



## News Release

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### POLAR CHANGES ON URANUS PUZZLE PLANET WATCHERS

Long considered the least interesting of the outer planets, Uranus has begun to attract the attention of planet watchers around the world. With its unusual axial tilt (the planet spins with its rotation pole lying in the plane of the solar system), Uranus' seasonal changes are extreme; a summer "day" lasts for more than 40 Earth years near the poles. But even in close-up images taken by Voyager 2, the planet itself seemed to exhibit only the blandest of weather.

The Hubble Space Telescope (HST) observed Uranus in 1994, 1997, and 2000-2002. In terms of seasons, this period corresponds roughly to the month of February on Earth. Voyager flew by Uranus during the equivalent of late December, just after the southern summer solstice (think Australia summer during US winter). Now, in Uranus' southern hemisphere, summer is ending and the planet's atmosphere is changing in remarkable ways. Throughout the period of HST observation, the most prominent feature at wavelengths longer than 600 nm—where methane absorbs significantly—has been a bright polar cap south of about  $-45^\circ$ . Now, a detailed comparison of these HST images by Kathy Rages (SETI Institute, Mountain View, CA) and colleagues reveals large-scale changes within this south polar cap.

Since 1994, the South Pole has darkened, and the brightness distribution within the polar cap has changed on scales of about  $10^\circ$  of latitude (HST's excellent spatial resolution can reveal latitude bands down to about  $5^\circ$  in width). For example, between 1997 and 2000, the edge of the polar cap (the polar "collar") became more prominent in the F850LP filter (850 nm wavelength). Also, in the F791W filter (791 nm), the southernmost latitudes darkened even more rapidly than the rest of the pole between 1994 and 2001, leaving an inner bright ring near  $-70^\circ$ .

Surprisingly, these changes do not appear to be taking place in the upper (methane) cloud near the 1-bar level, but rather in a thick cloud below the 3-4 bar level in the atmosphere. This deeper cloud, which may be composed of condensed hydrogen sulfide, could be darkening or subsiding to deeper pressure levels. It is quite puzzling that the deep cloud should respond to changes in sunlight when the higher methane cloud apparently does not. "A possible solution to this puzzle may be that rising polar temperatures during the summer cause methane ice particles to evaporate, increasing the visibility of any pre-existing structure in the deeper cloud," points out team member James Friedson (Jet Propulsion Laboratory, Pasadena, CA).

"We expected changes," says team member Heidi Hammel (Space Science Institute, Boulder, CO), "but the broad extent and rapid time scale of the change caught us off guard. We were looking for discrete cloud features—bright spots, if you will. Not major zonal changes."

All this Uranian action has not gone unnoticed by the planetary community. "During its first 3 years of observations, HST didn't take a single picture of Uranus," remarks Rages, "and even in 1994, the only reason Uranus pictures were taken was to look for faint satellites around the planet. In contrast, more than 250 HST pictures of Uranus have been taken since 2000." In addition, teams of astronomers are studying Uranus with the Keck 10-meter, the NASA Infrared Telescope Facility, the Very Large Array, and other ground-based facilities. As Uranus creeps inexorably toward its equinox in 2007, these and other astronomers will be watching the windy weather on this planet and wondering what to expect in the future. "Based on historical images of Uranus and more recent results from HST and Keck, we are beginning to suspect that the equinox view of the planet may be different from what we expected just a year ago," said Hammel, "but the details are Uranus' secret—for now."

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