

Probing Uranus' Vertical Aerosol Structure at Equinox

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Scientific Category: SOLAR SYSTEM

Scientific Keywords: ATMOSPHERES AND CHROMOSPHERES, GIANT PLANETS, RADIATIVE
TRANSFER

Instruments: NICMOS

Proprietary Period: 12

Orbit Request	Prime	Parallel
Cycle 16	4	0

Abstract

After a decade of quiescence following the Voyager flybys, Uranus' atmosphere has been exhibiting increasing activity approaching equinox that suggests a short timescale, dynamical, response in addition to a long timescale, radiative, response to the seasonal change of hemispheric heating. We propose to investigate this dichotomy by measuring Uranus' vertical aerosol structure over the entire surface, including both poles, at equinox when the forcing insolation is hemispherically symmetric, requiring that the sub-Earth latitude be less than a degree. Only at equinox (every 42 years) can the entire surface of the planet be viewed (over a full rotation) and mapped with the same viewing geometry. We will probe the morphology of the vertical haze structure using NICMOS narrow band filters beyond 1 micron to isolate different altitude regimes between the stratosphere and cloud deck and investigate its change since Cycle 7. We will use two complementary approaches: First, imaging will be done using medium- and narrow-band filters first to locate the dynamically-produced discrete cloud features, then to probe their vertical structure and morphology. The methane absorption bands are stronger in the proposed near-IR (1 to 2.5 microns) than at shorter wavelengths, and the strong H₂ pressure-induced absorption from 2.1-2.4 microns contributes to the peak opacity. This enhances the visibility of transient, spatially isolated features and allows their structure to be probed to higher altitudes; namely, to the upper troposphere where they would be evidence of convective overshoot, a dynamical manifestation that would support strong seasonally-induced static instability. In addition to probing the structure with filter photometry, we will measure longitudinal limb profiles to probe the vertical background haze distribution vs latitude. HST/NICMOS is required because it avoids telluric water absorption and OH+O₂ emission, and has a stable, well-characterized PSF, essential for limb studies and extracting the vertical structure of fine features crossing the disk. The proposed observations would complement the ground-based Uranus equinox campaign.

Investigators:

	Investigator	Institution	Country
PI	Dr. Laurence M. Trafton	University of Texas at Austin	USA/TX
CoI	Dr. Heidi B. Hammel	Space Science Institute	USA/CO

Number of investigators: 2

Target Summary:

Target	RA	Dec	Magnitude
URANUS			V = 5.52

Observing Summary:

Target	Config Mode and Spectral Elements	Flags	Orbits
URANUS	NIC1 Imaging F108N	DUP	1
	NIC1 Imaging F110W		
	NIC1 Imaging F110M		
	NIC1 Imaging F113N		
	NIC1 Imaging F160W		
	NIC1 Imaging F165M		
	NIC2 Imaging F171M		
	NIC2 Imaging F187W		
	NIC1 Imaging F145M		
URANUS	NIC1 Imaging F108N	DUP	1
	NIC1 Imaging F110W		
	NIC1 Imaging F110M		
	NIC1 Imaging F160W		
	NIC1 Imaging F165M		
	NIC2 Imaging F171M		
	NIC2 Imaging F187W		
	NIC2 Imaging F190N		
URANUS	NIC1 Imaging F108N	DUP	1

Target	Config Mode and Spectral Elements	Flags	Orbits
	NIC1 Imaging F110W		
	NIC1 Imaging F110M		
	NIC1 Imaging F160W		
	NIC1 Imaging F165M		
	NIC2 Imaging F171M		
	NIC2 Imaging F187W		
	NIC2 Imaging F204M		
URANUS	NIC1 Imaging F108N	DUP	1
	NIC1 Imaging F110W		
	NIC1 Imaging F110M		
	NIC1 Imaging F160W		
	NIC1 Imaging F165M		
	NIC2 Imaging F171M		
	NIC2 Imaging F187W		
	NIC2 Imaging F222M		

Total prime orbits: 4