THE FOCAL POINT

Vol. I, No.XII — *The Newsletter of the Atlanta Astronomy Club* — August 1989

TABLE OF CONTENTS

Voyager Watch 1989 1
Observer's Corner 3
More On The Saturn Occultation 4

CLUB CALENDAR

Next Meeting: August 25, 8:00 p.m. at Fernbank Science Center.

Program: Hal Crawford and Steve Gilbreath will speak about Voyager, its flyby of Neptune, and its past encounters. In addition the club is sponsoring with Fernbank a "Voyager Watch". Through the use of a satellite link, live images from Voyager will be available for public viewing on the evenings of Thursday, August 24 and Friday, August 25. Club members who are interested in helping should contact Hal at 320-9156 or Steve at 634-7466.

Editor: ..... Steve Gilbreath
Contributing Editors: ..... Dr. Ralph Buice, Hal Crawford, Richard Jakiel, Mark Lancaster

The Focal Point is published monthly during the academic year by the Atlanta Astronomy Club, Inc. The AAC is a non-profit organization dedicated to the advancement of amateur astronomy. Meetings are held the third Friday of each month (except the second Friday in December) at the Bradley Observatory on the Agnes Scott campus. Dues are $25 annually for a single membership and $30 for a family membership and include a subscription to **Sky & Telescope** magazine and use of the club observatory in Villa Rica.

Submissions: Article submissions are welcome, and may be delivered to the editor for consideration. Articles on computer floppy disk are encouraged.

OFFICER'S PHONE NUMBERS

Leonard Abbey	*President*	634-1222
Bill Bagnuolo	*Program Chrm*	498-5451
Richard Jakiel	*Observing Chrm*	473-9873
Eugenia Abbey	*Recording Sec*	634-1222
Steve Gilbreath	*Corresponding Sec*	634-7466
Bud Rosser	*Treasurer*	879-0304

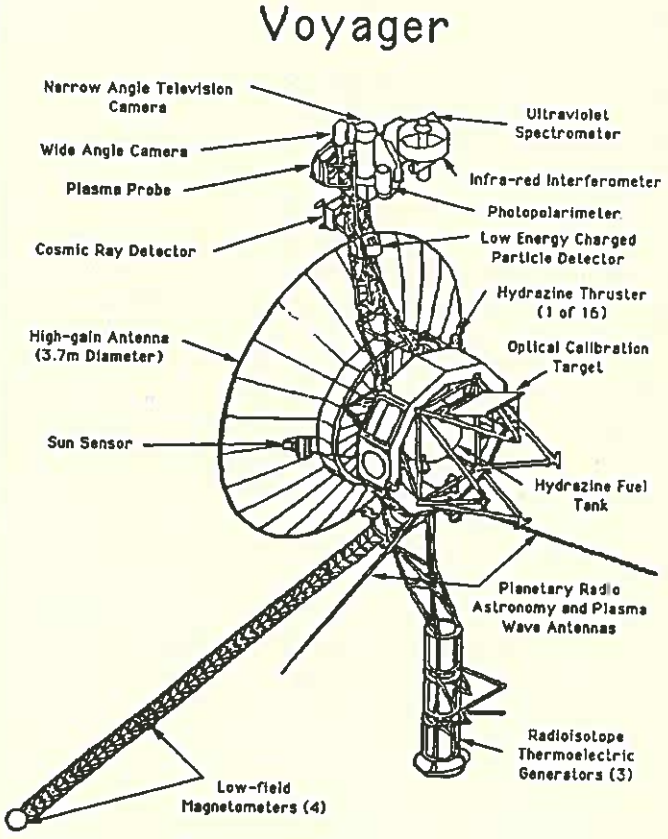
VOYAGER WATCH 1989: WHAT WILL VOYAGER DISCOVER AT NEPTUNE?

by Hal Crawford

> "Our voyager knew marvellously well the laws of gravitation, and all the attractive and repulsive forces. He used them so appositely that, sometimes with the help of a sunray, sometimes availing himself of a comet, he travelled from world to world, he and his, like a bird flitting from branch to branch."
>
> -- Voltaire (Micromegas, 1752)

On August 20, 1977, Voyager 2 lifted off the launch pad at Cape Canaveral, Florida. Followed soon after by Voyager 1, the interplanetary explorer was a technological marvel even for its time -- after all, personal computers were just coming on the scene, and calculators were finally beginning to drop below $30. Yet Voyager 2 was so complex that its computers could be reprogrammed at any time during its flight. Weighing in at 1800 pounds and carrying 105 scientific instruments, the Voyager series spacecraft certainly rank as the most sophisticated automatic probes ever built.

The primary objective of the Voyager probes was to explore the planets Jupiter and Saturn. However, the opportunity



soon became apparent that by reprogramming the probe's computers, Voyager 2 would be able to take advantage of certain gravitational "sling-shot" characteristics of the two planets and speed on to the planet Uranus -- and then on to Neptune!

Twelve years later, the final objective of Voyager 2 is about to be realized. Although traveling at over 40,000 miles per hour, it has taken over three years since its last encounter with the planet Uranus to reach its final destination. Once the flyby is complete, the spacecraft will continue its journey out of the solar system. Final transmissions from both spacecraft may be detectable nine billion miles away -- some 18 years from now! Yet it will be over 26,000 thousand years before Voyager 2 passes out of the Oort Cloud, exiting our solar system and entering interstellar space.

The Voyager Spacecraft

The Voyager 2 carries a vast array of instruments and cameras. On-board sensors are capable of measuring magnetic fields, low-energy charged particles, cosmic rays, and the solar wind. A 3 degree wide-angle and a 0.4 degree telephoto camera are mounted on a platform at one end of the probe. Interferometers and spectrometers can probe the planetary atmospheres. Even the way signals transmitted from the spacecraft back to Earth can be analyzed to learn even more characteristics of the outer planets. And all this data can be recorded for playback later using a built-in tape recorder.

The power requirements for all of the instruments total 450 watts, which is provided by nuclear thermoelectric generators utilizing Plutonium. The power output has been diminishing by an average of 25 percent per year, but enough power is still available to handle the upcoming flyby.

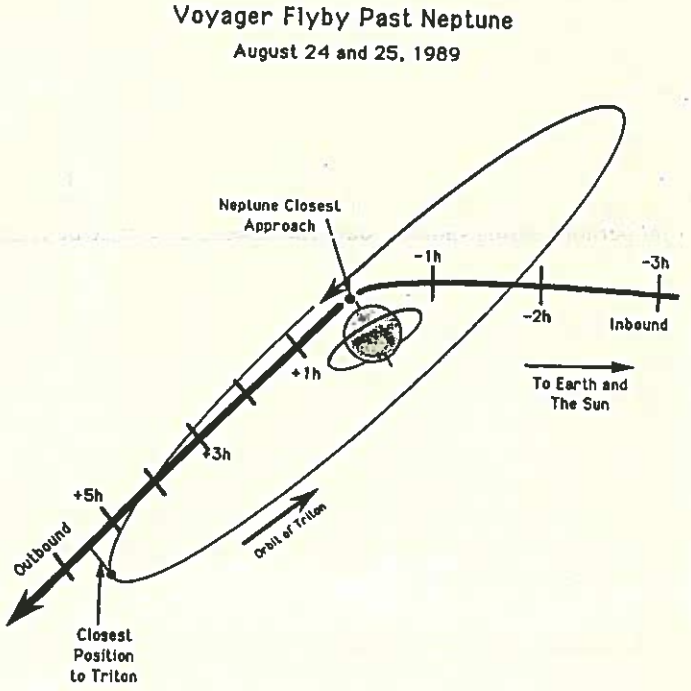
As information is transmitted back to Earth, an array of antennas around the world are poised to receive the data from the probe. These antennas, called the Deep Space Network (DSN), are located in the Mojave Desert in California, near Madrid, Spain, and near Canberra, Australia. As the data is received, it is passed it on to the Jet Propulsion Laboratories (JPL) in Pasadena, California. There the information is processed and collated for further analysis.

The antenna members of the DSN have each been enlarged since 1986 to handle the decreased signal strength from the probe. Additional telecommunications support will be provided by Australia's 64-meter Parkes Radio Observatory near Canberra, which will receive Voyager data simultaneously with the Australian DSN complex for even more improved signal accuracy. Also arrayed for the Neptune encounter are the California DSN station and the twenty-seven 25-meter antennas of the National Radio Astronomy Observatory's Very Large Array (VLA) near Socorro, New Mexico. The 64-meter Usada Tracking Station, owned by Japan's Institute of Space and Astronomical Science (ISAS), will provided additional tracking during critical Neptune and Triton radio science observations.

The Challenges Ahead

The mission has not been without its hazards. In April 1978, the primary receiver shut down permanently, leaving only the backup. Soon after the backup receiver began to have trouble locking onto the signal from Earth. Engineers soon realized that the problem was related to temperature and the frequency shift caused by Earth's rotation, and were able to compensate for it with minimal difficulty. The camera platforms of both Voyager probes have jammed for several days, although the problem in Voyager 2 has not recurred since 1981. Gradual computer memory loss is another concern, but for now, all science investigation teams at JPL are poised and ready for a flood of data.

The entire critical portion of the flyby will take less than 8 hours. Once the computers have been programmed for the flyby, there really isn't much that the scientists at JPL can do during the flyby but sit and wait for the results, since it would



take over four hours to transmit new instructions to Voyager should a problem be discovered at the last minute. Located over 4 billion miles away from Earth now, the radio signals simply don't travel fast enough at the speed of light to provide "instantaneous" communication.

The primary objectives of the Neptune flyby are to obtain the planet's basic features, such as color, cloud top features, size, mass, composition, temperature, and rotation rate; to search for and characterize new moons and rings; to determine the presence and characteristics of the magnetosphere; and to search for planetary phenomena, such as lightning, or radio emissions.

Of course, it is the pictures that will enthrall both the

scientific community and the public. Neptune light levels are 1,000 times dimmer than the amount of light the Earth receives from the sun, so special maneuvers will be used to insure that Voyager will pick up clear, solid images of the planet. Many physicists expect that unlike the bland features of Uranus, Neptune will have brightly colored blue to blue-green cloud bands, resembling Jupiter.

It is the hope of many scientists that Voyager will resolve one of the more baffling mysteries of Neptune -- while Jupiter, Saturn, and Uranus have definite ring structures, no such indications has been conclusively found of Neptune. In fact, the current evidence suggests that Neptune has not rings, but ring arcs -- bands of matter which only partially surround the planet.

Targeted areas for Voyager with Neptune are the moons Nereid and Triton. About 600 miles in diameter, Nereid is the smaller and more distant of the targeted moons. It takes 360 days to circle Neptune -- almost as long as it would take the Earth to circle the Sun! As Voyager approaches Neptune, it will do a quick study on Nereid, transmitting pictures some eight hours before the closest Neptune approach.

Triton will receive much closer study. In order to use Neptune's gravitational pull to swing the probe within 25,000 miles of Triton, Voyager must pass Neptune barely 3,100 miles above its north pole, literally skimming the spacecraft over the cloud tops. This could place the probe in some jeopardy -- if the craft collides with any ring matter -- an unlikely but possible scenario -- Voyager could easily be destroyed or rendered inoperable, losing valuable data that would otherwise be transmitted back to Earth.

Should plans go as well as expected, however, Triton will receive careful study. This moon orbits Neptune every 5.9 days, and although slightly less than the size of Earth's moon, it is believed to have an atmosphere. Data from this encounter could very well be spectacular.

Voyager 2 has already exceeded the best expectations of planetary scientists and astronomers everywhere. Having performed all primary functions admirably, the spacecraft will join her companion in exploring the outer reaches of the solar system -- and beyond.

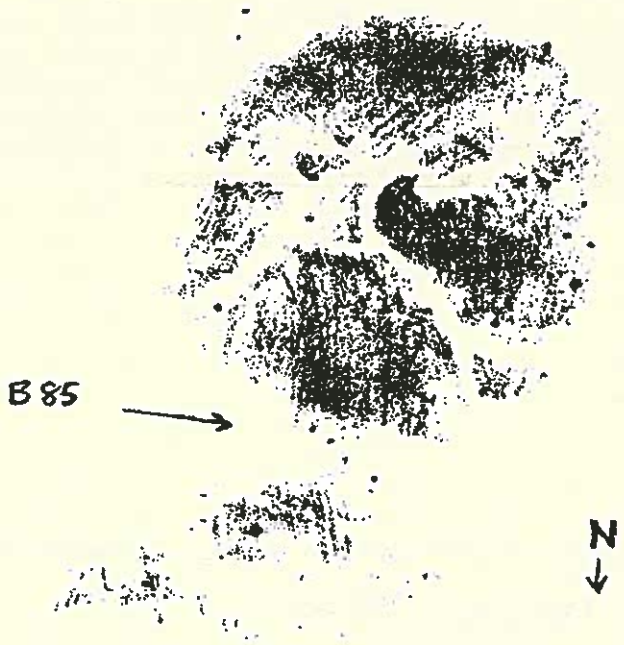
OBSERVER'S CORNER

by Richard Jakiel

Summer skies are cluttered with nebulae, open and globular clusters, and the star strewn fields of the Milky Way. Two of my favorite areas to explore with a telescope are the constellations Sagittarius and Scorpius. The open cluster NGC 6231 is the most brilliant visible in the summer sky, yet it is rarely observed due to its southern declination (-41 degrees). It is located near the bottom-west side of the Scorpion's tail, near the bright naked-eye double, Zeta Scorpius. Visible to the naked eye on dark nights and easily located in a finder scope, NGC 6231 is a delight to observe. An 8 inch scope will reveal a dense cluster of over 100 stars, the brightest being of 5 to 6 magnitude and electric blue in color.

Surrounding NGC 6231 are several other bright clusters, the most impressive of these is H12 (=Cr316 + Tr24, Uranometria 2000), a sprawling cluster of several hundred stars of magnitudes 7 through 14. Lying to the north and easier to find is the bright globular cluster M4 (NGC 6121). A 3.5 inch scope can resolve this globular, and in the club's 20 inch scope it becomes a blazing mass, with a distinct double line of stars stretching across the core. Nearby is NGC 6144, a fairly dim 10th magnitude globular only .5 degrees NW of Antares. In a 8 or 10 inch scope it is a round fuzzy spot about 4 minutes in diameter. The club's 20 inch scope however, does resolve this cluster into a mass of faint stars of 15th to 16th magnitude, thus revealing the true nature of the object.

Moving to the east into Sagittarius, we come to one of my favorite stomping grounds in the summer sky. M8, or the Lagoon Nebula, is a gigantic complex of light and dark nebulosity enveloping a bright open cluster. On dark, moonless nights away from the ever present light pollution, M8 is easily visible to the naked eye as a small nebulous patch set against the Milky



M20 (Triffid Nebula) 13.1" scope 133X

Way. An 8 or 10 inch scope appears to be the best size for viewing this object, as it overflows the field when viewed with larger apertures. The most interesting feature is the "hourglass", a dense mass of dust and gas that is reminiscent of the inner regions of the Orion Nebula. This object is bright and of high contrast so don't be afraid of using high magnification on it!

Moving northward, there are a number of large faint nebulous regions, the most prominent of which is NGC 6526; a large low contrast expanse with several small condensations.

Continuing northward, we come to the real prize of our journey - M20, the Triffid Nebula. Easily visible in a finder, it is a rather disappointing fuzzy patch when viewed in a small scope. Once again, an 8 or 10 inch begins to reveal an intricate network of light and dark nebulosities forming the well known triskelion structure. My 13.1 inch reveals a fascinating network of secondary dark lanes and scalloping as shown in the accompanying diagram. Larger scopes in the 17.5 to 20 plus range can reveal subtle hues of pink and blue under excellent conditions.

Many of you have seen M20, but how many of you can claim to have seen reflection nebula just to the north of the main mass? It is not difficult to see at a dark site, and it is separated by a dark nebula, Barnard 85. Many dark nebula are quite easy to see, for example the "Fish Mouth" in M42, under the swan's neck in M17, or the dark lanes bisecting M8 or M20. Others can be more difficult, such as the Horsehead Nebula in Orion. The summer Milky Way is loaded with such nebula ranging in size from the Cygnus Rift, down to small spots less than 3 minutes across. A good area to look for these is the region surrounding M11 in Scutum.

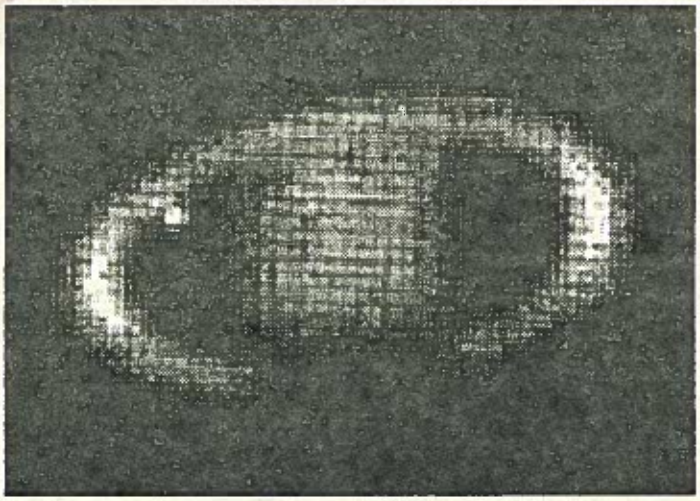
Lastly, summer hazy and stable skies can result in excellent planetary observations. On July 7, I observed unusual structures on Saturn. For the fist time I could remember, I observed several small spoke-like projections on the western side of the A ring. I was using an 8 inch f/6 scope at 274x and 211x with an 82A filter. If anyone else has seen such features - let me know.

MORE ON THE SATURN OCCULTATION

by Steve Gilbreath

Last month astronomers were treated to a rare sight as Saturn occulted the star 28 Sagittarius. Unfortunately, in the Atlanta area, it was less than exciting due to the clouds and rain which blocked the evening sky. However, astronomers in other parts of the country were lucky enough to observe the event and one of them, Darrell Green, of Los Angles, even shared his account with us. (see the Focal Point; July 1989)

One of the observatories studying the occultation was Yerkes in upstate Illinois. Bob Loewenstein of Yerkes was kind enough to distribute this CCD image of Saturn and 28 Sagittarius taken at 1:42 CDT through their 41 inch reflector. 28 Sagittarius can be seen in the upper left, between the ring and the planet.



THE FOCAL POINT

First Class Delivery

Article submissions and address corrections to:
Steve Gilbreath, Editor
1410-C Druid Valley Dr.
Atlanta, Ga. 30329

AAC membership renewals to:
Bud Rosser, Treasurer
5198 Avanti Court
Stone Mountain, Ga. 30088

W. Tom Buchanan
105 Carriage Station Circle
Roswell, GA. 30075