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A visible/thermal radiation environment simulator for the BepiColombo Laser Altimeter

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BepiColombo is ESA's mission to the planet Mercury and is expected to launch in 2013. The payload will consist of two orbital elements: the Mercury Magnetospheric Orbiter (MMO) and Mercury Planetary Orbiter (MPO). The BepiColombo Laser Altimeter (BELA) is among the instruments that have been selected for flight aboard the MPO. The MPO will circle the planet in an elliptical, polar orbit with an altitude range of 400–1500 km and a 2.3 hr orbital period.

Mercury's proximity to the sun subjects the planet to intense solar fluxes (6.3–14.5 kW m^{-2}). These fluxes can lead to locally high planetary surface temperatures ($\sim$700 K). For some orbital configurations, direct solar fluxes or high thermal emission from the planet can enter the 5 and 20 cm apertures of the BELA transmitter and receiver, respectively. This raises concerns that thermal problems associated with these radiative loads might compromise instrument performance by causing, for example, transmitter/receiver misalignments, optical figure deformations, or permanent component damage. Consequently, we have constructed a thermal/visible radiation facility with which we can test individual prototype components, and eventually the integrated instrument, for such problems.

The facility consists of a vacuum chamber with a heating panel ($T \leq 300$ C) to simulate the hot hermean surface, a temperature-controlled shroud to simulate the radiative spacecraft environment, a temperature-controlled mounting plate to simulate the spacecraft platform, and a 2.5 kW xenon lamp to simulate the solar flux with a 30 cm diameter beam. We present models of the time-dependent visible/IR fluxes, a description of the Mercury environment simulator, and a discussion of the simulator's ability to achieve the modeled fluxes.