2 NOVEMBER 1989
THURSDAY MORNING

Session 14: Titan
(Moderator TBA)
8:30–12:00, Grand Ballroom

14.01

Preliminary Results from the Occultation of 28 Sgr by the Saturn System: Titan

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The 3 July 1989 UT occultation of 28 Sgr by Titan was observed from two stations in Israel: the Wise Observatory 1m telescope and a portable 0.36m telescope at Kibbutz Ein Harod. It was also observed from Italy at the Vatican Observatory 0.6m telescope at Castel Gandolfo. Excellent data with signal/background of about 30/1 were obtained. Conditions were photometric in Israel, but due to clouds only emersion was cleanly observed at Castel Gandolfo. The Wise data are at a wavelength of 0.73 μm, while the other data are at dual wavelengths of 0.43 μm and 0.8 μm. The star was readily detectable throughout the occultation, reaching a minimum normalized flux ϕ of about 0.05, which does not show obvious wavelength dependence. Preliminary analysis shows that the occultation probed Titan's atmosphere at a radius of about 3000 km. The Israel chords and Vatican chord were respectively about 1500 km and 500 km south of the center line. Preliminary fits to the lightcurves indicate that the scale height at the half-flux level is 50-60 km. There is some evidence that scale heights are larger by $\sim$ 10% on the immersion (sunset) limb with respect to the emersion (sunrise) limb. There is evident correlation of fluctuations between the Israel stations, which were separated by $\sim$ 130 km along the Titan limb, although the correlation fades as the normalized flux drops below 0.5.

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14.02

The occultation of 28 Sgr by Titan on July 3, 1989

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The occultation of 28 Sgr (SAO 187255) by Titan was monitored in Europe, on July 3, 1989, from the following stations:

Site	telescope	instrument	filter
Meudon	1-m	SIT vidicon	clear
-	0.6-m	high-speed photometer	B
Pic du Midi	2-m	AsGa	8900, 7500 Å
-	1-m	SIT vidicon	B
-	0.6-m	CCD	6500 Å
Catania	0.91-m	high-speed photometer	B
-	0.61-m	3-channel photometer	U,B,V

Isothermal fits to the lightcurves provide the half-flux times t (U.T.) and the scale-heights H of the sub-occultation points for each station:

Site	t_i	H_i (km)	t_e	H_e (km)
Meudon	22:39:17.6	53.	22:44:38.2	38. (?)
Pic du Midi	22:39:36.8	52.	22:44:55.2	48.
Catania	22:38:32.0	50.	22:43:43.7	48.

The corresponding half-flux radius of Titan's shadow is 2980 km, i.e. 405 km above the surface (R= 2575 km). At both Meudon and Pic du Midi, a central flash was detected, each of them with a double-peaked structure, at 22:41:51 and 22:42:55 at Meudon, and at 22:42:06 and 22:42:20 at Pic du Midi. The height of the central flash strongly increases with the wavelength. The maximum height of the central flash, in units of the unocculted stellar flux, is $\approx$ 40% at Meudon on the vidicon (4500-8500 Å), and is essentially undetectable in the blue. The heights observed at Pic du Midi are 12.7%, 9.7%, 4.5% and 1.7% at 8900,7500,6500 and 4500 Å, respectively. A faint increase of signal of 1.1%, lasting 16 sec, is detected at Catania around 22:41:34. We discuss the implications of these observations on Titan's oblateness. Finally, the overall occultation profiles are not symmetric with respect to the middle of the event: the star was continuously detected during the first half of the occultation, while it was completely hidden behind Titan during the second half. This indicates that the probed hemispheres have different thermal and/or absorbing properties.

14.03

The Stratospheric Profile of HCN on Titan from Millimeter Observations

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Measurements of the (1-0) line of hydrogen cyanide at 88.6 GHz in the Titan atmosphere are reported. Synthetic spectra were fitted to the observations in order to derive the vertical distribution of HCN in the stratosphere. The observed line is significantly narrower than that computed for constant stratospheric mixing ratios, implying an increase of the HCN concentration with altitude. From a least-squares analysis taking into account measurement noise and calibration uncertainties, a mean mixing ratio scale height of 47^{+36}_{-11} km is derived for the 100- to 300-km region. The HCN abundance is found to be best constrained around the 170-km level where the inferred mixing ratio is $3.3^{+0.9}_{-0.8} \times 10^{-7}$. The results are consistent with recent analyses of Voyager infrared data. The inferred vertical concentration gradient is much steeper and the abundance in the lower stratosphere smaller than predicted by current photochemical models. Theoretical HCN profiles may however be brought into agreement with the present results by reducing the magnitude of the vertical eddy mixing assumed in the stratosphere.

14.04

Titan's 2 Micron Spectrum at 4 cm^{-1} Resolution

C.A. Griffith, T. Owen (SUNY Stony Brook)

Titan's 2 micron albedo results from absorption due to the presence of nitrogen, hydrogen and methane and from scattering due to haze and tropospheric clouds. Carbon dioxide and the products of methane photolysis exist in abundances which are too low to significantly affect the albedo. As absorption due to nitrogen and hydrogen determines only the continuum, the two micron spectrum can be used to study the distribution of scattering particles and methane. We are also interested in trying to determine what the clarity of the atmosphere is in the methane window at 2 microns.

We have reproduced a single sampled spectrum of Titan between 4650 and 4700 wavenumbers (of resolution 4 cm^{-1}) with a radiative transfer model which includes the effect of hazes, clouds and methane. Preliminary results with this very narrow spectral region indicates that a bright scatterer (perhaps clouds) at the tropopause is needed to interpret the spectrum. We also find that the 4600 cm^{-1} region is sensitive to the atmosphere above 40 km from the surface and the 4700 cm^{-1} region probes below the tropopause. In order to extend our analysis of distribution