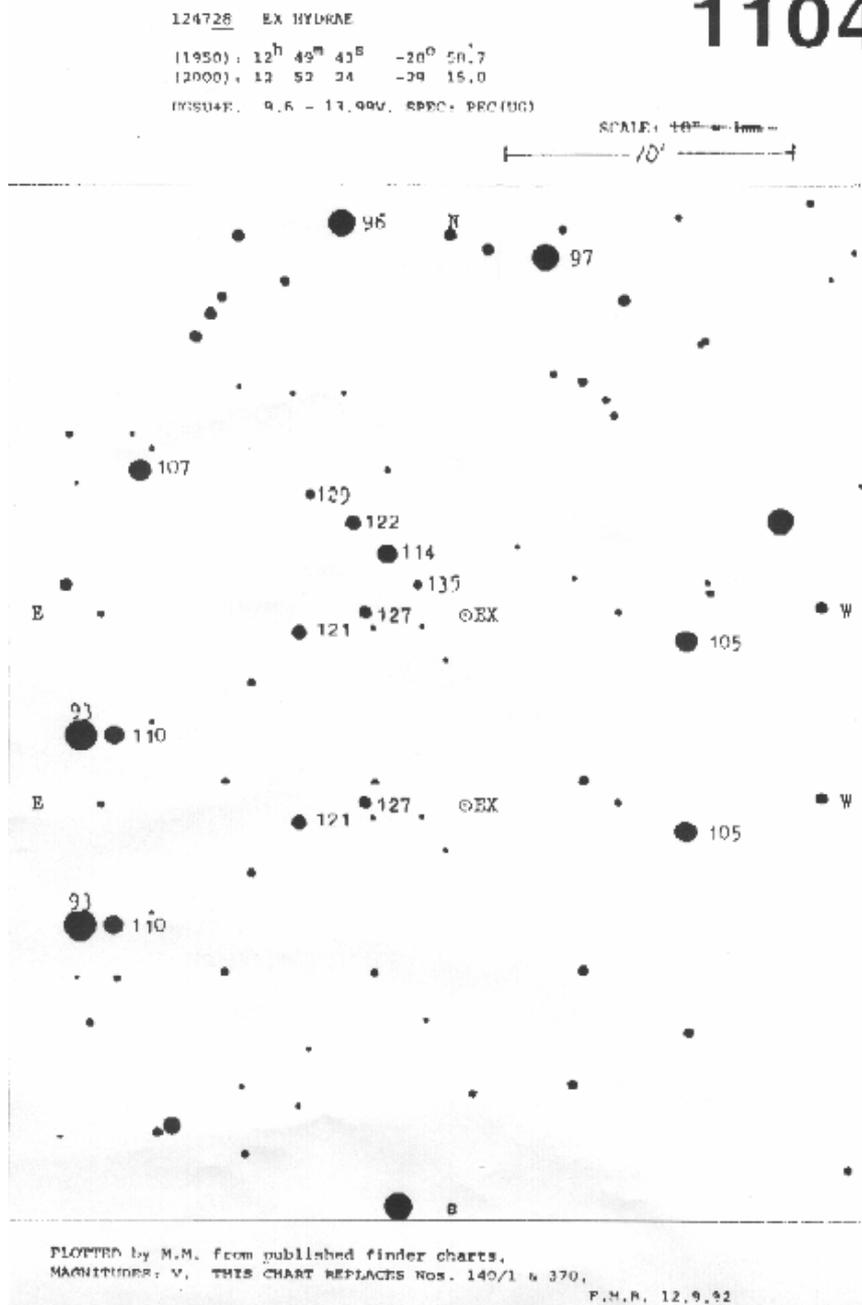
At minimum, EX varies continually round about Magnitude 13 but at outburst, it reaches magnitude 10. The outbursts are rare and only last about two days so it is easy for the astronomical community to miss an outburst, unless the star is monitored continuously by amateurs.

You do not have to be able to see it, just report it as fainter than 12.0 or 12.7 or whatever but when you DO see a bright outburst, you should report it immediately to Jan Hers, myself, the VS Network or the AAVSO.

Enjoy EX Hya!

Danie Overbeek.

1104



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 "Left overs" from a burglary, asking R3,500.

Phone Chris Lubbe on cellular 082-710-2850, or phone 011-786-8236

SOUTHERN SKY STAR HOPPING

Deep-Sky Observing

by

Eric Brindeau and Peter Baxter

This month we star hop in the regions of the large constellations of **CAPRICORNUS** and **AQUILLA**, which will be gracing our night skies for the months to come. We also take a peak close to the galactic centre near the constellations of **SAGITTARIUS** and neighbouring **SCORPIUS**, which are fast heading towards the western horizon.

We will be hopping to a few of the brighter deep sky objects that can be found in a small scope, as well as offering a few challenging ones. **Neptune** and **Uranus** are both travelling through Capricornus at the moment, and we suggest adding these to your observing itinerary.

If you recall the previous SSSH article that featured the constellation of LEO, you might have been enjoying the beautiful sight of Venus edging slowly towards Regulus that lies on the ecliptic.

THE DEEP SKY STAR HOP

We have been admiring the night sky regions of Scorpius and Sagittarius, as the galactic centre of the Milky Way has passed overhead. These constellations have so many deep-sky objects, they seem to equal the density of the star fields in the rich knots of the Milky Way, several spiral arms thick. It is easy to understand how many of us do not get to explore further than the Lagoon (M8), Trifid (M20) and the Omega (M17) nebulas which are small deep-sky macrocosms on their own. Sagittarius alone contains more Messier objects than any other constellation (7 globular clusters, 5 open or galactic clusters and 3 gaseous nebulas).

We will use the *sting* of the Scorpio tail to star hop passed the open cluster of **M7** and head for a challenging planetary nebula in Sagittarius.

Scorpius is a magnificent constellation, one of the few that visually live up to its name. An imaginary line drawn from alpha (α) Crucis through alpha (α) Centaurus will take you roughly to Scorpio with the unmistakable red super giant of Antares.

Starting at upsilon (υ) and lambda (λ) Scorpii, the two stars that make up the scorpions sting, head for G which is positioned by triangulating chi (χ) and lambda (λ) Scorpii. Very close to G is perhaps one of the easiest globular clusters to find. **NGC 6441** lies right next to the bright yellow G making a stunning contrasting view. The globular appears as a bright round hazy disk at magnitude 8.0 and is difficult to resolve even in the largest amateur telescopes.

Moving further towards Sagittarius you will pass the magnificent naked eye open cluster **M7**. This object can be appreciated in almost any size scope, but a good pair of binoculars remains one of the best ways to enjoy the wide sprinkling of stars. **M7** is nearly double the size of the full moon and contains about 80 stars brighter than 10th magnitude.

If you are viewing with an 8" or larger telescope, you may want to try to find the tiny 10th magnitude globular cluster **NGC 6453** lurking on the edge of the open cluster. **M7** is also home to a few faint planetary nebulas, beginning at magnitudes 13 and fainter.

Finding **NGC 6453** seems a daunting task at first as one is faced with such an array of stars. The globular lies to the edge of **M7**, slightly away from the denser centre and easily located using three brighter guide stars that remind one of Orion's belt.

Centre the cluster in your finder and try to keep in mind an imaginary line going back to the Scorpio sting. To one side of the cluster centre are three distinctively spaced bright stars, which form a line in between the Scorpio sting and **M7**. The closest star of this trio to the centre of the open cluster has a fainter companion. Visualising a triangle with the first star (with its companion) and the next of the trio as the base will give you the location of the globular cluster. **NGC 6453** appears as a small irregular shaped disk of even brightness, with a few stars involved as seen in a 12". Finding this gem is a challenge and it is worth the hunt.

Sagittarius the Archer is too an easily recognisable constellation. We would have to disagree with Patrick Moore in his book "Stars of the Southern Skies" where he states "*-but there is no obvious pattern. It is often nicknamed the Teapot, though I have never been able to understand why!*" As a shape the Teapot makes more visual sense once you grasp the figure for the first time – granted that for us in the southern hemisphere the Teapot is not always directly perceivable as it is often seen on its side or upside-down.

The next object is a 13th magnitude planetary nebula **NGC 6563**, which is located near the Teapot spout. If you have ground and polished you're own 6" or larger mirror in the societies telescope making classes, this object will test its performance and your viewing skills. It is now referred to as Peter Baxter's Planetary in our unofficial catalogue after finding this little planetary in his 6" f/6.5 scope finished in the classes a few years ago.

Peter Baxter's Planetary is very faint, but the undertaking is made simpler as this object is very easy to locate. Imagine an equilateral triangle using epsilon (ε) and eta (η) Sagittarii as the base, the planetary will fall at the apex. Aligning your finder with eta (η) and epsilon (ε) in view, you will see a small right-angled triangle at the apparent apex. The planetary lies almost midway of the hypotenuse (long side) as in the accompanying finder sketch. Depending on the

sky conditions and the size of scope, you might have to use averted vision to see this round grey disk. In a 12" scope it appears as a round pale grey disk 50x35 arcseconds with even illumination.

CAPRICORNUS and **AQUILLA** are the most prominent constellations coming up behind Sagittarius. Capricornus the Sea Goat is associated with the ocean-orientated part of winter constellations along with Aquarius, Pisces and Cetus. Aquila the Eagle can be seen soaring as its spread wings dominate the evening skies (more like a manta ray).

Using a lot of imagination, Capricornus represents a goat with a fish tail. Using less imagination, we liken Capricornus to the continent of Africa (the early version as first sketched by the 16th century seafarers!). In John Sanford's "Observing the Constellations", he describes how some amateurs have come to call Capricornus the "*Bikini Bottom*" (must have originated from an astronomical society in Florida). The large constellation is devoid of many deep-sky objects, but it is the starting point of finding two bright globular clusters as well as being home (for the moment) of the planets Uranus and Neptune.

M 30 is a rich globular cluster for the small telescope and can be seen in binoculars as a fuzzy spot. Catalogued by Messier in 1764, this globular is bright and the edges can be resolved in scopes as small as 4 inches. **M 30** is easy to find by using epsilon (ε) and zeta (ζ) as the base of a triangle, the globular falling at the apex next to a bright star 41 Capricorni. The accompanying star hop uses three pairs of stars to get there – starting with delta (δ) and gamma (γ), going through epsilon (ε) and chi (χ) and ending with the bright pair containing 41 Capricorni. Studying the arrangement of stars carefully will reveal a horseshoe string of stars as situated on one edge.

Before leaving Capricornus, study the multiple star system of alpha (α) Capricorni. Alpha (α) is a naked eye double consisting of the components a_1 and a_2 which are 376 arcseconds apart (unrelated). Each star is again a double – a_1 has a 9th magnitude companion and a_2 has an 11th magnitude companion (also a double star).

Another excellent bright globular cluster lies to the other side of Capricornus (on the West Coast) in the top of the constellation Aquarius. Burnham's describes the fine globular cluster **M 2** as a "ball of glowing mist". At an integrated magnitude of 6.0, this globular should be a naked eye object for someone with keen eyesight. It lies in a sparsely populated region of the sky with no distinct bright markers to star hop from.

Starting with the tip of Africa in Capricornus as our point of departure using delta (δ) and gamma (γ), move into Aquarius and find the first really bright star – beta (β) Aquarii. **M 2** is a star hop away in the same direction as we have just come. The finder scope views will show the exact star detail as one moves away from beta (β) towards **M 2**, which is flanked by two pairs of stars. The cluster begins to resolve in telescopes of 8 inches and up.

Below Altair, the brightest star in Aquila, you will find the small constellation of **DELPHINUS** the Dolphin. This kite-shaped constellation is easily recognised and lies on the edge of the Milky Way in a fairly open part of the sky. What first attracted our attention is the beautiful double star gamma (γ) Delphini, consisting of two yellow stars of 4th and 5th magnitudes - moderately easy to split in small scopes at 9.6

arcseconds.

Delphinus is also home to two planetary nebulas, as well as two globular clusters – one of which is thought to be the most remote globular of our galaxy (comparable to the Magellanic clouds). The globular is lying at about 150 000 light years from the centre of our galaxy, making it about 185 000 light years from the solar system. Considering the interesting fact that globular clusters indicate a galaxy's extreme dimensions, this is an interesting deep sky target.

NGC 7009 glows at magnitude 11.5 (or 10.6 depending on the source) and appears as a one-arcminute disk. The globular remains a fuzzy disk in amateur telescopes, the brightest stars are of 16th magnitude! **NGC 7006** is visible in a 6" scope and it is not too difficult to hunt down.

If you have an equatorial mount or other drive system which will allow you to set the RA (right ascension) and DC (declination), centre your view on gamma (γ) and either move your scope in 18 minutes of RA, or switch your drive off while you go make coffee. The co-ordinates for gamma are provided below.

To star hop, centre gamma (γ) in your finderscope and start to move the scope in the same direction as the line from alpha (α) to gamma (γ). Not too far away you will come across two odd box shapes as per the finder sketch. The globular lies just to the top of the parallelogram-shape, making a triangle with the top two stars of that asterism.

NAME	TYPE	CONST	RA	DEC	MAG	SIZE
M2	Globular	Aquarius	(21h33.5m	- 0deg 49')	6.5	13'
M30	Globular	Capricornus	(21h40.4m	-23deg 11')	7.5	11.0'
M7	Open Clu	Scorpius	(17h53.9m	-34deg 49')	3.3	80'
NGC6441	Globular	Scorpius	(17h50.2m	-37deg 03')	8.0	3.0'
NGC6453	Globular	Scorpius	(17h59m	-34deg 35')	9.9	3.5'
NGC7006	Globular	Delphinus	(21h01.5m	+16deg 11')	10.6	2.8'
NGC6563	Planetary	Sagittarius	(18h12m	-33deg 51')	13	54"x41"
(γ)	Gamma	Delphinus	(20h46.7m	+16deg 07')	4.5&5.5	

Light Pollution

16 July 1999

"Technological Fog" May Cut Off Humans
From Rest of Universe, Astronomers Warn

Humans may cut themselves off from valuable new knowledge about the rest of the universe in a few years by enveloping the Earth in a fog of light and radio emissions, an international group of astronomers warned today.

Astronomical research, which has strongly contributed to human progress for thousands of years, now is under threat from activities in space and on the ground, according to the conclusions of a special environmental symposium of the International Astronomical Union (IAU) attended by scientists from 25 countries. The symposium, "Preserving the Astronomical Sky," was held July 12-16 at the United Nations facilities in Vienna, Austria.

"The threats to astronomy not only jeopardize our ability to gain important new scientific knowledge by studying the universe, but also will increasingly affect other human activities," said Dr. Johannes Andersen, General Secretary of the IAU. "In particular, outer space, once a pristine environment, is rapidly becoming overexploited and polluted," Andersen added.

The symposium participants called for international cooperation to reduce the threats of light pollution, radio interference and space debris. "These problems are global in scale and effect, and long-term in nature. International efforts are needed to resolve them, as the UN already has done for the oceans and the Antarctic continent," Andersen said.

Specifically, the astronomers reported that:

"Wasted light" spilled into the night sky has made much of the world unsuitable for astronomical research. In addition, this problem costs billions of dollars that otherwise could be spent for more productive uses. One report presented at the symposium, showed, for example, that wasted light measured from space costs at least USD \$720,000 annually in Vienna, \$2.9 million in London, \$4.2 million in Washington, D.C., and \$13.6 million in New York City. The solution is to use good outdoor

lighting techniques that not only protect the astronomical sky but also improve nighttime visibility, safety and security as well as save the money now used to produce the wasted light - a true win-win situation.

Radio signals from satellites and airborne platforms now threaten our ability to study the extremely faint radio emissions from celestial objects. This imperils radio astronomy, which has revolutionized our understanding of the universe in the past half-century, including the discovery of pulsars, quasars and the radio-emitting "afterglows" of gamma ray bursts. Radio astronomers were the first to suffer from interference such as that coming from globe-girdling systems of communication satellites that cannot be avoided, even in the most remote parts of the world. They pointed out that radio telescopes are so sensitive that a hand-held wireless telephone placed on the Moon would be one of the "brightest" objects in the radio sky. However, others now are beginning to feel the effects, including users of navigational and environmental-studies satellites. With proper engineering techniques and reasonable regulation, the interference problem can be controlled at marginal cost, allowing astronomers to continue studying the universe and others to use radio communication facilities. The astronomers also called for the establishment of regions on the Earth to be designated "radio-quiet zones" where the most important radio observatories of today and tomorrow can be protected from interference. The science ministers of the Organization for Economic Cooperation and Development, meeting in Paris last month, underlined the urgency of this problem. They agreed to establish a high-level task force to develop long-term solutions that will safeguard both humankind's radio windows on the universe and the efficient development of commercial telecommunications.

The outer space environment is being degraded by the proliferation of orbiting debris that can

damage or destroy manned and unmanned satellites, and already interferes with ground-based astronomy. A scientist at the symposium reported that there is an estimated 2,000 tons of material in low Earth orbit and that the Earth currently is circled by more than 100,000 objects larger than 1 centimeter.

Large, bright objects in space could have ruinous effects on astronomy as well as on the natural nighttime environment and the cultural values of people around the world. There are proposals for mirrors to direct sunlight toward Earth, "artistic" or celebratory objects in space such as a "star of tolerance" satellite, and advertisements in orbit. Some of these objects would be so bright that they would permanently damage the eyesight of anyone who might look at them with binoculars, according to a report presented to the symposium.

"Astronomy is a vigorous science that continues to rivet the attention of millions of people worldwide. It has given us many important contributions and a sense of our place in a vast and exciting universe. The night sky is an integral part of the cultural heritage of peoples around the world," said Dr. Woodruff Sullivan, of the University of Washington, one of the symposium organizers.

"We cannot afford to allow the pollution of the sky - both by light and radio waves - to deprive us of the ability to unravel the mysteries of the universe. The IAU Symposium called for global efforts to resolve pollution problems that already have deprived millions of their view of the

universe, and threaten cultural resources as well as vital research efforts around the world," Dr. David Crawford, Executive Director of the International Dark-Sky Association, another symposium organizer, said.

Future projects that may degrade the space environment at any wavelength of the electromagnetic spectrum should be subject to prior international environmental impact assessment before approval, as is now done for major projects on Earth, the symposium participants recommended.

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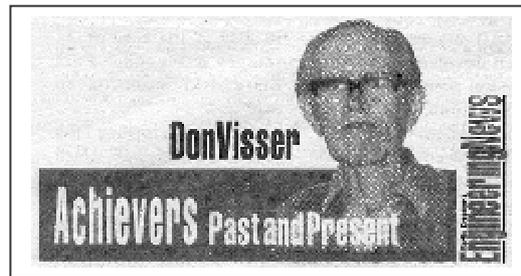
Venus Lends a Helping Hand: En route to Saturn, the Cassini spacecraft flew less than 400 miles above Venus today gaining a boost in speed from that planet's gravity. This story includes a tutorial on "gravity assist" maneuvers and how they are used to propel spacecraft to the outer planets.

FULL STORY at: http://science.nasa.gov/newhome/headlines/ast24jun99_1.htm

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Sir David Gill - Space-travel Forerunner

by Don Visser

David Gill literally worked in the dark for years. It was only in 1888, nine years after his arrival at the Cape, that electric lighting was installed in his house and the observatory.

In a letter to a friend in England he wrote: "Our electric lighting was installed in February and is a complete success. All the instruments are now so illuminated that we are wondering how it is possible to observe without it."

Soon after this he was offered the position of professor of mathematics at Cambridge University but he refused the chair as he felt he could do more for astronomy by completing his work at the Cape.

In 1896 during one of his periodic visits to England he was awarded the honour of CB, Companion of Bath. Four years later a knighthood was conferred upon him. His knighthood was popularly received all over the world.

Meanwhile he never stopped adding instruments to his observatory. In 1896 the Treasury granted him funds to erect a transit circle at the Cape. Added to his excitement was the offer made to him by **Frank Maclean**, a brilliant English spectroscopist, of his large Victoria telescope equipped for spectroscopic and photographic work.

This Victoria telescope and the transit circle are still at the observatory in Cape Town. When all these instruments were installed, the observatory in Cape Town became the finest observatory in the Southern Hemisphere. It was now so

equipped that the southern stars could be studied as effectively as the stars in the Northern Hemisphere. It must be remembered that not only was Gill the finest astronomer in the world but he was also the leading scientist in our country in his day. He was elected the first president of the SA Association for the Advancement of Science in 1902. This Association is still in existence and meets regularly.

Years of constant hard work finally caught up with Sir David, his health suffered and he was forced to retire from his directorship of the Cape observatory. His wife too had been frail in health for many years. They left the Cape in 1906 after 27 years unbroken service. During his years of retirement in London Sir David wrote his famous book *History and Description of the Cape Observatory* as well as filling his hours writing lectures and articles and receiving the many visitors who frequently called on him. In his leisure hours his favourite sports were golf and deer-stalking. He was a busy and happy man, active physically and mentally to the end.

In 1909 he was elected president of the Royal Astronomical Society.

Happiness was the keynote of his life and successes. He was happy in his work as an astronomer, happy and sincere in all his friendships and extremely happy in his married life. Of his married life he said, "We are a very Derby and Joan couple who like to be together as much as possible". Gill's one source of unhappiness was his wife's constant ill-health and her recurring illness caused him to suffer

deeply.

Gill received the Royal Astronomical Society's gold medal for the second time in 1908 and in 1913 he received the insignia of the *Commandeur de la Legion d'Honneur*. He also received the German *Pour le Merite* which was the highest award that Germany could bestow on him. When he received the news he turned to his wife and said: "Well I am an overrated man". He received more world-wide honours than any other astronomer of his day.

David's seventieth birthday was his last. He received congratulatory telegrams and letters from all over the world. In reply to a cable from his staff at the Cape observatory he wrote: "One of the greatest joys of my old age is to watch the progress of the Cape Observatory and to find my old fellow workers are still as keen as ever and that the dear old observatory is still to the front and going on to higher and better things.

Gill and men of his calibre were the forerunners of our modern space travel and development. They were the men who paved the way by seeking out the secrets of the heavens and

providing our scientists with all the required information about the stars and star distances. Knowledge of these facts is essential today before men and missiles can be projected into space with any feeling of confidence and security.

Gill died on January 24, 1914 and was buried in the town of his birth, Aberdeen. He had enjoyed a long and full life crowded with activity. Not only had he contributed to the world of science but he had also added to the sum of human knowledge.

Acknowledgements:

They Came to South Africa by Fay Jaff

The Dictionary of South African Bibliography

By the way...the next time you drive along Gill Street on your way to or from the Observatory, give a thought to the person after whom it is named!

Submitted (with permission) Eric Brindeau

Telescope Wanted

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In the Sky this Month

August 1999

dd hh	dd hh
4 02 Jupiter 4.2 N of Moon	18 12 Mars 7.3 S of Moon
4 18 LAST QUARTER	19 02 FIRST QUARTER
5 00 Saturn 3.1 N of Moon	20 01 Moon at apogee
5 15 Mercury stationary	20 12 Venus in inferior conjn.
6 17 Aldebaran 0.8 S of Moon Occn	20 23 Pluto stationary
7 18 Uranus at opposition	24 06 Mercury greatest brilliancy
8 01 Moon at perigee	24 15 Neptune 0.0 S of Moon Occn.
10 03 Mercury 1.2 S of Moon Occn.	25 12 Jupiter stationary
10 14 Venus 7.7 S of Regulus	25 13 Uranus 0.9 S of Moon Occn.
11 12 NEW MOON Eclipse	26 12 Mercury 10.2 N of Venus
12 05 Venus 9.0 S of Moon	30 15 Saturn stationary
12 07 Regulus 1.1 S of Moon Occn.	31 07 Mercury 1.4 N of Regulus
14 17 Mercury greatest elong. W(18)	31 09 Jupiter 4.0 N of Moon

September 1999

dd hh	dd hh
1 07 Saturn 3.0 N of Moon	17 21 FIRST QUARTER
2 20 Moon at perigee	18 03 Mars 13.3 S of Pluto
2 23 Aldebaran 0.9 S of Moon Occn	20 23 Neptune 0.8 S of Moon Occn.
2 23 LAST QUARTER	21 21 Uranus 0.8 S of Moon Occn.
7 17 Venus 8.1 S of Moon	23 11 Equinox
8 15 Regulus 1.1 S of Moon Occn.	25 11 FULL MOON
8 16 Mercury in superior conjn.	26 21 Venus greatest brilliancy
9 21 Venus stationary	27 13 Jupiter 3.8 N of Moon
9 22 NEW MOON	28 12 Saturn 2.7 N of Moon
10 00 Mercury 1.6 S of Moon	28 18 Moon at perigee
16 10 Mars 6.7 S of Moon	30 04 Aldebaran 0.0 S of Moon Occn
16 19 Moon at apogee	30 17 Mercury 1.7 N of Spica
17 06 Mars 2.8 N of Antares	