INFRARED IMAGING OF MARS BETWEEN 2.4 μm AND 5.0 μm.

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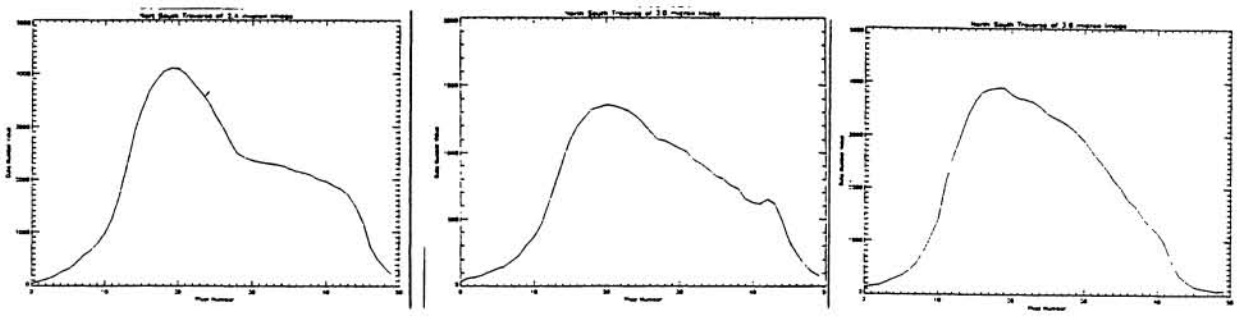
Introduction. While the appearance of Mars in the visible is well known, few near-infrared images exist. The sensitivity of the 2.0 μm to 5.0 μm wavelength region to the presence of volatiles (water and CO2 frost) and volatile bearing minerals (hydrated minerals, sulfates, and carbonates) make this wavelength range an exciting region to study. Spectroscopic imaging provides a way of examining compositional variations as well spatial distribution. The data presented here were collected on June 15,1990 at the NASA Infrared Telescope Facility using Protocam, a 62x58 InSb array camera with a circular variable filter. Images were collected by stepping through the circular variable filler for wavelengths between 2.4 μm and 4.95 μm. A plate scale of 0.2 arc-seconds / pixel was used. At the time of data collection, Mars was still quite small with an angular size of 7.3 arc-seconds. The Martian season was Southern Hemisphere spring (Ls=241°). The subearth point was located at 184° longitude, 23.8° S latitude. The center of the disk was in the southern highland region between Elysium and Amazonis.

Summary of Analysis of Images. The albedo features at 2.40 μm have decreased contrast at longer wavelengths, till they are unrecognizable at 4 μm. Figure 1 shows a series of North - South transects at 2.4 μm, 3.0 μm and 3.6 μm. Most of the dynamic range of the images is from limb, illumination, and viewing geometry effects. Representative images at 3.12 μm and 3.44 μm are shown in Figures 2 and 3. The 3.12 μm image is sensitive to absorption from water ice. Note that the 3.44 μm image is located in a CO2 frost band and the South Pole is completely absent. Identification of distinct surface units was best accomplished by using the 2.40 μm albedo image; the drop into the 3 μm bound water band, i.e. the difference between the 2.40 μm and 3.01 μm images; the rise out of the 3 μm band, i.e. the difference between the 3.12 μm and the 3.01 μm images; and the 3.44 CO2 frost band. Four surface units are identifiable: a CO2 frost polar unit, a northern plains unit, an equatorial unit, and a southern highland unit. At this resolution, there does not appear to be any latitudinal variation with the 3 μm band that is independent of albedo units at 2.4 μm. The northern plains unit and southern highland unit have similar slopes rising out of the 3 μm band but different albedos. The equatorial unit has a distinct color which may be compositional. The 3.4 μm CO2 frost band allows for easy identification of the extent of any CO2 frost deposit. The southern polar cap is clearly absent in the images at 3.44 μm. No absorption feature is detected at 4 μm which would indicate carbonates. There is no spectral indication of water ice in the south polar cap. Additionally, at the spatial resolution of the images, no optically thick water ice clouds can be seen.

Note. More images of Mars were taken Jan. 2 - 4, 1991 using the same instrument. A comparison to the June images will be undertaken to look for seasonal variations by the time of the conference.

Figure 1. North-South transects through the South Pole of Mars illustrating the change in contrast between the classical visible albedo features which are still very apparent at 2.4 μm (a), but decrease at longer wavelengths 3.0 μm and 3.6 μm (b and c).



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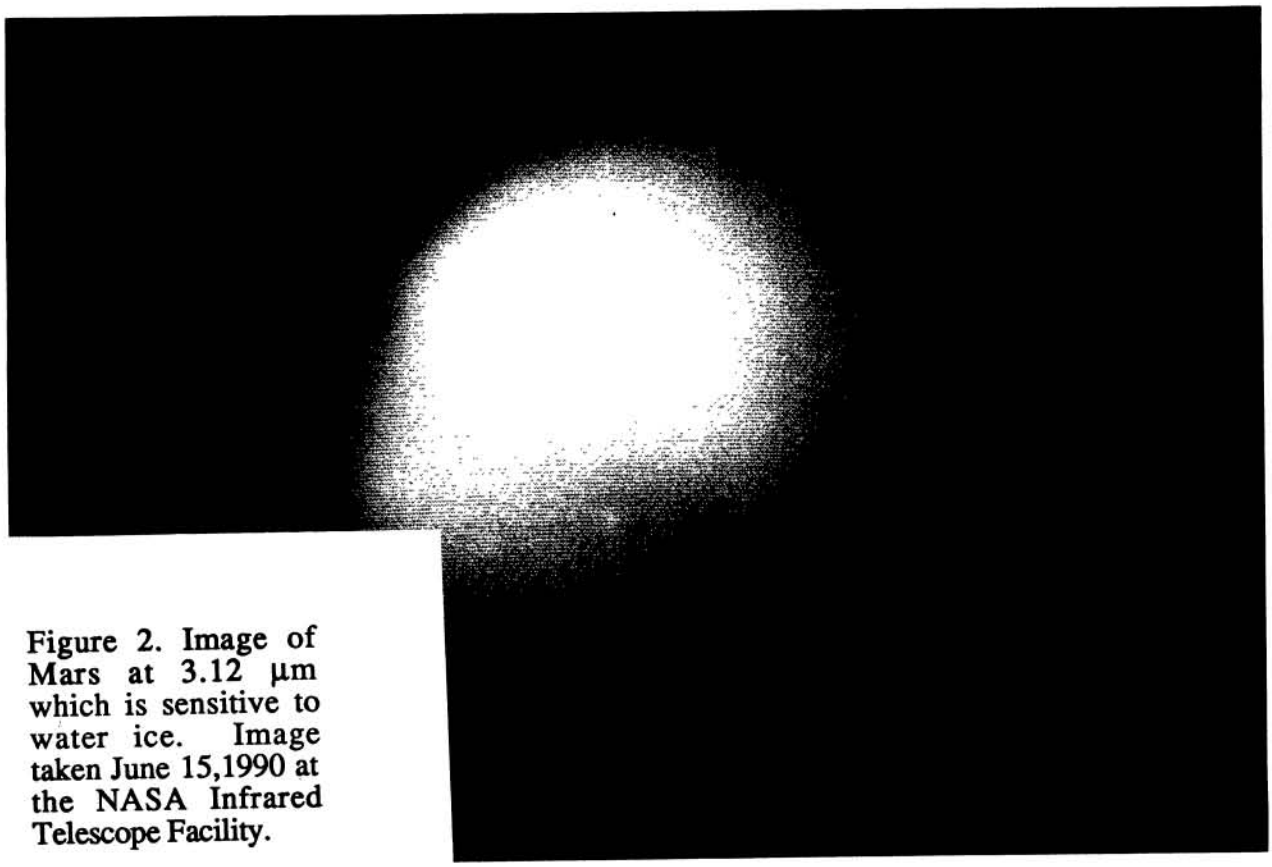

Figure 2. Image of Mars at 3.12 μm which is sensitive to water ice. Image taken June 15,1990 at the NASA Infrared Telescope Facility.

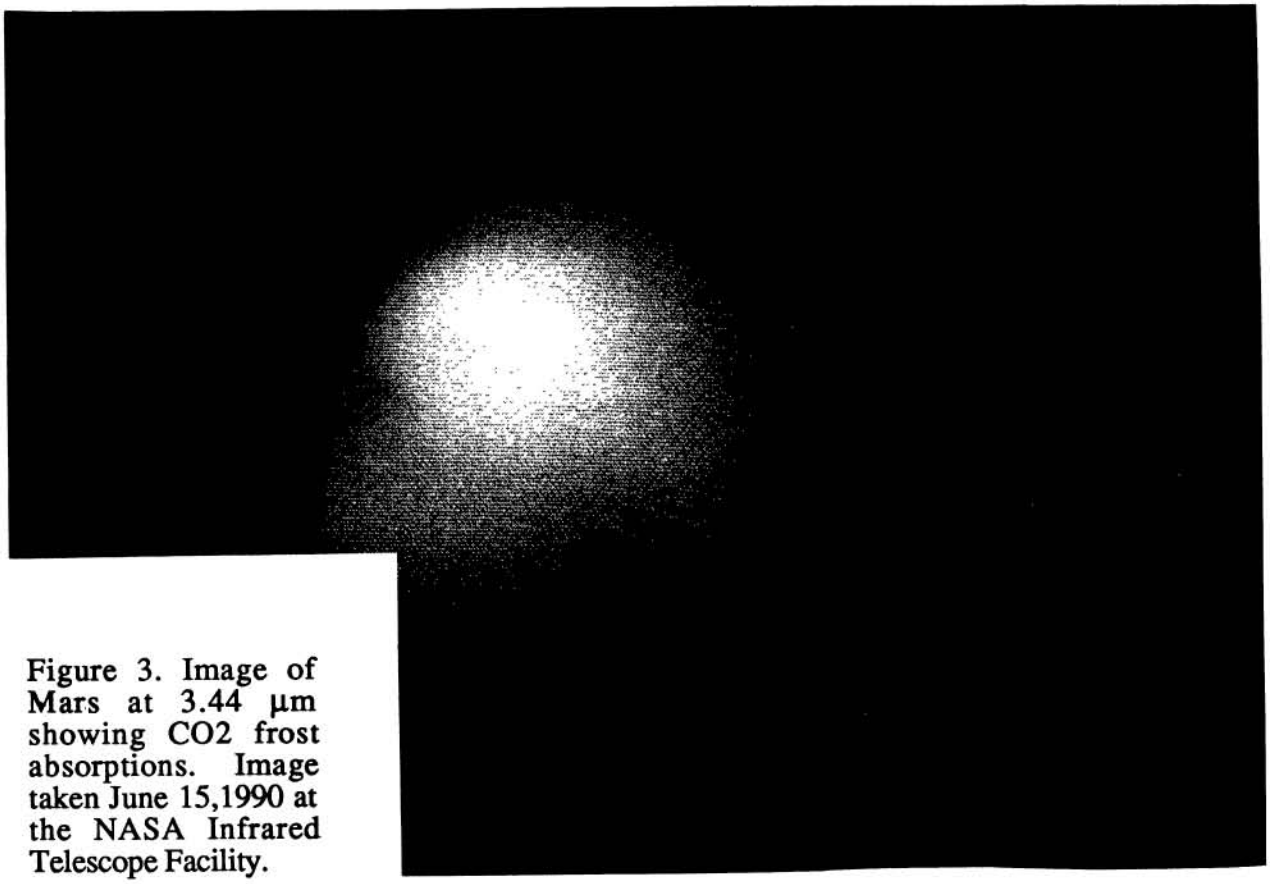

Figure 3. Image of Mars at 3.44 μm showing CO2 frost absorptions. Image taken June 15,1990 at the NASA Infrared Telescope Facility.

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