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Selected lunar craters as seen in joint data of SMART-1/SIR and Clementine/UVVIS/NIR

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During the last decade various missions to the moon have delivered a huge amount of data. By combining these data sets in a single scientific analysis we will be able to learn more about the lunar mineralogy. Selected observations of the SIR near-infrared point spectrometer on board SMART-1 with spectral range 0.9 to 2.4 microns are combined with ten-band spectra at 415, 750, 900, 950, 1000, 1100, 1250, 1500, 2000 and 2600 microns extracted from Clementine UVVIS and NIR images. By joining the low spectral resolution data of UVVIS and NIR with the high spectral resolution data of SIR, we are able to base our analysis of the lunar surface mineralogy on more spectral details. High spatial resolution images of Clementine [1,2] set up the geologic context for the SIR point spectra. Using the merits of both missions we can extend our knowledge about the mineralogy of lunar surface units. Especially for large craters with peaks, rings and complex wall structures the high spatial resolution of space based missions give the unique possibility to determine mineralogy of the diverse features they exhibit. With the new data source from SIR instrument, we may verify results about single mineralogy features [3] from special craters, such as Tsiolkovsky. Several orbits of SIR cross the walls, the floor and the peak of this big crater. Relative spectra of SIR observations and the corresponding relative spectra of UVVIS and NIR observations are compared. The Clementine NIR data set of 6 spectral bands from 1.1 to 2.78 microns can be used to check for the compatibility of Clementine and SIR observations.

Different photometric models were used for the reduction of the two instrument data sets to account for changing viewing conditions. The data sets exhibit a resolution of approximately 100 m for Clementine UVVIS and NIR images, and an orbit dependent resolution of SIR between 330 and 3000 m. Clementine image pixels are summed up to match the SIR footprint. At low resolution, small bright area features are hidden in the background of the common mineralogy of a site. Freshly exposed material of low maturity easier reveals its mineral content and is mostly found in confined areas like young craters. Thus providing us with a possibility to identify lunar minerals at small scale, directly by the absorption bands in their spectra and their relative reflectance, space missions with high spatial resolution give us a clear advantage to Earth-based telescope observations.

[1] http://starbase.jpl.nasa.gov/archive/clem1-l-u-5-dim-uvvis-v1.0

[2] ftp://pdsimage2.wr.usgs.gov/cdroms/clementine/Clem_NIR_V0.1

[3] C.M.Pieters, S.Tompkins, Journal of Geophysical Research, Vol. 104, page 21.935, 1999