of the upper atmosphere was monitored at 12μ in the C_2H_6 emission band; the surface temperature was monitored at 20μ where most of the outgoing flux comes from the surface. In order to look for a phase change of CH_4, we monitored the Titan spectrum, in the CH_4 bands at 0.6–0.9μ, during and after the emersion.

Observations were performed at La Silla on June 28, 1980, both on the 3.6 m and the 1.52 m telescopes. Monitoring of T_B (12μ) and T_B (20μ)was performed at the Cassegrain focus of the 3.6 m telescope, using an IR photometer designed at Paris-Meudon Observatory (Epchtein, 1981). The filters were centered at 11.3μ and 20.0μ with a FWHM of 1.3μ and 5.0 μ respectively. The typical integration time for a flux determination was 2 mn. Titan's spectrum between 0.6 and 0.9μ was monitored at the Cassegrain focus of the 1.52 m telescope using the Boller and Chivens spectrograph associated with a Reticon camera. The dispersion was 228 Å/mm and the spectroscopic resolution about 6 Å. The slit was a 2 × 2 arcsec aperture. The time needed to record one scan was 5 mn. Spectra of Saturn and the sky were recorded after each Titan scan for comparison.

On June 28, the emersion occurred approximately at sunset (21:45 U.T.). Both the IR and the visible experiment suffered from limitations due to the rapid change in sky brightness with time. Significant data were obtained from 22:05 to 25:30 U.T. from the spectroscopic experiment, and between 22:20 and 25:30 U.T. from the IR experiment.

Results

We did not obtain any indication of a variation of the temperatures at 11.5μ and 20μ versus time, and our values were in agreement with previous observations (McCarthy et al., 1980). So the conclusion of the IR observation is that both the temperature of the upper atmosphere of Titan and the surface temperature were not modified during the 4-hour eclipse.

We did not observe any change in the CH_4 bands (6190, 7250, 7950, 8900 Å) either. The equivalent width of the 7250 Å band, located at the maximum sensitivity wavelength, was 68 ± 5 Å and remained constant within the error bars during the whole experiment; this value is in agreement with previous observations (Wamsteker, 1975). This implies that there has been no change in the CH_4 distribution nor in the scattering properties of the atmosphere after a 4 hours eclipse. This implies that the atmosphere is very stable, and that the aerosols of very large thermal inertia probably dominate the energy budget of the upper atmosphere. This is consistent with a thick atmosphere, predominantly composed of nitrogen as suggested by Voyager 1 results. The present set of observations will provide new constraints upon the new model for Titan's atmosphere that will be based on the Voyager data.

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Upper Limit of the Gaseous CH_4 Abundance on Triton

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Triton, Neptune's largest satellite, has been known for a long time to be able to retain an atmosphere of heavy gases, due to its mass and temperature. Several attempts for detecting the gaseous CH_4 molecule in Triton's spectrum have been inconclusive (Cochran and Cochran, 1977; Cruikshank et al., 1979). In contrast, Benner et al. (1978) reported the identification of a CH_4 gaseous absorption at 8900 Å, as well as Cruikshank and Silvaggio (1979) in the near-infrared; from the second study, an abundance of 7 m-Am (meter-Amagat)* was derived.

A new observation of Triton was recorded on June 28, 1980, at the 1.52 m telescope on La Silla with the Boller and Chivens spectrograph and a Reticon 1024 C camera, in the 6000–9000 Å range. The dispersion was 228 Å/mm, corresponding to a spectroscopic resolution of about 6 Å. The exposure time was 1 hour. The adjacent sky was recorded under the same exposure conditions for comparison. Spectra of the scattered light of the Sun and spectra of Neptune were also recorded for comparison and calibration. The data were degraded to a resolution of 25 Å to improve the S/N ratio (30 at 7250 Å).

There is no trace of CH_4 absorption at 6190, 7250, 7950 and 8900 Å. Using the 7250 Å band which corresponds to the wavelength of maximum sensitivity, the upper limit of equivalent width is 4 Å, which in turn corresponds to an upper limit of 3.5 m-Am for a one-way column abundance of CH_4 on Triton.

Our result is in agreement with the recent result of Johnson et al. (1980) who found from the 8900 Å band an upper limit of 1 m-Am of CH_4 on Triton. The disagreement with Cruikshank and Silvaggio's result might come from true differences in scattering processes in the visible and near-infrared ranges. Additional data are certainly needed in order to reconcile visible and IR observations.

* One meter-Amagat corresponds to a column of gas of 1 m under standard conditions (1 atm. 273 °K).

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