Geophysical Research Abstracts, Vol. 7, 09411, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09411

Diversity of the Martian Surface Photometric Properties.

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In the past, reflectance measurements of selected rocks and soils over a wide range of illumination geometries have been obtained by the Viking Lander, Mars Pathfinder and MER multispectral imaging facilities and provide local constraints on the interpretations of the physical and mineralogical nature of the Martian surface materials.

A new investigation from orbit that can be addressed from *Mars Express* (*MEx*) with the multi-angular *High Resolution Stereo Camera (HRSC)* dataset generated with the nadir-looking, stereo and photometric channels (i.e., 5 geometries acquired at 679nm), is to derive the surface photometric characteristics for mapping the variation of the soil/bedrock optical properties of Mars. In order to compensate the limited number of observational geometries associated with one HRSC acquisition, we combine at least two overlapping strips acquired at different times along the mission and so cover as much as possible the phase angle domain. Then, an inverse method optimizing the determination of the global set of Hapke parameters, developed and tested on experimental data produced with a laboratory wide-field multispectral imaging facility, is implemented on the HRSC orbital dataset [1,2]. It is found that 8 to 10 different angular configurations are sufficient for constraining in a satisfactory way the retrieval of the photometric quantities. However, given the phase angle coverage ranging typ-

ically between 30 and 60°, we cannot retrieve the parameters related to the opposition effect. Conversely, parameters b, c,describing the material properties through the particle phase function approximated by the double Henyey-Greenstein function ($b$determines the phase function form and$c$the forward / backward scattering behavior), the surface roughness θ parameter and the single scattering albedo w appear to be well determined.

First regional surveys of the photometric properties are carried out on various types of martian surfaces, with a medium resolution cell comprised between 1.6x1.6 and 0.4 x 0.4 km^2. In this approach, the local variations of incidence and emission angles induced by the topographic variations are not yet taken into account but should be considered in the future when investigating either geological features with pronounced topography and/or when decreasing the spatial scale of the analysis. Under the present limitations, the results produced so far for the interior of Gusev crater [3], for local areas located within Syrtis Major and Hesperia Planum regions demonstrate that it can be used for characterizing the martian surface scattering properties through the atmosphere, as they reveal significant variations of the phase function parameters, surface roughness and texture in relation to the various investigated geologic surfaces. It shows that one may access from orbit to geology-driven surface photometric properties complementary to the TES and THEMIS thermophysical data.

References: [1] Cord A.M. et al. (2003), *Icarus , 165*, 414. [2] Pinet et al. (2005), LPSC 36^{th}, # 1721. [3] Pinet et al. (2005), this issue.