

Multidimensional analysis of electromagnetic fields

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Abstract

Multidimensional measurements of electromagnetic fields in space plasmas can be processed by various methods to obtain information about the polarization and propagation properties of the corresponding wave modes. New developments are planned in the frame of EPN-2020-RI.

1. Introduction

New developments will be based on a set of multidimensional methods for electromagnetic fields which have been previously used for analysis of data from

- STAFF-SA instrument onboard the Cluster spacecraft
- STAFF/DWP instrument onboard the Double Star TC-1 spacecraft
- LFEW instrument onboard the Double Star polar TC-2 spacecraft
- Cassini RPWS data
- IMSC and ICE instruments on the DEMETER spacecraft
- Polar PWI-HFWR data
- Van Allen Probes EMFISIS data

A demonstrator for multi-dimensional spectral analysis of electromagnetic fields has been developed in the frame of the demonstrator for on-line data analysis and related visualization tools of the EuroPlaNet-RI project.

2. Spectral matrix analyser

The Spectral matrix (SM) analyzer will be a tool designed to analyze multi-component measurements of electromagnetic waves. It will implement a number of methods used to estimate polarization and propagation parameters, such as

- the degree of polarization,
- sense of elliptic polarization and
- axes of polarization ellipse,
- the wave vector direction,
- the Poynting vector,

The results will be represented in different visual and numerical formats.

3. Summary

Dedicated set of methods for multi-dimensional analysis will be used to calculate characteristics of electromagnetic waves from in-situ spacecraft measurements that are the key signatures of fundamental process in the solar wind and planetary magnetospheres. These methods will be developed into a part of coordinated data analysis service.

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