RETRIEVAL OF SURFACE LAMBERT ALBEDOS FROM THE MARS RECONNAISSANCE ORBITER CRISM DATA. P. C. McGuire[1], M. J. Wolff [2], R. E. Arvidson[1], M. D. Smith[3], R. T. Clancy[2,] S. L. Murchie[4], J. F. Mustard[5] , S. M. Pelkey[5], T. Z. Martin[6] and the MRO/CRISM Team, [1]McDonnell Center for the Space Sciences, Dept. of Earth & Planetary Sciences and Dept. of Physics, Campus Box 1169, Washington University, Saint Louis, MO 63130, Email: mcguire@wunder.wustl.edu, [2]Space Science Institute, 4750 Walnut Street, Suite 205, Boulder, CO 80301, [3]NASA Goddard Space Flight Center, Mail Code 693, Greenbelt, MD 20771, [4]Applied Physics Laboratory, Laurel, MD 20723, [5]Department of Geological Sciences, Box 1846, Brown University, Providence, RI 02912, [6]Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena CA 91109.

Introduction: By November 2006, the CRISM hyperspectral imager [1] on the Mars Reconnaissance Orbiter (MRO) will begin acquiring hyperspectral image cubes of the martian surface and atmosphere. The intent of this abstract is to outline an approach for extracting surface Lambert Albedos from multispectral and targeted mode observations.

Observations: CRISM will produce four types of observations:

- Targeted mode imaging observations from 0.4 to 4.0 μm with 18 to 36 m/pixels, with accompanying emission phase function observations
- Multispectral window observations with ~100 m/pixel resolution and 70 spectral bands
- Multispectral mapping mode observations with ~200 m/pixel and 70 spectral bands
- Emission phase function observations acquired periodically and on gridded locations to characterize atmospheric properties

Standard and Special Products: The standard products to be released to the Planetary Data System will focus initially on image cubes with data values expressed as radiance. Ancillary files will be provided to allow users to do their own retrieval of atmospheric and surface properties. For the multispectral mapping data the Team will also produce map-projected estimates of radiance on sensor, using a map-tile scheme.

The non-map projected standard products form the input for further processing to retrieve surface Lambert Albedos, at first as a special or informal set of products designed for scientific analyses by the CRISM Team. The intent is to introduce retrieved surface albedo data sets as standard products for delivery to the Planetary Data System, if and when the products can be validated as scientifically useful and correct with a high degree of certainty.

Retrieval of Surface Lambert Albedos: Our approach is divided into two parallel paths: retrieval of Lambert Albedos for the 70 multispectral bands for the targeted, multispectral window, and multispectral mapping data sets, and use of the emission phase function observations for the targeted mode data to provide improved estimates of aerosol properties for use in the retrieval process.

Climatological tables will be built based on historical patterns and will allow for the retrieval of estimated optical depths of dust & ice aerosols, as well as surface temperature, indexed by the location and time of the observations. The surface temperature and the aerosol optical depths will be used, together with the measured radiance for each wavelength channel, to retrieve Lambert Albedo using a look-up table approach. The DISORT radiative transfer (RT) model [2] will be used to pre-compute a grid of models, which will then be used to map I/F-on-sensor to Lambert Albedo using a multi-dimensional linear interpolation algorithm. Specifically, the DISORT RT calculations will be compiled as a function of Lambert Albedo, dust and ice optical depths, lighting and viewing conditions, surface temperature, and standard atmospheric P,T conditions. Results will be put into radiative look-up tables and for each observation the relevant Lambert Albedo will be retrieved using the combination of the climatological and radiative tables. We will also experiment with use of a simple algorithm to predict long wavelength emissivity from Lambert Albedos extracted from shorter wavelengths in which solar radiation dominates.

For the targeted mode data we will incorporate the emission phase function observations to characterize ice and dust aerosols for a few wavelength channels. Results will be interpolated to the remainder of the targeted mode data wavelength channels to provide improved (relative to precomputed tables discussed above) estimates of aerosol optical depths. With better estimates of these properties, together with use of DISORT calculations and custom-generated radiative look-up tables, the intent is to retrieve surface Lambert Albedos for each of the 512 spectral bands.

As part of the systematic processing we also plan on computing summary spectral parameters from the Lambert albedo calculations [3].

References:

[1] Murchie, S. L, et al. (2002) *LPS XXXIII*, 1697.
[2] Stamnes, K. et al. Appl. Opt. 1988.
[3] Pelkey, S. M. et al. (2005) *LPS XXXVI*, 1458.