# MINERALOGY OF THE MARTIAN SURFACE FROM MARINER 6/7 INFRARED SPECTROMETER DATA.

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The Mariner 6/7 Infrared Spectrometer experiment data from the 1969 Mars flyby encounters represent a valuable source of information about the IR reflection/emission spectrum of Mars in the 1.9 to 14.4 μm region. The author in 1989 archived a digital version of the raw data set through Planetary Data System; that data set has stimulated considerable interest for its potential to resolve mineralogical questions about the Martian surface and airborne dust. The author has continued study of the data set both to improve understanding of its calibration, and to pursue specific research goals.

During 1990, the wavelength calibration of the IRS data was completely redone, using information from inflight spectra of Mars taken through a polystyrene film and from the locations of Martian $CO_2$ bands. The response functions of the various wavelength channels of the two instruments were then rederived, using laboratory blackbody spectra.

Also during 1990, a particular approach was taken to study the IRS data in which the effects of uncertain wavelength and intensity calibration can be minimized. This involves doing ratios of spectra. These are of particular value when applied to study contrasts between various albedo domains on the Mars surface, and between spectra with differing emission angle. The latter provide a means of assessing the contribution of the atmosphere and airborne dust to the spectra.

In Fig. 1 we show two near-IR radiance spectra for very different albedo regions. In the 2-2.5 μm range, the brightness difference is obvious. Note, however, that beyond the 2.7 μm $CO_2$ band, the spectra do not differ. This region is dominated by the absorption of bound water in surface materials. It is apparent that the the strength of this band does not correlate with the albedo. Thus, it is unlikely that light-colored dust has a different proportion of bound water than darker materials.

Fig. 2 shows a ratio of two spectra obtained at very different total solar pathlength (airmass). The two marked features indicate how atmospheric bands are accentuated. This technique is being applied to study the behavior of various spectral features. Fig. 3 contains a radiance spectrum covering the entire spectral range of the instrument, showing the transition from solar reflectance to thermal emission domains. Note the strong silicate absorption feature between 8 and 12 μm. This spectrum is made possible by recent attention to the problem of calibrating the IRS instruments.

An additional result is the first radiance spectra of the south polar $CO_2$ ice cap in the transition region (Fig. 4). Here, noise is evident near 6 μm. The behavior of the 15 μm band edge indicates a strong thermal inversion. The peak near 9.5 μm is likely due to emission by dust in the atmosphere over the cold cap.

REFERENCES: Martin, T.Z. (1990) Mariner 6/7 Infrared Spectrometer: Data Set Restoration. Submitted to *Icarus*.

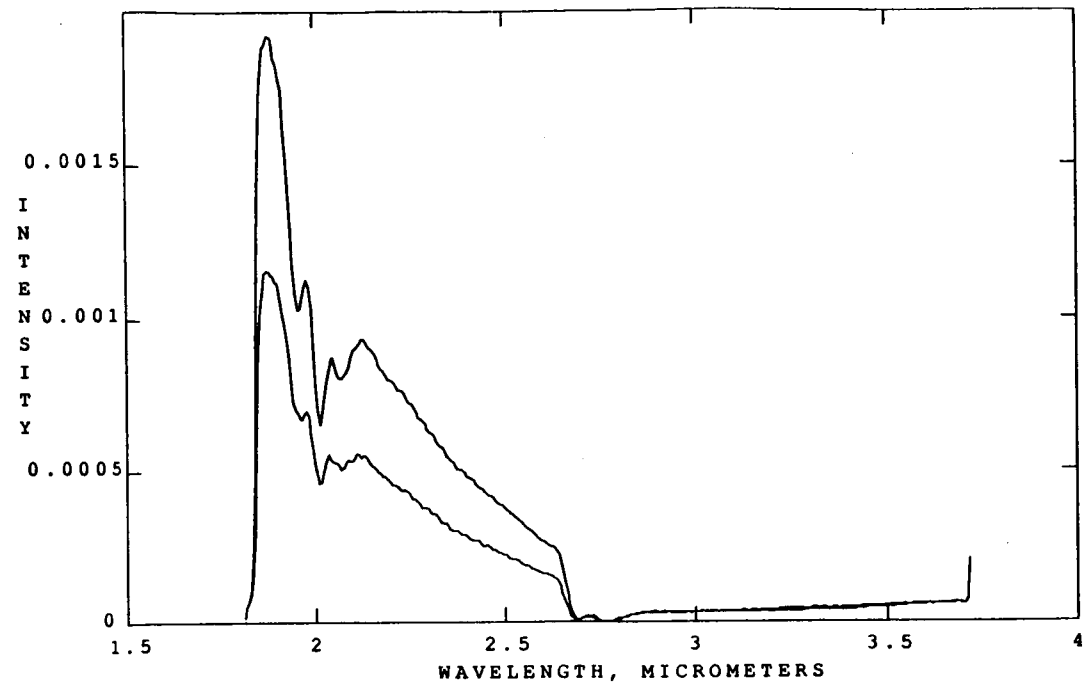


Fig. 1. Near-IR spectra with differing albedo.

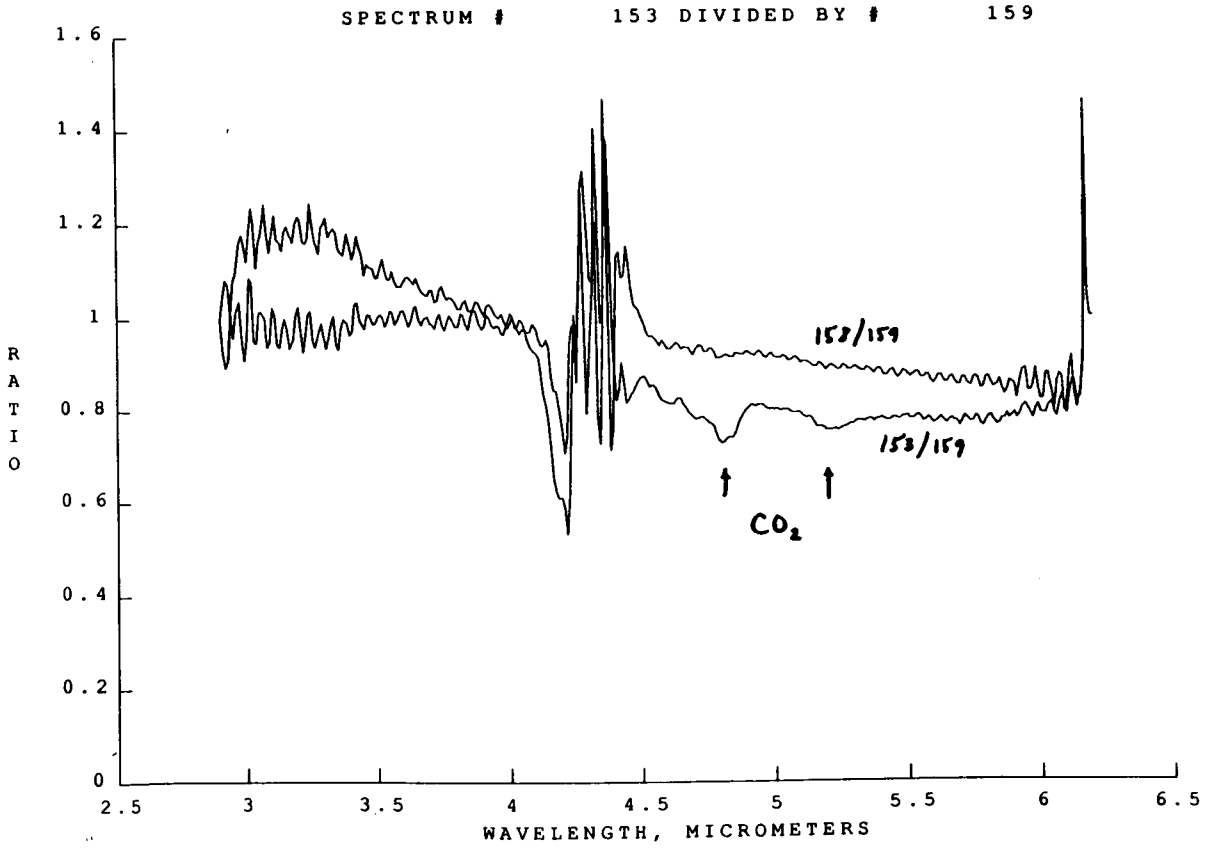


Fig. 2. Ratio spectra showing atmospheric features.

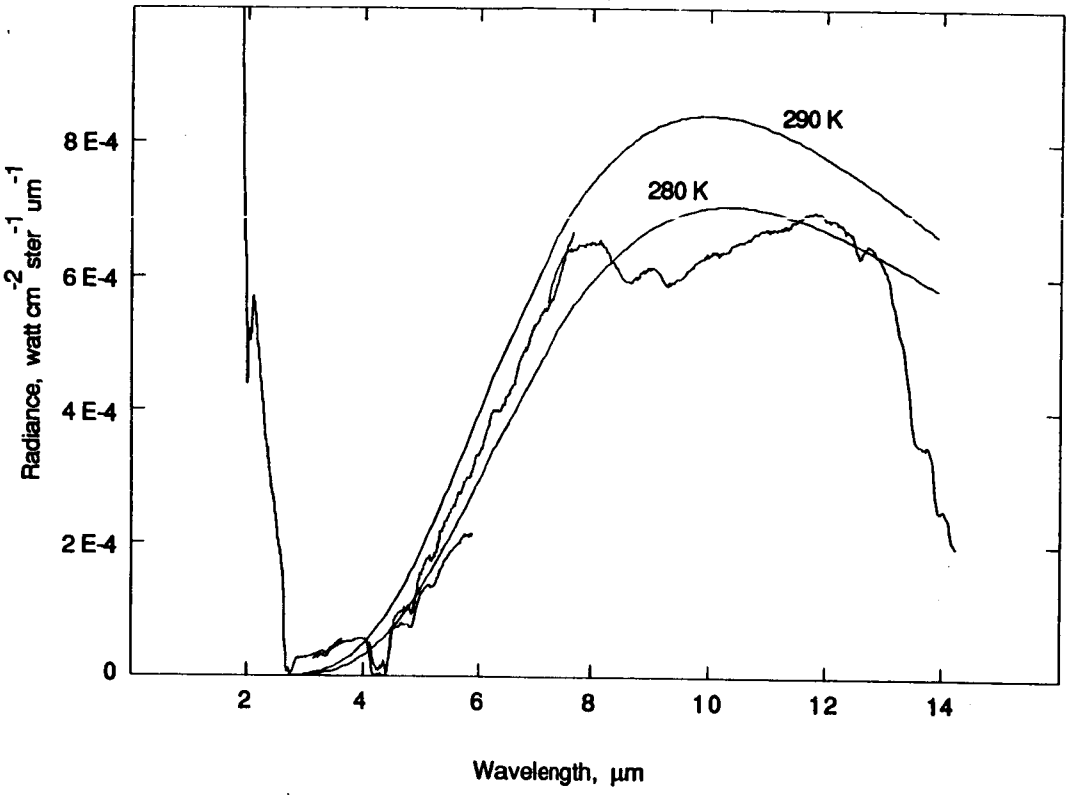


Fig. 3. Radiance spectrum - Mariner 7 #98.

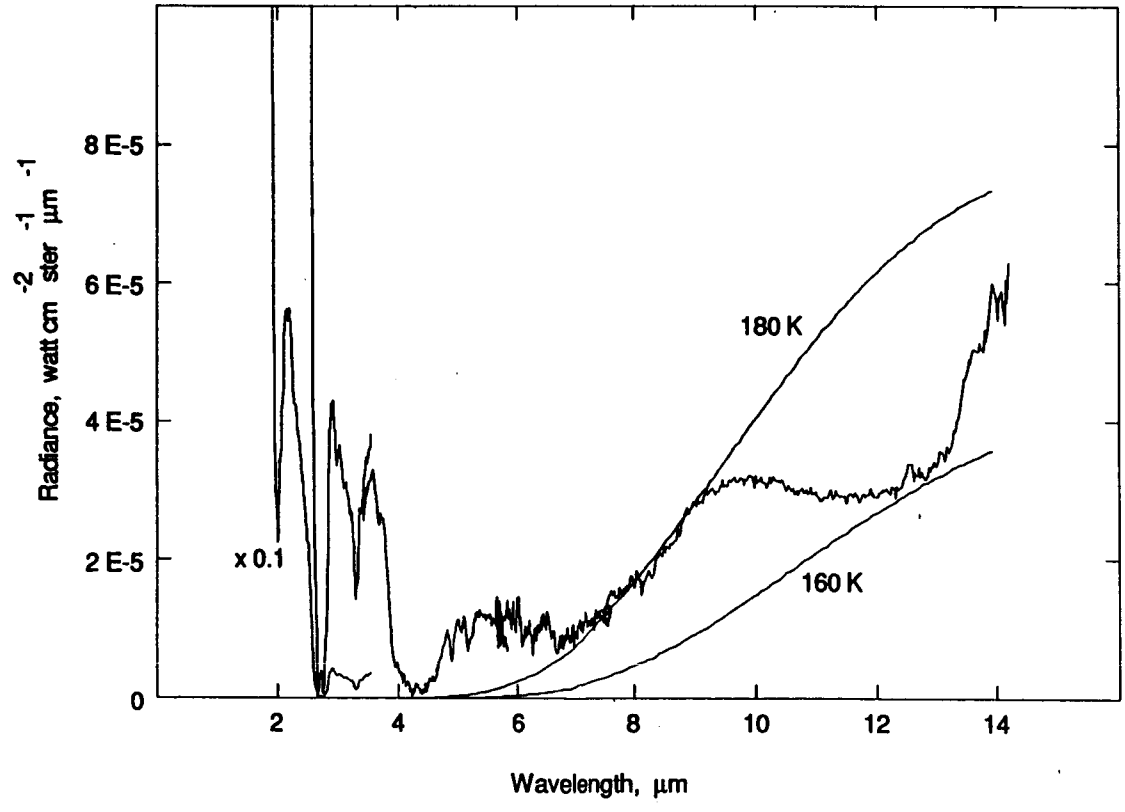


Fig. 4. Radiance spectrum of the south polar cap.