**THERMAL INFRARED OBSERVATIONS OF MARS (7.5-12.8$\mu$m) DURING THE 1990 OPPOSITION;** T. Roush[1,2,3], F. Witteborn[1,3], P. Lucey[1,4], A. Graps[1,5], and J. Pollack[3]

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Thirteen spectra of Mars, in the 7.5 to 12.8$\mu$m wavelength region, were obtained on 7 December 1990 from the Infrared Telescope Facility (IRTF) atop Mauna Kea, Hawaii. Throughout the night the humidity was 6 $\pm$3%. For these observations a grating with an ultimate resolving power of 120 (shortest wavelengths) to 250 (longest wavelengths) was used and wavelengths were calibrated for each grating setting by comparison with the absorption spectrum of polystyrene measured prior to each set of observations. By sampling at the Nyquist limit at the shortest wavelengths, an effective resolving power of about 120 over the entire wavelength range was achieved. A total of four grating settings were required to cover the entire wavelength region. The wavelength of each was: 1)7.50-9.53$\mu$m; 2)7.615-9.64$\mu$m; 3)9.50-11.35$\mu$m; and 4)11.23-12.83$\mu$m. A typical observing sequence consisted of: 1)positioning the grating in one of the intervals; 2)calibrating the wavelength positions; and 3)obtaining spectra for a number of spots on Mars. Several observations of the nearby stellar standard star $\alpha$ Tauri were also acquired throughout the night. Each Mars spectrum represents an average of 4 to 6 measurements of the individual Mars spots. As a result of this observing sequence, the viewing geometry for a given location or spot on Mars does not change, but the actual location of the spot on Mars' surface varies somewhat between the different grating settings (see Figure 1).

A 1.6 arc second aperature was used and when convolved with the nominal seeing ($\approx$1.5 arc seconds) results in an effective aperature size of 2.2 arc seconds. Because 1)the effective size of the aperture was small relative to Mars ($\approx$18 arc seconds) and 2) the center of the spots were separated by 2.5 arc seconds the spectra were able to sample variations in both martian surface albedo and air mass. Ten of the spectra sampled along the central meridian of Mars during two different times during the night (*e.g.* Figure 1). Early in the evening these spectra sampled from 200-220W and 45N-70S. Late in the evening these spectra sampled from 260-280W and roughly the same latitudinal range. Also, late in the evening two additional spectra sampled along the photometric equator, providing spectra of relatively high martian air mass with both relatively high and low ground temperatures. One additional spectrum was obtained by tracking the classical low albedo feature, Syrtis Major as it rotated across the disk.

Initial analysis of these data is underway and comparisons with similar observations obtained from the Kuiper Airborne Observatory during the 1988 [1] and 1990 [2] oppositions are planned. Several ratio spectra are shown in Figure 2 where the spectrum of each spot on Mars is divided by the spectrum of the center spot. These ratios exhibit differences which are due to both atmospheric and surface variations.

References: [1]Pollack *et al.*, JGR, 95, 14,595 [2]Pollack *et al.*, pers. comm. 1991.

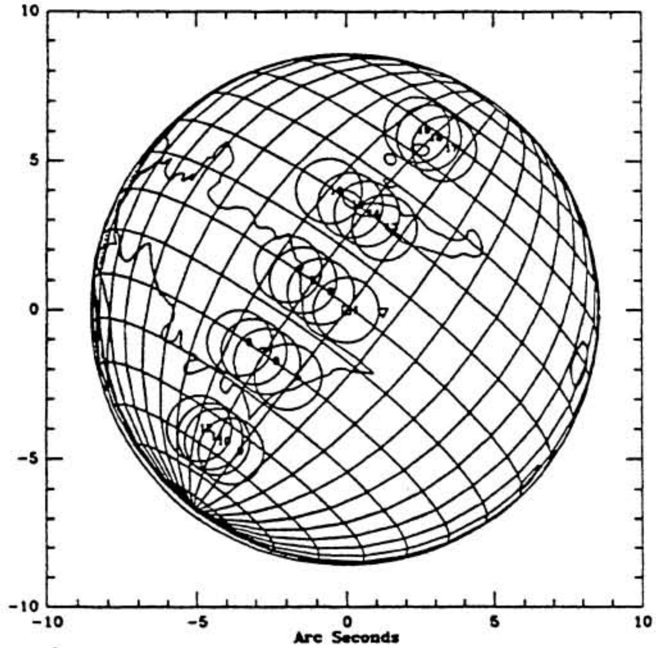


Figure 1. Location of spots where spectral data were obtained during the early observing session. The outline of several topographic and albedo features of Mars are included for orientation, North is to the upper right and the morning limb is to the left. Each circle represents the region of the surface for which spectra were collected. Circle number 1 at the center of the disk represents the area sampled by the shortest wavelength grating setting and by the time the data was collected for the next grating setting the region indicated by circle number 2 had rotated to the position of circle number 1. Sub-Earth point (□), Lat.=10.96S, Long.=200.06W. Sub-solar point (▽) Lat.=6.23S, Long.=193.23W.

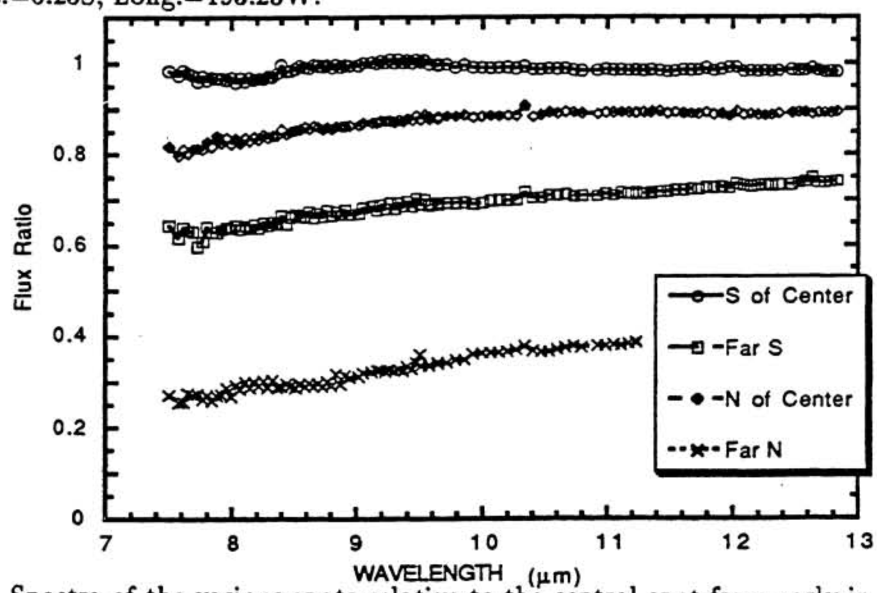


Figure 2. Spectra of the various spots relative to the central spot from early in the evening on 7 December 1990. Spectra from each grating setting are scaled to each other in the region of overlap.