



Numerical modeling of the BepiColombo Laser Altimeter performance

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BepiColombo is ESA's mission to the planet Mercury and is expected to launch in 2012. 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 proposed for flight aboard the MPO. By measuring the round trip travel time of laser pulses to the Hermean surface, BELA will determine the distance between the MPO and the surface along the altimeter's optical axis. These data will enable the construction of full-surface topographical maps of the planet which, from large scale surface figure measurements to more localized signatures of cratering or possibly volcanism, could provide a wealth of information pertaining to Mercury's structure and evolution. Additionally, examination of return pulse shapes could provide data about small scale surface properties such as mineralogy or roughness within the laser footprint. BELA uses a pulsed Nd:YAG laser transmitter and a reflective receiver telescope to feed a silicon avalanche photodiode through a narrow bandpass filter in order to capture and time tag laser pulse echoes. The specification of design parameters for these components is intended to support topographic mapping of Mercury over one Earth year with meter scale range accuracy. Because altimeter performance is influenced by a variety of hardware and environmental factors, and because the competition between these influences is not always intuitive, we have developed a numerical model to assist with instrument evaluation and parameter selection. We present a description of the model, some output for the nominal parameter set, and estimates of predicted flight performance.