Voyager

B U L L E T I N

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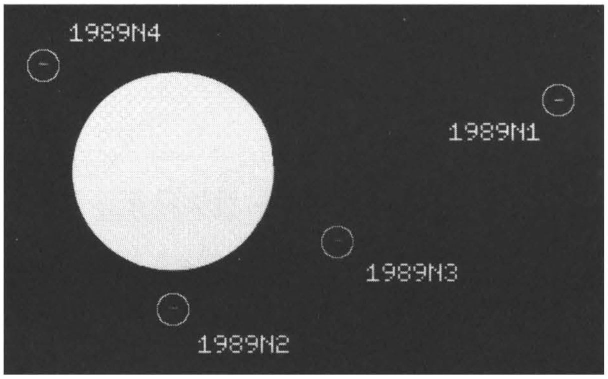


Neptune's four new small moons appear as streaks due to motion of the spacecraft during this 46-second exposure. Neptune is severely overexposed so the new moons can be distinguished. (P-34540)

Moons, Moons, Moons

As some scientists have expected, Neptune is proving to have a large family of moons too small to be seen from Earth-based telescopes. Three additional new moons have recently been confirmed in images returned from Voyager 2 from a distance of about 22 million miles from Neptune.

The discoveries bring the current total number of Neptune moons to six, with more moons expected to be discovered as Voyager 2 nears the planet. Scientists would have been more surprised had no new moons been found near Neptune. Small moons are believed to play a part in maintaining the orbits of ring particles at Jupiter, Saturn, and Uranus. Neptune is believed to have partial arcs or rings.

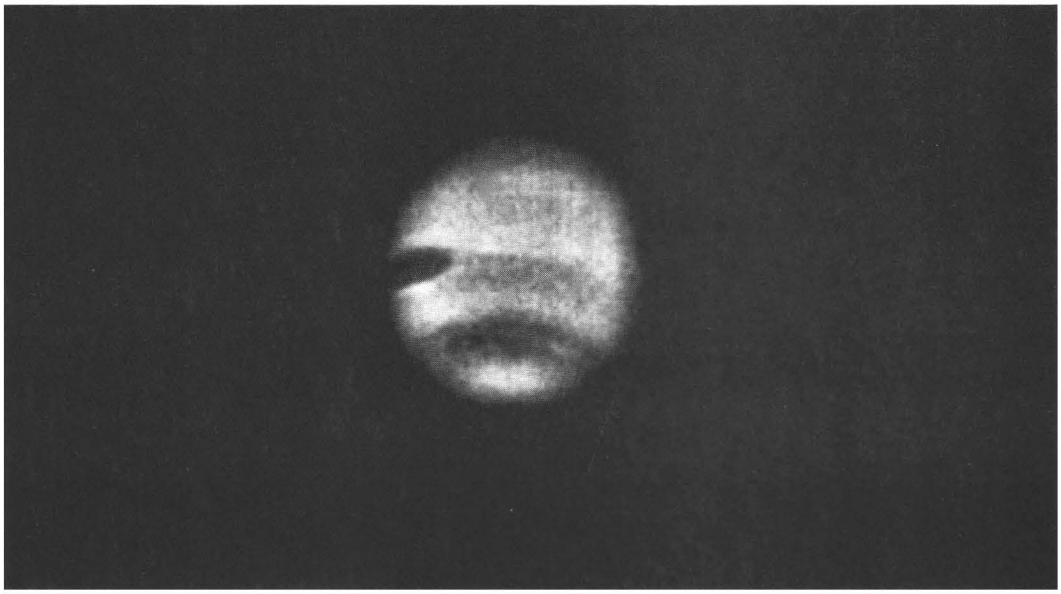
The three newest moons, temporarily designated 1989 N2, 1989 N3, and 1989 N4 in order of their discovery, orbit in the region where the ring arcs are believed to exist, based on Earth-based telescopic observations. All of the new moons are smaller than the 200- to 600-km diameter moon 1989 N1 discovered in July, and occupy nearly circular and equatorial orbits around the planet.

The computer sequence that contains the instructions for Voyager 2's near-encounter observations has recently been altered to add one image of 1989 N1 from a distance of 140,000 km (87,000 mi), about 45 minutes before the spacecraft's closest approach to Neptune on August 25. The image will be shuttered during a radio science antenna calibration maneuver, which fortuitously turns the spacecraft at just the right rate to remove most of the image smear which would otherwise result because of the high relative velocities between the spacecraft and the target. The resulting image should show surface features as small as 3 km (2 mi) on this small moon.

The fact that all of the new moons orbit in the same direction as the planet rotates makes the large moon Triton even more of an oddity, since it orbits in the opposite direction. Current theories of solar system formation suggest that the planets and moons formed out of a swirling disk of gases and dust and, thus, all should rotate and orbit in the same direction.

Moon or Ring Arc	Orbital Radius (from Center of Neptune)*		Orbital Period
Postulated Inner Arc	42,000 km	(26,100 mi)	~6 hrs
1989 N3	52,000 km	(32,300 mi)	8 hrs 10 min
Postulated Interior Arc	57,000 km	(35,420 mi)	~9 hrs
1989 N4	62,000 km	(38,500 mi)	10 hrs 20 min
Postulated Outer Arc	67,000 km	(41,600 mi)	~12 hrs
1989 N2	73,000 km	(45,400 mi)	13 hrs 30 min
1989 N1	117,650 km	(73,100 mi)	26 hrs 56 min
Triton	354,590 km	(220,340 mi)	5 days 21 hrs
Nereid	5,510,660 km	(3,424,300 mi)	359 days

*Subtract one Neptune radius (24,712 km at 1 bar pressure level) to calculate distance from Neptune's cloudtops.



Embedded in the middle of Neptune's dusky southern collar is a dark oval with a bright central core. (P-34504)

Course Correction

Voyager 2's path towards Neptune was fine-tuned slightly on August 1, when a course correction moved the spacecraft slightly sideways and changed its velocity by about 2.1 miles per hour. After re-orienting itself as instructed by flight controllers, the spacecraft expelled pressurized hydrazine (N_2H_4) fuel for about seven and a half minutes to change its course.

At launch, each Voyager spacecraft carried about 105 kilograms (230 pounds) of hydrazine propellant in a pressurized tank. To date, Voyager 2 has expended about 64 kilograms (140 pounds) of hydrazine. Each spacecraft has four thrusters for trajectory correction maneuvers and twelve thrusters for attitude control (attitude refers to the spacecraft's orientation in space, using the Sun and a star as references), and each thruster delivers about 0.2 pounds of thrust.

Current plans include two more trajectory correction maneuvers, on August 15 and 21, to fine-tune the flight path for Neptune. Accurate delivery of the spacecraft to the Neptune aimpoint is especially important to the radio science experimenters, who must know the timing of the start of the spacecraft's disappearance behind Neptune as seen from Earth (Earth occultation) with an accuracy of 1 second.

Neptune's Weather

Neptune's cloudtops show a surprising amount of variability, considering that Neptune receives about two-tenths of a percent as much power per unit area as does the Earth, and about 4 percent as much as Jupiter. These estimates take into account both energy received as sunlight and energy upwelling from the planet's interior. This energy is a factor in creating weather systems on all planets.

While the large dark oval, first seen this spring, has remained relatively constant in position, a bright cloud to the north and east was seen to separate from the dark spot over a 53-hour interval from July 9 to 12. In addition, a smaller dark spot apparent in the dark collar near the south pole rotates faster than the large dark spot. This finding indicates that the winds on Neptune have different velocities at different latitudes, as is the case for Jupiter, Saturn, and Uranus.

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