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Heliophysics and Space Weather: Integrating Data, Expanding Horizons

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Space Weather represents a "science with applications" that inherently requires the integration of various areas of study and expertise for a detailed description of the physical parameters characterizing interplanetary space and its interaction with the planetary environment. The scientific component of this discipline, heliophysics, is currently seeking new data to improve short and long-term forecasts and further test our understanding of scientific fundamentals. Indeed, in many cases, the availability and quality of data are not sufficient to validate the models developed by the scientific community to address the remaining open questions (e.g., magnetic reconnection, coronal heating, particle acceleration, and magnetic field transport).
In the coming years, significant progress can be anticipated, driven by the launch of new space missions, the construction of new ground-based infrastructures, and a paradigm shift in data access. Large national research centres will collaborate to standardize and make available interdisciplinary datasets. New, broader, and more detailed datasets will open up new opportunities for the application of advanced methodologies, such as Machine Learning, already used with significant success for Space Weather event prediction, and will support the expansion of the discipline towards Planetary Space Weather and the study of planetary habitability in relation to stellar activity.

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