**ANALYSIS OF MARS HST OBSERVATIONS.** P. H. Smith,[1] B. J. Bos,[1] M. Lemmon,[1] G. P. McStroul,[1] R. J. Reid[1]. [1]Lunar and Planetary Laboratory, University of Arizona, P.O. Box 210092, 1629 E. University Boulevard, Tucson, AZ 85721. (psmith@lpl.arizona.edu)

**Introduction:** During the 1997 Mars opposition, several observations of Mars were obtained with the Wide Field/Planetary Camera 2 (WFPC2) of the Hubble Space Telescope (HST). We have analyzed two sets of those observations obtained on March 30 and March 31 of 1997 as part of HST GO Programs 6741 and 6793. Our analysis has included a search for evidence of the coarse-grained hematite deposit reported by the Mars Global Surveyor Thermal Emission Spectrometer (TES) as well as other materials [1]. Although no compelling evidence has verified the TES discovery, spectral signatures have been identified at other locations on the Martian disk that may be consistent with coarse-grained hematite.

**Background:** The combined data set of HST GO Programs 6741 and 6793 consists of 18 Planetary Camera (PC) images of Mars. The exposures were obtained on two consecutive days in 16 different filters. The filters cover the wavelength range from 255 nm to 1020 nm.

Due to the rather large calibration uncertainties for some of the filters, the linear ramp filters (LRF) in particular, each image was normalized by its total Martian disk DN average. This allowed us to search for subtle local differences in the spectra of certain Martian regions relative to the overall spectrum.

The data set also required post-registration of the images due to the rotation of Mars between the exposures. We registered the 18 images based on the known sub-earth locations on Mars in each exposure and the time between them. We believe that this method of registration achieved reasonably good image registration across the entire visible disk except for portions near the edge. The maximum registration error was approximately 0.5-1.5 pixels.

**Analyses and Results:** One of our primary methods of data analysis involved fitting a second order polynomial function to the last five bands in the data set (763.2 nm, 833.1 nm, 892.9 nm, 954.5 nm, and 1018.4 nm) at each pixel on the Martian disk. Each pixel was then classified according to the wavelength location of the peak or trough of its polynomial function. Figure 1 shows the classified image. Yellow regions are areas whose spectra show a dip in reflectance in the 810-910 nm range as one might expect for coarse-grained hematite. The TES hematite location did not meet this criterion for a potential hematite spectrum. Figure 2 compares the spectra of two pixels from different yellow regions with one from a magenta colored region.

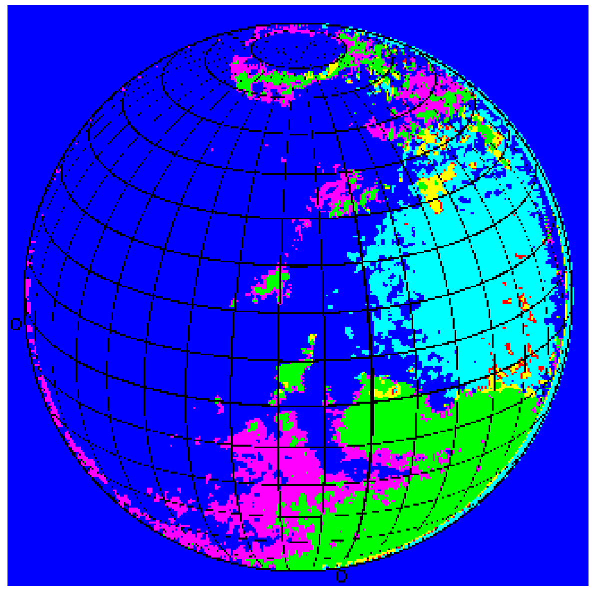

Figure 1. Classification based on the extremum location of a $2^{nd}$ order polynomial function: 763 nm<red<810 nm, 810 nm<yellow<910 nm, 910 nm<green<980 nm, 980 nm<magenta<1042 nm, light blue<763 nm, dark blue> 1042 nm.

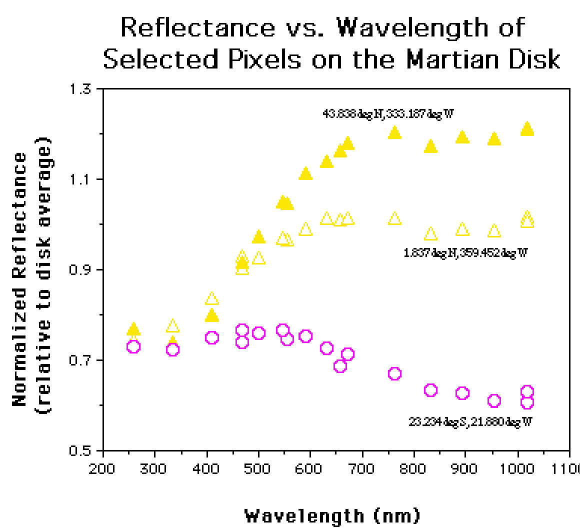


Figure 2. Plot comparing the spectra from two different yellow classes and a magenta class on the Martian disk.

We also performed principal components (PC) transformations on the data set to better understand the sources of variance in the HST images and to remove the overall albedo from the material signatures. The PC analysis has allowed us to easier detect sources of error in the images. For instance, one possible reason for the failed detection of the TES hematite site could be due to the presence of cloud cover over that location. Another potential complication in interpreting the HST data was seen in striping due to errors in the flat-fields. We expect more interesting results and better interpretations of the data set with further work in the PC space.

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**References:**

[1] http://emma.la.asu.edu/webdata/hematitpr.html.