CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for May 2001

Contents:

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

Editorial

I looked up into the 05:00 sky this morning after ten days of getting up too late for darkness and saw that Venus has overtaken us and is now beaming brightly in the East. It really is quite impressive when one considers that it was only about a month ago that it was still glowing low in the evening sky. Mars is also glowing redly overhead in the early morning sky and is of course much brighter than it's anti-namesake Antares.

Some articles of interest have been gleaned from the various NASA email lists and for those of you with access to the internet, a URL which points to a site giving the whole story or some additional information, is usually supplied.

And guess what - Hubble celebrates it's 11th birthday and has just added picture number 100,000 to it's extensive photo archive. *(Good going for a spacecraft which wears glasses!)* There is a pointer to the Hubble archive website(s) which are a rich source of astronomical beauty.

Brian Fraser has submitted some information for the Variable of the Month which this month is R Leo. A concise write-up and a chart make up the whole package.

The highlights of overhead occurrences for the next two months are also supplied by Brian, and Eben van Zyl supplies the 3rd in his *Life in the Universe* series which is part 2 of the *How was the Earth formed* section. Even though we tend to take for granted our existence in the universe, when reading Eben's words, one realises how everything has to mesh "just so" in order for us to live.

And just to be different - the Oscars kicked off with this year's host, comedian Steve Martin, and the crew of the international space station doing the honours. Also featuring later in the proceedings was the person who first conceived the Geostationary orbit, Sir Arthur C Clarke.

As always, our continued best wishes to Danie as he continues with his recovery.

The Editor - *chris@penberthy.co.za*

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Notice of Meeting

The **May** meeting of the Johannesburg Centre of the Astronomical Society will be held in the Sir Herbert Baker Library, 18a Gill Street, Observatory, on Wednesday the 9th of May 2001 at 18:00.

Topic:

Planispheres

Future Meetings

June 13th	**Eclipse explained**	**Medley of Speakers**
July 16th (Saturday)	**A.G.M.**	**Bring 'n Braai after**
August 8th	**Eclipse Experiences**	**Miscellany of Speakers**

If you have any ideas for topics or subjects that you feel should be presented at future meetings of the Johannesburg Centre, please contact one of the Committee members, or email us with the details thereof. The Editor.

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 eyepiece time with them.

19th May	15th September	**Year End Star Party 2001**
23rd June	13th October	*"T.B.A."*
21st July	17th November	8th December (*provisionally*)
18th August		

Public Viewing *(weather permitting)*

Public viewing nights are on the Friday nearest First Quarter, and are held at the Old Republic Observatory, 18a Gill Street, Observatory, Johannesburg. Starting time around 19:30. There will be no Public viewing in April as the appropriate Friday falls on a Public Holiday.

Please note that the Public viewing nights are held subject to suitable weather conditions.

25th May	21st September
29th June	19th October
27th July	23rd November
24th August	

Annual General Meeting.

We have decided once again to hold the A.G.M. on a Saturday to encourage members to attend and enjoy a bring 'n braai as soon as the Society business is finished (hopefully no more than an hour). We will also be opening the "Mars Bar" and the Domes and hope some of you will bring your 'scopes along as the time of the year (if not the lighting) lends itself to clear viewing.

The meeting starts 18:00, and the society reports and election of the new committee should take no longer than an hour - we should be braaing and socialising shortly thereafter.

Please give some thought to which persons you would like to elect to committee for the 2001/2 period and make sure that they themselves are willing to serve before you nominate them.

Jo'burg Centre Outings for 2001

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.

Nylsvlei - we have a booking for the weekend of the 14th - 16th September for 30 people.

You may contact Ed Finlay on 083-449-1103 if you wish to book a place on this outing.

Boyden - We are busy attempting to negotiate a suitable weekend with Martie Hoffman.

Haartebeeshoek - Saturday 21st of July at 16:00. (Just be by the main gate from about 15:45).

Please contact Wolf Lange on 849-6020 or 636-4725 to supply numbers & remember to bring along briquettes/fire starters/matches as well as eats & drinks for the braai afterwards.

A visit to the Suikerbosrand Nature Reserve.

Tswaing Crater - still trying to set up a day visit under the guidance of Prof. Reimold

Other ASSA Centres (e.g. the Pretoria Centre) - and try to see if we can organise some joint ventures.

Telescope Making Classes

Would you like to make your own telescope?…or finish off a partially finished one? Well your opportunity has arrived (once again). Join the Telescope Making Class being held under the guidance of Brian, Evan and Chris. Contact Brian on 803-8291 if you are interested.

Eclipse Book Auction

One of Brian Fraser's Eclipse tourists has donated 14 special, out-of-print and never to be reprinted, Eclipse books to the Society and your committee has decided to allow members to submit bids to purchase these rare items.

These books are commercially worth between R120 and R150 depending on the Rand/Dollar exchange rate but it could be argued that they are worth more as they will no longer be available in bookshops.

If you are interested in purchasing one of these books, please submit your bid, by post or by hand to a committee member in a sealed envelope and these will be collected to be opened at the June monthly meeting. Cut-off time for the arrival of bids is 20:00 on the evening of 13th June 2001. (*Best not to trust the postal service!*)

The envelopes will be opened during the meeting, and ranked according to the bids presented. The lucky purchasers will be advised (by phone if not at the meeting) and will then have to make payment to the Jo'burg Centre's within 3 days. If this is *NOT* done, the person will forfeit their right to purchase which will then be allocated to the next person on the list.

Please supply your name and contact details on your bid, as well as the price that you are willing to pay for the book.

Please do not send cash with your bid.

For further details contact a committee member as per the table under the Editorial.

HOW WAS THE EARTH FORMED?

Part 2

Where the material from the second peak of supernova explosions was more concentrated, the outlying material became attracted and rotated around the concentrations. Due to the angular momentum, the gas and dust gradually formed an ellipsoid shape and as this ellipsoid rotated faster and faster, it flattened into a disc. Such discs have been discovered, e.g. around the bright star Vega in Lyra and also around Beta Pictoris. The material which spiraled in on the centre, formed the star (now the third generation of stars), whilst the outlying material gravitated into elliptical orbits around the newly forming star. Particles of material were constantly being overtaken by faster moving particles on the inside of the orbit and in so doing they adhered together to form larger and larger clumps spread about in all the orbits. G H Wetherill (in the Scientific American, 0ctober 1969) gave the results of his computer model. He started with 100 separate clumps (planetoids or planetesimals) and found that after 30 million years they had accreted to only 22 separate bodies; and after 79 million years they would have compacted to 11 separate bodies; and after 100 million years to only 4 separate bodies. The four inner terrestrial planets of the Sun could have accreted in this way - after 100 million years!

The newly formed Sun consisted of 78% hydrogen, 20% helium and 2% heavier elements, such as carbon, nitrogen, oxygen, neon, magnesium, aluminium, silicon and iron. The cores of the planets contained these heavy elements. The largest core formed was that of Jupiter, 28 800 km in diameter, Saturn a bit smaller, 20 000 km, the Earth 12 756 km and Mercury, 4878 km in diameter. When one considers the greater distances apart of Jupiter, Saturn and the other outer planets, one sees that the material must have been very evenly spread in space. Gases were occluded in the dusty material; the inner planets had most of their gases blown away by the solar wind which was very strong during the formative years of the Sun. The gravitational forces of the smaller planets were not able to hang on to their lighter gases, such as hydrogen and helium but the outer planets exercised sufficient force to retain very large gaseous envelopes. The pressure of the overlying layers of gas compressed the hydrogen and helium into liquids - Jupiter having a liquid hydrogen layer 25 000 km thick.

The separate clumps in the space between Mars and Jupiter were prevented from accreting into a single large planet by the gravitational force of Jupiter. The largest of these Minor Planets (by edict of the International Astronomical Union, they must not be called Asteroids) is Ceres, 1000 km in diameter. 7 are more than 300 km in diameter; 18 between 300 and 200 km; 41 between 200 and 100 km and the rest (thousands), less than 100 km. Some of them have been perturbed and now orbit the Sun in orbits within those of Mars and the Earth. Great numbers of small bodies have been left in the Kuiper Belt, outside the outer planets. Some of them have also been perturbed and now occupy orbits between the outer planets.

In the neighbourhood of the Earth the Moon was accreted as a separate body, as a companion planet of the Earth. (Theories which postulate that the Moon consists of matter that was blasted off the Earth (Chamberlin and Moulton) cannot explain why the Moon's orbit around the Earth is so very nearly a circle. If the Moon had been shot off from the Earth, its orbit would have been very eccentric).

When we look at the present surfaces of the planets, we see that they all have craters where clumps of matter crashed down. Mercury and the Moon never had an atmosphere nor any water and they bear silent testimony to the condition in which they were left at the end of the process of accretion when the last clumps had fallen onto the surfaces. These surfaces have been left unaltered because no water or wind erosion took place on the Moon and on Mercury. Many of the craters were formed by clumps of loosely aggregated matter which did not penetrate deeply into the surface and formed wide craters. Venus does have some craters but many must have been obliterated

by volcanic action. The craters which were formed on the Earth's surface have all been worn away by water erosion. Those craters still extant were formed in recent times, during the lapse of the last 3,9 milliard years. Mars shows more craters than the Earth because Mars never had as much water as the Earth and its atmosphere is much more tenuous than that of the Earth. Many craters on Mars have, nevertheless been partly covered by dust. The surfaces of the Minor Planets that have, so far, been photographed, show hordes of craters, formed by solid bodies. Even the two tiny satellites of Mars are covered in craters. Of all the craters on the side of the Moon facing the Earth which are more than 1 km in size, the size which occurs most frequently, is 48 km. To form a crater of this size requires a loosely-aggregated clump 9 km in size.

Craters could not form on the liquid surfaces of the gas giants but all their satellites are peppered with craters.

The testimony borne by the cratered surfaces, shows the condition reached when the greatest part of the bombardment had come to an end at about 3,9 milliard years ago. The dated ages of Moon rocks, show that the process of accretion had started about 4,6 milliard years ago. If we draw a straight line 46 centimetres long to represent 4,6 milliard years, then every centimetre represents one hundred million years. The bombardment would have come to an end 7 centimetres from the left hand end of the line. To the present time, 39 centimetres were left.

The Moon has several large plains, the Maria, where heavy solid bodies crashed. The gravity above these plains is stronger than elsewhere above the Moon's surface showing that dense objects lie buried under the lava which covered the plains. The fact that there are relatively few craters in the maria, shows that the maria must have been formed at the end of the period of accretion, because the date of the lava is 4,6 milliard years.

The great lava flows on the Moon show that immense heat was set free when the objects crashed. At a point of impact, the rocks would have been, not only liquefied, but also vaporised and spread over great areas, e.g. the 1000 kilometer long rays emanating from crater Tycho near the Moon's south Pole. The date of 4,6 milliard years corresponds very well with Schramm's finding of 5 milliard years for the time of the last peak of supernova explosions. The Sun and the stars in its neighbourhood, must have formed from this peak of supernovae and, together with these stars, their retinues of planets.

As the material which went to form the Earth, crashed down, the violence of the impacts, as well as the pressure exerted by the overlying layers, caused the metals to melt and, being denser, they sank to the nucleus of the Earth. Today the Earth is credited with an inner core 2500 km in diameter of which the density has been raised from 7,7 to about 12 grams per cubic centimetre, as a result of the pressure. The temperature at the core is 6800 degrees and although the melting point of iron is only 1100°, this inner core is solid. Above the inner core there is a layer of molten iron-nickel 2230 km thick. This is where the Earth's magnetism is seated. It became possible to calculate the depths of the various layers from the study of waves which emanate from earthquake centres. Above the liquid nickel-iron layer, there is the semi-liquid mantle 2860 km thick. On the mantle floats the rocky crust making up the continents, on the average 38km thick, but at some points under the deepest oceans, only 27 km thick.

How did the Earth obtain its plentiful supply of water? Some theorists hold that the water came from comets, it being known that the nuclei of comets consist of fine particles, occluded in ices of methane and ammonia and water. However, comet nuclei are very small, not more than 50 km in size, and it is difficult to see how, even millions of comets could have supplied the Earth with its trillion (10^{13}) cubic kilometres of water. One should rather look to the action of volcanoes to explain the source of the Earth's water. Water was occluded in the primeval nebula and as this matter accreted, water was also bound within the inner layers of the Earth. Hydrogen and oxygen were in plentiful supply in the matter of the supernova explosions and the two elements would readily have combined to form water. The plummeting material would

certainly have carried water with it. Later, volcanoes, of which the Earth had thousands, belched out gases, 95% of which consist of steam. When the steam came into the atmosphere, it readily condensed into boiling water which poured down in torrents. These torrents eroded the craters on the surface so that only traces of them are left, e.g. the Vredefort dome which is the oldest and largest impact crater remaining on Earth's surface. The thousands of metres of sedimentary rock in which the gold reefs of the Southern Transvaal and Northern Free State occur, required torrents gushing for many hundreds of millions of years for their deposition.

Why hasn't Venus got large masses of water? This is due to the fact that the steam which was belched out on Venus, could not condense in Venus' atmosphere, the temperature of which was (and still is) over 450°. The steam was thus blown away by the Solar wind and Venus was left high and dry.

In the same way as steam was blown away from Venus, hydrogen and helium was blown away from the Earth and Earth was left with an atmosphere of gases which were readily formed in the remnants of the supernova explosions**;** gases such as methane, CH_4, ammonia, NH_3 and carbon dioxide, $C0_2$ and of course steam. Why not oxygen? Because all the oxygen would have readily formed oxides, sulphates and carbonates of all and every substance in the neighbourhood - the stuff of which the rocks of Earth's crust is composed and, of course, oxygen would have combined with hydrogen to form water.

The last craters that were formed, were easily eroded away by the torrents of hot water, very hot water.

The atmospheric gases, methane, ammonia, carbon dioxide played a critical role in the development of life on Earth. How did life originate in the first place?

Fred Hoyle supports the panspermia theory. He says that the universe is pervaded by micro-organisms in the molecular clouds in space and even with bacteria. Hoyle reckons that the conditions on the primeval Earth were too harsh for life to develop. Peter D Ward and Donald Brownlee have written an excellent book "Rare Earth" in which they also support the panspermia idea. The harsh conditions that Hoyle mentions, did come to an end. Be that as it may, everyone agrees that the first living forms on Earth were unicellular blobs that developed in water, containing nutrients that were conducive to the processes by which cells split and multiplied into millions and formed multicellular organisms. The gases in the primeval atmosphere played a critical role in this development. To find out what happened, Stanley Miller and Harold Urey in 1952 passed electric sparks through a mixture of the gases methane, ammonia, hydrogen and water vapour in a sealed flask. After a week, they found that the collecting tube below the flask contained amino acids and that the pressure in the flask had been reduced. The amino acids must therefore have been formed from the gases in the flask.

Amino acids are the cross-rungs between two helical strands of phosphates and sugars in the molecule of deoxyribonucleic acid which F H C Crick and J D Watson had developed in 1960 (for this they won the Nobel prize). This helical molecule has the ability to "tear apart" and then to build up two separate DNA molecules - it enables the cell to divide into two to form two cells.

On the primeval Earth, somewhere between 3,8 and 3,5 milliard years ago (a time-span of three hundred million years) the self-replicating cell became established fact. The oldest signs of fossils from living organisms date back to 3,5 milliard years ago. Lightning had played the role of the electric sparks used by Crick and Watson.

For about two milliard years, the waters on earth contained a green slime, the ancestors of all later life forms. The green of the algae was due to the chlorophyll molecule which has an atom of magnesium in its centre and Earth was the green planet. The chlorophyll acted as catalyst which enabled the living cells to combine with water to form H_2CO, formaldehyde, which, by the way does occur in interstellar nebulae.

Water combines with carbon dioxide to form carbonic acid:

$$H_2O + CO_2 \rightarrow H_2CO_3$$

but in the presence of the catalyst chlorophyll and sunlight, they form formaldehyde and oxygen is set free:

$$H_2O + CO_2 \rightarrow H_2CO + O_2.$$

More involved reactions led to the formation of nutrients, such as glucose but still accompanied by the liberation of oxygen:

$$12H_2O + 6CO_2 + light \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$$
$$energy$$

This process of photosynthesis occurred in all the cells and the amount of oxygen in the atmosphere steadily increased. Photosynthesis is the process whereby cells manufacture their food using water, carbon dioxide and sunlight. The atmosphere of methane, ammonia, nitrogen, carbon dioxide and water vapour thus gave way to an atmosphere which today consists of oxygen 20%, nitrogen 79% and 1% of traces of carbon dioxide, argon, neon.

The Earth has now become the blue planet, the atoms in the atmosphere dispersing the short wave lengths of sunlight. The oxygen that was set free by living cells as a waste product, became the energy storehouse for the animals which later populated the Earth. The existence of life on Earth depends on many factors that are finely balanced. The total numbers of carbon and oxygen atoms are approximately equal. If there was a preponderance of carbon atoms, the carbon dioxide would have suffocated life**;** if there was a preponderance of oxygen, living cells would have been oxidised out of existence. Water, the most important substance in the life chain, is at its densest at 4° above its freezing point, so that ice floats and life can go on below the ice. If water was at its densest at, or below, freezing point, lakes and seas and oceans would have been solid blocks of ice and life could not exist.

The Earth's orbit lies within the Sun's ecosphere where water can exist in its three states. Venus is too hot; Mars too cold. The average height of the continents above sea level, is only 840 metres, whereas the average depth of the oceans is 3,8 km. 29,2% of Earth's surface is dry land and 70,8% is under water. If Earth had 10% more water, all the continents would have been under water and no land animals could have evolved. Only one third of the dry land is arable! The Earth's magnetic field wards off inimical rays such as gamma rays and the atmosphere absorbs X-rays and most of the ultraviolet in sunlight. And so we can go on, enumerating the fine balances on which life on Earth depends. No wonder Hoyle says, it is done by design of the Intelligent Universe.

Jan Eben van Zyl

Aerial explorers: Self-inflating solar-heated balloons

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In the continuous quest to find cost-effective methods to explore the planets, NASA engineers have risen to the occasion by developing a variety of new balloon methods inspired by centuries-old, solar-heated hot-air balloons, as well as by conventional helium light-gas balloons.

For NASA, balloons are of considerable interest as a means of lowering spacecraft to a planet's surface, delivering instruments to various altitudes and performing aerial photography and other forms of remote-sensing science. Balloons can also potentially conduct explorations faster and cover greater distances than conventional ground-based planetary explorers.

"Solar-heated balloons can descend more slowly than heavier parachutes to drop off a payload, and yet they can rise again after the drop-off. They offer us bonus science because they can take off repeatedly during daylight hours, and land in hard-to-reach terrain," said Jack Jones, technical monitor for balloon activities at

NASA's Jet Propulsion Laboratory in Pasadena, Calif. "Our inspiration comes from the centuries-old Montgolfiere balloons named after the two French Montgolfier brothers who flew the first hot-air balloon by burning a pile of wool and old shoes in 1783."

Other balloons use ammonia, which evaporates with solar heat, and causes inflation of the balloon. Helium balloons can also potentially be used and can fly for several weeks, which is much longer than the one-day flights of the solar heated balloons. The helium balloons tend to be heavier and more complicated since they must be stronger and carry their own high-pressure compressed gas cylinders for in-flight filling. All of these balloons can be used to explore the atmosphere and large areas of a planet's surface. "Thus far, most of our work has concentrated on balloon deployment testing in Earth's upper atmosphere, which simulates deployment in the cold, thin atmosphere like that of Mars," said Jones.

Engineers in JPL's Mechanical Systems Engineering and Research Division are also developing a variety of aerovehicles to explore other solar system bodies, such as Venus, Saturn's moon Titan, and the outer planets (Jupiter, Saturn, Uranus and Neptune). The aerovehicles include balloons designed to enable scientific exploration by either hovering over or soft landing on planetary bodies. Another class of inflatable drag devices, called ballutes, may someday be used to decelerate a spacecraft's speed to allow insertion into orbit.

In addition to solar-heated balloons, hot-gas balloons also look promising for Jupiter and Saturn, while balloons on Uranus and Neptune can capture light, high-altitude gas to float in the heavier atmosphere below the methane clouds. These balloons may be able to study the gas planets' internal energy sources and atmosphere.

On Venus, a combination helium-and-water or steam balloon may be used to make repeated descents to the hot, scalding surface with re-ascents to the upper, cooler clouds and perhaps help define what caused Earth's twin to have such a hot, greenhouse atmosphere. And on Titan, a helium-filled "aerover" may be able to fly like a blimp and then land as an amphibious rover to explore that moon's strange frozen surface and liquid hydrocarbon lakes or seas.

More information on JPL's balloon activities is available at:-

http://www.jpl.nasa.gov/adv_tech/balloons/summary.htm

JPL's planetary balloon activities are funded by the NASA Mars Exploration Office and the NASA Cross Enterprise Program. Managed for NASA by the California Institute of Technology in Pasadena, JPL is the lead U.S. center for robotic exploration of the solar system.

The Web between the Worlds

The first is a site that has been set up by the moderator of the Shallow Sky email list - Akkana - who was responding to a question on the list regarding Schiller, with the following message.

"That was exactly my goal when I wrote the Hitchhiker's Guide to the Moon:

http://www.shallowsky.com/moon/

You can search for "Schiller" and see the references to it, or you can just click on the pages that are on the terminator right now and see what features people find worthy of mention."

I have accessed this site several times and always found it very useful

I also received the following email during the past week and am quite impressed with the number of links available from this website - those of you busy on the Telescope Making Class may find this site of particular interest.

"Hi Brian and Chris - I thought this page might be of interest"

STAR Astronomy - Telescope Making Links

http://www.starastronomy.org/TelescopeMaking/Links/index.html

For those of you who enjoy the stunning Hubble Space Telescope images seen in the Astronomical Press and occasionally (not often enough) in the local newspapers, browse the following websites.

http://www.jpl.nasa.gov/wfpcfavorites
http://www.jpl.nasa.gov/pictures/wfpc
http://heritage.stsci.edu/public/2001may/supplemental.html
http://www.noao.edu/image_gallery/html/im0661.html
http://www.stsci.edu

Happy browsing. . . . . .

Chris Penberthy

Variable of the Month

R Leonis

If you go out into the garden and look up towards the north the most conspicuous constellation you see is Leo the lion. Mainly because of the reversed-question-mark pattern, Leo cannot be mistaken for any other constellation. And Regulus, the brightest star in Leo, is very obvious, even from the city.

This months variable is R Leo, a Mira type variable not far from Regulus. It gets to about 5th magnitude at its brightest and can easily be followed in a small telescope, or even with a pair of binoculars. This type of variable can be observed about once a week and will soon show the sinusoidal-type light curve typical of Miras.

Why observe these stars? Because their light curves seem to vary with every cycle and astronomers could do with another couple of hundred years of observations to work out what they are doing. So your observations could help solve the mystery.

Brian Fraser

OSCARS GO GLOBAL WITH INTERNATIONAL INTRODUCTION FROM SPACE

From: NASANews@hq.nasa.gov
RELEASE: 01-55

It may not exactly be the big break they were looking for, but the Expedition Two crew onboard the International Space Station made its Hollywood debut during Sunday night's Academy Awards ceremony, which was seen by an international television audience of nearly 800 million viewers.

The 73rd annual Oscars started with a weightless space station introduction of this year's host - actor, comedian and writer, Steve Martin - albeit only a life-sized likeness. American astronaut Susan Helms, flanked by her crewmates, Russian Commander Yury Usachev and fellow astronaut Jim Voss, gave the show's master of ceremonies a proper send-off.

"The Academy Awards is one of the few events that you know the entire world watches," said NASA Administrator Daniel S. Goldin. "When producers of the Oscars' ceremony approached us, we thought it was an excellent opportunity to expose a global audience to the important work being done by NASA and its international partners in orbit on the International Space Station."

"The pace up there is incredible. The crew works so hard and is so dedicated," added Goldin. "It was nice to be able to offer them a chance to relax for a moment and have a little fun with the rest of the world."

Producers from the Academy of Motion Picture Arts and Sciences have a history of closely guarding details of the opening ceremony, and this year's program was no different. The introduction, shot in the near zero-gravity of space, was taped last week during the STS-102 mission that delivered the members of the Expedition Two crew to their new home.

For the next five months, the crew will open the space-based research outpost for business, beginning scientific work, checking out a new Canadian-supplied robotic arm and installing a new airlock designed for both U.S. and Russian spacesuits.

Additional information on the International Space Station, Expedition Two, and the Academy of Motion Picture Arts and Sciences is available on the Internet at:-

http://www.spaceflight.nasa.gov
http://www.oscar.org

Chart for Variable of the Month

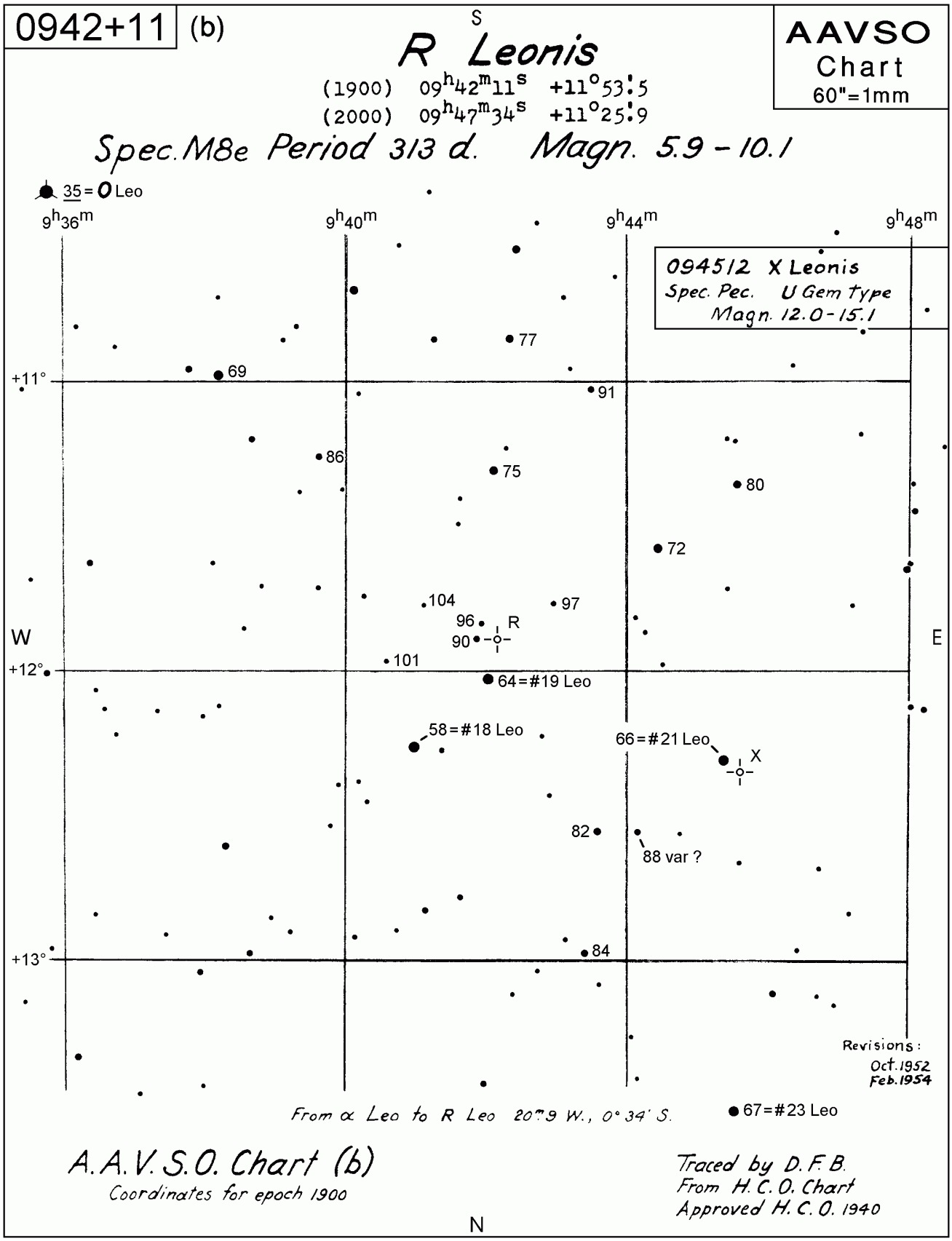

Chart courtesy of the AAVSA Website - http//www.aavso.com

Diary of Astronomical Phenomena:- 2001

May 2001

dd hh	dd hh
1 05 Mercury greatest brilliancy	15 10 LAST QUARTER
2 04 Moon at perigee	16 22 Mercury 2.8 N of Jupiter
4 20 Venus greatest brilliancy	19 09 Venus 4.5 N of Moon
7 14 FULL MOON	22 03 Mercury greatest elong. E(22)
7 18 Mercury 3.7 N of Saturn	23 03 NEW MOON
10 19 Mars 2.0 S of Moon	23 06 Saturn 1.3 N of Moon
10 21 Neptune stationary	24 07 Jupiter 1.5 N of Moon
11 13 Mars stationary	24 19 Mercury 3.1 N of Moon
12 13 Mercury 7.9 N of Aldebaran	25 13 Saturn in conj. with Sun
14 00 Neptune 3.0 N of Moon	27 04 Moon at perigee
15 01 Moon at apogee	29 20 Uranus stationary
15 08 Uranus 3.2 N of Moon	29 22 FIRST QUARTER

June 2001

dd hh	dd hh
4 09 Mercury stationary	17 23 Venus 1.7 N of Moon
4 10 Pluto at opposition	18 18 Mercury 3.7 S of Jupiter
6 02 FULL MOON	19 22 Saturn 0.0 N of Moon Occn.
6 19 Mars 3.9 S of Moon	21 00 Mercury 3.1 S of Moon
8 09 Venus greatest elong. W(46)	21 03 Jupiter 0.9 N of Moon Occn.
10 08 Neptune 3.0 N of Moon	21 07 Solstice
11 16 Uranus 3.3 N of Moon	21 12 NEW MOON Eclipse
11 17 Moon at apogee	21 23 Mars nearest to Earth
13 17 Mars at opposition	23 17 Moon at perigee
14 04 LAST QUARTER	28 03 FIRST QUARTER
14 13 Jupiter in conj. with Sun	28 04 Mercury stationary
16 14 Mercury in inferior conjn.	

LOCAL TIMES of RISE and SET for the MAJOR PLANETS, 2001

Site Location:- Long. **+28.0** deg. Lat. **-26.0** deg. Local Time:- **UT +2.0** hrs.

Date	Sun		Mercury		Venus		Mars		Jupiter		Saturn	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
May 01	06.32	17.37	07.14	18.04	03.46	15.39	20.31	10.18	09.03	19.38	08.05	18.55
May 11	06.38	17.31	08.06	18.31	03.28	15.20	19.53	09.43	08.34	19.07	07.32	18.20
May 21	06.43	17.26	08.30	18.48	03.20	15.05	19.10	09.02	08.04	18.37	06.58	17.45
May 31	06.48	17.23	08.18	18.43	03.18	14.54	18.21	08.16	07.35	18.07	06.25	17.11
Jun 10	06.52	17.22	07.31	18.07	03.20	14.45	17.28	07.26	07.06	17.37	05.51	16.36
Jun 20	06.55	17.23	06.24	17.11	03.26	14.38	16.33	06.33	06.37	17.07	05.17	16.01
Jun 30	06.57	17.26	05.34	16.24	03.34	14.35	15.40	05.40	06.08	16.37	04.43	15.27