High-temperature Spectroscopy in the Planetary Emissivity Laboratory of Dlr for Mertis on Bepicolombo

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Analyzing the surface composition of Mercury's regolith from remote-sensing measurements is a challenging task. In preparation for the Mercury Radiometer and Thermal Infrared Spectrometer (MERTIS) instrument on the BepiColombo mission of the European Space Agency and the Japan Aerospace Exploration Agency, and in support of the National Aeronautics and Space Agency's MErcury Surface, Space ENvironment, Geochemistry, and Ranging (MESSENGER) mission, we have completely refurbished the Planetary Emissivity Laboratory (PEL) at Deutsches Zentrum für Luft- und Raumfahrt (DLR) in Berlin.

MERTIS is a mapping thermal infrared spectrometer covering the wavelength range 7-14 µm with an integrated radiometer extending the wavelength coverage out to 40 µm. MERTIS will globally map the mineralogy of Mercury with a spatial resolution of 500 m in a spectral range not covered by MESSENGER.

To facilitate the data analysis of MERTIS, the PEL has been upgraded to allow measurement of the emissivity of Mercury-analogue materials at grain sizes smaller than 25 µm and at temperatures of more than 400°C, typical for Mercury's low-latitude dayside. The PEL development follows a multi-step approach. We have already obtained emissivity data at mid-infrared wavelengths that show significant changes in spectral behavior with temperature indicative of changes in the crystal structure of the samples. We have tested new calibration targets that will allow the acquisition of emissivity data over the full wavelength range from 1 to 50 µm with good signal-to-noise ratio. Currently we are in the final verification steps of the full setup.

In parallel with the laboratory work with are developing and testing data analysis techniques to deal with the wealth of data to be returned by MERTIS. We are currently focusing on approaches using clustering and neural network techniques. These approaches are being tested on our laboratory data as well as on visible and near-infrared spectral reflectance data returned by the MESSENGER spacecraft.

References

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