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The Status of the Mercury Thermal Radiometer and Thermal Infrared Spectrometer (MERTIS) for BepiColombo

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The Mercury Radiometer and Thermal Infrared Spectrometer (MERTIS) is one of the selected payloads of the ESA/JAXA BepiColombo mission, to be launched in 2016. The scientific objectives of MERTIS are to 1.) Study Mercury's surface composition, 2.) Identify rock-forming minerals, 3.) Map the surface mineralogy, and 4.) Study surface temperature variations and thermal inertia. The instrument consists of an uncooled grating push-broom IR-spectrometer (TIS) and a radiometer (TIR), which will operate in the wavelength regions of 7-14 μm and 7-40 μm, respectively [1,2]. From its nominal orbit, MERTIS will map the surface globally at a spatial resolution of about 500 m and for approximately 5-10% of the surface at a resolution of up to 280 m. MERTIS consists of more than 10 miniaturized, highly integrated subsystems, including mirror optics, two IR detectors (bolometer and radiometer) with read-out electronics, two actuators (pointing unit and shutter), two on-board blackbody calibration targets at 300 and 700 K, two baffles (planet, space), heater, temperature sensors, and two cold redundant instrument controllers and power supplies. We have built, calibrated, and delivered the MERTIS instrument to ESA. The Flight Model of the instrument is now fully functional and integrated on the spacecraft. In its flight configuration, MERTIS has a mass of less than 3.1 kg and during nominal science operations has a power consumption of 7.9 – 9.9 W. After calibration, the SNR of MERTIS is 266 at 8 μm wavelength and a temperature of the scene of 700 K and a dwell time of 100 ms [3,4]. With additional data processing on-board a higher SNR is expected. This is much better than the required SNR of >100, which is necessary to resolve mineral bands with low spectral contrast [1,5,6]. To alleviate the problem of limited downlink capabilities of BepiColombo, we have created a highly optimized operational scenario to reduce the MERTIS data rate by about 60% from the original plan. We also made progress with our laboratory programs in Münster and Berlin that produce reference spectra of Mercury-relevant minerals for the Berlin Emissivity Database (BED) [7,8]. In addition, temperature effects on the spectral information are studied in Berlin [9,10] and effects of space weathering are studied in Münster. We also developed thermal models of the lunar surface, which we now test and apply to the mercurian surface.

References:

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