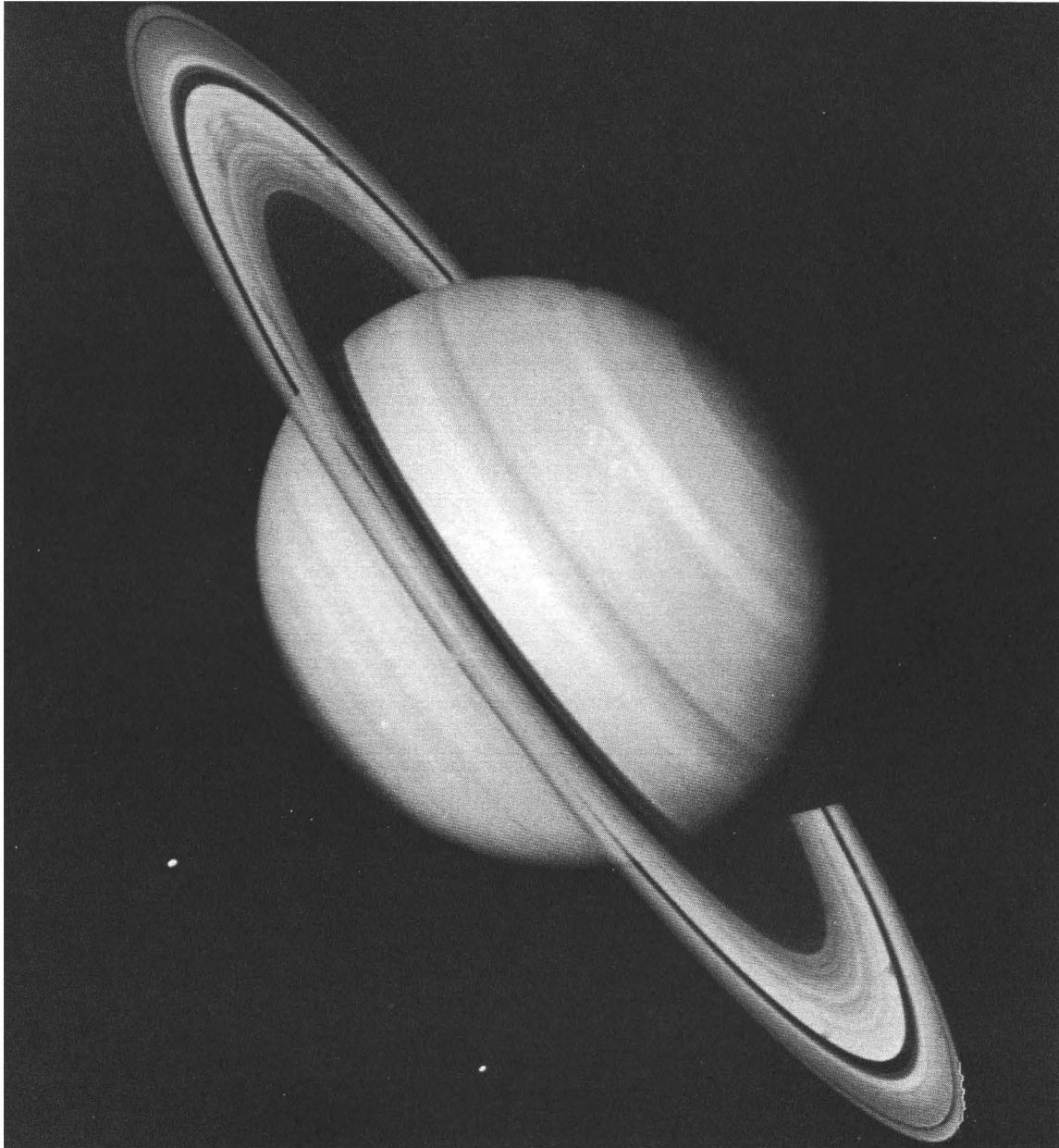


Voyager Bulletin

MISSION STATUS REPORT NO. 63 AUGUST 14, 1981



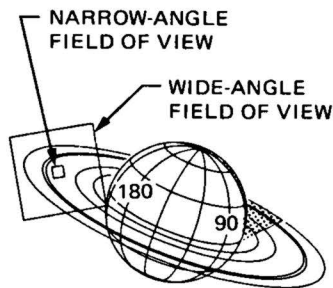
In this Voyager 2 photograph of Saturn taken July 21, 1981, from a range of 33.9 million kilometers (21 million miles), two bright, presumably convective cloud patterns are visible in the mid-northern hemisphere. Several dark spoke-like features can also be seen in the broad B-Ring (left of planet). The moons Rhea and Dione appear to the south and southeast of Saturn, respectively.

NASA

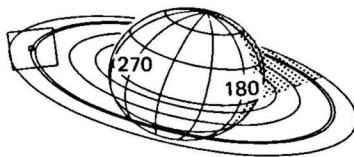
National Aeronautics and
Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Voyager 2: Saturn Minus 12 Days

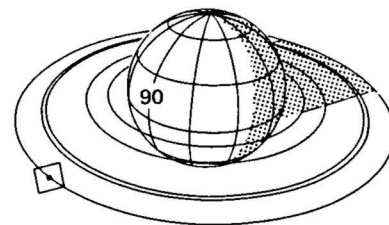
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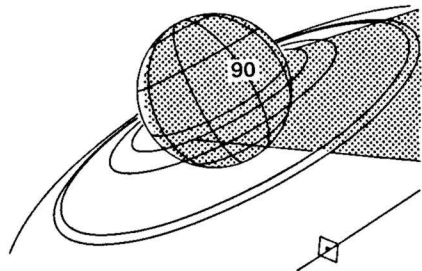
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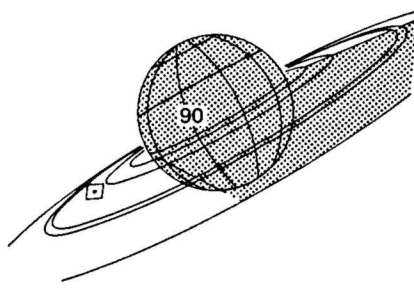
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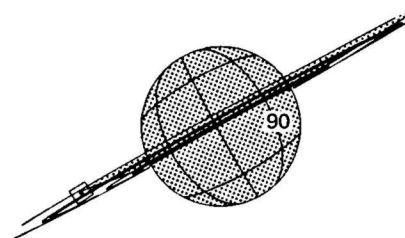
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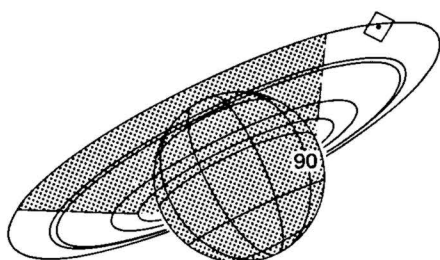
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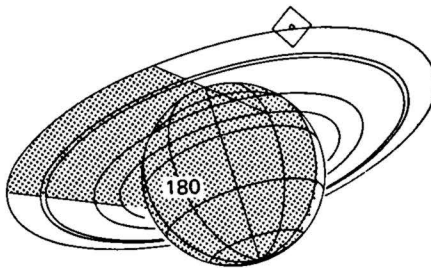
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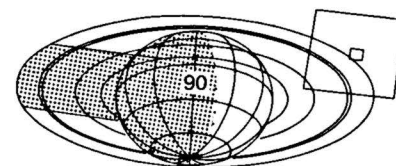
S+1h



S+2h



S+4h



S+24h

These computer-generated plots show how Voyager 2's view of the rings will change as the spacecraft flies past Saturn on August 24-26. The planet size is constant in these views to allow a comparison of Voyager's wide- and narrow-angle cameras' fields-of-view at various times (the locations of the fields-of-view shown here are not necessarily where the cameras will be pointing at these times but are shown only for size comparison; the longitudes given are also for reference only). One day before closest approach, Voyager 2 will still be above the ring plane on its inbound flight. The rings will continue to "open up" as the spacecraft draws near. At the moment of closest approach, only the west limb of the planet will be lit; the rest of the planet will be in shadow. Voyager 2 will dip below the ring plane nearly one hour after closest approach. The planet and rings will be in shadow. As it continues its outbound journey, Voyager 2 will remain below the ring plane, looking back on the planet as the rings once again "open up". All observations on the night side of the planet will be tape recorded for later playback to Earth, since the spacecraft will be out of radio communications with Earth for about 1-1/2 hours.

Mission Highlights

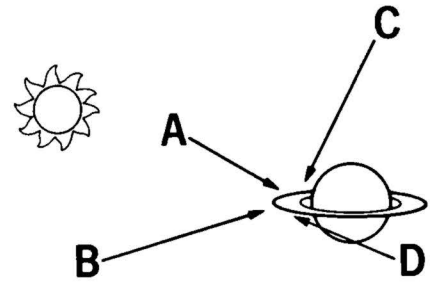
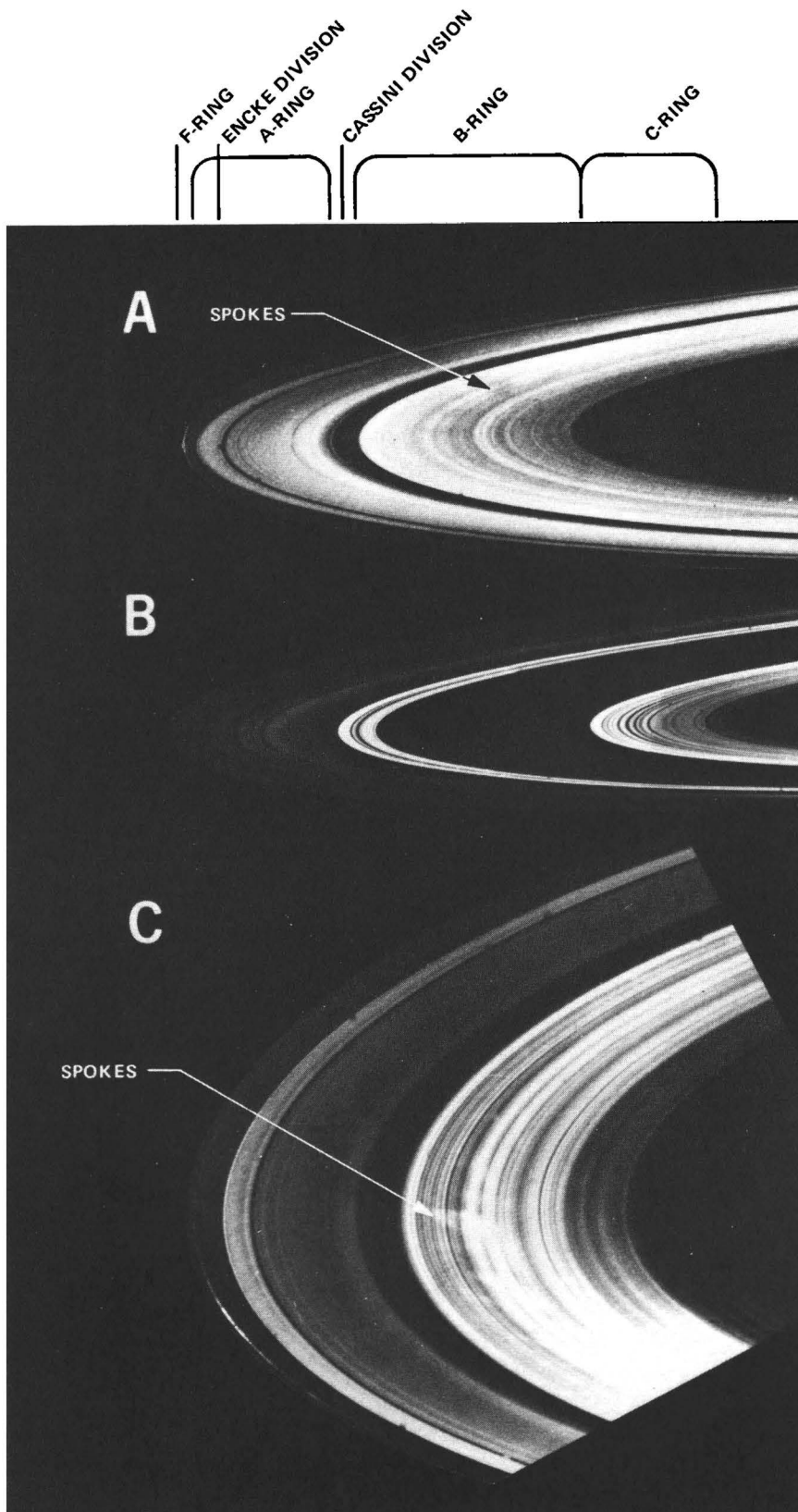
Voyager 2 is rapidly nearing its rendezvous with the Saturn system on August 25. As the spacecraft closes in on its target, all instruments are taking data on a regular basis. The Deep Space Network is providing round-the-clock tracking coverage.

Since Voyager 1's spectacular findings at the Saturn system last fall, Voyager 2 has been extensively reprogrammed to further explore many of the puzzling and interesting phenomena discovered by its twin.

Voyager 1 was expressly targeted for a close flyby of Saturn's largest satellite, haze-shrouded Titan. Voyager 2 is expressly targeted to continue on to the planets Uranus

(January 1986) and Neptune (August 1989), so its observations of the Saturn system have been programmed around this requirement. Voyager 2 will not have a close flyby of Titan, but the photopolarimeter will look for aerosols in Titan's haze layers. Voyager 2 will come closer to Enceladus, Tethys, Hyperion, Iapetus, and Phoebe than did its twin. High-resolution photographs of Enceladus and Tethys will reveal more about their surfaces. Enceladus is highly reflective and appears to have few impact craters. Tethys has a 750-kilometer-long valley. Voyager 2 will also learn more about their thermal properties. Improved resolution photographs of Hyperion and Iapetus will also reveal more about the surfaces of these two icy satellites.

Voyager 1 passed too far from the outermost known Saturn satellite, tiny Phoebe, to photograph it, but Voyager 2 will photograph Phoebe on September 4. There is some specula-



Voyager 1 provided these perspectives of Saturn's rings in November 1980. The legend at top correlates to the ring features in the three mosaics, all of which are shown at the same scale. Voyager 2 will obtain pictures from angles similar to A and B, but not C. Instead, Voyager 2 will obtain pictures from below the ring plane, looking back at the sun from the unlit side (point D).

From point A, above the rings with the sun behind the spacecraft, the least dense areas appear dark since light passes through them. The densest areas appear brightest in this view because they contain the greatest number of particles to reflect sunlight. The B-Ring spokes appear dark in this view taken on Voyager 1's approach to the planet.

From point B, below the rings with the sun above and behind the spacecraft after ring plane crossing, detail can now be seen in the optically thin C-Ring and Cassini Division. Both of these features contain just enough material to scatter light but not enough to block its transmission to the unlit (southern) face of the rings. More optically thick regions, such as the A- and B-Rings, appear dark, as do true gaps (regions totally devoid of particles).

From point C, above the rings looking back toward the sun on the outbound leg, regions of the rings that are thought to have a significant amount of small (micrometer-sized) particles appear bright in forward scattered light. This includes the F-Ring, portions of the A- and B-Rings, and in particular, the B-Ring spokes.

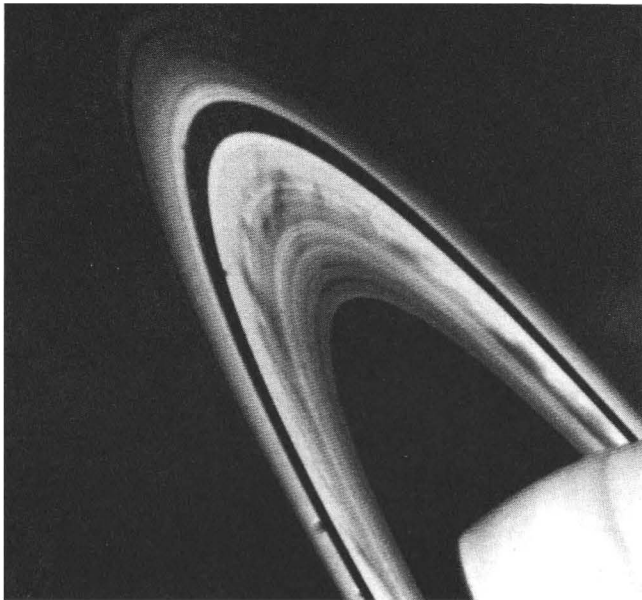
tion that Phoebe, which orbits in the opposite direction of the other satellites, could be a captured asteroid.

Voyager 1 images of the surfaces of Mimas, Dione, and Rhea showed them to be heavily cratered but also showed evidence of crustal evolution — fractures and sparsely-cratered plains.

Many small moonlets have been discovered both from earth-based and spacecraft observations. Some of these

small satellites appear to play an important role in ring dynamics. Without these moonlets, the rings might have long since dissipated into space, with nothing to keep them locked in orbit around the planet. Voyager 2 will target its cameras to capture the already-known moonlets, and will also look for other as yet undiscovered moonlets.

Several small satellites also share orbits with some of the larger satellites. 1980S6, about 160 kilometers diameter,



Prominent dark spokes are visible in the outer half of Saturn's broad B-Ring in this Voyager 2 photograph taken on August 3, 1981 from a range of about 22 million kilometers (14 million miles). The features appear as filamentary markings about 12,000 kilometers (7,500 miles) long, which rotate around the planet with the motion of particles in the rings. Because the sun is now illuminating the rings from a higher angle, Voyager 2's photographs reveal ring structure from a greater distance than that seen by Voyager 1 in its November 1980 encounter.

orbits about 60° ahead of Dione (1120 kilometers diameter). 1980S25 and 1980S13, discovered from ground-based observations, orbit near the L4 and L5 Lagrangian points (mathematical points of stability) in the orbit of Tethys. The L4 and L5 points lead and trail Tethys by 60° . About 30 to 40 kilometers in diameter, these tiny "trojans" trace small "tadpole"-shaped orbits along the orbit trail of Tethys.

Voyager 2 will concentrate many of its observations on Saturn's rings, a complex system of particles orbiting the planet in orderly (for the most part) fashion. The main ring system, from the D-Ring nearest the planet out to the F-Ring, stretches about 70,000 kilometers. The rings have been named in order of their discovery, and from the planet outwards, are referred to as the D, C, B, A, and F-Rings. Each of these rings has been found to contain many smaller ringlets, most of which are in circular orbits. A narrow G-Ring and a wide, diffuse E-Ring have also been located even farther from the planet. Voyager 2 will make special observations of two known "eccentric" or non-circular rings — one in the C-Ring and one in the Cassini Division between the A and B-Rings. The F-Ring appears to be composed of two or three elements which appear to intertwine, or to have clumpy regions. Voyager 2 will investigate this unusual ring by photographing it from several different angles to obtain pseudo-stereo images. Spokelike features extending radially across a section of the B-Ring will also be scrutinized to learn more about their dynamics — why do they form, how long do they exist, are they related to the planet's magnetic field. A 13-hour series of photographs will be taken of the B-Ring spoke areas about 3 days before closest approach. The spokes are thought to be particles of fine dust electrostatically levitated above the main body of the dense B-Ring. Their dissipation is caused by more rapid rotation of their inner portions, causing the spokes to "stretch" and eventually break up. During ring plane crossing, when the rings can be imaged edge-on, a

series of three photographs will be taken with hopes of seeing the levitation phenomenon.

Voyager 1 measurements of ring particle sizes show that while most of the ring particles are dust motes, many "particles" in the A-Ring may be as large as 30 feet; in the Cassini Division as large as 25 feet; and in the C-Ring as large as six feet. An important observation by Voyager 2's photopolarimeter will determine the ring sizes and densities by tracking starlight from the distant star Delta Scorpii as it passes through the ring material on the way to the spacecraft. The intensity of the starlight reaching the spacecraft will vary with the optical densities of the rings. This star occultation measurement will stretch from the D-Ring nearest the planet all the way to the F-Ring.

Voyager 1 discovered an auroral ring at Saturn's north pole, similar to the auroras caused at Earth's poles by particles spiraling in along magnetic field lines. Voyager 2 will track the limb (edge) of the planet against the night sky, studying aurora-like emissions at lower latitudes (also first observed by Voyager 1). The interrelationship of the magnetic field lines, the ring particles, and these ultraviolet emissions may be very complex.

At Saturn, Voyager 2's infrared spectrometer will study the planet at various latitudes to learn more about its temperature balance. The spacecraft's radio signal will provide better measurements of the planet's atmosphere and ionosphere as the signal passes more vertically through these atmospheric levels than did Voyager 1's signal.

Both Voyagers carry six instruments designed to study interplanetary and interstellar space, magnetic fields, and planetary magnetospheres which trap particles from interplanetary space. Voyager 2 will maneuver several times within the Saturn system to allow these instruments to sample Saturn's magnetosphere. During these maneuvers, the spacecraft will be out of communication with Earth as the antenna is pointed away from Earth. Voyager 2 is expected to cross Saturn's bowshock in the early morning of August 24 (GMT). The bowshock marks the entry into space dominated by Saturn rather than by the sun. Particles streaming from the solar wind at supersonic speeds suddenly go subsonic at the bowshock. Voyager 1 reported re-entering Jupiter's magnetic tail earlier this year, indicating that the tail is extremely long and "flaps" back and forth in the solar wind like an enormous "tattered" wind sock. Planetary tails are measured by the absence of solar plasma and the presence of trapped plasmas. Jupiter's magnetotail may possibly have swept across Saturn several times earlier this year. Evidence of these crossings may be apparent in Voyager 2's measurements of Saturn's interesting magnetic environment.

The fields and particles instruments include high- and low-field magnetometers as well as instruments to measure low-energy charged particles, cosmic rays, plasma, plasma waves, and planetary radio emissions. Radio bursts from Saturn allowed Voyager 1's planetary radio astronomy experiment to determine Saturn's rotation rate to be 10 hours 39.4 minutes.

On August 18, Voyager 2's flight path will be adjusted one last time before Saturn. The next trajectory correction, on September 29, will set the course for Uranus. Voyager 2's observations of Saturn this month will be the last photos we will receive from another planet until Voyager 2 approaches Uranus in late 1985.