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Estimating fundamental physics parameters through a combined analysis of future planetary missions.

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The modeling of the solar system evolution relies on the knowledge of parameters related to helio- and fundamental physics, such as the Nordtvedt parameter (η), the temporal variation of the solar gravitational constant (GM), and coefficients (e.g., β and γ) of the Parameterized Post-Newtonian (PPN) formalism for Einstein's theory of General Relativity. The enhancement of spacecraft tracking performances experienced in the last number of years has made the precise estimation of these parameters possible. Important goals have been achieved with past planetary missions (e.g., Cassini and MESSENGER) and more exciting results are expected from the BepiColombo mission, which will guarantee unprecedented accuracies for microwave systems.

A planetary mission aimed at enhancing the estimation performances of heliophysics and relativistic parameters even further would require measurements over long temporal scales (>3-4 years). We present here a strategy to overcome this limitation based on the combined analysis of tracking data from missions that have already been launched or planned for launch in the near future. The simultaneous analysis of radio tracking data acquired in very different geometrical configurations has the twofold advantage of augmenting the spatial baseline and reducing the correlations between adjusted parameters in the dynamical model.

We present the results of our numerical simulations that account for several different configurations involving orbiters and landers.