

# CANOPUS

**The Astronomical Society of Southern Africa**

**Johannesburg Centre**

**Monthly Newsletter for June 2002**

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

## Editorial

How many of you managed to visit ScopeX 2002? For those of you who didn't make it, you really missed out on an excellent outing followed by a very good Star Party. The weather was on our side for once and our members and those visitors who chose to brave the cold were rewarded by some interesting views of the Major Planets which were clustered together a little above the horizon just after sunset. Also of wide interest were objects such as Alpha and Omega Centauri and the Jewel Box, as well as the various components of the Southern Cross etc...

**Eben van Zyl** has submitted another article on the genius of Kepler and how he deduced the mathematical relationship between the times of revolution of, and the average relative distances of the Planets from the Sun, and **Dave Gordon** has given us some feedback on the opening of the Blue Hills observatory as well as some initial feedback on ScopeX.

**Brian Fraser** gives us some pointers to a few heavenly happenings for the next 2 months, including a table of the rising and setting of the Sun and the 5 "original" planets. Remember, if you need the tables for the Sun, Moon and Planets - just dive into the website to pick up data covering the whole year. **Chris Stewart** and **Lerika Cross** have submitted a thank-you message after the success of ScopeX.

Interesting...NASA is going to attempt to resurrect the dormant NEAR/Shoemaker spacecraft which soft-landed on the surface of the asteroid Eros - here's wishing them success in the venture.

ECLIPSE chasers - remember we have a solar eclipse on 4<sup>th</sup> December. If you would like to be there, contact a committee member, or Brian Fraser for further details on how to get to the area of interest.

Some more sad new for ASSA members. **Bob Stobie** passed away during May and we've included a short note that Cliff Turk sent out to members.

*The Editor*

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## Notice of Monthly Meeting

The Monthly Meeting of the Johannesburg Centre of the Astronomical Society will be held in the Johannesburg Planetarium, Wits University, on Wednesday the 12<sup>th</sup> of June, 2002 at 20:00.

Curtain raiser:-

### The Universe

Followed by:-

### The Splendour of the Southern Skies

By: **Dave Gordon**

## Telescope Making Classes

Would you like to make your own telescope?...or finish off a partially completed 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 (016) 366-0955 if you are interested. You may also subscribe to the email list server by sending an email to [assa\\_telescopemaking-request@list.to](mailto:assa_telescopemaking-request@list.to) with the word SUBSCRIBE in the body of the message. It will mail you back asking for confirmation - just follow the instructions.

To send email to all subscribers to the list, merely send a single message to [assa\\_telescopemaking@list.to](mailto:assa_telescopemaking@list.to) and the list server will distribute the message to everyone concerned.

## Public Viewing ( *weather permitting* )

Public viewing nights are held *subject to suitable weather conditions* on the Friday nearest First Quarter, and are held at the Old Republic Observatory, 18a Gill Street, Observatory, Johannesburg. Starting time around 19:30. *See the ASSA event calendar for the proposed viewing dates.*

## For Sale

### Meade LX200 7"

- \* 8 x 50mm Viewfinder
- \* Electrical DC Adapter
- \* 26mm & 40mm Meade Eyepieces
- \* Meade Variable Polarizing Filter
- \* Tripod / Wheely-bars
- \* Diagonal

**Price R35000.00**

Contact Ivana Meyer

Tel: 011 465 2803(h)  
011 390 1145(w)

### Celestron C4.5 Telescope

Sturdy wooden / metal tripod  
5mm  
25mm  
30mm

Celestron ortho magnifiers

**Price R4200.00 o.n.c.o.**

Contact Dudley or Linda Davis

Tel 011 763 7766  
or 082 458 6192

## ASSA Jo'burg Centre - Calendar of Events

Month	Day/ Date	Event	Details
Jun	Sat 08	The Great Magic Physics Show by Tony Voorvelt - from 14:00 to 16:00	Physics Department building at Wits University.
Jun	Mon 10	Committee Meeting 17:30	
	Wed 12	<b>Monthly Meeting</b>	TBA - hopefully at discoverer of a recent supernova
	Fri 14	<i>Public Viewing</i>	FireWalking
Jul	Mon 8	Committee Meeting 17:30	
	Wed 10	<b>ASSA Jo'burg Centre A.G.M.</b>	
	Fri 12	<i>Public viewing</i>	
Aug	Fri 9	<i>Public Holiday</i> - probably no viewing	
	Mon 12	Committee Meeting 17:30	
	Wed 14	<b>Monthly Meeting</b>	TBA
Sep	Fri 6	<i>Public viewing</i>	
	Mon 9	Committee Meeting 17:30	
	Wed 11	<b>Monthly Meeting</b>	TBA
Oct	Mon 7	Committee Meeting 17:30	
	Wed 9	<b>Monthly Meeting</b>	TBA
	Fri 11	<i>Public viewing</i>	
Nov	Fri 8	<i>Public viewing</i>	
	Mon 11	Committee Meeting 17:30	
	Wed 13	<b>Monthly Meeting</b>	TBA
Dec	Tue 3	Star Party at Tshipese before	
	Wed 4	Solar Eclipse 2002	
	Mon 9	Committee meeting	
	Wed 11	<b>Year End Monthly Meeting</b>	Informal get together and viewing

### Reminders

2002	ASSA Symposium / hosted by Pretoria Centre/ At Aloe Ridge Hotel and Conference Centre LEONIDS Nov 19 <b>December 4, Solar Eclipse</b>
2003	Centenary of Flight <b>August: Mars opposition</b> <b>Mercury Transit</b>
2004	Centenary Sir Herbert Baker Library Building Johannesburg Centre to host 2004 ASSA Symposium <b>June 8, Venus Transit</b>

### Sad News regarding Bob Stobie

*We received the following email from Cliff Turk earlier this month.*

Dear All,

I regret to have to bring you the sad news that Bob Stobie died last evening. I received a telephone call from the Observatory advising me that he went into hospital for a by-pass operation and was apparently satisfactory around mid afternoon, but had a heart attack a couple of hours later.

I know no more, but will pass on any further details as I hear them.

Cliff

## HOW DID KEPLER DO IT? ( Part III )

Kepler's analysis of the positions of Mars as measured by Tycho Brahe led him to formulate his first two laws in 1609.

### Kepler's First Law

The planets move in orbits which are ellipses, having the Sun as one focus.

### Kepler's Second Law

The radius vector from the Sun to the planet sweeps out equal areas in equal periods of time.

We saw in parts I and II of this series of articles on Kepler, how he determined the distances of the planets from the Sun, relative to the Earth's average distance from the Sun, 1 astronomical unit. Kepler obtained the values given in the table:

Planet	Period of Revolution	Period in years = T	Average Dist. from Sun = R
Mercury	88 Days	0,241	0,387
Venus	225 Days	0,616	0,725
Earth	365.25 Days	1,000	1,000
Mars	687 Days	1,881	1,524
Jupiter	4333 Days	11,86	5,2
Saturn	10760 Days	29,46	9,54

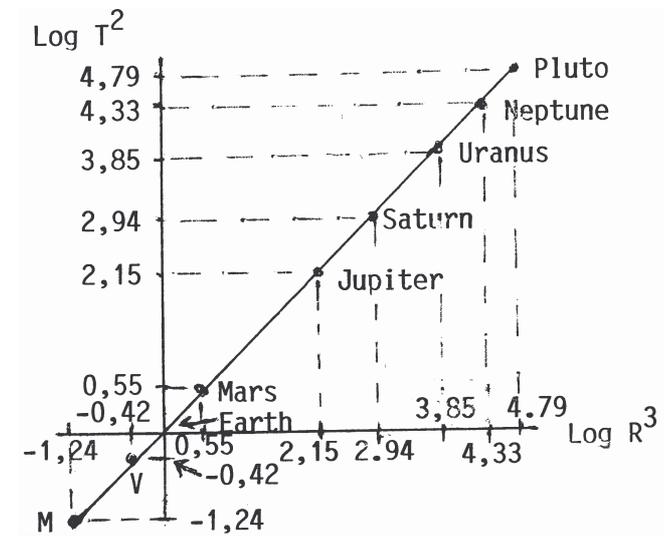
Looking at the figures in the table, Kepler saw that the longer the period of revolution, the greater the average relative distance from the Sun. While Mercury's period is 0,241 years, that of Saturn is 29,46 years, i.e. 122.2 times greater. The relative distances of the two planets increased from 0,387 to 9,54 AU, i.e. 24,65 times. What relationship could there possibly be between 122,2 and 24,65? It seemed as if Nature was fickle. Nine years long Kepler battled with the figures and during that period of time he had to defend his 69 year old mother who had been charged with witchcraft! The case dragged on for three years.

By 1618 Kepler had succeeded in cracking the puzzle. He had found that there was a definite mathematical relationship between the SQUARES of the times of revolution and the CUBES of the average relative distances from the Sun.

Planet	T in years	T <sup>2</sup>	Dist. R in AU	R <sup>3</sup>	T <sup>2</sup> ÷ R <sup>3</sup>
Mercury	0,241	0,058	0,387	0,058	1,000
Venus	0,616	0,379	0,725	0,381	0,995
Earth	1,000	1,000	1,000	1,000	1,000
Mars	1,881	3,538	1,524	3,539	1,000
Jupiter	11,86	140,6	5,200	140,6	1,000
Saturn	29,46	867,9	9,540	868,2	0,999

The table showed that  $T^2 \div R^3 = \text{Constant} = 1,000$ , namely that the SQUARE of the period of revolution (in years) is proportional to the CUBE of the average relative distance in astronomical units. This relationship was also found to hold for Jupiter's four moons as well as for the planets, Uranus, Neptune and Pluto which were discovered later. This was **Kepler's Third Law**.

To represent Kepler's Third Law graphically, it is best to use the logs of the numbers. (The log of a number is the power to which 10 has to be raised to equal the number, e.g. the log of 100 is 2 because  $100 = 10$  raised to the power 2.)



The straight line shows the linear relationship between the squares of the times of revolution and the cubes of the average distances from the Sun.

Isaac Newton used Kepler's finding, that  $T^2 = R^3$  to derive the Law of Gravitation. Robert Hooke had suggested that circular motion necessitated a force towards the Centre. Newton found this force to be balanced by the centrifugal force in circular motion by  $F = m \times R \div T^2$ , where F is

the force of attraction of the Sun;  $m$  is the mass of the planet and  $T$  is the planet's time of revolution in years.

Substituting Kepler's value of  $R^3$  for  $T^2$ , Newton obtained the relation:  $F = m R \div R^3$ , so that  $F = m \div R^2$ , i.e. the Sun's force of gravitation is proportional to the mass of the planet ( $m$ ) and inversely proportional to the SQUARE OF THE DISTANCE, which is the Law of gravitation.

When double stars were discovered by William Herschel more than a century later, it was found that they obeyed Newton's Law of gravitation and also Kepler's Third Law.

By using Kepler's law:  $T^2 = R^3$ , = Constant, it became possible to calculate the sum of the masses of the two stars of a binary system,

simply by measuring the period of revolution of the two stars around their mutual Centre of gravity, their baricentre. After a double star has been observed for at least one complete revolution, the shape of the elliptical orbits can be derived, as well as the sizes of the two ellipses. This enables the ratio of the two stellar masses to be calculated. From this ratio and the sum of the masses, the individual masses are easily deduced. For example the sum of the masses of the two members of Alpha Centauri works out to be 1,96 solar masses. The ratio of the sizes of the two ellipses is 55 : 43, so that the individual masses work out to 1,1 and 0,86 solar masses. Being a G2 V star; Alpha Centauri-A of mass 1,1 solar mass is very similar to the Sun.

Jan Eben van Zyl

## Johannesburg ASSA's Autumn Star Party

Does the Jo'burg Centre of ASSA have a very active membership? You bet! Our two most recent events, namely the Autumn Star Party on May 11th and the inauguration of Scope-X the following week is proof that this society is going places.

More than 40 visitors supported the Autumn Star Party. Thank heavens for clear skies as there were 15 telescopes in full swing at the gathering. Highveld bush fires this time of the year are a hazard for sky watchers and many visitors commented on the resultant poor seeing and visibility. By sunset, one noticed the effect created by this haze extending to as much as 30 degrees above the horizon.

It was a real treat to see all five planets aligned in the early evening sky. Mercury was extremely low in the west followed by a rapidly descending Saturn into the smoky haze. Mars is currently tiny in the telescope at only 4 arc seconds in diameter and Venus is blindingly bright but bland at magnitude -4 and at 86% phase. This phase will gradually reduce in coming weeks when Venus will become a little more astronomically enticing. Our majestic Jupiter more than made up for the poor telescopic show of the four preceding planets with a grand showing of its cloudy disc and moons, Little Io gave us a transit egress to marvel over, much to the delight of our star party visitors.

Early evening saw the opening of Dave Gordon's new observatory. The roof was rolled off the main structure "officially" shortly after 18:00. Silence, then a strange rumbling noise as the roof began to roll, followed by some anxious creaking and finally, a loud pop ... the sound of a champagne cork and ... relieved applause.

Shortly after, fires were lit and hungry star gazers settled into some fine food, wine and wide angle lenses. It was interesting to note the variety of telescopes in operation, from a 12 inch Schmidt Cassegrain to a 6 inch Chinese-built refractor. There were home-made scopes aplenty with the 8 inch Dobsonians being well represented.

As the evening progressed, seeing conditions deteriorated further. The evening sky actually became lighter as smoke particles in the low atmosphere reflected the light from Pretoria, Midrand, Fourways and of course the main city. Consequently, our party was restricted to the viewing some of the brighter "Hollywood Objects". Omega Centaurus (NGC 5139) the Jewel Box (NGC 4755), Sombrero Galaxy (M104), M16 (the butterfly cluster), M17 in Scorpius... to name a few.

The event was a great success and another will be planned for later this year. It goes without saying though that the success of any society or gathering of people with a common interest in a subject is wholly dependent on the enthusiasm of

its membership. Particularly in the case of an astronomy society, it is the members who must give direction to that society.

Your society's committee has strived to boost membership with recent events such as Hobby-X and Scope-X. Our membership has increased beyond our initial expectations and this means many new faces to our meetings, both beginner and experienced within astronomy. Now more than ever, we need to listen to the needs of our members.

Many of us have been pleasantly surprised to realise that there is a tremendous level of activity of amateur astronomy within our suburbs (my eyes were opened to the large numbers of enthusiasts within Johannesburg experimenting with CCD and taking superb astro-images). We never see this activity because so many of our members have, for one reason or another, withdrawn from monthly meetings and much of our organised activity.

Your committee is in place to organise YOUR events, talks, demonstrations, beginner classes, advanced classes, slide shows ... anything you want from your society. But you need to let us know what we can organise for you. A quiet membership means your committee arranges activities based on what they think you want.

Why not tell us what you want. For example, if you would like to drive a few kilometres out of the city with a few other members to observe and learn the sky, learn how to find the south celestial pole, learn how to star hop, learn how to read star maps, etc, you need to tell us.

I leave you with my email address in the hope that you will consider your needs for you to grow your hobby and then let me know so I can take these suggestions back to your committee for real action and implementation.

Here's to a society that's really looking up!

**Dave Gordon.**

*dave@turboread.com*

*A picture taken at the opening of the Blue Hills Observatory*



## Guinness Records Names JPL's Aerogel World's Lightest Solid

MEDIA RELATIONS OFFICE  
JET PROPULSION LABORATORY  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
PASADENA, CALIF. 91109 TELEPHONE (818) 354-5011  
<http://www.jpl.nasa.gov>

A new version of aerogel, the particle-collecting substance on NASA's Stardust spacecraft, has been recognized by Guinness World Records as the solid with the lowest density.

Dr. Steven Jones of NASA's Jet Propulsion Laboratory, Pasadena, Calif., a materials scientist who created the aerogel used by Stardust, also created a lighter version that weighs only 3 milligrams per cubic centimeter (.00011 pounds per cubic inch.) The team received the official certificate yesterday.

Guinness World Records approved the new aerogel's application for the least dense solid in March. Astronomer David Hawksett, Guinness World Records' science and technology judge, decided that Jones' aerogel beat out the previous record holder, an aerogel that weighed 5 milligrams per cubic centimeter (.00018 pounds per cubic inch.)

Aerogel is pure silicon dioxide and sand, just as is glass, but aerogel is a thousand times less dense than glass because it is 99.8 percent air. It is prepared like gelatin by mixing a liquid silicon compound and a fast-evaporating liquid solvent, forming a gel that is then dried in an instrument similar to a pressure cooker. The mixture thickens, and then careful heating and depressurizing produce a glassy sponge of silicon.

What remains is sometimes called "solid smoke," for its cloudy translucent color and super-light weight. Surprisingly, this seemingly brittle substance is durable and easily survives launch and space environments.

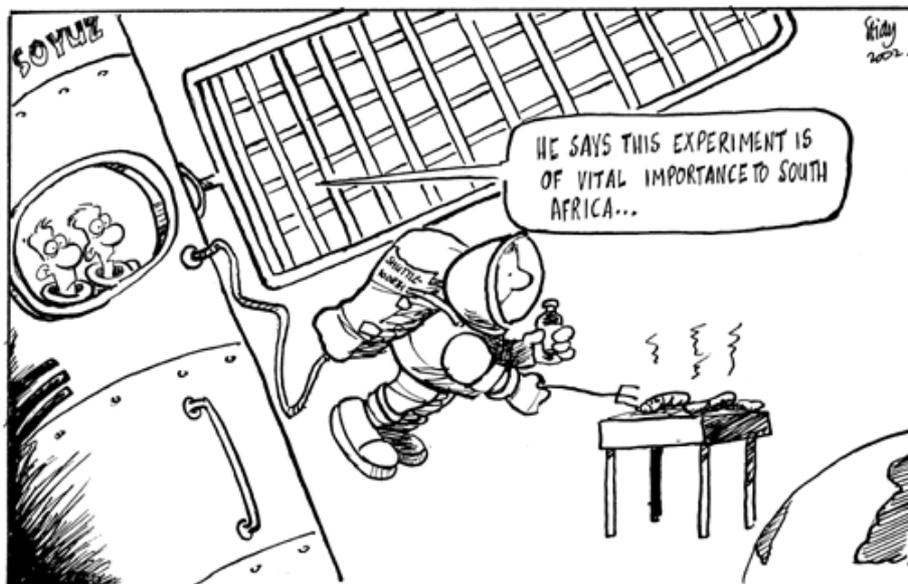
"It's probably not possible to make aerogel any lighter than this because then it wouldn't gel," Jones said. "The molecules of silicon wouldn't connect. And it's not possible to make it lighter than the density of air, 1.2 milligrams per cubic centimeter (.00004 pounds per cubic inch), because aerogel is filled with air." To change the density, Jones simply changes the amount of silicon in the initial mixture.

Stardust will use aerogel to capture particles from comet Wild 2 in 2004. NASA used aerogel for thermal insulation on the Mars Pathfinder mission. It will also be used on the 2003 Mars Exploration Rover, and may aid a proposed fundamental-physics testing mission and the Mars Scout Program.

More information is available at:

<http://stardust.jpl.nasa.gov/tech/aerogel.html> .

JPL is a division of the California Institute of Technology, Pasadena, Calif.



# ASTRONOMERS FIND JUPITER-LIKE WEATHER ON BROWN DWARFS

NASA Ames Research Center  
RELEASE: 02-65AR

For the first time, researchers have observed planet-like weather acting as a major influence on objects outside our solar system.

A team of scientists from NASA and the University of California, Los Angeles (UCLA), has found cloudy, stormy atmospheres on brown dwarfs, celestial bodies that are less massive than stars but that have more mass than giant planets like Jupiter. The discovery will give scientists better tools for interpreting atmospheres and weather on brown dwarfs or on planets around other stars.

"The best analogy to what we witness on these objects are the storm patterns on Jupiter," said Adam Burgasser, astronomer at UCLA and lead author of the study. "But I suspect the weather on these more massive brown dwarfs makes the Great Red Spot look like a small squall." Jupiter's Great Red Spot is a massive storm more than 15,000 miles across and with winds of up to 270 miles per hour. Burgasser teamed up with planetary scientist Mark Marley, meteorologist Andrew Ackerman of NASA Ames Research Center in California's Silicon Valley, and other collaborators to propose how weather phenomena could account for puzzling observations of brown dwarfs.

"We had been thinking about what storms might do to the appearance of brown dwarfs," Marley said. "And when Adam showed us the new data, we realized there was a pretty good fit." The team calculated that using a model with breaks or holes in the cloudy atmosphere solved the mysterious observations of cooling brown dwarfs.

Brown dwarfs, only recently observed members of the skies, are "failed stars at best," said Ackerman. Not massive enough to sustain the burning of hydrogen like stars, brown dwarfs go through cooling stages that scientists observe with infrared energy-detecting telescopes. They appear as a faint glow, like an ember from a fire that gives off both heat and light energy as it dims.

Astronomers expected brown dwarfs, like most objects in the universe, to grow steadily fainter as they cool. However, new observations showed

that during a relatively short phase brown dwarfs appear to get brighter as they cool. The explanation lies in the clouds.

At least 25,000 times fainter than the sun, brown dwarfs are still incredibly hot, with temperatures as high as 2,000 degrees Kelvin (3,140 F). At such high temperatures, things like iron and sand occur as gases. As brown dwarfs cool, these gases condense in the atmosphere into liquid droplets to form clouds, similar to water clouds on Earth. As the brown dwarf cools further, there is a rapid clearing of the clouds caused by atmospheric weather patterns. As the clouds are whisked away by the storms, bright infrared light from the hotter atmosphere beneath the clouds escapes, accounting for the unusual brightening of the brown dwarfs.

"The model developed by the group for the first time matches the characteristics of a very broad range of brown dwarfs, but only if cloud clearing is considered," said Burgasser. "While many groups have hinted that cloud structures and weather phenomena should be present, we believe we have actually shown that weather is present and can be quite dramatic."

By using Earth's weather as a starting point, Ackerman helped the team work storms-that include wind, downdrafts and iron rain-into their calculations. "The astrophysicists needed some help understanding rain because it's not an important process in most stars," Ackerman said. "We used observations and simulations of terrestrial clouds to estimate the effect of iron rain on the thickness of an iron cloud."

The team's study, to be published in the June 1 issue of *Astrophysical Journal Letters*, will help researchers determine the make-up of atmospheres outside our solar system. "Brown dwarfs have traditionally been studied like stars, but it's more of a continuum," Marley said. "If you line a mug shot of Jupiter up with these guys, it is just a very low-mass brown dwarf." Brown dwarfs are a training ground for scientists to learn how to interpret observations of planet-like objects around other stars, he said. "Everybody wants to find brown dwarfs that are even colder

and have water clouds just like Earth. Once we find those, that will be a good test of our understanding."

NASA, the National Science Foundation and the Hubble Postdoctoral Fellowship funded this study and supplied much of the data. Other

collaborating institutions include Vanderbilt University, Nashville, Tenn.; Washington University, St. Louis; U.S. Naval Observatory, Washington, D.C.; and California Institute of Technology, Pasadena, Calif. More information about this study is available at:

<http://www.journals.uchicago.edu/ApJ/journal/contents/ApJL/v571n2.html>

## Cellphones

I was recently returning home from a meeting out of town, and I decided I needed to stop at one of those rest areas on the side of the road. I go into the washroom. The first stall is taken, so I go into the second stall. I had just sat down when I hear a voice from the other stall.....

"Hi there, how is it going?"

Okay, I am not the type to strike up conversations with strangers in washrooms on the side of the road. I didn't know what to say, so finally I say:

"Not bad....."

Then the voice says: "So, what are you doing?"

I am starting to find this a bit weird, but I say:

"Well, I'm on my way back home from the beach"

Then I hear the person, all flustered, say: "Look, I'll call you back-----every time I ask you a question-this idiot in the next stall keeps answering me!"

## NEAR Resurrection: Bringing Back the Dead Spacecraft

By Leonard David

*space.com*

23 May 2002

A death-defying comeback might be in store for NASA's Near Earth Asteroid Rendezvous (NEAR) spacecraft. The probe is now muted, quietly resting in a no-shout zone on the surface of asteroid 433 Eros.

An attempt to reconnect with NEAR may occur at year's end as the rocky world and Earth move into close proximity and sunlight washes over the spacecraft's energizing solar panels.

The stab-in-the dark at re-establishing radio contact with NEAR could be done though NASA's Deep Space Network managed by the Jet Propulsion Laboratory in Pasadena, California.

Those who worked on the NEAR project hope it can be revived. But it's a long shot, they quickly add.

Super-cold temperatures may have done in the electronics aboard the spacecraft. On the other hand, turning on NEAR would be coup de grace of cosmic proportion. A fit-and-fiddle spacecraft would give engineers confidence in future hardware designs - equipment that can take a beating but keep on keeping on.

Full story here:

[http://www.space.com/scienceastronomy/solarsystem/near\\_reboot\\_020523.html](http://www.space.com/scienceastronomy/solarsystem/near_reboot_020523.html)

## Names to be Landed On Asteroid With Japan's MUSES-C Mission

*The following press release was received from The Planetary Society's Japanese affiliate, TPS/Japan:*

Meet Your "Star Prince" with MUSES-C: The World's First Endeavor to Land Names on An Asteroid  
May 13, 2002:

The Planetary Society of Japan (TPS/J) in cooperation with The Planetary Society, will mount a worldwide public outreach program to land one million names on an asteroid with Japan's MUSES-C mission. Entitled "Let's fly to

meet your star prince," the program will enhance public interest in MUSES-C, the world's first sample return mission to an asteroid. "Star Prince" refers to the title character in Saint-Exupery's famous story, "The Little Prince."

The Little Prince makes his home on an asteroid.

Japan's Institute of Space and Astronautical Science, ISAS, will launch the MUSES-C spacecraft in November-December this year. TPS/J will collect names to send aboard the spacecraft from May 10 through July 6, 2002.

"The Planetary Society maintains close ties with The Planetary Society of Japan and strongly supports the effort to involve the public in the MUSES-C Mission," said Louis Friedman, Executive Director of The Planetary Society.

MUSES stands for a series of missions performed by the Space Engineering Spacecraft launched by MU rocket. "C" means the third mission of this series. ISAS, the space agency responsible for Japanese robotic exploration of the solar system, successfully flew names of 270,000 people aboard "NOZOMI," which means hope, to Mars in July 1998.

The TPS/J program seeks to send names of at least one million people from around the world aboard the spacecraft to land on the surface of the asteroid. The names will be etched on an

aluminum foil sheet enveloped inside a target marker, a softball-sized artificial ball. The target marker will be released onto the asteroid surface as a guiding landmark, enabling the spacecraft to touch down on sample-collecting sites safely and correctly.

The MUSES-C mission will land on Asteroid 1998SF36, which is about 700m x 300m in size and orbits at an averaged distance of 0.9AU from Earth.

TPS/J is the first international affiliate of The Planetary Society. Since its inauguration, TPS/J has been engaged in various public outreach activities through its website, publications and participation in planetary-related events in an effort to enhance public interest in exploring our solar system and search for extraterrestrial intelligence, SETI.

To join the campaign on the Internet, visit:

<http://www.planetary.or.jp/muses-c/pc/en/>

for details. If you have any questions, fax TPS/J at 011-81-3-5280-2500.

## ODYSSEY FINDS WATER ICE IN ABUNDANCE UNDER MARS' SURFACE

*NASA*News@hq.nasa.gov

RELEASE: 02-99

Using instruments on NASA's 2001 Mars Odyssey spacecraft, surprised scientists have found enormous quantities of buried treasure lying just under the surface of Mars-enough water ice to fill Lake Michigan twice over. And that may just be the tip of the iceberg.

"This is really amazing. This is the best direct evidence we have of subsurface water ice on Mars. We were hopeful that we could find evidence of ice, but what we have found is much more ice than we ever expected," said William Boynton, principal investigator for Odyssey's gamma ray spectrometer suite at the University of Arizona, Tucson.

Scientists used Odyssey's gamma ray spectrometer instrument suite to detect hydrogen, which indicated the presence of water ice in the upper meter (three feet) of soil in a large region surrounding the planet's south pole. "It may be better to characterize this layer as dirty ice rather than as dirt containing ice," added Boynton. The detection of hydrogen is based both on the intensity of gamma rays emitted by hydrogen,

and by the intensity of neutrons that are affected by hydrogen. The spacecraft's high-energy neutron detector and the neutron spectrometer observed the neutron intensity.

The amount of hydrogen detected indicates 20 to 50 percent ice by mass in the lower layer. Because rock has a greater density than ice, this amount is more than 50 percent water ice by volume. This means that if one heated a full bucket of this ice-rich polar soil it would result in more than half a bucket of water.

The gamma ray spectrometer suite is unique in that it senses the composition below the surface to a depth as great as one meter. By combining the different type of data from the instrument, the team has concluded the hydrogen is not distributed uniformly over the upper meter but is much more concentrated in a lower layer beneath the top-most surface.

The team also found that the hydrogen-rich regions are located in areas that are known to be very cold and where ice should be stable. This relationship between high hydrogen content with

regions of predicted ice stability led the team to conclude that the hydrogen is, in fact, in the form of ice. The ice-rich layer is about 60 centimeters (two feet) beneath the surface at 60 degrees south latitude, and gets to within about 30 centimeters (one foot) of the surface at 75 degrees south latitude.

"Mars has surprised us again. The early results from the gamma ray spectrometer team are better than we ever expected," said R. Stephen Saunders, Odyssey's project scientist at NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif. "In a few months, as we get into Martian summer in the northern hemisphere, it will be exciting to see what lies beneath the cover of carbon dioxide dry-ice as it disappears."

"The signature of buried hydrogen seen in the south polar area is also seen in the north, but not in the areas close to the pole. This is because the seasonal carbon dioxide (dry ice) frost covers the polar areas in winter. As northern spring approaches, the latest neutron data indicate that the frost is receding, revealing hydrogen-rich soil below," said William Feldman, principal investigator for the neutron spectrometer at Los Alamos National Laboratories, New Mexico.

"We have suspected for some time that Mars once had large amounts of water near the surface. The big questions we are trying to answer are, 'where did all that water go?' and 'what are the implications for life?' Measuring and mapping the icy soils in the polar regions of Mars as the Odyssey team has done is an important piece of this puzzle, but we need to continue searching, perhaps much deeper underground, for what

happened to the rest of the water we think Mars once had," said Jim Garvin, Mars Program Scientist, NASA Headquarters, Washington.

Another new result from the neutron data is that large areas of Mars at low to middle latitudes contain slightly enhanced amounts of hydrogen, equivalent to several percent water by mass. Interpretation of this finding is ongoing, but the team's preliminary hypothesis is that this relatively small amount of hydrogen is more likely to be chemically bound to the minerals in the soil, than to be in the form of water ice.

JPL manages the 2001 Mars Odyssey mission for NASA's Office of Space Science, Washington. Investigators at Arizona State University, Tempe, the University of Arizona, Tucson, and NASA's Johnson Space Center, Houston, operate the science instruments. The gamma-ray spectrometer was provided by the University of Arizona in collaboration with the Russian Aviation and Space Agency, which provided the high-energy neutron detector, and the Los Alamos National Laboratories, New Mexico, which provided the neutron spectrometer. Lockheed Martin Astronautics, Denver, developed and built the orbiter. Mission operations are conducted jointly from Lockheed Martin and from JPL, a division of the California Institute of Technology in Pasadena.

Additional information about the 2001 Mars Odyssey and the gamma-ray spectrometer is available at /is available on the Internet at: <http://mars.jpl.nasa.gov/odyssey/> and <http://grs.lpl.arizona.edu>.

## Sending RATs to Mars

Jet Propulsion Laboratory  
April 29, 2002

NASA and JPL are sending RATS to Mars to work as field geologists. A RAT is not quite a furry little friend, but rather a high-tech robot with diamond teeth, called a Rock Abrasion Tool (RAT).

One RAT will ride on each of the twin Mars Exploration Rovers, launching to Mars in the summer of 2003. These RATS will allow humans to remotely "crack open" rocks on Mars for the first time in the history of Mars exploration.

"This is terribly exciting, but it's a little intimidating because no one has ever tried to get into a rock on Mars before," says Stephen Gorevan. Gorevan is

the chairman of Honeybee, the small robotics contractor for the Rock Abrasion Tool that sits half a mile away from ground zero in New York City. Gorevan explains that past Mars missions to the surface had different science and technology objectives. "The Viking landers in the 1970's scooped up dirt on Mars and the Sojourner rover proved we could move around on Mars in 1997." Digging into a rock is the next step for the maturing Mars program.

Bringing a rock back from Mars or sending a human geologist comes with prohibitive costs, so sending the RAT is the next best thing. The tool

will enable scientists to peer inside a rock, where they can analyze unweathered minerals and learn about the origins of rocks. Rick Paynter, deputy lead for Quality Assurance on the Mars Exploration Rover project at NASA's Jet Propulsion Laboratory, explains that the RAT will help "peel off the orange rind" and reveal new information about the evolution of Mars. It will also help with comparing rocks on Mars to rocks on Earth.

The Mars Exploration Rover will traverse Mars, find a rock that's interesting, nuzzle up to it, and maneuver its robotic arm to press the RAT up against the chosen rock. The RAT, which is the size of a soda can, will shave away the top layers of the rock. That process may take anywhere from 30 minutes to three hours to remove a round hole about 45 millimeters (1.5 inches) in diameter and 5 millimeters (1/8th inch) deep, depending on the texture of the rock.

It's more like an electric shaver than a drill, says Steve Kondos, contract technical manager at JPL. "The difference is, the shaver heads move in and out rather than being stationary - this takes less power. Power, energy, and mass are precious on the rover, so in order to be efficient, we shave the rock rather than drill it, which is power intensive."

#### The RAT Brushes Its Teeth

After the RAT shaves off part of a rock, it scurries aside via a Dr. Seuss-like arm device, which also holds a camera and chemical analysis tools to explore the newly exposed rock layers. Before it goes to grind another rock, it turns around and brushes its "teeth" against a RAT brush that acts like a shoe polisher as the RAT "teeth" spin against it to clear out leftover rock. The RAT is designed to grind away one rock, but could shave up to as many as 10 rocks.

#### The RAT With the Right Stuff

Like any aspiring astronaut, the RAT must prove it has the right stuff before it can launch. The Rock Abrasion Tool is the brainchild of Mars Exploration Rover Principal Investigator, Steve Squyres of Cornell University, Ithaca, NY. Gorevan of Honeybee says, "Squyres thought of the need to expose a rock on Mars, and got us from point A to point B. Our job has been to get from point B to point Z."

After winning the competitive instrument contract, the Honeybee team has had to follow strict size, mass, and pressure requirements generally dictated by the strength limitations set by the robotic arm.

The Honeybee team had to use its ingenuity to come up with the optimum way to provide a mini crater in a Martian rock. Gorevan says, "We cobbled and cogitated together to test ideas, and we're at about point W on the way to Z."

Last week, Steve Kondos and Rick Paynter from JPL hand-delivered to Honeybee the motors that run the RATS. "We're really conservative at JPL. The value of the instrument far exceeds the cost," says Paynter. "We split the motors and carried them in different pieces of luggage and took separate planes to New York City."

Now that JPL delivered the motors, "we have a clear path to finish our environmental tests and 'shake and bake' the RAT." "Shake and bake" is a process used by engineers to ensure that instruments can withstand the intense vibrations and heat of launch, the extraordinary impact of landing on Mars, and the strong radiation exposure during interplanetary cruise. As time races toward launch, other challenges still remain. "One surprise has been to find how much dust is created by the RAT," explains Gorevan at Honeybee. As the robot grinds away at a rock, it generates dust plumes and leaves RAT "droppings" that can blow onto the solar arrays of the rovers or the cameras.

"Honeybee's claim to fame in NYC is a long way from its new role with Mars - they created the giant moving parts on the Coca-Cola sign in Time Square," says Rick Paynter from JPL. Steve Kondos from JPL calls the RAT people at Honeybee ingenious. "They are concerned with cost and schedule milestones, and best of all, they are fun to be with. Since we come from LA, the Honeybee team introduces us to little known spots, like a deli where the bread is so good that Frank Sinatra used to have loaves shipped from Manhattan to Hollywood every week."

New York, 9/11, and Mars

"After September 11 happened, the first thought was how the team at Honeybee was affected", explains Kondos. "We called immediately, but of course couldn't get in contact with them." Luckily, no one on the team was hurt.

NASA Headquarters just approved putting an American flag on the rock shield of the Rock Abrasion Tool. "It's not the equivalent of placing the American flag in the rubble pile, but it's something like that." Kondos is quiet for a moment, then adds, "We're not stopping our progress and hiding, we're rising to the stars."

## ASSA SYMPOSIUM 2002

The Fifth ASSA Symposium will be held from Friday November 29 to Sunday December 1 at the Aloe Ridge Hotel and Observatory, and is being organised by the Pretoria Centre of ASSA.

The Symposium will bring together professional and amateur astronomers to present and listen to papers on a wide range of topics. There will be papers on latest research, instrumentation, amateur observing, history, and an entire session devoted to the total eclipse of the sun which takes place on the morning of December 4 from northern South Africa, the first total eclipse of the sun visible from South Africa since 1940.

We are privileged to confirm Dr Janet Mattei will attend from the AAVSO.

Persons interested in presenting a paper at the Symposium, or attending the Symposium can contact the Chairman of the Organising Committee, Tim Cooper, at [tpcoope@mweb.co.za](mailto:tpcoope@mweb.co.za), or on 011-967-2250.

Registration forms will be sent out shortly and will also be available electronically.

**Tim Cooper**



### Meade Syndrome.

- 1) The process whereby any notable event, or planned activity relating to astronomy, will, at the appropriate time, result in the local increase of atmospheric water vapour to the extent that all starlight is blocked from view. This cloud cover will dissipate as soon as the event has passed, or planned activity is abandoned.
- 2) The intense frustration resulting from 1) above, coupled with the partial desire to dispose of the telescope conflicting with the hope that next time the sky will be clear.



## THANK YOU!

We would like to extend a big THANK YOU to each and every one of you for making ScopeX a reality on Saturday. It is only through the direct efforts of people like yourselves that it was possible for the event to succeed, and by all accounts it was a stupendous success. That you took the trouble to present yourselves, bring equipment (some rather bulky and/or delicate and thus difficult to move), risked exposure of your treasured possessions to the masses, patiently fielded questions from the public and generally spread enthusiasm, is truly appreciated. We believe that the event has done a lot to promote our Society and we hope as a result to have an influx of new blood that will ensure the perpetuation of our organisation.

For a small Society, this was a big endeavor. Thus far, the feedback has only been good. We may rightly be proud and pleased that we managed to draw the biggest ever number of paying bodies on one day to the Museum, with over 1000 visitors attending. **Demetri Friend**, the Assistant Director for the Museum, who was present from 8h00 until 22h00 when the last group left, said the Museum will be very happy to host the event again. From our side, it was an ideal venue in all respects and we are already looking forward to the next such event.

Initial feedback from the commercial exhibitors is very positive and they have asked to be included in the next event. It was also very pleasing to hear positive comments from the public, coupled to enquiries as to when the next event is planned for. Even the Museum Cafe owner was very unhappy to hear we will not be having a ScopeX at least once a month as he also did very well on the day.

### YOUR VIEWS PLEASE

We plan to put a short report together on the lessons learnt on Saturday. So, while the day is still relative fresh on your mind, please let me have your views on where we went wrong, what we did right, what we should maybe include for next time. Please drop us a note and/or join us for a brainstorming session at the telescope making class on Saturday.

Based on comments from the public, an idea has started to surface of maybe having a regular Star Party combined with an auditorium show at the same venue. Would you support such an idea? If so, how often do you feel should such a session be held?

### T-SHIRTS, SWEAT SHIRTS, CAPS

Please contact **Lerika** (082 650 8002 or lerika@icon.co.za) if you would like to buy any of the left-over items, which are selling at essentially cost prices

### SPECIAL OPTICS

We will take the selection of optics donated by Eloptro to the telescope making class. There are many pieces that it would be interesting to experiment with, or just play with for educational effect. You are welcome to scratch through them and take what you want, but please make a nominal donation to the Society's coffers.

### NEXT ASSA MONTHLY MEETING

*Please note that the June meeting will be held at the Planetarium when we plan a special show on the Splendour of the Southern Sky. ALL ( including visitors / non-members ) ARE WELCOME TO ATTEND.*

Regards, and thanks again,

**Chris Stewart & Lerika Cross**

*See Picture from ScopeX on facing page.....Ed.*

# The Sky this Month

## June 2002

dd hh	dd hh
1 18 Uranus 4.4 N of Moon	12 11 Mars 0.7 S of Moon...Occn.
3 00 <b>LAST QUARTER</b>	13 03 Jupiter 2.3 S of Moon
3 05 Uranus stationary	13 21 Venus 1.4 S of Moon
3 18 Venus 1.7 N of Jupiter	18 01 <b>FIRST QUARTER</b>
4 14 Moon at apogee	19 09 Moon at perigee
7 03 Pluto at opposition	21 13 Solstice
8 09 Mercury stationary	21 15 Mercury greatest elong. W(22)
9 11 Saturn in conj. with Sun	24 03 Mercury 2.5 N of Aldebaran
9 14 Mercury 2.5 S of Moon	24 22 <b>FULL MOON</b> <i>Eclipse</i>
9 20 Venus 4.9 S of Pollux	27 16 Neptune 4.3 N of Moon
10 21 Saturn 1.2 S of Moon	29 02 Uranus 4.4 N of Moon
11 00 <b>NEW MOON</b> <i>Eclipse</i>	

## July 2002

dd hh	dd hh
2 07 Moon at apogee	13 12 Venus 3.8 S of Moon
2 10 Mercury 0.3 S of Saturn	14 00 Mercury greatest brilliancy
2 18 <b>LAST QUARTER</b>	14 11 Moon at perigee
3 06 Mars 0.9 N of Jupiter	17 05 <b>FIRST QUARTER</b>
4 17 Mars 5.7 S of Pollux	19 06 Mercury 5.5 S of Pollux
5 04 Earth at Aphelion	20 01 Jupiter in conj. with Sun
7 13 Jupiter 6.5 S of Pollux	20 14 Mercury 1.2 N of Jupiter
8 12 Saturn 1.5 S of Moon	21 02 Mercury in superior conjn.
9 09 Mercury 1.3 S of Moon	24 10 <b>FULL MOON</b>
10 10 Venus 1.1 N of Regulus	24 23 Neptune 4.3 N of Moon
10 10 <b>NEW MOON</b>	25 13 Mercury 0.7 N of Mars
10 22 Jupiter 2.8 S of Moon	26 09 Uranus 4.2 N of Moon
11 03 Mars 2.2 S of Moon	30 00 Moon at apogee

### LOCAL TIMES of RISE and SET for the MAJOR PLANETS, 2002

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
Jun 10	06.52	17.22	05.26	16.25	09.27	19.56	08.19	18.43	08.59	19.31	06.48	17.24
Jun 20	06.55	17.23	05.09	16.02	09.31	20.12	08.07	18.34	08.28	19.02	06.14	16.50
Jun 30	06.57	17.26	05.23	16.03	09.31	20.27	07.53	18.24	07.57	18.32	05.40	16.16
Jul 10	06.56	17.30	06.04	16.32	09.27	20.40	07.39	18.15	07.26	18.03	05.06	15.41
Jul 20	06.54	17.34	06.54	17.26	09.20	20.51	07.23	18.05	06.55	17.34	04.32	15.07
Jul 30	06.49	17.39	07.28	18.23	09.11	21.01	07.06	17.56	06.24	17.05	03.58	14.32