

The *Prairie* Astronomer

The Official Newsletter Of The Prairie Astronomy Club, Inc.
April 1998

Volume 39 Issue #4

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MEETINGS & EVENTS

PAC MEETING
TUESDAY APRIL 28, 1998, 7:30 PM
at Hyde Memorial Observatory

ASTRONOMY DAY
SATURDAY MAY 2, 1998
At Morrill Hall

NSP-5 PLANNING MEETING
THURSDAY MAY 14, 7:30 PM
at Mahoney State Park Lodge

MAHONEY STAR PARTY
FRIDAY MAY 22, 1998
at Mahoney State Park - Driving Range

PAC MEETING
TUESDAY MAY 26, 1998, 7:30 PM
at Hyde Memorial Observatory

PAC-LIST: Mark Dahmke maintains an e-mail list for PAC. If you have an e-mail address and are not on the PAC List, you may subscribe by submitting an e-mail to list@4w.com. Write "Subscribe PAC-List" in the body of the e-mail.

April's Program:

At the April PAC meeting, Peter Morin will be presenting a program on the basics of sundials. This will include the factors considered when designing, using, and interpreting sundials. Doctor Morin, a family physician in Lincoln, will have his own sundial, The Saint Petersburg Sundial, at the presentation. He will also have information on the North American Sundial Society, history of sundials, and how to get the most out of prefabricated sundials.

If you would like to present a program at the monthly PAC Meeting, call **Erik Hubl** at 488-1698 or email at ehubl@ci.lincoln.ne.us

Only 2½ months until NSP !!!

You won't want to miss the 5th Annual Nebraska Star Party
At Merritt Reservoir, July 18-25, 1998.

For more information, or to register, call the
NSP Hotline: (402) 466-4170
See page 12 for the latest NSP update

ASTRONOMY DAY Saturday May 2

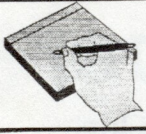
set-up is from 8:30am to 9 am
Opens at 10am and closes at 4pm
Location: Mueller Planetarium at Morrill Hall
Speakers: Rick Pirko and Marta Boswell

If you need any more info contact:
Brian Weber Thta1Orion@aol.com

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The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: Regular \$20/yr, Family \$22/yr. Address all new memberships, renewals, or questions to: The Prairie Astronomy Club, Inc., PO Box 80553, Lincoln, NE 68501. For other club information, contact one of the following: Dave Knisely -President (402) 223-3968, Doug Bell V.P. (402) 489-8197, Liz Bergstrom - Treasurer (402) 464-2038. All newsletter comments and articles should be sent to: Dave Scherping, 640 S. 30th St., Lincoln, NE 68510 (402) 477-2596 or e-mail dscherp1@aol.com ten days prior to the club meeting. Club meetings are held the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.



SECRETARY'S REPORT

Minutes of the March 31, 1998 PAC Meeting

By Dave Scherping

The March 1998 meeting of The Prairie Astronomy Club was held March 31, 1998. The meeting commenced at 7:35pm, as PAC president Dave Knisely introduced 3 visitors.

The first item on the agenda was the presentation of this year's Volunteer Of The Year awards by the Hyde Observatory Supervisory Staff. Ron Veys presented this year's awards to Robert "Doc" Manthey and Mark Fairchild. Both of these individuals have put in a great many hours making Hyde Observatory a success and they both should be commended. Congratulations to Doc & Mark and thanks for your efforts.

Dave Knisely mentioned that our next PAC star party will be at Wagon Train Lake on Friday April 24th. Dave Scherping gave a brief review of the March star party which was held at the same location. The event was blessed with clear skies and no wind and it was attended by all 3 of our dedicated observers, Bill Wells, Dave Scherping, and Tom Miller.

Dave Knisely then gave a brief review of some of the current astronomical events, including supernovae in Ursa Major and Sagittarius. He also mentioned that Solar activity is up, and there was even a naked-eye sunspot (with eye protection, of course).

Astronomy Day will be held May 2nd at Morrill Hall. Brian Weber has agreed to be this year's coordinator. We need volunteers to set up, display, and demonstrate telescopes, computers, etc. Please call Brian if you want to help. We will set up beginning around 8:30am, and the display will be open from 10:00am-4:00pm. If it's clear that evening, we plan to set up the scopes at Hyde for observing. Also, the university's student observatory, located on the parking garage next to the stadium, will be open to the public on Friday night.

Speakers at Astronomy Day will be Rick Pirko and Marta Boswell. A motion was made by Holly Johnson for PAC to donate \$100 toward food lodging for the speakers. The motion was seconded and carried.

Dave Knisely briefly mentioned the trip to the Cosmosphere. We still haven't heard from OAS, so a date has not been set. For those interested, the Cosmosphere's web site is www.cosmo.org.

The first Mahoney Star Party of 1998 will be held Friday May 22nd at the Driving Range at Mahoney State Park. We need a lot of support from PAC members, especially those with telescopes. This will be Memorial Day weekend, so we expect a large crowd of visitors.

Liz Bergstrom gave an update on the search for a new observing site. The committee is looking at two prospective site, one near mead and one near Sterling. If interested in helping on the committee, contact Liz.

Liz gave the treasurer's report. Our membership has dropped to 66. Liz recently talked with an accountant about taxes. Apparently, a form should have been filled out last August in regards to the sale of the Atlas site. Dave Knisely thought John Bruce filed a form. Liz needs to know the exact purchase date of the site. Dave K will contact Doug Bell to see if he has the site folder. If not, Dave will check the safe deposit box.

Dave Hamilton gave an update on the Nebraska Star Party planning and handed out registration brochures. The speaker list has been finalized, and will include Tippy D'Auria, Carolyn Peterson, Dave Knisely, Gary Fugman, Steve Edmondson, and Mike Ford. Topics for Brenda Culbertson's beginners field school have been finalized. We need people to help Brenda, by serving as mentors. The next NSP meeting will be April 9th.

Larry Hancock proposed moving the club library to Hyde, and volunteered to buy a locking book shelf to keep the books in. The Hyde staff agreed this would be acceptable. A motion was made to proceed with this. It was seconded and carried.

The meeting was then adjourned.

Following the business meeting, an excellent program was given by Joe Babcock, entitled "History of Astronomy from Ptolemy to Herschel. Thanks, Joe for the wonderful presentation.

Mathematical Proof Of The Month

Theorem: $\$1 = 1¢$.

Proof:

$$\begin{aligned}\$1 &= 100¢ \\ &= (10¢)^2 \\ &= (\$0.1)^2 \\ &= \$0.01 \\ &= 1\end{aligned}$$

From: Benjamin.J.Tilly@dartmouth.edu (Benjamin J. Tilly)



PRESIDENT'S REPORT

By: *Dave Knisely*

We have a big slate of club activities in May. May 2nd is ASTRONOMY DAY, held in the lobby of Mueller Planetarium on the UNL campus. We will need a number of things for the display, so contact Brian Weber if you are interested in helping out with this year's event. It's a great way to showcase what you are doing in the hobby of Amateur Astronomy.

On May 14th at 7:30 p.m. is the next meeting of the Nebraska Star Party planning committee at Mahoney Lodge in Mahoney State Park. If you are interested in seeing what is going on, or you want to help, come to this meeting. As for NSP itself, remember that it is less than three short months to the 5th Annual Nebraska Star Party at Merritt Reservoir, so be sure and get your registrations in now. Dave Hamilton is handling them, so if you are planning to go, contact him either at the meeting or at 421-2058.

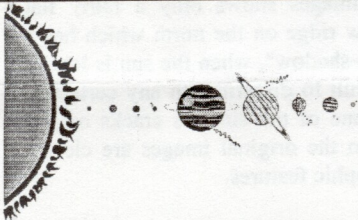
This is the closest major star party to us, and it offers not only pristine observing conditions, but a number of interesting daytime activities and recreational opportunities. It might make a nice vacation for the family, so please consider it in your summer plans.

On May 22nd is the first Mahoney Public Star Party, to be held on the driving range of Mahoney State Park. This is the weekend of Memorial Day, and it is a good excuse to not only visit the new SAC museum during the afternoon (they close at 6 p.m.), but to get in a little observing and to help let the public see what our fascinating hobby is all about. I hope to see you there!

We still haven't received word on dates which would work for the trip to the Kansas Cosmosphere and Space Center in Hutchinson, Kansas, but I still hope to set up a date soon. See you at the meeting!

Observer's Report

By: *Dave Scherping*



The Planets in May

- Mercury:** At greatest elongation west (27°) on May 4th. Visible low in the east during morning twilight. Best early in the month.
- Venus:** Rises in the east during morning twilight.
- Mars:** Not visible until late July. In conjunction with the Sun on May 12th.
- Jupiter:** Low in the eastern pre-dawn sky, moving from Aquarius into Pisces in late May.
- Saturn:** Will become visible in the eastern morning sky in late May.
- Uranus:** In Capricornus in the morning sky.
- Neptune:** In Capricornus in the morning sky.
- Pluto:** In Ophiuchus in the morning sky. At opposition May 28th.

If anyone has the desire to write this column on a monthly basis, please contact Dave Scherping at 477-2596. Thanks.

SELECTED OBSERVING TARGETS FOR MAY

NGC3187, 90, 91, 95

This is a nice group of four galaxies. It's very easy to find, located midway between the first two stars in the sickle of Leo. Three of the four galaxies are fairly easy, the fourth one is a real challenge.

M3

This is a really nice globular cluster, located midway between Arcturus in Bootes and Cor Caroli in Canes Venatici. With the exception of M13 in Hercules, this is about the nicest globular that can be seen from Nebraska.

NGC4565

This is one of the best examples of an edge-on spiral galaxy. It's located just off the edge of the Coma Berenices star cluster on the side facing Arcturus. While your scanning the vicinity looking for NGC4565, you're bound to find at least a couple of other nice galaxies as well.

3C-273

If you've never seen a quasar, now's your chance. This is the brightest quasar at magnitude 13.0. Its coordinates are 12h29.1' and +02°03'. It's not much to look at (stellar-like), but it's nice to be able to say you found it, and it's mind-boggling to contemplate what you're actually looking at.

THE "FACE" ON MARS

By Dave Knisely

In 1976, the Viking 1 orbiter began to take a series of high resolution photographs of the Martian surface in areas which were candidates for landing sites for the lander portion of the mission. The pictures were taken at a very low sun angle to reveal the presence of large obstacles which might damage a landing spacecraft. On July 25th, 1976 during orbit 35, the orbiter imaged a peculiar feature near the eastern edge of the albedo feature Mare Acidalium, at 41N, 9.5W, north of Cydonia Mensae. From certain angles, the butte-like feature tends to resemble a mask-like face, with two unequal eyes and a bent mouth surrounded by a sloping plateau making up the rest of the head. It is about 2.5 km (1.56 mi) long, 2 km wide (1.25 mi), and about 350 meters (1148 ft) high at its highest point.

On orbit 70, the "face" was again imaged under a higher sun angle, and showed slightly more detail. In the second view, the right "eye" is seen as being somewhat smaller than the left one, and is located further below the level of the left one, thus giving the "face" a rather distorted look. A bulge or mound is visible just above the left eye's outline, showing that much of the left "eye" is just a shadow cast by this mound. The mouth's eastern side is bent at nearly a 45 degree angle to the line of the western side of the mouth. The entire northeast half of the "face" appears to have a more constant slope than the southwestern side, making the entire feature look more like a crude child's drawing than a monument. In Martian geologic terminology, the "face" is known as a "knob", a remaing outcropping of rock after erosion has removed less dense material. The low sun angle exaggerates the relief of the feature, making it look more pronounced than it really is. Numerous other butte or mesa-like features are present in the area, but the so-called "city" just to the west of the "face" appears to be just a cluster of mountain-like knobs.

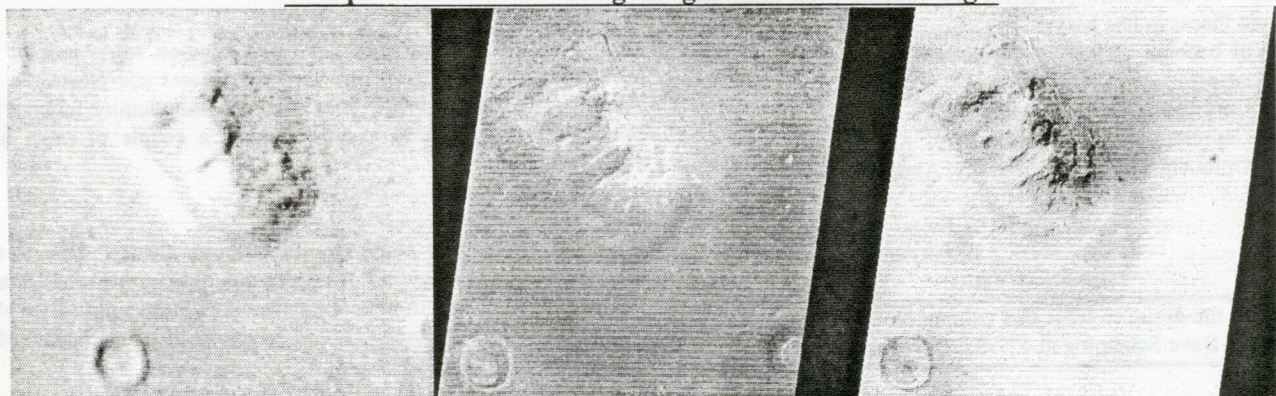
The original Viking orbiter images containing the most detailed views of the "face" are picture number (PICNO) 36A72 at 47 meters/pixel scale, and number 70A13 at 43 meters/pixel scale. Since it takes at least two pixels to "resolve" a surface feature, the true maximum surface resolution of these two images is probably closer to 100 meters. These images are available from NASA, and on several websites on the Internet.

One location containing the images and a detailed discussion on the face can be found on the FACE ON MARS page at: <http://barsoom.mss.com/education/facepage/face.html>. Some people took the original raw images and did enlargement and some enhancement in a way which introduced non-existent detail below the true resolution limit of the Viking camera (such as "teeth" in the mouth). Such enhanced images are basically useless for a serious study of the face.

On April 5th 1998, the Mars Global Surveyor imaged a strip of Mars which included the location of the "face". With resolution ten times higher than that of the Viking images, the picture was taken with a much higher sun angle (nearly 62 degrees high, roughly from the southeast) to reveal the true nature of the feature. The image showed a highly eroded low mesa, with a sloping outer edge, sinuous cracks, some sharper ridges, and irregular terrain which shows no sign of the feature being anything but a natural one. Considerable fine detail is visible in the MGS image, but it takes some imagination (at least, initially), to make this feature resemble a face. Fine radial (possibly erosional) patterns are clearly visible over much of the southern part of the "face". The western half of the "mouth" is a shallow depression between two ridges, and is somewhat irregular in form. No "teeth" are seen in the mouth (indeed, much of the eastern half of the mouth seems to be missing). Only the "nose" seems to show up with much certainty, and it appears very rocky and irregular. The area around the where the left "eye" appeared in the Viking images shows only a fairly flat surface with a partially encircling low ridge on the north which has a nice flat-topped bulge to cast an "eye-shadow", when the sun is low in the west. The right eye is very difficult to discern with any certainty, since a portion of it appears to be one of the sinuous cracks on the "face's" eastern side. The "eyes" seen the original images are clearly more shadow effects than real topographic features.

The "face" in the original Viking images looks more like that of a monkey than of a man, but it is still an interesting feature, and will probably trigger more interest as the years go by.

Comparison of best Viking image with two MOC images



NASA ASTRONOMERS FIND PLANET CONSTRUCTION ZONE AROUND NEARBY STAR

Taken from the NASA Jet Propulsion Laboratory web site: <http://www.jpl.nasa.gov>

NASA astronomers using the new Keck II telescope in Hawaii have discovered what appears to be the clearest evidence yet of a budding solar system around a nearby star.

Scientists released an image of the probable site of planet formation around a star known as HR 4796, about 220 light-years from Earth in the constellation Centaurus. The image, taken with a sensitive infrared camera developed at NASA's Jet Propulsion Laboratory, shows a swirling disc of dust around the star. Within the disc is a telltale empty region that may have been swept clean when material was pulled into newly formed planetary bodies, the scientists said.

"This may be what our solar system looked like at the end of its main planetary formation phase," said Dr. Michael Werner of JPL, who co-discovered the region, along with Drs. David Koerner and Michael Ressler, also of JPL, and Dana Backman of Franklin and Marshall College, Lancaster, PA. "Comets may be forming right now in the disc's outer portion from remaining debris."

The discovery was made on March 16 from the giant 10-meter (33-foot) Keck II telescope atop Mauna Kea, Hawaii. Keck II and its twin, Keck I, are the world's largest optical and infrared telescopes. Attached to the Keck II for this observation was the mid-infrared camera, developed by Ressler at JPL and designed to measure heat radiation.

The four scientists reported their discovery in a submission to *Astrophysical Journal Letters*. The disc was discovered independently and contemporaneously at the Cerro Tololo Observatory in Chile by another team of scientists, led by Ray Jayawardhana of the Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, and Dr. Charles Telesco of the University of Florida, Gainesville.

Koerner of JPL said the finding represents a "missing link" in the study of how planetary systems are born and evolve. "In a sense, we've already peeked into the stellar family album and seen baby pictures and middle-aged photos," Koerner said. "With HR 4796, we're seeing a picture of a young adult star starting its own family of planets. This is the link between discs around very young stars and discs around mature stars, many with planets already orbiting them."

This is the first infrared image where an entire inner planetary disc is clearly visible," Werner said. "The planet-forming disc around the star Beta Pictoris was discovered in 1983 by the Infrared Astronomical Satellite (IRAS), and also later imaged with the Hubble Space Telescope, but glaring light from the star partially obscured its disc."

The apparent diameter of the dust disc around HR 4796 is about 200 astronomical units (one astronomical unit is the distance from Earth to the Sun). The diameter of the cleared inner region is about 100 astronomical units, slightly larger than our own solar system.

HR 4796 was originally identified as an interesting object for further study by Dr. Michael Jura, an astronomy professor at the University of California, Los Angeles. The star, HR 4796, is about 10 million years old and is difficult to see in the continental United States, but is visible to telescopes in Hawaii and the southern hemisphere.

The discovery of the HR 4796 disc was made in just one hour of observing time at Keck, but the JPL team plans to return to Hawaii in June for further studies. They hope to learn more about the structure, composition and size of this disc, and to determine how discs around stars in our galaxy produce planets. They plan to study several other stars as well, including Vega, which was featured prominently in the movie, "Contact."

The Harvard/Florida research team that also found the HR 4796 disc included Drs. Lee Hartmann and Giovanni Fazio of Harvard-Smithsonian Center for Astrophysics, and Scott Fisher and Dr. Robert Pina of the University of Florida.

JPL's use of the Keck telescope is supported by NASA's Origins program, a series of missions to study the formation of galaxies, stars, planets and life, and to search for Earth-like planets around other stars that might have the right conditions for life.

The W. M. Keck Observatory is owned and operated by the California Association for Research in Astronomy, a joint venture between the University of California, the California Institute of Technology and NASA. Use of the Keck Observatory for Origins research is managed by JPL for NASA's Office of Space Science, Washington, DC. JPL is a division of Caltech.

The research of both teams was supported in large part by the NASA Origins Program, with additional support to the Harvard/Florida team from the National Science Foundation, the National Optical Astronomy Observatories, and the Smithsonian Institution; and with additional NASA support for the Caltech/JPL-Franklin & Marshall team, including use of the Keck Observatory.

The Keck II image of HR 4796 is available on the web at <http://www.jpl.nasa.gov/releases/98/hr4796.html>. The image and information on the MIRLIN camera is available at <http://cougar.jpl.nasa.gov/mirlin.html>. A false-color image of the HR 4796 disc is available at <http://www.astro.ufl.edu/news/>. Information on the Keck Observatory is available at <http://www2.keck.hawaii.edu:3636>. Information on the Origins program is available at: <http://origins.jpl.nasa.gov>.

NASA's FLYING LABORATORY CONDUCTS EARTH SCIENCE MISSION

Taken from the NASA Jet Propulsion Laboratory web site: <http://www.jpl.nasa.gov>

NASA's airborne imaging radar system is set to its first major campaign of 1998, a three-week series of missions involving 11 flights from April 17 through May 1 focusing on 13 imaging and data-collection Earth science experiments.

The highly modified jetliner is one of three specialized aircraft in NASA's Airborne Science Program based at NASA's Dryden Flight Research Center, Edwards, CA. The DC-8 serves as a platform for multiple experiments at altitudes up to 42,000 feet.

The current campaign centers on the remote imaging and data-collection capabilities of the Airborne Synthetic Aperture Radar (AIRSAR) system developed at NASA's Jet Propulsion Laboratory. Two AIRSAR antenna systems mounted on the DC-8's left rear fuselage, assisted by an integrated Global Positioning System/Inertial Navigation System, allow for precision measurement of the resulting high-resolution digital elevation models.

According to Chris Jennison, Dryden's mission manager for this campaign, the primary objective of this series of flights is to obtain data for use in topographic mapping, geologic research and hydrology.

"Because it produces such a wide variety of data, the synthetic aperture radar can be used to interpret many different environmental and natural phenomena, such as moisture content and soil studies," he said. "We fly at a very specific altitude and a very precise speed. By accurately measuring the time between when a radar pulse is sent out and when it's returned to the antenna, the radar can produce a very fine resolution image."

AIRSAR was developed more than a decade ago by JPL radar scientists and engineers. It is an all-weather imaging device that can penetrate clouds, forest canopies and, in dry areas, thin sand and dry snow packs.

AIRSAR sends and receives radar waves that are sensitive to the material on Earth's surface such as geologic features, vegetation and water content.

Experiments are being flown over mountains in the Pacific Northwest, the Missouri River floodplain, the Gulf Coast, several locations in the Southwest and a number of geologic sites in California. Individual missions are being flown from McChord Air Force Base, Tacoma, WA.; Kelly Air Force Base, San Antonio, TX; and Dryden at Edwards Air Force Base in Southern California.

One flight over the Pacific Northwest is focused on a multi-altitude forestry study over Oregon's Santiam Pass as well as data collection over Blue Glacier in Washington's Olympic Mountains.

"Data collection at three different altitudes allows the study of the varying degrees of radar penetration into the forest canopy. This will shed light on the use of interferometry to estimate the vertical characteristics within a forest," said Ellen O'Leary, AIRSAR science coordinator at JPL. Interferometry is a technique that collects three-dimensional images of the surface.

Three flights from Dryden will target AIRSAR on 11 different geologic sites around California. These studies range from sites of surface deformations due to earthquake activity and oil and water extraction, to evaluation of the radar's ability to estimate snow properties and the amount of water released during melting. Study locations extend from the Geysers Natural Area and the Hayward Fault in Northern California to the Santa Cruz and Monterey Bay coastal areas, the Sierra Nevada range and the Santa Monica and San Gabriel Mountains in the southern part of the state.

The AIRSAR science mission is managed by JPL, a division of the California Institute of Technology, for NASA's Office of Earth Sciences, Washington, DC.

DEEP SPACE 1 LAUNCH RESCHEDULED TO OCTOBER

The planned July 1998 launch of NASA's Deep Space 1 technology validation mission from Cape Canaveral, FL, has been rescheduled for October.

The delay is due to a combination of late delivery of the spacecraft's power electronics system, and an ambitious flight software schedule, which together leave insufficient time to test the spacecraft thoroughly for a July launch.

The power electronics system regulates and distributes power produced by not only the solar concentrator array, a pair of experimental solar panels comprised of 720 cylindrical Fresnel lenses, but also by an on-board battery. Among many other functions, it helps the solar array to operate at peak efficiency and ensures that the battery is able to cover temporary surges in power needs so that the ion propulsion system (which needs electricity for its basic operations) receives a steady power supply.

"With a new launch date for this bold mission, we can be more confident that we will be ready to fully exercise our payload of important technologies." Chief Mission Engineer Dr. Marc Rayman of the Jet Propulsion Laboratory (JPL) in Pasadena, CA, explained.

"The entire DS1 team looks forward to this opportunity to make a significant contribution to science missions of the future through the capabilities we are testing on DS1."

Deep Space 1 is the first launch of the New Millennium Program, a series of missions designed to test new technologies so that they can be confidently used on science missions of the 21st century. Among the 12 technologies that the mission is designed to validate are ion propulsion, autonomous optical navigation, a solar concentrator array and an integrated camera and imaging spectrometer.

The earlier July launch period for DS1 allowed it to fly a trajectory encompassing flybys of an asteroid, Mars and a comet. By the end of May, the mission design team is scheduled to finalize new target bodies in the Solar System for DS1 to encounter based on an October launch date.

The New Millennium Program and Deep Space 1 are managed by JPL for NASA's Office of Space Science. JPL is a division of the California Institute of Technology.

ULYSSES COMPLETES FIRST FULL ORBIT AROUND THE SUN

Taken from the NASA Jet Propulsion Laboratory web site: <http://www.jpl.nasa.gov>

After a seven-and-a-half-year flight covering 3.8 billion kilometers (2.4 billion miles), Ulysses -- the only spacecraft ever to explore the Sun's polar regions -- has completed its first full orbit.

Having passed under and over the Sun's poles, Ulysses has returned to the region of space occupied by Jupiter, which is more than five times the distance of the Earth from the Sun. Ulysses flew past Jupiter in February 1992 and used that giant planet's gravity to achieve the spacecraft's current orbit. The spacecraft is now on the opposite side of the Sun from Jupiter and poised to return to the Sun's poles during the peak of solar activity.

"Before the Ulysses mission, very little was known about the regions above and below the solar equator because our solar observations were restricted," said Dr. Edward J. Smith, project scientist of the joint NASA-European Space Agency mission. "We knew that the Sun and solar system were enveloped in a huge, tenuous cloud of gas and dust, known as the heliosphere, but we did not know how this vast space around the solar system was structured."

Like its mythological namesake, Ulysses, launched in 1990, ventured into unknown territory to conduct the first ever investigation of this huge magnetic bubble shielding the solar system from interstellar space. When the spacecraft arrived, the Sun was in the quiet phase of its 11-year solar cycle, with a relatively low amount of activity. In this phase, circumstances were ideal for revealing the underlying structure of the Sun's atmosphere and the solar wind in their simplest form. Improved knowledge of these solar dynamics helps scientists better understand the origin of such events as auroras and magnetic storms in Earth's atmosphere.

Ulysses, which is powered by a radioisotope thermoelectric generator because of the distance it needs to travel from the Sun during the most distant phase of its orbit, carries nine instruments that have gathered data continuously since launch. Some instruments detect the outward-blowing solar wind and its magnetic field, which create the heliosphere. Others record cosmic rays coming in from the galaxy, which are strongly influenced by the solar wind. Ulysses picks up natural radio signals emitted by the Sun, the planets and the heliosphere itself. Innovative techniques can detect foreign atoms and dust particles entering this protective magnetic balloon.

During the first orbit, Ulysses data revealed that the gas consists principally of energetic atoms from which one or more electrons have been removed to form ions. These ions become positively charged when they lose their electrons. In addition, three classes of charged particles have been identified on the basis of their energy and place of origin.

"At the lowest energy, but dominant in number, are the particles that originate on the Sun and continuously stream outward, forming the solar wind," Smith said. "More energetic but less numerous particles originate beyond the orbit of Earth. These accelerated particles occur in bursts and are found near 'weather fronts,' which develop several times a month. At the highest energies, and even lower in number, are the cosmic rays, which originate outside the solar system in the Milky Way galaxy."

Ulysses scientists found that the space between the Sun's equator and poles can be divided into distinct regions, just as the Earth can be divided into tropical, temperate and arctic zones.

The speed of the solar wind is divided into two zones, one extending from the equator to about 30 degrees latitude. The typical wind flow in the equatorial region consists of particles traveling at variable rates, alternating between speeds of 350 kilometers to 400 kilometers per second (nearly 1 million miles per hour). Above this zone, extending all the way to the highest latitude, is fast wind traveling at double the speed -- about 750 kilometers per second (about 2 million miles per hour) -- and at a relatively steady flow. These winds come from coronal holes in the Sun, which are close to the poles and fairly large when the Sun is in a quiescent state. The speeds in the high latitude zones north and south are nearly equal, despite their separation by slow wind around the equator.

"This division of the wind into three zones -- north, equatorial and south -- is also seen in the magnetic field measurements," Smith said. "In the fast, high-latitude wind, large amplitude waves are continuously present, traveling outward from the Sun. These unusually large, strong waves are similar to waves moving along a taut rope. They move outward along a large scale solar magnetic field that is stretched outward into space by the solar wind."





Energetic particle bursts also divide space into two regions. The bursts occur from the equator to between 40 and 70 degrees latitude, after which they disappear. Particles in this region of fast wind surprised scientists, who then had to develop new models of the Sun's global magnetic field. Since the particles are guided along the large-scale field, these field lines appear to be transported from high to low latitude through the Sun's equatorial region.

Unlike the particle bursts, galactic cosmic rays occupy a single zone stretching from the equator to the poles, without a significant increase in number. Magnetic field observations made by Ulysses explain this relatively uniform distribution, Smith said. "Although the cosmic rays might have easier access to the poles by following the converging magnetic lines of force, the outward-traveling waves in the fast wind oppose their entry and compensate for this potential increase."

As Ulysses begins its second solar cycle, the Sun is now becoming increasingly active, with more sunspot activity and solar eruptions leading to the next peak around 2000. Conditions will be dramatically different when the spacecraft reaches the polar regions again at the turn of the century. In this stormy phase, Ulysses, along with an international fleet of Sun explorers -- including NASA's Advanced Composition Explorer, Wind spacecraft and joint missions such as Polar and SOHO -- will allow scientists to better understand the connections between activities on the Sun and their potential for impacting atmospheric conditions on Earth.

Ulysses is managed jointly by NASA and the European Space Agency to study the regions above and below the Sun's poles. The Jet Propulsion Laboratory manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC. JPL is a division of the California Institute of Technology, Pasadena, CA.

The PRAIRIE ASTRONOMY CLUB CALENDAR for APRIL 1998

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
MAHONEY STAR PARTY DATES Friday May 22 nd Friday June 26 th Friday August 21 st Friday September 25 th Friday October 23 rd					1	2 ASTRONOMY DAY Morrill Hall, UNL
3 1ST QUARTER 	4 Mercury at Greatest Elongation West (27°)	5 η Aquarid Meteor Shower	6	7	8	9
10	11 FULL MOON 	12 Mercury 0.8° S of Saturn	13	14 NSP-5 Planning Mtg. 7:30 PM at Mahoney State Park Lodge	15	16
17	17	19 3RD QUARTER 	20 Jupiter 0.4° N of Moon	21	22 MAHONEY STAR PARTY *** Venus 1.7° N Of Moon	23 Saturn 1.7° N of Moon
24	25 NEW MOON 	26 PAC MEETING 7:30 PM Hyde Obs.	27	28	29 Venus 0.3° N of Saturn	30
31						

LONG-TERM CALENDAR

MAY '98	Saturday May 2	ASTRONOMY DAY	- Morrill Hall
	Thurs May 14	NSP PLANNING MEETING	- Mahoney State Park Lodge
	Friday May 22	MAHONEY STAR PARTY	- Mahoney State Park
JUNE '98	Friday June 26	MAHONEY STAR PARTY	- Mahoney State Park
	Thurs June 11	NSP PLANNING MEETING	- Mahoney State Park Lodge
	Thurs June 25	NSP PLANNING MEETING	- Mahoney State Park Lodge
JULY '98	Thurs July 9	NSP PLANNING MEETING	- Mahoney State Park Lodge
	July 18 - 25	NEBRASKA STAR PARTY	- Mahoney State Park
AUG '98	Friday Aug 21	MAHONEY STAR PARTY	- Mahoney State Park
SEPT '98	Friday Sept 25	MAHONEY STAR PARTY	- Mahoney State Park
OCT '98	Friday Oct 23	MAHONEY STAR PARTY	- Mahoney State Park

Carroll Moore Memorial Sundial Dedication

Open Invitation to Prairie Astronomy Club Members:

Nebraska Wesleyan University and the Carroll Moore family will have a formal dedication of the "Carroll Moore Memorial Sundial" following Baccalaureate Services, or at approximately 12:30 p.m., on Saturday, May 16th.

The equatorial sundial, which is beautifully sculpted from Minnesota granite, is located on the campus mall just near the south entrance of Olin Hall of Science. The dedication will be held at this site, and light refreshments will be served following the program. In the event of rain, please assemble in Olin A.

The Carroll Moore Memorial Sundial is a gift to the University from June Moore and a fitting tribute to Carroll's devotion to the study and teaching of astronomy, his thirty-three years of dedicated service to Nebraska Wesleyan University, and his active citizenship as a member of the University Place community.

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P.O. Box 80553
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Next PAC Meeting
March 31, 1997
7:30 PM
Hyde Observatory

EARL MOSER 9/98
P O BOX 162
HICKMAN NE 68372-0162