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Next generation of space physics missions: Multipoint magnetic field and plasma parameters measurements in the solar wind

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This paper has the objective to discus the technical-scientific feasibility of a Deep Space mission to be proposed to the Brazilian Space Agency (AEB) in 2005. This mission will be proposed to study the interplanetary magnetic field and the plasma structure of the solar wind. It will consist of a set of identical spacecraft flying in formation in the inner heliosphere during the ascending and maximum phase of the solar cycle 24. It is know that the primary cause of magnetic storms are intense, long duration southward interplanetary magnetic field structures which interconnect with the Earth's magnetic field and allow solar wind energy transport into the Earth's magnetotail/magnetosphere. During the most active phase of the solar cycle, solar maximum, the sun's activity is dominated by flares and disappearing filaments, and their concomitant Coronal Mass Ejections (CMEs). Coronal Holes are present, but the holes are small and do not extend from the poles to the equator as often happens in the descending phase of the solar cycle. The fast (> 500 km/s) CMEs coming from the sun into the interplanetary space are the solar/coronal features that contain high magnetic fields. These intense southward magnetic fields are observed in the sheath, in the ejection itself and in the rear of the ejection. The interaction between CMEs and the background solar wind, fast co rotating streams and other CMEs are also very important sources of intense southward magnetic fields. In order to study the interplanetary origin of intense geomagnetic storms, several studies have analyzed plasma parameters, composition, ionization state and the interplanetary magnetic field measured by instruments on board of spacecraft as ISEE3, IMP8, Helios, Ulysses, Wind, SOHO and ACE. Great advance on the understanding of the CME structure and interaction with the background solar wind have been reached. However, the spatial scale of these structures could be greater than 0.2 AU, and this kind of observation usually allows just one line of view as the structure pass throughout the spacecraft. In order to improve our knowledge of solar wind structure and its dynamics it is necessary to measure the spatial structure of the interplanetary magnetic field and plasma parameters. We will discuss the scientific questions and objectives of the mission, possible target regions in space and the payload instrumentation and measurement requirements. The determination of the number of spacecraft, their configuration and the costs of this mission will not be discussed here.

Keywords: **solar wind**, **interplanetary magnetic field**, **space physics missions:**, **coronal mass ejections**, **deep space mission**, **plasma physics**

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