

Astronomy

Ron Cowen reports from Bethesda, Md., at the annual meeting of the American Astronomical Society's Division for Planetary Sciences

Repaired Hubble views two outer planets

New images of Neptune show that the planet's atmosphere changes dramatically over just a few months, perhaps even within a week's time. Taken by the Hubble Space Telescope in June and October, these are the highest-resolution pictures of the planet since Voyager 2's 1989 flyby.

Both sets of images confirm that Neptune's Great Dark Spot — a major storm feature seen by Voyager 2 — has vanished. The storm center has either dissipated or been masked by other aspects of the atmosphere, says Heidi B. Hammel of the Massachusetts Institute of Technology.

The June images, analyzed by John T. Trauger and David Crisp of NASA's Jet Propulsion Laboratory in Pasadena, Calif., and their colleagues, reveal bright, high-altitude cloud features, including a cloud band in the northern hemisphere.

This could be the same band that Hammel found with a ground-based telescope (SN: 10/30/93, p.287). But she and G. Wesley Lockwood of the Lowell Observatory in Flagstaff, Ariz., note that although Hubble images taken Oct. 10 show a brilliant northern cloud, it vanished in images taken 1 week later.

Hammel and other researchers speculate that Neptune's variability may be

True-color, composite image of Neptune taken by Hubble.

linked to an interior heat source as well as its orientation to the sun. The relatively featureless Uranus doesn't have such a source, but this planet is developing some interesting traits as its orientation becomes temporarily more like Neptune's.

Indeed, images of Uranus taken recently by Hubble suggest that the planet isn't the bland body it has sometimes seemed. On Aug. 14, Hubble became the first telescope to view Uranus in detail since Voyager 2 flew past in 1986.

Hubble glimpsed at least five inner satellites discovered by Voyager, as well as Uranus' outer ring, Epsilon, and additional ring structures. Comparing the actual locations of the Uranian moons seen by Hubble with the positions researchers had calculated using Voyager 2 data should determine their orbits more precisely.

The pictures show a high-altitude haze above the planet's south pole. In addition, Hubble found what appears to be a pair of vast clouds in Uranus' southern hemisphere — the part of the planet that points toward the sun. Voyager 2 saw similar features, but the contrast is greater in the Hubble images. This may stem from a change in solar illumination at the pole.

During some parts of the Uranian year, the sun stays directly over the planet's south pole. Such was the case during the Voyager encounter. But at other times, the orbital motion of Uranus tips the pole away from the sun. For example, during Hubble's recent observations, the pole was tipped about 35° from the sun. When the pole is tilted, solar illumination varies during the day, possibly altering the brightness of polar clouds.

Cloud motion in the Hubble images may indicate a combination of the planet's rate of rotation and wind speed at the cloud sites.



Kenneth Seidelmann, U.S. Naval Obs./NASA

Composite of three Hubble images of Uranus shows the planet's rings, inner moons, and bright clouds. Motion between exposures makes each moon appear as a string of three dots.

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Behavior

In the valleys of thought

The outer layer, or cortex, of the brain bunches up into a convoluted mass of folded tissue that displays on its surface only the top of each fold. The cortical valleys, or fundi, that lie beneath these swarming cerebral summits may help coordinate problem solving and other complex types of thinking, two psychologists suggest in a new study.

"More demanding and complex cognitive functions... rely on cortical fundal activity to a higher degree than do less demanding processes," they conclude in the Oct. 25 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Hans J. Markowitsch of the University of Bielefeld in Germany and Endel Tulving of the University of Toronto first noted this feature of the cortex in a positron emission tomography (PET) study of memory that they conducted (SN: 3/26/94, p.199). Sentence recall showed a link to blood-flow bursts in or near fundal tissue at the front of the cortex.

Markowitsch and Tulving then combined these data with findings from 29 PET studies conducted by other researchers. Each project included information on whether cerebral blood-flow changes during various mental tests were concentrated in or near the fundus or in other parts of the cortex.

Overall, fundal regions accounted for nearly one-half of the reported areas of peak cortical activity. Cortical valleys displayed the most activity during particularly complex problem-solving and memory tasks. Yet these areas compose only about 8 percent of the entire cortex, the scientists say.

Many investigators doubt that PET scanners clearly separate fundal activity from blood-flow surges at other spots along cortical folds. Markowitsch and Tulving disagree, citing the wide range of PET-specified fundal activity, which increases as mental tasks get tougher.

Anatomical studies indicate that fundal cells handle short-range communications in the brain. These neurons may also serve as "hubs of cross-cortical traffic," where related lines of information converge to make complex thinking possible, Markowitsch and Tulving theorize.

Psychotherapy: When enough is enough

About 1 year of weekly, individual psychotherapy sessions produces good psychological health in three out of four people who voluntarily seek such help, contend Stephen Mark Kopta, a psychologist at the University of Evansville (Ind.), and his coworkers.

Half of all psychotherapy outpatients achieve significant gains in emotional adjustment by the end of 11 sessions, or 2 ½ months of treatment, they report in the October JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY.

"This research holds promise for establishing guidelines for the financing of psychotherapy," Kopta's team concludes.

A total of 854 adults completed checklists of psychiatric symptoms before starting psychotherapy at one of five mental health centers, at several points during treatment, and when the sessions ended. At most, therapy lasted for 52 sessions. Psychotherapists usually emphasized the understanding of unconscious emotions and conflicts. Few participants received psychoactive drugs.

The researchers compared patients' checklist responses to responses already obtained from 974 adults with no marked symptoms of psychological disturbance.

Short-term distress, such as temper outbursts, crying easily, or feeling restless, lessened substantially over the course of psychotherapy in most cases. Chronic distress, such as feeling worthless and worrying too much, also shrank considerably. But only about 40 percent of participants showed improvement in problems related to character traits, such as being easily annoyed or arguing frequently with others, the researchers hold.

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