



Combined MLA and BELA altimetry crossover analyses for Mercury geodesy and interior studies

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The Mercury Laser Altimeter (MLA) on board of the Mercury Surface, Space Environment, Geochemistry and Ranging (MESSENGER) mission provided the first high-resolution topographic models and geodetic insights about Mercury's internal structure, though its data was mainly limited to the northern hemisphere. The BepiColombo Laser Altimeter (BELA) will offer complementary global altimetry coverage due to its near-circular orbit. As a result, combining observations from MLA and BELA could significantly improve our knowledge of the geodetic parameters of Mercury, and help solve current open questions on its internal structure and composition.

We present expected improvements on Mercury's geodetic parameters, such as obliquity, librations, rotation rate, and radial displacement Love number h_2 , by comparing crossovers-based solutions for these parameters within consistent closed-loop simulations of MLA and BELA altimetry data. Our simulations incorporate realistic altimetric ranges to available DEMs (enhanced with synthetic sub-resolution features), orbital dynamics, and perturbations.

We also discuss the benefits of cross-dataset crossovers (i.e., consisting of a BELA track crossing with an MLA track), in particular to densify the sparse set of crossovers resulting from each mission at low latitudes

While this approach is mainly applicable to the northern hemisphere, it results in reduced uncertainties that are then mapped through Markov Chain Monte Carlo analysis to improve constraints on plausible internal structure models for Mercury.