

CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for June 2000

Contents:

Editorial

Notice of Meeting

The Moon and outer planets in alignment..... Raymond Barbour

JPL and NASA News..... Bill Wheaton

Dog Bones in Space???..... NASA News

Improved GPS accuracy Brian Fraser

Variable of the Month Danie Overbeek

Tar molecules found in Space..... Max Planck Institute

In The Sky This Month Brian Fraser

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

Editorial

We're almost halfway through the year - as this editorial is being typed, the Winter Solstice is exactly one month away and the weather has been quite chilly - unlike last year when many people questioned whether or not Winter actually ever arrived.

The ASSA Jo'burg Centre's year, which runs from July to June, is almost at an end and as you're all aware, the AGM will be held on Saturday 15th July at our physical address from 19:00 to 20:00 after which we will have a bring 'n braai.

With the AGM in mind, we would like you to give some thought to your committee for the year to come. If any of you would like to see a particular person serving on the committee, or would like to serve on the committee yourself, please put their/your names forward so that we can include them on the ballot paper for the election. *Bear in mind that the person being nominated must of agree to their nomination.*

Bill Wheaton makes a welcome return to these pages after an enforced absence of some months and gives us an update on the NEAR-Shoemaker probe. *Welcome back Bill.*

Brian lets us know about the astronomical phenomena for the next two months, and Raymond has supplied a short write up and some pictures of the alignment of the Moon and superior planets at the beginning of April. Pretty good stuff for a first attempt.

For those of you that use the GPS (*Global Positioning System*) there is good news in that the Selective Availability feature, which introduced a small inaccuracy in the readings measured by the civilian GPS receivers, has been switched off. My own receiver is now giving accuracies as good as eight feet! I've included President Clinton's announcement in this regard (submitted by Brian) for your perusal.

The Editor

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Notice of Meeting

The **June** 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 14th of June, 2000 at 20:00.

Topic:

Backyard Astronomy

By: **Wolf Lange & Ed Finlay**

Future Meetings

July 15 th (<i>Saturday</i>)	A.G.M.	A Bring 'n Braai
August 9 th	T.B.A.	
September 11 th	T.B.A.	

Are there any subjects that you would like to hear at one of the monthly meetings? Contact your local friendly committee member and ask her/him to discuss it in committee.

Dark Sky Viewing

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

3 rd June	23 rd September	Year End Star Party 2000
1 st July	28 th October	<i>"Under the Full Moon"</i>
26 th August	25 th November	9 th December

Jo'burg Centre Outings for 2000

Your Committee is making arrangements for several outings during the year. Amongst these are some old favourites as well as a couple of new ones which should prove interesting.

The proposed trip to Nylsvlei during the Winter months has been dropped in favour of a return to our old winter retreat at Swinburne. Unlike Nylsvlei, Swinburne remains contactable from civilisation.

Boyden (July/August timeframe) is also looking a little dicey at present as we are having problems contacting the UOFS people who control access to the observatory.

We will also be looking at the possibility of arranging visits to other ASSA Centres (e.g. the Pretoria Centre) during the year - more information to follow.

Our overnight visit to Haartebeeshoek appears to be a no go as all time to the end of the year has already been booked up. However, Wolf Lange may be able to organise an overnight visit to a reserve just South of Jo'burg and we are pursuing this opportunity at present.

ASSA Annual General Meeting

The ASSA Parent Body would like us to host their AGM. As *our* AGM will be on 15 July (see below) we have agreed to host the ASSA AGM at the Sir Herbert Baker Library on our normal meeting night of Wednesday 12 July. We will publish more information in the next issue of Canopus.

This year's AGM and Bring 'n Braai

Last year we held a braai as part of our AGM and the smallish turnout notwithstanding, it was a quite successful. So going by the feedback we have received in this regard, it has been decided that the A.G.M. will be held at 19:00 on *Saturday* the 15th of July in the Sir Herbert Baker Library.

Please note the earlier starting time of 19:00. The meeting will run between 19:00 and 20:00 and then we will retire to the Braai area to partake of whatever gastronomic delights we can create. The domes will also be opened for whomever is interested in viewing the wonders of the Wintery night sky. With a bit of luck, we may be able to persuade Tony to open the 26" as well.

Other Talks

Tony Voorvelt arranges (and sometimes presents) monthly lectures on the last Friday of each month. These are held in the 26" telescope building and there is a charge of R10 for adults and R5 for children or senior citizens. The talks which start at 19:30, last for approximately 45 minutes and there is always a practical demonstration to backup the lecture.

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.



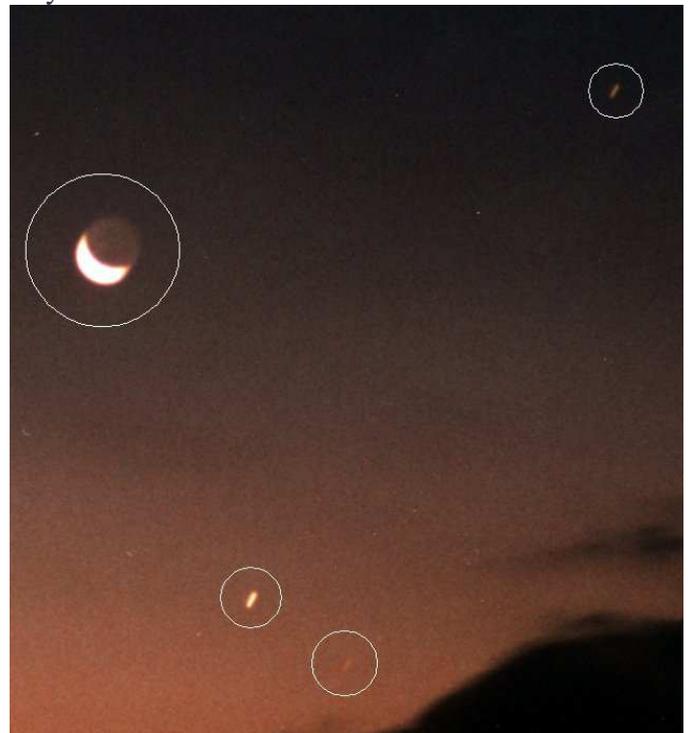
The Moon and Outer Planets in Alignment



Hi,
Here are 3 pictures. A wide angle - 10s on 100 ASA film, a zoomed in 30s on 100 ASA film. I've also marked the moon and three planets on the last picture. These photos were taken in an open field near my home in Edenvale shortly after sunset. They are my first attempts at astrophotography since getting my camera and tripod.



I did not see Mars with the naked eye but knew where it should be from Starry Night. The trails on the marked picture show that the objects must be stars or planets.
Ray



The above photographs taken by, and the text submitted by, **Raymond Barbour**

JPL and NASA News

Bill Wheaton IPAC - June 2000

He's Back!

After some high-tech adventures of my own (a virtuoso, state-of-the-art hip repair) caused me to go on vacation here for 6 months, it is a pleasure to be able to return to writing these columns once again. What with the disasters on Mars, and various other ups and downs, there is much more that needs attention even than usual; but as usual, "rather than try to cover everything I will only attempt to uncover a little", as a favorite physics professor in college said long ago.

NEAR Shoemaker at Eros

NEAR, the Near-Earth Asteroid Rendezvous mission, to asteroid 433 Eros, finally slipped into Eros orbit on 14 February 2000, nearly 14 months late. To celebrate, it was renamed NEAR Shoemaker on 14 March 2000, in honor of the pioneer planetary geologist Dr. Eugene M. Shoemaker, tragically killed in a 1997 car accident in the Australian outback. We discussed NEAR in some detail here in 1998 November, its scientific objectives and instrument complement. But complications arose immediately afterwards. Most of you probably remember the truly hair-raising save of the entire mission in late December 1998. Without the major rocket engine burn planned for 20 December, Eros would pass NEAR by, and the spacecraft would fall in its orbit back to the orbit of Earth from which it came months earlier. The maneuver began on schedule, but due to a software error in the on-board computer, it aborted catastrophically when it was only about 10% complete. The spacecraft was left out of control, in an orientation unknown either to controllers on Earth or to its own control computer. Because the parabolic high-gain antenna was not pointed towards the Earth, normal communication was impossible, and because the solar panels were not oriented towards the Sun, there was every danger that the batteries would run down before control could be recovered. Meanwhile, Eros was receding into the distance at nearly 1 km per sec, about 2,000 mph.

Heroic efforts by mission controllers and analysts, aided by an emergency mobilization of the world-wide resources of NASA's Deep Space Network, saved NEAR from the awful fate that threatened. Control was regained just before Christmas, a new command sequence was designed and beamed up, and on 3 January 1999 a revised large rocket burn brought NEAR almost to a stop (with respect to Eros) -- but trailing far behind, and with only a limited amount of fuel available to catch up. Catching up then took the remaining time, over a year, until last February 14; but only about 55 meters per sec worth of fuel had to be used, because the spacecraft veritably oozed back across the intervening million km to Eros, at an average approach speed of only about 30 m per sec, something like 65 mph.

Since that time NEAR Shoemaker has been busily carrying out the scientific program originally planned. Regular readers may recall that Eros is one of the largest near-Earth approaching asteroids; its size has by now been measured to be about 33 km by 13 km by 13 km, with a mass of some 7.3 trillion metric tons, giving a density of about 2.5. As described here in November 1998, NEAR is the first mission ever to orbit a grossly non-spherical body; one which is moreover tumbling, end-over-end, in a flat spin. This introduces huge complications into the orbit determination and navigation of NEAR, which become rapidly more severe as the spacecraft moves into closer and closer orbits.

Happy to say, all those problems seem to have been successfully solved by the wizards of astrodynamics at JPL and APL. (NEAR Shoemaker is managed and operated by the Applied Physics Laboratory, APL, at Johns Hopkins University; however, the orbit determination has been done by JPL, under a subcontract with APL.) NEAR has fixed solar panels which need to mostly point at the Sun. The science instruments all look out together, perpendicular to this axis. Thus it makes sense normally to orbit in a plane perpendicular to the solar direction; this is why the figure says "View from the Sun". This plan also gives good shadows along the terminator for excellent

visibility of optical features. The spin axis of Eros is essentially fixed in space. Fortunately for the complexity of the navigation at least, it does not wobble about this axis, as in principle it might. When NEAR first reached orbit in February, it was summer at the north pole, and the spin axis pointed not far from the Sun.

Since then in its apparent motion about the sky, the Sun has moved about 60 degrees, and NEAR is lately orbiting over the poles. As the Sun passes south of the equator, the north pole, as in September on Earth, will enter its winter darkness, and the south pole will emerge from the shadow that has heretofore hidden it.

Eros Early Orbit Phase - View from the Sun

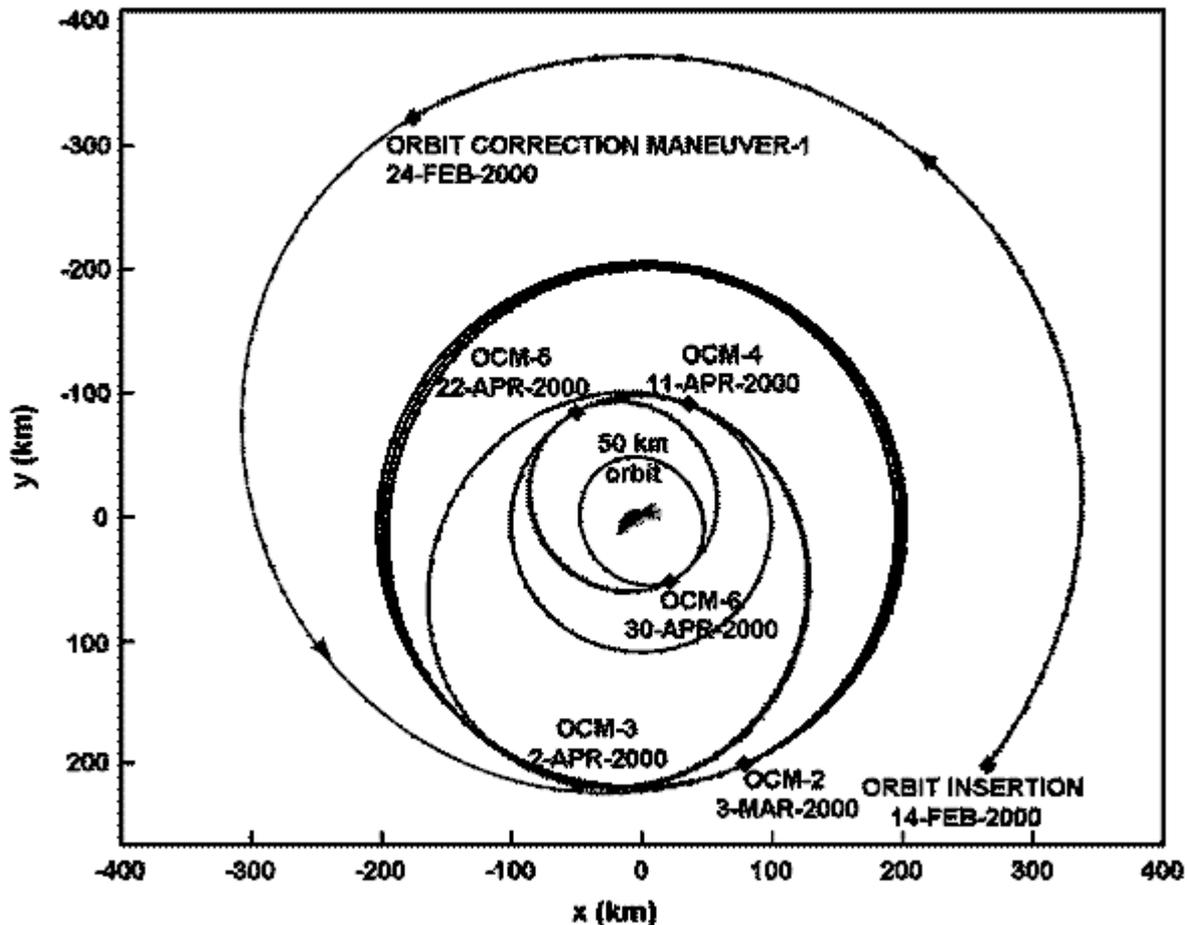


Figure from APL, Johns Hopkins University

The initial trajectory led to a circular 200 km orbit (the bundle of adjacent orbits in the figure) with a 10 day period, which NEAR entered on March 3, and where it remained for about a month. During this period the shape, rotation, and mass distribution were determined to guide operations at closer distances. It then moved to a ± 100 km, 3.4 day orbit where it stayed only from 11-22 April, before moving to the current 50 km, 1.2 day orbit, reached April 30. This orbit gives the Multispectral Imager (MSI) camera a current field of view of typically 1.4 km and a resolution of about 5 m. It will remain in such low orbits, dipping for a week to 35 km in July, until late August.

Fascinating as the pictures are, they are not the main part of the mission science results, only a little of which have yet been released. NEAR includes, beside the 7-color visible and near-infrared MSI camera, an infrared spectrometer, a laser altimeter, an X-ray and gamma-ray spectrometer, and a magnetometer, as well as an important radio science investigation. Early scientific results are to appear, as has been customary, in several papers published together in the American journal *Science*. Eros was classified as an S-type asteroid, the class that dominates the inner part of the Asteroid Belt. The spectra of such asteroids seems to imply that they consist of iron- and magnesium-bearing silicates (pyroxene and olivine) mixed with metallic nickel and iron.

On the other hand, the relationship between asteroids and meteorites is not clear. The "ordinary chondrites", the most common meteorites, are primitive, undifferentiated objects, apparently unchanged since the Solar System formed 4.6 billion years ago. The "stony-iron" meteorites seem to be remnants of a body that was large enough to have a melted-iron core. Spectroscopically, it appears that the S-type asteroids are unrelated to the ordinary chondrites. Yet if so, then we do not know where these most common meteorites come from. Before NEAR Shoemaker, Eros appeared to have some similarity to both the stony-irons and ordinary chondrites, but seemed more closely related to the stony-irons.

Now, somewhat surprisingly, it has become clear that Eros contains very little iron. In fact no magnetic field has been detected at all, probably a disappointment for the magnetometer team. Yet the implications are very interesting. Also, no sign of any significant concentrations of mass have yet been found. Technically, the gravity seems to be consistent with the shape, assuming uniform density, out to at least the sixth order in the standard mathematical expansion of the gravitational field. The absence of iron suggests that either the S-type asteroids are quite different than the stony-iron meteorites they seem to resemble; or maybe Eros is in some way atypical, perhaps not type S after all.

Information about NEAR and Eros may be found at <http://near.jhuapl.edu/>, including (of course) lots of pictures.

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Short Items

Despite the gloom that prevails about Mars, the Mars Global Surveyor keeps quietly returning wonderfully comprehensive information about the planet. Unless more pressing matters intervene, I hope to cover some of these in the near future.

BOOMERANG, a recent balloon-based experiment that observed the cosmic microwave background for 10 days with high precision from Antarctica, now gives compelling evidence that the large-scale geometry of the Universe differs from flatness - - which is to say ordinary Euclidean geometry - - by no more than 15% or less. Unsurprising as this might seem from the view of 19th century physics, it is in fact not at all required by more modern theories. Yet it is the value predicted by the most popular "cosmic inflation" models for the early Universe. The problem is now that flatness seems to require a somewhat delicate relationship between the total density of matter (both ordinary and "hidden" or dark), and "quintessence", that mysterious source of the recently resurrected Cosmological Constant; which Einstein and everyone else abandoned long ago when Hubble discovered the cosmic expansion.

Finally, Ed Stone, director of JPL during most of the 1990's, and a hero of the Voyager missions to Jupiter, Saturn, and beyond, has announced plans to retire next year. JPL is operated for NASA by the California Institute of Technology, and Caltech president David Baltimore has lately announced formation of a committee to search for a successor.

Bill Wheaton

NASA NEWS

(*extract from*) **RELEASE: 00-74**

ASTRONOMERS CATCH IMAGES OF GIANT METAL DOG BONE ASTEROID

NASA astronomers have collected the first-ever radar images of a "main belt" asteroid, a metallic, dog bone-shaped rock the size of New Jersey, an apparent leftover from an ancient, violent cosmic collision.

The asteroid, named 216 Kleopatra, is a large object in the main asteroid belt between Mars and Jupiter; it measures about 135 miles (217 kilometers) long and about 58 miles (94 kilometers) wide. Kleopatra was discovered in 1880, but until now, its shape was unknown.

FANTASTIC NEWS ABOUT GPS ACCURACY!!!

For Immediate Release May 1, 2000

STATEMENT BY THE PRESIDENT REGARDING THE UNITED STATES' DECISION TO STOP DEGRADING GLOBAL POSITIONING SYSTEM ACCURACY

Today, I am pleased to announce that the United States will stop the intentional degradation of the Global Positioning System (GPS) signals available to the public beginning at midnight tonight. We call this degradation feature Selective Availability (SA). This will mean that civilian users of GPS will be able to pinpoint locations up to ten times more accurately than they do now. GPS is a dual-use, satellite-based system that provides accurate location and timing data to users worldwide. My March 1996 Presidential Decision Directive included in the goals for GPS to encourage acceptance and integration of GPS into peaceful civil, commercial and scientific applications worldwide; and to encourage private sector investment in and use of U.S. GPS technologies and services.

To meet these goals, I committed the U.S. to discontinuing the use of SA by 2006 with an annual assessment of its continued use beginning this year. The decision to discontinue SA is the latest measure in an on-going effort to make GPS more responsive to civil and commercial users worldwide. Last year, Vice President Gore announced our plans to modernize GPS by adding two new civilian signals to enhance the civil and commercial service. This initiative is on-track and the budget further advances modernization by incorporating some of the new features on up to 18 additional satellites that are already awaiting launch or are in production. We will continue to provide all of these capabilities to worldwide users free of charge. My decision to discontinue SA was based upon a recommendation by the Secretary of Defense in coordination with the Departments of State, Transportation, Commerce, the Director of Central Intelligence, and other Executive

Branch Departments and Agencies. They realized that worldwide transportation safety, scientific, and commercial interests could best be served by discontinuation of SA. Along with our commitment to enhance GPS for peaceful applications, my administration is committed to preserving fully the military utility of GPS. The decision to discontinue SA is coupled with our continuing efforts to upgrade the military utility of our systems that use GPS, and is supported by threat assessments which conclude that setting SA to zero at this time would have minimal impact on national security. Additionally, we have demonstrated the capability to selectively deny GPS signals on a regional basis when our national security is threatened. This regional approach to denying navigation services is consistent with the 1996 plan to discontinue the degradation of civil and commercial GPS service globally through the SA technique.

Originally developed by the Department of Defense as a military system, GPS has become a global utility. It benefits users around the world in many different applications, including air, road, marine, and rail navigation, telecommunications, emergency response, oil exploration, mining, and many more. Civilian users will realize a dramatic improvement in GPS accuracy with the discontinuation of SA. For example, emergency teams responding to a cry for help can now determine what side of the highway they must respond to, thereby saving precious minutes. This increase in accuracy will allow new GPS applications to emerge and continue to enhance the lives of people around the world.

Submitted by **Brian Fraser**

VARIABLE OF THE MONTH: CI AQL.

There are about two dozen galactic novae in my repertoire. Some of these are known, or suspected to be recurrent but others lie low as far as we know, once they have done their thing. The only way to tell is to keep observing their fields, night after night, month after month, year after year. One of these is RR Pic, which I mentioned some time back. This is the star which R Watson of Beaufort West saw when walking to work one early morning in 1925. I have watched it well over a thousand times and never a peep out of it. Dull work, you may say and so it would be if you were paid to do it. Amateurs have a different approach - whenever one points the telescope at an old nova, one's heartbeat quickens a little and one thinks "Tonight's the night (maybe)".

CI Aquillae was found to be in outburst on 1917 June 25 on a Heidelberg patrol plate. Little was known of the star because it was not observed visually at the time. Then, on 2000 April 28 it showed up on a photo taken by Minoru Yamamoto of Aichi, Japan. Minoru alerted the astronomical community promptly and the star has been intensively studied, photometrically and spectroscopically in the last ten days. It shows interesting variations which point to a compound system. It is still at magnitude 9 and is well within the reach of Canopus readers.

My German colleague Patrick Schmeer tells me that he had already decided to add CI Aql to his repertoire when the Email news of Minoru's discovery arrived. Patrick is the amateur who, to my chagrin, discovered the U Sco outburst on a night when Edenvale had cloud. He was actually on holiday, away from his observatory and made the discovery using binoculars. Now THAT is dedication for you!

Enjoy CI Aql and contact me if you want more data on it or on other old novae.

Danie Overbeek
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Tarlike macro-molecules detected in 'stardust'

Max-Planck-Institute for Extraterrestrial Physics

April 26, 2000

Mass-spectrometer CIDA of the Garching based Max-Planck-Institut on the NASA spacecraft STARDUST produces puzzling results

The first in-situ chemical analysis of interstellar dust particles produces a puzzling result: These cosmic particles consist mostly of 3-dimensionally cross-linked organic macro-molecules, so-called polymeric-heterocyclic-aromates. "They rather resemble tar-like substances than minerals" say Dr. Franz R. Krueger (contractor) and Dr. Jochen Kissel, Max-Planck-Institut für extraterrestrische Physik (for extraterrestrial Physics), Garching near Munich, Germany, in the latest issue of 'Sterne und Weltraum' a monthly, German language Astronomy magazine in Heidelberg, Germany.

So far, 5 interstellar dust particles (dust between the stars) have hit the Garching built dust impact mass spectrometer CIDA (Cometary and Interstellar Dust Analyzer) onboard the NASA spacecraft STARDUST. Launched on Feb 7th 1999 STARDUST will visit comet Wild-2 (pronounced Vild-2) in 2004.

Extract from a JPL News release of 26th April 2000

In the Sky this Month

June 2000

dd hh	dd hh
1 04 Saturn 2.7 N of Moon	11 10 Venus in superior conjn.
1 04 Jupiter 3.9 N of Moon	16 23 FULL MOON
1 16 Pluto at opposition	18 11 Moon at apogee
2 07 Venus 3.6 N of Moon	20 07 Neptune 1.3 N of Moon
2 12 NEW MOON	21 02 Solstice
3 02 Mars 3.7 N of Moon	21 12 Uranus 1.6 N of Moon
3 02 Venus 5.3 N of Aldebaran	21 20 Venus 0.4 S of Mars
3 13 Moon at perigee	22 23 Mercury stationary
4 04 Mercury 3.7 N of Moon	25 01 LAST QUARTER
9 03 FIRST QUARTER	28 20 Saturn 2.6 N of Moon
9 12 Mercury greatest elong. E(24)	29 02 Jupiter 3.6 N of Moon

July 2000

dd hh	dd hh
1 16 Mars in conj. with Sun	17 06 Mercury stationary
1 20 NEW MOON <i>Eclipse</i>	17 12 Neptune 1.1 N of Moon Occn.
1 20 Mars 2.3 N of Moon	18 16 Uranus 1.5 N of Moon
1 22 Moon at perigee	23 05 Mars 5.8 S of Pollux
2 05 Venus 1.8 N of Moon	24 12 LAST QUARTER
2 06 Mercury 3.2 S of Moon	26 10 Saturn 2.4 N of Moon
2 09 Mercury 4.9 S of Venus	26 20 Jupiter 3.3 N of Moon
4 17 Earth at Aphelion	27 10 Mercury greatest elong. W(20)
6 13 Mercury in inferior conjn.	27 22 Neptune at opposition
7 05 Mercury 5.7 S of Mars	29 18 Mercury 0.8 S of Moon Occn.
8 13 FIRST QUARTER	30 08 Moon at perigee
8 15 Venus 5.8 S of Pollux	30 12 Mars 0.8 N of Moon Occn.
15 17 Moon at apogee	31 03 NEW MOON <i>Eclipse</i>
16 14 FULL MOON <i>Eclipse</i>	

LOCAL TIMES of RISE and SET for the MAJOR PLANETS, 2000

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 09	06.52	17.22	08.40	19.04	06.49	17.19	07.22	17.47	05.04	15.56	04.58	15.55
Jun 19	06.55	17.23	08.22	18.59	07.05	17.31	07.13	17.37	04.35	15.24	04.24	15.20
Jun 29	06.57	17.26	07.34	18.22	07.19	17.46	07.02	17.27	04.06	14.53	03.49	14.44
Jul 09	06.56	17.30	06.28	17.20	07.29	18.03	06.50	17.18	03.36	14.21	3.15	14.09
Jul 19	06.54	17.34	05.40	16.28	07.36	18.21	06.37	17.09	03.05	13.49	2.39	13.33
Jul 29	06.50	17.39	05.31	16.11	07.39	18.38	06.23	17.00	02.34	13.16	2.04	12.56