

Near-Infrared Spectroscopic Imaging of Mars' South Polar Cap

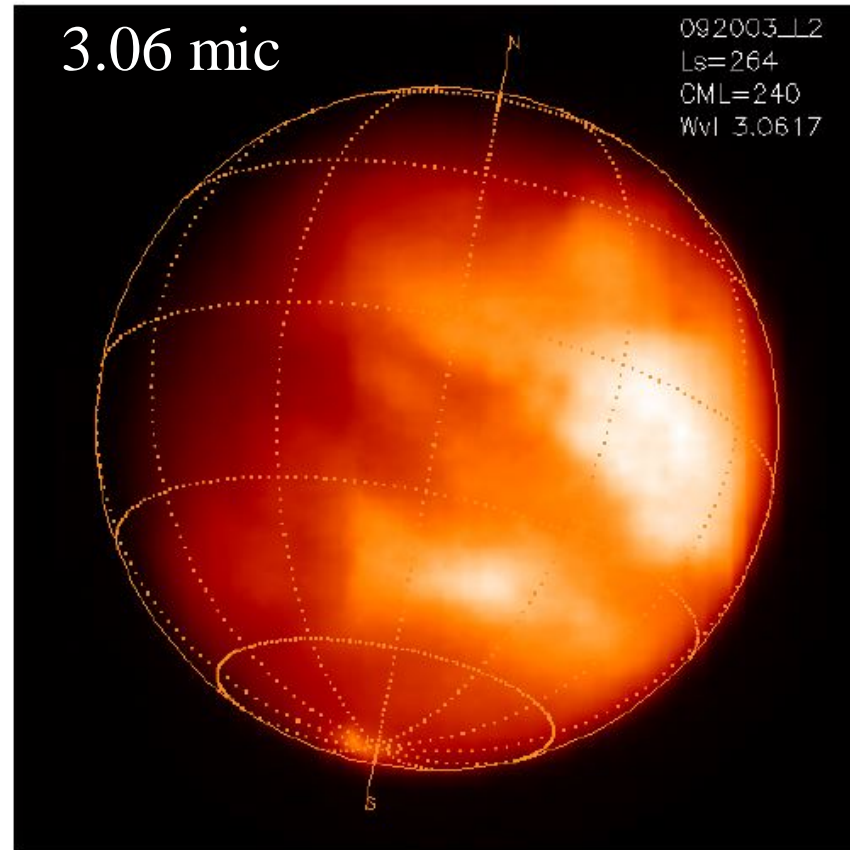
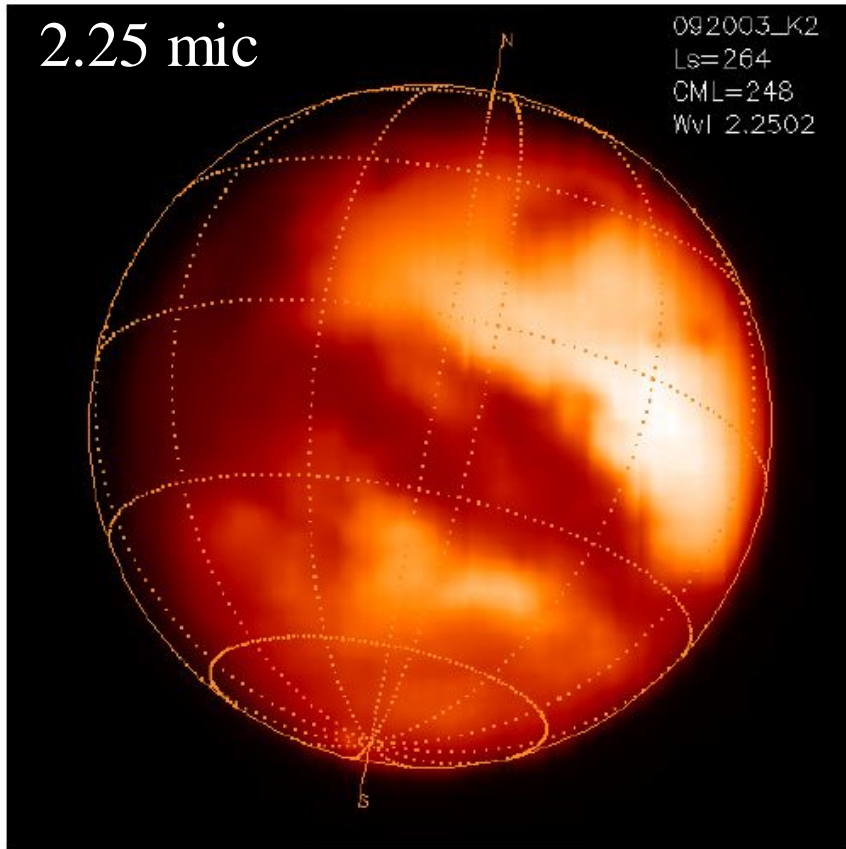
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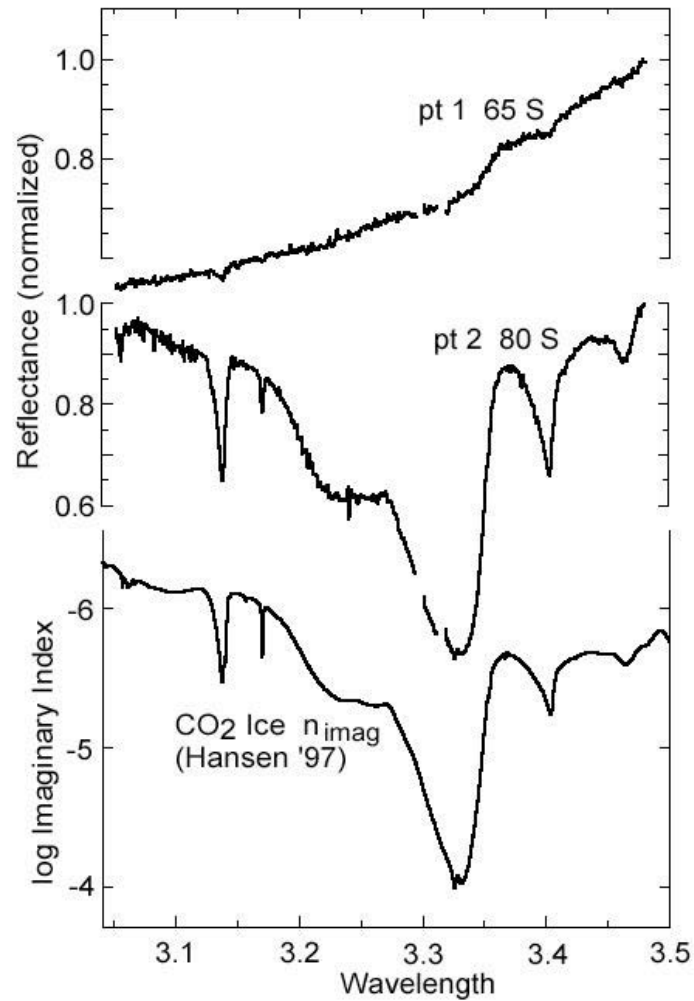
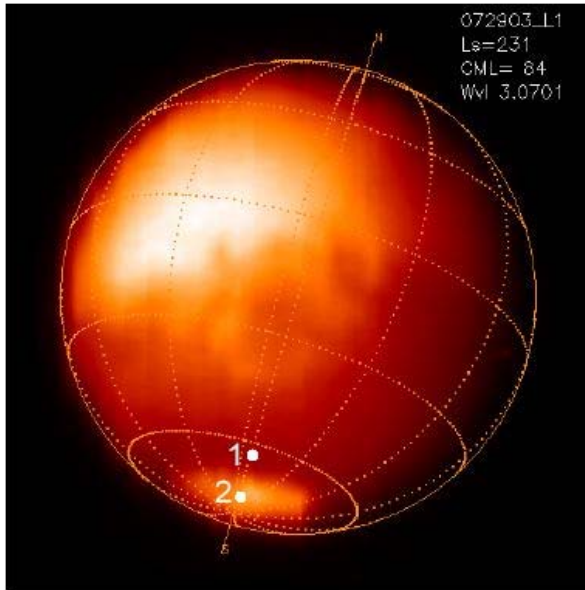
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D.A. Glenar et al. 2004, Icarus, submitted. “Bright-Region Radiative Properties within the Mars South Polar Cap (Ls=231) from Near-Infrared Spectroscopic Imaging

- Observed Mars with SpeX during the 2003 opposition. Image cubes were obtained by scanning the slit across Mars.
- The observations were motivated by the need to understand the annual changes in the polar cap. Annual polar cap seems to be independent of the amount of dust in the atmosphere. To understand this it is necessary to have knowledge of the "grain size" (the photon path length between scattering events), concentrations of admixed dust and water ice, and the surface albedo spectrum. Such information is provided by SpeX.



2.25 and 3.06 μm images from two of the Sep. 2003 data cubes (Ls= 264). The perennial polar cap shows up clearly in the 3.06 μm image. Spatial resolution is 150 km or better at the sub-Earth point.



Near-infrared south polar cap spectra at $L_s=231$. Left: Monochromatic image at $3.07 \mu\text{m}$ showing maximum contrast between the polar cap and bare soil. Right: Spectra of a high albedo region and an off-cap reference position near the central meridian (dot positions). Laboratory ice absorption-coefficient spectra (Hansen 1997) are added for comparison.

Results:

- Ice grain radii of 10-15 μm yield a good fit to the observations.
- Evidence is found for a distribution of photon path lengths within the ice that might be better represented by a multi-modal grain size model.
- Dust and water ice concentrations are found to be 0.002-0.007 wt % and 0.002 wt % respectively. The latter is consistent with southern hemisphere water vapor abundances measured by MGS/TES during the cap condensation season.
- A representative spectral (1-10 μm) surface albedo for the bright region was determined-- to be used in modeling the annual polar cap behavior.