A Space and Solar Physics Data Model

from the SPASE Consortium

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1. Executive Summary

The Solar and Space Physics communities need a unified data environment to facilitate finding, retrieving, formatting, and obtaining basic information about data essential for their research. With the increasing requirement for data from multiple sources, this need has become acute. A unified method to describe data and other resources is the key to achieving this unified environment. The SPASE (Space Physics Archive Search and Extract) Data Model provides a basic set of terms and values organised in a simple and homogeneous way, to facilitate access to Solar and Space Physics resources. The SPASE Data Model is comparable to the data models developed by the Planetary Data System (PDS) and the International Virtual Observatory Alliance (IVOA) for planetary and astronomical data, respectively. The SPASE Model will provide the detailed information at the parameter level required for Solar and Space Physics applications.

The SPASE consortium is an international team of space and solar physicists and information scientists. It first examined many existing data models, but found none to be adequate. A set of terms based on a half-dozen or so of the most complete of such models was refined based on applying the model at various levels of detail to a large number of existing products to arrive at the current version. The major creators of SPASE-based product descriptions are expected to be domain-based Virtual Observatories ("VxOs"), data centers, and individual data and model providers. The SPASE Data Model will continue to evolve in a controlled way as data and service providers and benefiting researchers suggest improvements to extend its framework of common standards. Success of the model will be measured by the extent of community support and use.

The present Data Model provides enough detail to allow a scientist to understand the content of Data Products (e.g., a set of files for 3 second resolution Geotail magnetic field data for1992 to 2005), together with essential retrieval and contact information. A typical use would be to have a collection of descriptions stored in one or more related internet-based registries of products; these could be queried with specifically designed search engines which link users to the data they need. The Data Model also provides constructs for describing components of a data delivery system. This includes repositories, registries and services.

This document provides potential users of SPASE with the Data Model for review and use. Sections 2 and 3 provide an overview of the origins and the concepts of the data model. Section 4 presents the set of elements in a hierarchy that shows the natural relationships among them. This is followed by usage suggestion and pedagogic examples in Section 5 and 6, and by the complete set of definitions of terms and enumerated lists in Section 7.

2. Introduction

The Space and Solar Physics community is now addressing fundamental questions concerning the plasma and magnetic environment of the Sun, Heliosphere, and planets. We seek to understand everything from "microscopic" phenomena such as magnetic reconnection and turbulent energy dissipation to global issues such as how solar events are related to potentially damaging electric currents and energetic particles in the vicinity of the Earth. Multispacecraft and ground observatory investigations are becoming the norm, but there has been little corresponding unification of data access, formats and tools, resulting in a great deal of time being spent finding, retrieving and reformatting data. The key to reducing this inefficiency is a uniform way to describe adequately what exists. This is the purpose of the SPASE Data Model, which is intended to do for Space and Solar Physics what the Planetary Data System (PDS) is doing for Planetary Science, and what the International Virtual Observatory Alliance (IVOA) is doing for Astronomy and Astrophysics.

Astronomy, Planetary Science, and Space and Solar Physics have developed their data models with different objectives and constraints. Astronomy has objects defined by their direction, and makes much use of standard formats; PDS was developed for long-term archiving; while SPASE is oriented towards data searching and exploitation. PDS often does a better job of describing technical information such as how the data were processed, the form of the data etc., while SPASE includes a better physical description, which facilitates rapid data retrieval and exploitation. Over time, the Astronomy, PDS, and SPASE models may converge. The increasing use of, for example, time series in Astronomy and images in Space Physics may lead to stronger connections between the efforts in these areas. There will also be a need for SPASE to understand Earth Science data models, as Space Weather studies reveal the coupling of the larger plasma environment to terrestrial effects.

2.1. What is a data model?

A data model is a set of terms and their relationships that capture the essential concepts of a given domain. The Data Model presented here can be used to describe the scientific relevance of products resulting from observation and modeling in the domain of solar and space physics. These products typically consist of related collections of files that will be accessed, in whole or in part, by science users. Types of products include numerical datasets, display data plots, images, software, documentation, and event lists ("catalogues"). Products are a subset of a larger class of "Resources" that includes Spacecraft, Instruments, Repositories, and even People, that can be described by their own set of terms, and then referred to in product descriptions, rather than being repeatedly described in each product. This data model includes terms relevant to all "Sun-Earth Connection" domains, but it does not try to systematically include Earth Science terms. We also defer to later the question of a uniform description of "service resources" such as web-based format translators or display tools. We initially intend a level of description that will allow a scientist to use the data retrieved, and will add later a set of terms to describe specific access methods for direct data retrieval. At all stages, broad community input and feedback is essential.

2.2. What is its use?

The Data Model provides a set of terms that, ideally, can be mapped onto the terms used for specific products, thus providing a uniform means of access and description. The data model is intended to provide the cornerstone of one or more "Virtual Observatories" that will link broad ranges of solar and space physics in a natural way. More specifically, the data model should:

(1) Provide a way of registering products using a standard set of terms that allow the products to be found with simple searches and described so that users can determine their utility for a specific purpose;

(2) Allow searching for products containing particular physical quantities (e.g., magnetic field; spectral irradiance) that are variously represented in a diverse array of data products; and

(3) Create a means of mapping comparable variables from many products onto a common set of terms so that visualization, analysis, and higher-order query tools and services can be used on all of them without regard to the origin of the data.

The accomplishment of these tasks requires "middleware" (either at the provider or in a VxO) that understands product registries and performs the translations needed to map the idiosyncratic product and parameter names of each repository onto the standard terms. This intermediate layer, which can take many forms for different purposes, will provide the links necessary to connect user applications and search-and-retrieval front ends to data repositories. Ultimately, the data environment centered on the data model will involve a number of software tools as well, linked together as internet-based services or other means. Specific software tools and documentation associated with products will be straightforwardly accessible. This "system" has the potential to provide capabilities that can aid even expert users of a particular dataset (e.g., on-the-fly coordinate transformations, the ability to merge datasets from different instruments, easy reference to related indices or other data), in addition to providing the broad access needed to solve global problems in Sun-Earth connection physics. Success will require a concerted cooperative effort across disciplines. Existing efforts in Space and Solar Physics as well as in other areas such as Earth and Planetary Sciences and Astronomy will guide the work.

2.3. What process led to the current Data Model?

The data model presented here has grown from the efforts begun in 2002 that became formalized in regular teleconferences of a group of interested data providers, including scientific and technical representatives of some of the largest data holdings in the US, Europe, and Japan. As the effort to provide seamless access to distributed data proceeded, it became clear that the data model efforts were central. Thus, in March of 2003 a meeting of many of the people in the Contributors list at the beginning of this document was convened to begin the data model construction in earnest. The initial effort involved collecting terms from CDPP, SWRI, NSSDC, ISTP, and other sets to form a starting point. Two years of teleconferences, e-mailed revisions, and occasional face-to-face efforts, along with the application of the terms to specific cases, led to the release of version 1.0 of the data in November 2005. The version of the data model described in this document is an extension of this earlier release.

The general philosophy of the Data Model is to describe products using a natural taxonomy of data sources and of the physical world as represented in actual or potential datasets and models. The resulting Data Model has been put to many tests, but will have to evolve as new products are considered.

2.4. The Data Model in a Virtual Observatory context

The current conceptual model is intended to serve as the basis for interoperability between independent data systems. It is an attempt to capture the various concepts that are used to represent the knowledge to be shared in the Space and Solar Physics domains. These concepts are used to

convey queries and responses between the user and various remote data systems. Many such systems, in diverse fields, are now functioning or planned. The paradigm for this interoperability is the "Virtual Observatory", originally coined by the astronomical community as a way to allow any researcher, anywhere in the world, to access all known observations of a chosen patch of the sky using the Internet to query repositories of information distributed around the world at data centers and observatories.

The concepts presented in this document are independent of any implementation, but we have in mind a likely map of the eventual data environment. Figure 1 illustrates a possible architecture; the details will depend on the outcome of a number of current efforts and their coordination. The web site http://lwsde.gsfc.nasa.gov gives a guide to many currently active projects and a great deal of background information. Of particular interest there is the document entitled, "A Framework for Space and Solar Physics Virtual Observatories."

Figure 1 is very schematic, but the "Access Points" could be discipline specific "VxOs" that aggregate the repositories they serve, making them all appear as one. This is now done by the VSO for solar data. The VSO can then be treated as a repository by other services (VSPO and EGSO currently do this). The "Gateways" in the figure would be places where large numbers of products are registered with pointers to Access Points, Repositories, and other services (not shown) as needed. With the right connections and a common language, the data environment becomes very rich and flexible. Note that more conventional access to any of the Repositories could continue as before.

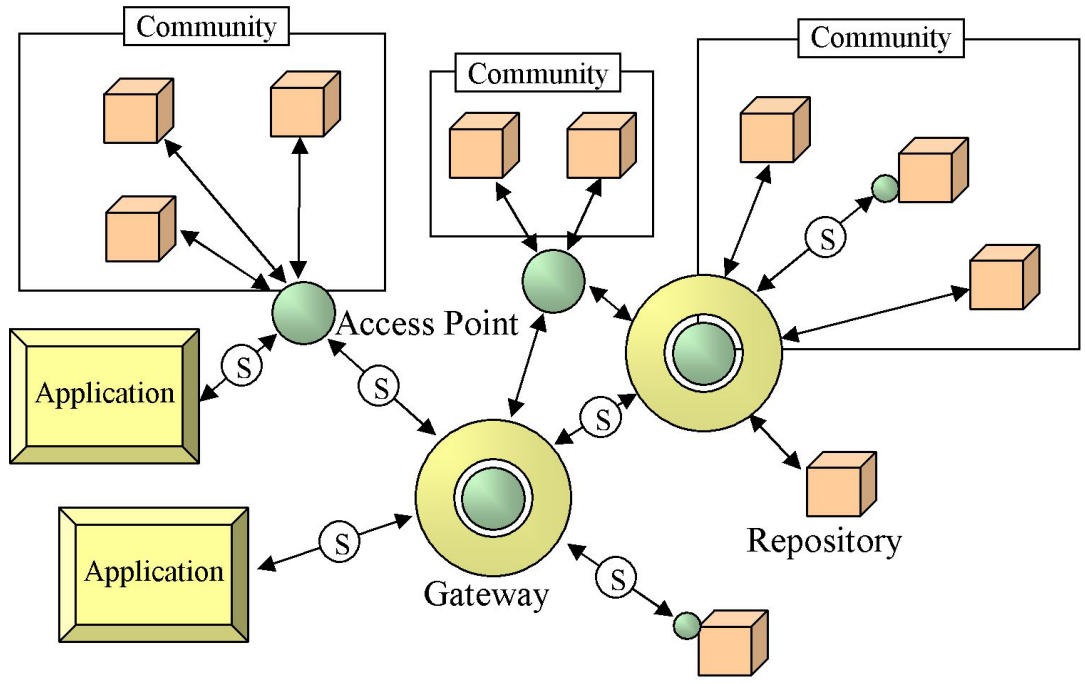


Figure 1: A possible data environment architecture. Information and data flows from Repositories to Applications through Access Points and Gateways. In this model, any Access Point or Gateway may be considered an instance of a Virtual Observatory. The portions of the system using SPASE-Data-Model-based messages are indicated with the Ⓢ.

A prototypical usage scenario is:

1. The scientist uses an application (e.g., a browser or IDL) to define his query in terms of the SPASE model.

2. The application contacts a relevant participating access point or gateway that may generate a response (e.g. URLs of files or services, or metadata about these), or may pass the query to other access points or gateways to obtain further information before responding to the query.

3. The application uses the replies either to present metadata to the user or to request the resource. A request may go directly to a repository or an access point, or may be routed through a gateway for additional services.

4. The requested resources might be processed in various ways at the repository, the access point, the gateway, or by a separate service. For example, the system may assemble a collection of resources, subset the data, generate a graphic, or reformat the resource prior to delivering it to the application.

We envision that different control authorities will maintain different aspects of the Data Model. For example, the list of observatory names is maintained by NSSDC, the definition of prime meridian used in describing local latitude and longitude is set by IAU, and the accepted format for time representation is defined by ISO. There will need to be a community-approved group to be the central authority on the Data Model; SPASE is currently serving as a prototype for this role.

It remains to be determined the extent to which registries of products will be centralized such that one location will contain the latest list obtained from registered data providers. There should be at least one common format for the exchange of product registries and metadata. An XML schema based format will likely provide the preferred method.

3. Data Model overview and general concepts

Special Note: In other data models what SPASE would call "granules" are sometimes referred to as "files" or "products"; and what SPASE refers to as a "product" is sometimes called "datasets".

As mentioned in the introduction, this Data Model focuses on describing Data Products, which are a subset of Resources. In general, each Resource Type consists of a similar collection of things that share a common descriptive hierarchy. Numerical Data and Display Data (pre-rendered Plots and Images based on data) are typically defined as collections of files that differ only in the time of the observations to which they refer. Note that what is delivered to the user may be generated dynamically from underlying files, and thus can be more variable: for a particular product, modes may change with time of observation, and calibrations with time of processing. Thus, in general, the delineation of a product is up to the providers. All of the terms in the Model require a precise definition to be useful, and these are provided in the Dictionary.

The SPASE Data Model describes Data Products by stating what was observed and where and when the data were obtained, as well as giving the source of the observations, and the location (repository), format and other technical aspects of the data. These descriptions are expressed using the appropriate Resource Type from the Data Model.

3.1. Resources

At the top level of the present Data Model is the Resource Type. These consist of the Product Types:

Numerical Data,
Display Data, and
Catalogue

and the Resource Types that support these:

Observatory,
Instrument,
Registry,
Repository,
Granule, and
Person.

Each of these types has its own set of terms. The present version of the dictionary provides a core set of terms that may be augmented by SPASE in the future. One method of providing external augmentation is through a URL that will provide the user with more information to supplement the metadata.

A set of Elements (the general model term for what could roughly be termed a keyword) is common to all Resource descriptions (with the exception of Granule and Person); they are grouped in a Resource Header, consisting primarily of:

Resource Name
Alternate Name
Release Date
Description
Acknowledgement
Contact
Information URL
Association ID

For Data Products, a similar set is grouped as Access Information, which can be replicated with the appropriate changes to describe copies of the product which may differ only in format, encoding or location. The Access Information provides the:

Repository ID
Availability
Access Rights
Access URL
Caveats
Format
Encoding
Acknowledgement

These general elements are often free text, although Instrument Name, Format, and various other terms are from well defined enumerated lists. Having enumerated lists will allow searches to be

more efficient, so that, for example, a simple query will isolate all registered products from a particular Region without worrying about many more-or- less equivalent terms.

3.2. Resource Identifiers

Every resource has a unique identifier so that it can tracked and referenced within a system. This identfier is defined by the authority for the resource. The entity which acts as the authority is determined by agency or group who provides the resource. Each resource identifier is a URI that has the form

scheme://authority/path

where "scheme" is "spase" for those resources administered through the SPASE framework, "authority" is the unique identifier for the name registry within the SPASE framework and "path" is the unique local identifier of the resource within the context of the "authority". The resource ID must be unique within the SPASE framework. This is assured as long as each "authority" is unique and each authority insures that the "path" is unique within its context.

To illustrate the definition of a resource identifier consider that there is a registered "authority" called "nssdc" which maintains information for spacecraft resources. One such spacecraft is GOES-8. Now "nssdc" decides that the "path" to the GOES-8 resource will be "GOES-8". So, the resource identifier would be:

spase://nssdc/GOES-8

It should then be possible in an operating system to provide the resource identifier to a service and that service would return the SPASE description of the resource.

3.3. Numerical Data Resources

Since Numerical Data resources are the key to most science investigations, our focus has been on providing a Data Model that will provide users with a means to exploit these data. It will be useful to agree on a uniform means for accessing the data (standard conventions for how to describe file naming and variable access methods), but initially our focus is on the scientific content of the data. We have initial sets of terms for the other Product Types, but these are less detailed; in many cases we expect much less detail will be needed even in the more final form.

The essential information for a Numerical Data resource description consists of what measured it, where to get it, its basic Measurement Type, whom to ask about it, and a few other simple descriptors. Of course, the more detailed the description, the more likely it is that users will understand what a product is and be more able and likely to use it.

Numerical Data resources (called "Datasets" in some systems) are described by the Headers plus other elements, including:

Observatory ID (link to Resource description)
Instrument ID (also a link)
Measurement Type (the general category, such as Thermal Plasma)
Temporal Description (time range available, resolution)
Instrument Region (where was the instrument)
Observed Region (the source of data)

Physical Parameter (very useful)

Other elements are part of a Numerical Data resource and can be used to provide additional details.

Each Physical Parameter is a description for a the physical quantity that the provider wishes to advertise in the product. This could consist of one entry describing image data as being a full-Sun image in white light, or it could contain many entries for the various parameters (density, temperature, velocity, variance in these, error bars, and quality flags) for a thermal plasma product. Each Physical Parameter would be described by a standard set of elements including:

Name
Parameter Key
Description
Caveats
Cadence
Units
Units Conversion
Coordinate System
Dimension
Measured
Support

Measured parameters are organized into four categories:

Photons: which are electromagnetic fields
Fields: distinguished from Photons by being measured as time series
Particles: which are forms of matter; and
Mixed: which are composite or derived quantities.

Support parameters are organized into three categories:

Positional: the location of a observation
Temporal: the time of a observation
Other: importan, but unclassified parameters

Each category has its own set of elements (and enumerated) lists based on the natural taxonomy of the physical world.

3.4. Display Data Resources

Display Data resources are very similar to Numerical Data resource, since they are based on the data, but are preprocessed images in, for example, JPEG, GIF or PNG format that show a picture of a graph or of an object or region. Generally these products will be summaries or browse-level images of data plots, so less detail will be needed in their description. The convention chosen here is that, for example, the FITS file containing the data for a solar H-alpha image is part of a Numerical Data Product, whereas a GIF or JPEG produced from that file, which is more difficult to use for quantitative purposes, is part of a Display Data Product. The Display Data resource can be associated (or coupled) to the Numerical Data resource by assigning the Resource ID of the Numerical Data resource to the Association ID in the Resource Header of Display Data resource.

3.5. Catalogue Resources

Catalogues can include complete listings of files and the times they cover, but this is not the main intent here. Rather, a Catalogue will typically consist of a set of start and stop times for "events" which can be anything from Coronal Mass Ejection occurrences in SOHO images, to intervals when data are available in a particular product, to identifications of when a spacecraft is in a particular region such as the Earth's magnetosheath. These types of catalogues are already being used for assistance in data searches by VSO and EGSO.

Another type of catalogue is one that provides summary or statistical information for a Numerical Data resource. In this case the catalogue can be associated with the Numerical Data resource by using the Association ID in the Resource Header.

3.6. Granules

Granules are a special type of resource which describes a piece of another resource such as a Numerical Data resource or Display Data resource. A Granule must reference which resource it is assocated with through its Parent ID element. The Granule inherits all the attributes of the parent resource.

3.7. Other Resource Types

The "nonproduct" Resource types are generally self-explanatory. They are:

Instrument
Observatory: A spacecraft, a cluster of spacecraft, groundbased chains, etc.
Person
Respository: A storage point for resources
Registry: An inventory of available resources
Service

3.8. Future Direction

Future versions of the SPASE Data Model will include terms for Software (tools for use of data), Models (physics- and empirically-based predictive schemes, often in the form of programs), Documents (focusing on support documents for other resources rather than on scientific papers) and other resources as the need arises.

3.9. General Considerations

The SPASE Entity-Relationship Tree of Section 3 has been produced from information held in a data base. This database also holds all the element definitions which are explained in Section 5 and tabulated in Section 6. From this database it is also possible to generate an XSD schema, which is the default encoding that has been developed for evaluating the Data Model. Thus, Resources are most naturally described by XML files, but this is not essential. The SPASE Data Model is implementation neutral and can be implemented using other grammars and technologies.

A PDF version of this document can be downloaded from the SPASE site, http://www.spase-group.org/

4. The Data Model presented hierarchically

The taxonomy tree shows the inter-relationship of elements in the data model. This provides a "big picture" view of the SPASE data model. This taxonomy is implementation neutral. Details for each element are contained in the data dictionary.

Notes: Occurence specifications are enclosed in parenthesis: 0 = optional, 1 = required, * = zero or more, + = 1 or more

```
+ Spase (1)
|       + Version (1)
|       + Catalog (*)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Access Information (1)
|       |       |       + Repository ID (1)
|       |       |       + Availability (0)
|       |       |       + Access Rights (0)
|       |       |       + Access URL (+)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Format (1)
|       |       |       + Encoding (0)
|       |       |       + Acknowledgement (0)
|       |       + Provider Resource Name (0)
|       |       + Provider Version (0)
|       |       + Instrument ID (*)
|       |       + Phenomenon Type (1)
|       |       + Time Span (0)
|       |       |       + Start Date (1)
|       |       |       + End Date (0)
|       |       |       + Relative End Date (0)
|       |       + Caveats (0)
|       |       + Keyword (*)
|       |       + Input Resource ID (+)
|       + Display Data (*)
|       |       + Resource ID (1)
```

```
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Access Information (1)
|       |       |       + Repository ID (1)
|       |       |       + Availability (0)
|       |       |       + Access Rights (0)
|       |       |       + Access URL (+)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Format (1)
|       |       |       + Encoding (0)
|       |       |       + Acknowledgement (0)
|       |       + Provider Resource Name (0)
|       |       + Provider Processing Level (0)
|       |       + Provider Version (0)
|       |       + Instrument ID (1)
|       |       + Measurement Type (+)
|       |       + Temporal Description (0)
|       |       |       + Time Span (1)
|       |       |       |       + Start Date (1)
|       |       |       |       + End Date (0)
|       |       |       |       + Relative End Date (0)
|       |       |       + Cadence (0)
|       |       |       + Exposure (0)
|       |       + Spectral Range (*)
|       |       + Display Cadence (0)
|       |       + Instrument Region (*)
|       |       + Observed Region (*)
|       |       + Caveats (0)
|       |       + Keyword (*)
|       |       + Input Resource ID (*)
|       + Numerical Data (*)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
```

```
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Access Information (1)
|       |       |       + Repository ID (1)
|       |       |       + Availability (0)
|       |       |       + Access Rights (0)
|       |       |       + Access URL (+)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Format (1)
|       |       |       + Encoding (0)
|       |       |       + Acknowledgement (0)
|       |       + Provider Resource Name (0)
|       |       + Provider Processing Level (0)
|       |       + Provider Version (0)
|       |       + Instrument ID (1)
|       |       + Measurement Type (+)
|       |       + Temporal Description (0)
|       |       |       + Time Span (1)
|       |       |       |       + Start Date (1)
|       |       |       |       + End Date (0)
|       |       |       |       + Relative End Date (0)
|       |       |       + Cadence (0)
|       |       |       + Exposure (0)
|       |       + Spectral Range (*)
|       |       + Instrument Region (*)
|       |       + Observed Region (*)
|       |       + Physical Parameter (+)
|       |       |       + Name (0)
|       |       |       + Parameter Key (1)
|       |       |       + Description (0)
|       |       |       + Caveats (0)
|       |       |       + Cadence (0)
|       |       |       + Units (0)
|       |       |       + Units Conversion (0)
|       |       |       + Coordinate System (0)
|       |       |       |       + Coordinate Representation (0)
|       |       |       |       + Coordinate System Name (0)
|       |       |       + Dimension (0)
|       |       |       |       + Size (1)
|       |       |       |       + Description (1)
|       |       |       + Measured (0)
|       |       |       |       + Field (0)
```

```
|       |       |       |       |       + Orientation (0)
|       |       |       |       |       + Field Qualifier (*)
|       |       |       |       |       + Field Quantity (1)
|       |       |       |       + Particle (0)
|       |       |       |       |       + Particle Type (+)
|       |       |       |       |       + Particle Qualifier (*)
|       |       |       |       |       + Particle Quantity (1)
|       |       |       |       |       + Atomic Number (*)
|       |       |       |       |       + Energy Range (0)
|       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       + High (0)
|       |       |       |       |       |       + Units (1)
|       |       |       |       |       |       + Bin (*)
|       |       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       |       + High (1)
|       |       |       |       |       + Azimuthal Angle Range (0)
|       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       + High (1)
|       |       |       |       |       |       + Units (0)
|       |       |       |       |       |       + Bin (*)
|       |       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       |       + High (1)
|       |       |       |       |       + Polar Angle Range (0)
|       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       + High (1)
|       |       |       |       |       |       + Units (0)
|       |       |       |       |       |       + Bin (0)
|       |       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       |       + High (1)
|       |       |       |       + Photon (0)
|       |       |       |       |       + Photon Qualifier (*)
|       |       |       |       |       + Photon Quantity (1)
|       |       |       |       |       + Frequency Range (0)
|       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       + High (0)
|       |       |       |       |       |       + Units (1)
|       |       |       |       |       |       + Bin (*)
|       |       |       |       |       |       |       + Low (1)
|       |       |       |       |       |       |       + High (1)
|       |       |       |       + Mixed (0)
|       |       |       + Support (0)
|       |       |       |       + Other (0)
|       |       |       |       + Positional (0)
|       |       |       |       |       + Orientation (+)
|       |       |       |       + Temporal (0)
|       |       + Caveats (0)
|       |       + Keyword (*)
|       |       + Input Resource ID (*)
|       + Granule (*)
|       |       + Resource ID (1)
|       |       + Release Date (1)
```

```
|       |       + Parent ID (1)
|       |       + URL (1)
|       |       + Start Date (1)
|       |       + Stop Date (1)
|       + Instrument (*)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Instrument Type (1)
|       |       + Investigation Name (1)
|       |       + Observatory ID (1)
|       |       + Caveats (1)
|       + Observatory (*)
|       |       + Resource ID (1)
|       |       + Resource Header (0)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Observatory Group (0)
|       + Person (*)
|       |       + Resource ID (1)
|       |       + Release Date (0)
|       |       + Person Name (0)
|       |       + Organization Name (1)
|       |       + Address (0)
|       |       + Email (*)
|       |       + Phone Number (*)
|       + Registry (*)
|       |       + Resource ID (1)
```

```
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       + Repository (*)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       + Service (*)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (1)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       + Access URL (1)
|       |       |       + Name (0)
|       |       |       + URL (1)
|       |       |       + Description (0)
```

5. Guidelines for Metadata Descriptions of Products

The following sections describe the details of the SPASE Data Model, especially the metadata used to describe data. There is a richness in the available metadata that allows very detailed descriptions of products. Many of the types of metadata may not apply in your case or you may not need much detail to adequately describe your data holdings. But it must be remembered that the better data are described, the easier they will be to use.

To determine what level of detail is needed, we recommend considering not only what the user needs to find the correct data, but also what is needed to know if the data will be useful for the requestor’s purpose. The user might get this information by contacting you, but if the data were moved somewhere else and only the data description were available to determine the utility, consider if the user would have sufficient information to know if this is the right data set and what problems might be associated with the use of these data. Documentation may be added as a Resource Type to a future version of the SPASE Data Model, but for now we recommend using "Information URLs," available for each resource, to provide links to more detailed information about data products and their sources.

In summary, products need not be described in minute detail, but users will need, at minimum, information for assessing what the data products represent and where to find them. Of course it is also useful to include information on how the data can be applied and common pitfalls in their use, but the first need is to make the products usefully visible.

6. Examples

As an example let us describe a person using SPASE metadata. This person is "John Smith" from Smith Foundation. While the SPASE data model is implementation neutral, XML representation is preferred. This example uses the SPASE XML form.

```
<?xml version="1.0" encoding="UTF-8" ?>
<Spase>
   <Person>
     <ResourceID>spase://person/jsmith@smith.org</ResourceID>
     <PersonName>John Smith</PersonName>
     <OrganizationName>Smith Foundation</OrganizationName>
     <Address>1 Main St., Smithville, MA</Address>
     <Email>jsmith@smith.org</Email>
     <PhoneNumber>1-800-555-1212</PhoneNumber>
  </Person>
</Spase>
```

For a more extensive example let us consider a collection of numerical data from the magnetometer on the ACE spacecraft. This data set has been averaged to 1 minute intervals (cadence) and spans the beginning of the mission to the end of 2004 (1997-09-01 through 2004-12-31). The ACE spacecraft orbits the L1 point between the Earth and the Sun. While the SPASE data model is implementation neutral, XML representation is preferred. This example uses the SPASE XML form. The presented URLs are fictitious and will not direct you to the actual data.

```
<?xml version="1.0" encoding="UTF-8" ?>
<Spase>
  <version>1.1.0</version>
  <NumericalData>
     <ResourceID>spase://UCLA/ACEMAG200301</ResourceID>
     <ReleaseDate>2006-07-26T00:00:00.000</ReleaseDate>
     <ResourceHeader>
        <ResourceName>ACEMAG200301</ResourceName>
        <Acknowledgement>
           User will acknowledge the data producer and instrument P.I. in any

           publication resulting from the use of these data.
        </Acknowledgement>
      <Description>
         ACE MFI 1-minute averaged magnetic-field data in GSE coordinates
         from Jan 2003. These data have been derived from the 16 second
         resolution ACE MFI which were linearly interpolated to a 1-minute
         time grid with time stamps at second zero of each minute.
      </Description>

      <Contact>
         <Role>Principal Investigator</Role>
         <PersonID>spase://person/nfness@bartol.udel.edu</PersonID>
      </Contact>

      <Contact>
         <Role>Co-Investigator</Role>
         <PresonID>spase://person/Charles.Smith@unh.edu</PersonID>
      </Contact>

      <Contact>
         <Role>Data Producer</Role>
         <PresonID>spase://person/jweygand@igpp.ucla.edu</PresonID>
```

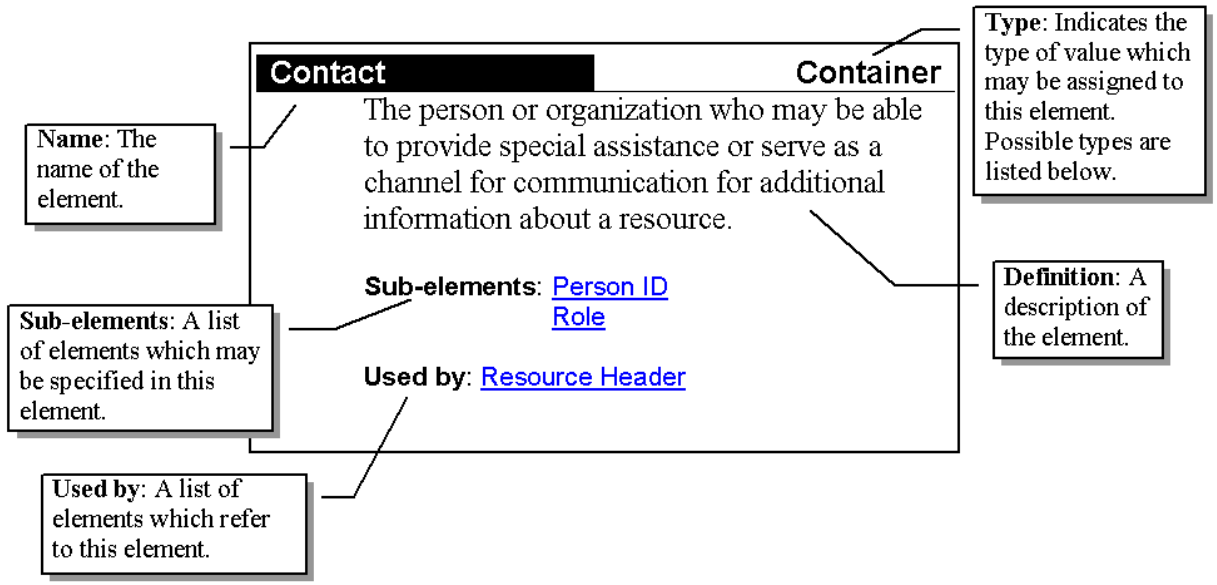
```
      </Contact>
    </ResourceHeader>

    <AccessInformation>
      <AccessRights>Open</AccessRights>
      <Format>text</Format>
      <Encoding>GZIP</Encoding>
      <AccessURL>

<URL>http://www.igpp.ucla.edu/getResource?format=text&id=spase://UCLA/ACEMAG200
301</URL>
      </AccessURL>
    </AccessInformation>

    <AccessInformation>
      <AccessRights>Open</AccessRights>
      <Format>Matlab 7</Format>
      <Encoding>None</Encoding>
      <AccessURL>

<URL>http://www.igpp.ucla.edu/getResource?format=matlab7&id=spase://UCLA/ACEMAG
200301</URL>
      </AccessURL>
    </AccessInformation>

    <InstrumentID>spase://nssdc/ACE_MFI</InstrumentID>
    <MeasurementType>Magnetic Field</MeasurementType>

    <TemporalDescription>
      <TimeSpan>
        <StartDate>1997-01-01T00:00</StartDate>
        <EndDate>2004-01-31T23:59</EndDate>
      </TimeSpan>
      <Cadence>PT00:01:00</Cadence>
    </TemporalDescription>

    <InstrumentRegion>Heliosphere.NearEarth</InstrumentRegion>
    <ObservedRegion>Heliosphere.NearEarth</ObservedRegion>

    <PhysicalParameter>
      <Name>SAMPLE_TIME_UTC</Name>
      <ParameterKey>time</ParameterKey>
      <Description>
       Sample UTC in the form DD MM YYYY hh mm ss where
         DD   = day of month (01-31)
         MM   = month of year (01-12)
         YYYY = Gregorian Year AD
         hh   = hour of day     (00:23)
         mm   = minute of hour  (00-59)
         ss   = second of minute (00-60).
      </Description>
      <Support>
        <Temporal>UTC</Temporal>
      </Support>
    </PhysicalParameter>

    <PhysicalParameter>
      <Name>MAGNETIC_FIELD_VECTOR</Name>
      <Units>nT</Units>
      <CoordinateSystem>
        <CoordinateRepresentation>Cartesian</CoordinateRepresentation>
        <CoordinateSystemName>GSE</CoordinateSystemName>
      </CoordinateSystem>
      <Description>
```

```
           Magnetic field vector in GSE Coordinates (Bx, By, Bz).
        </Description>
        <Measured>
           <Field>
              <FieldQualifier>Vector</FieldQualifier>
              <FieldPhysicalQuantity>Magnetic</FieldPhysicalQuantity>
          </Field>
       </Measured>
    </PhysicalParameter>

    <PhysicalParameter>
       <Name>SPACECRAFT_POSITION_VECTOR</Name>
       <CoordinateSystem>
          <CoordinateRepresentation>Cartesian</CoordinateRepresentation>
          <CoordinateSystemName>GSE</CoordinateSystemName>
       </CoordinateSystem>
       <Units>EARTH RADII</Units>
       <UnitsConversion>6378.16 km</UnitsConversion>
       <Description>
          ACE spacecraft location in GSE coordinates (X,Y,Z)."
       </Description>
       <Support>
         <Positional>
            <Orientation>X</Orientation>
            <Orientation>Y</Orientation>
            <Orientation>Z</Orientation>
         </Positional>
       </Support>
    </PhysicalParameter>

  </NumericalData>
</Spase>
```

7. Definitions of the Data Model Terms

How to Read a Definition

Each element has certain attributes and context for use. The details for each element are presented in the following form:



The value associated with an element must be one of the following:

Container : An element that is a container of other elements. If "Container" is specified the element must have sub-elements specified. When a container element is used no value is assigned to the element. All values are contained within the sub-elements.

Numeric : An element that has a value which is a real number expressed in base 10.

Date : An element that has a value which is a date. A date is given in the ISO 8601 recommended primary standard notation: YYYY-MM-DD. where YYYY is the year in the Gregorian calendar, MM is the month of the year between 01 (January) and 12 (December), and DD is the day of the month between 01 and 31. It may also have an optional time portion (See Time). The time portion must follow the date portion with both portions separated by a "T". For example, "2004-07-29" is July 29, 2004 and "2004-07-29T12:30:00" is precisely 12:30 on July 29, 2004.

Enumeration : An element that has a value selected from a list of values. The list to use is indicated in the definition. For example, "Enumerates - see Project List" indicates only values found in the "Project List" may be assigned to this element.

Count : An element that has a value which is a base 10 integer number.

Item : An element which indicates a state or existence of an attribute. An item is valueless. An item may not contain other elements, but could have attributes. An item may also be an member of an enumerated list.

Text : An element that has a value which is a sequence of characters. The number of characters

may be limited and is indicated in the definition. A text may have a formation rule. If so this is indicated in the definition.

Access Information — Container

Attributes of the resource which pertain to how to acquire the resource, availability and storage format.

Sub-elements:

- Access Rights
- Access URL
- Acknowledgement
- Availability
- Encoding
- Format
- Repository ID

Access Rights — Enumeration

Permissions granted or denied by the host of a product to allow other users to access and use the resource.

Allowed Values:

- Open
- Restricted

Access URL — Text

Attributes of the method of acquiring a resource including a URL, name and description.

Sub-elements:

- Description
- Name
- URL

Acknowledgement — Text

The individual, group or organization which should be acknowledged when the data is used in or contributes to a presentation or publication.

Activity Index — Item

An indication, derived from one or more measurements, of the level of activity of an object or region, such as sunspot number, F10.7 flux, Dst, or the Polar Cap Indices.

Address — Text

Directions for finding some location; written on letters or packages that are to be delivered to that location.

Aerosol — Item

A suspension of fine solid or liquid particles in gas.

Alfven Mach Number — Item

The ratio of the bulk flow speed to the Alfven speed.

Alpha Particle — Item

A positively charged nuclear particle that consists of two protons and two neutrons.

Alternate Name — Text

An alternative or shortened name used to refer to a resource. This includes acronyms, expanded names or synonym for a resource.

Antenna — Item

A sensor used to measure electric potential.

ASCII — Item

A sequence of characters that adheres to American Standard Code for Information Interchange (ASCII) which is an 7-bit character-coding scheme.

Association ID — Text

The resource identifier for a resource with which this resource is closely associated.

Atmosphere — Item

The neutral gases surrounding a body that extends from the surface and is bound to the body by virtue of the gravitational attraction.

Atomic Number — Numeric

The the number of protons in the nucleus of an atom.

Auroral Region — Item

The region in the atmospheric where electrically-charged particles bombarding the upper atmosphere of a planet in the presence of a magnetic field produce an opitcal phenomenum.

Availability — Enumeration

An indication of the method or service which may be used to access the resource.

Allowed Values:

Offline
Online

Average — Item

The statistical mean; the sum of a set of values divided by the number of values in the set.

Average Charge State — Item

A measure of the composite deficit (positive) or excess (negative) of electrons with respect to protons.

AVI — Item

Audio Video Interleave (AVI) a digital format for movies that conforms to the Microsoft Windows Resource Interchange File Format (RIFF).

Azimuthal Angle — Item

The horizontal angular distance from a reference direction. For a vector (X,Y,Z) in any coordinate system, the azimuthal angle is arctan(Y/X).

Azimuthal Angle Range — Container

The range of possible azimuthal angles for a group of energy observations. Default units are degrees.

Sub-elements:

Bin
High
Low
Units

Base64 — Item

A data encoding scheme whereby binary-encoded data is converted to printable ASCII characters. It is defined as a MIME content transfer encoding for use in internet e-mail. The only characters used are the upper- and lower-case Roman alphabet characters (A–Z, a–z), the numerals (0–9), and the "+" and "/" symbols, with the "=" symbol as a special suffix (padding) code.

Bin — Container

A grouping of observations according to a band or window of a common attribute.

Sub-elements:

High
Low

Binary — Item

A direct representation of the bits which may be stored in memory on a computer.

Bow Shock Crossing — Item

A crossing of the boundary between the undisturbed (except for foreshock effects) solar wind and the shocked, decelerated solar wind of the magnetosheath.

BZIP2 Item

An open standard algorithm by Julian Seward using Burrows-Wheeler block sorting and Huffman coding. See <http://www.bzip.org/>

Cadence Time

The time interval between the start of successive measurements.

Calibrated Value

Data wherein sensor outputs have been convolved with instrument response function, often irreversibly, to yield physical parameter values.

Cartesian Item

A coordinate system in which the position of a point is determined by its distance from two or three mutually perpendicular axes.

Catalog Container

A tabular listing of events or observational notes, especially those that have utility in aiding a user in locating data. Catalogues include lists of events, files in a product, and data availability.

Sub-elements:

- Access Information
- Caveats
- Input Resource ID
- Instrument ID
- Keyword
- Phenomenon Type
- Provider Resource Name
- Provider Version
- Resource Header
- Resource ID
- Time Span

Caveats Text

Information which may be important in the avoidance of misuse of the resource. This includes things such as instrument maladies, corruption or contamination.

CDF Item

Common Data Format (CDF). A binary storage format developed at Goddard Space Flight Center (GSFC).

CEF Item

Cluster Exchange Format (CEF) is a self-documenting ASCII format designed for the exchange of data. There are two versions of CEF which are not totally compatible.

CEF 1 Item

Cluster Exchange Format (CEF), version 1, is a self-documenting ASCII format designed for the exchange of data. The metadata contains information compatible with the ISTP recommendations for CDF.

CEF 2 Item

Cluster Exchange Format (CEF), version 2, is a self-documenting ASCII format designed for the exchange of data and introduced for Cluster Active Archive. Compared to version 1, the metadata description of vectors and tensors is different.

CGM Item

Corrected Geomagnetic - A coordinate system from a spatial point with GEO radial distance and geomagnetic latitude and longitude, follow the epoch-appropriate IGRF/DGRF model field vector through to the point where the field line crosses the geomagnetic dipole equatorial plane. Then trace the dipole magnetic field vector Earthward from that point on the equatorial plane, in the same hemisphere as the original point, until the initial radial distance is reached. Designate the dipole latitude and longitude at that point as the CGM latitude and longitude of the original point. See <http://nssdc.gsfc.nasa.gov/space/cgm/cgmm_des.html>

Channeltron — Item

An instrument that detects electrons, ions, and UV-radiation, according to the principle of a secondary emission multiplier. It is typically used in electron spectroscopy and mass spectrometry.

Charged Particle Flux — Item

Measurements of fluxes of charged or ionized particles at above thermal energies, including relativistic particles of solar and galactic origin. May give simple fluxes, but more complete distributions are sometimes possible. Composition measurements may also be made.

Chromosphere — Item

The region of the Sun's (or a star's) atmosphere above the temperature minimum and below the Transition Region. The solar chromosphere is approximately 400 km to 2100 km above the photosphere, and characterized by temperatures from 4500 - 28000 K.

Circular — Item

Relative to polarization, right-hand circularly polarized light is defined such that the electric field is rotating clockwise as seen by an observer towards whom the wave is moving. Left-hand circularly polarized light is defined such that the electric field is rotating counterclockwise as seen by an observer towards whom the wave is moving. The polarization of magnetohydrodynamic waves is specified with respect to the ambient mean magnetic field : right-hand polarized waves have a transverse electric field component which turns in a right-handed sense (that of the gyrating electrons) around the magnetic field.

Co-Investigator — Item

An individual who is a scientific peer and major participant for an investigation.

Component — Item

A part of a multi-part entity, e.g., the components of a vector.

Contact — Container

The person or organization who may be able to provide special assistance or serve as a channel for communication for additional information about a resource.

Sub-elements:

- Person ID
- Role

Coordinate Representation — Enumeration

The method or form for specifying a given point in a given coordinate system

Allowed Values:

- Cartesian
- Cylindrical
- Spherical

Coordinate System — Container

Specification of the origin and orientation of axes against which the location of some point is given and the representative form of each point.

Sub-elements:

- Coordinate Representation
- Coordinate System Name

Coordinate System Name — Enumeration

Identifies the coordinate system in which the position, direction or observation has been expressed.

Allowed Values:

- CGM
- DM
- GEI
- GEO
- GSE
- GSEQ

GSM
HAE
HEE
HEEQ
HG
HGI
J2000
LGM
MAG
MFA
RTN
SC
SE
SM
SR
SR2
SSE

Corona — Item

The outermost atmospheric region of the Sun or a star, characterized by ionization temperatures above 10^5 K. The solar corona starts at about 2100 km above the photosphere; there is no generally defined upper limit.

Coronal Mass Ejection — Item

A solar event which involves a burst of plasma which is ejected from the Sun into the interplanetary medium.

Counts — Item

An enumeration of the number of detection events occurring in a particle detector per unit time or over detector accumulation times.

Cross Spectrum — Item

The Fourier transform of the cross correlation of two physical or empirical observations.

Cylindrical — Item

A system of curvilinear coordinates in which the position of a point in space is determined by its perpendicular distance from a given line, its distance from a selected reference plane perpendicular to this line, and its angular distance from a selected reference line when projected onto this plane.

Data Producer — Item

An individual who generated the resource and is familiar with its provenance.

Dayside — Item

Sunward of a dawn-dusk meridian, either on the surface of, or above, some reference body.

Description — Text

A detailed description of the resource which should include discussions of the main quantities in the resource, possible uses and search terms. A description should also include whether any corrections (i.e, geometry, inertial) have been applied to it.

Deviation — Item

The difference between an observed value and the expected value of a quantity.

Differential — Item

The ratio of the intensity of radiant energy scattered in a given direction to the incident irradiance and thus has dimensions of area per unit solid angle.

Dimension — Container

Attributes of an independent variable or axis associated with the data.

Sub-elements:

Description
Size

Display Cadence — Time

The time interval between the successive display elements.

Display Data — Container

A graphical representation of data wherein the underlying numeric values are not (readily) accessible for analysis.. Examples are line plots and spectrograms.

Sub-elements:

Access Information
Caveats
Display Cadence
Input Resource ID
Instrument ID
Instrument Region
Keyword
Measurement Type
Observed Region
Provider Processing Level
Provider Resource Name
Provider Version
Resource Header
Resource ID
Spectral Range
Temporal Description

DM — Item

Dipole Meridian - A coordinate system centered at the observation point. Z axis is parallel to the Earth's dipole axis, positive northward. X is in the plane defined by Z and the line linking the observation point with the Earth's center. Y is positive eastward. See <http://cdpp.cnes.fr/00428.pdf>

Dopplergram — Item

A map or image depicting the spatial distribution of line-of-sight velocities of the observed object.

Double Sphere — Item

A dipole antenna of which the active (sensor) elements are small spheres located at the ends of two wires deployed in the equatorial plane, on opposite sides of a spinning spacecraft.

Dust — Item

Free microscopic particles of solid material.

Dynamic Spectra — Item

A three-dimensional representation of successive spectra which allows time evolution to be clearly seen. Time is plotted along the abscissa, frequency (or particle energy) along the ordinate, and the spectral power density (or differential particle flux) is represented by different shades of grey, or color. This representation is also known as a spectrogram.

Earth — Enumeration

The third planet from the sun in our solar system.

Allowed Values:

Magnetosheath
Magnetosphere
Magnetosphere.Magnetotail
Magnetosphere.Main
Magnetosphere.Polar
Magnetosphere.Radiation Belt
Near Surface
Near Surface.Atmosphere
Near Surface.Auroral Region

Near Surface.Ionosphere
Surface

Electric — Item

The physical attribute that exerts an electrical force.

Electric Field — Item

Measurements of electric field vectors (sometimes not all components) as a time series.

Electron — Item

An elementary particle consisting of a charge of negative electricity equal to about 1.602 x 10**(-19) Coulomb and having a mass when at rest of about 9.109534 x 10**(-28) gram.

Electron Drift Instrument — Item

An active experiment to measure the electron drift velocity based on sensing the displacement of a weak beam of electrons after one gyration in the ambient magnetic field.

Electrostatic Analyser — Item

An instrument which uses charged plates to analyze the mass, charge and kinetic energies of charged particles which enter the instrument.

Email — Text

The electronic address at which the individual may be contacted expressed in the form "local-part@domain".

Emissivity — Item

The ratio of radiant energy from a material to that from a blackbody at the same kinetic temperature

Encoding — Enumeration

A set of unambiguous rules that establishes the representation of information within a file.

Allowed Values:

ASCII
Base64
BZIP2
GZIP
None
Unicode
ZIP

End Date — Date

The specification of a stopping point in time.

Energetic Particle Instrument — Item

An instrument that measures fluxes of charged particles as a function of time, direction of motion, mass, charge and/or species

Energetic Particles — Item

Pieces of matter that are moving very fast. Energetic particles include protons, electrons, neutrons, neutrinos, the nuclei of atoms, and other sub-atomic particles.

Energetic Solar Particle Event — Item

An enhancement of interplanetary fluxes of energetic ions accelerated by interplanetary shocks and/or solar flares.

Energy — Item

The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy)

Energy Range — Container

The minimum and maximum energy values of the particles represented by a given "physical parameter" description.

Sub-elements:

Bin
High
Low
Units

Equivalent Width — Item

The area of the spectral line profile divided by the peak height or depth.

Exposure — Time

The time interval over which an individual measurement is taken.

Faraday Cup — Item

An instrument consisting of an electrode from which electrical current is measured while a charged particle beam (electrons or ions) impinges on it. Used to determine energy spectrum and sometimes ion composition of the impinging particles.

Field — Container

The space around a radiating body within which its electromagnetic attributes can exert force on another similar body that is not in direct contact.

Sub-elements:

Field Qualifier
Field Quantity
Orientation

Field Qualifier — Enumeration

Characterizes the directional and statistical aspects of the field observation.

Allowed Values:

Average
Component
Deviation
Magnitude
Peak
Perpendicular
Variance
Vector

Field Quantity — Enumeration

The physical attribute of the field.

Allowed Values:

Cross Spectrum
Electric
Magnetic
Potential
Poynting Flux

Fit — Item

Values that make an model agree with the data.

FITS — Item

Flexible Image Transport System (FITS) is a digital format primarily designed to store scientific data sets consisting of multi-dimensional arrays (1-D spectra, 2-D images or 3-D data cubes) and 2-dimensional tables containing rows and columns of data.

Flux — Item

In radiation studies, this refers to the amount of radiant energy passing through a unit area

Flux Feedback — Item

A search coil whose bandwidth and signal/noise ratio are increased by the application of

negative feedback at the sensor (flux) level by driving a collocated coil with a signal from the preamplifier.

Forbush Decrease — Item

A rapid decrease in the observed galactic cosmic ray intensity following the passage of an outwardly convecting interplanetary magnetic field disturbance, such as those associated with large CME's, that sweep some galactic cosmic rays away from Earth.

Format — Enumeration

The organization of data according to preset specifications. The value is selected from a list of accepted names for known, well documented formats.

Allowed Values:

AVI
Binary
CDF
CEF
CEF 1
CEF 2
FITS
GIF
HDF
HDF 4
HDF 5
HTML
IDFS
IDL
JPEG
MATLAB_4
MATLAB_6
MATLAB_7
MPEG
NCAR
NetCDF
PDF
PNG
QuickTime
Text
TIFF
UDF
VOTable
XML

Fourier Transform Spectrograph — Item

An instrument that determines the spectra of a radiative source, using time-domain measurements and a Fourier transform.

Frequency — Item

(1) The number of occurrences within a given time period. (2) Vibrations per second of the photon field; may be given as a single number, multiple numbers, or as ranges.

Frequency Range — Container

The range of possible values for the observed frequency.

Sub-elements:

Bin
High
Low
Units

Gamma Rays — Item

Photons with a wavelength range: 0.00001 to 0.001 nm

GEI — Item

Geocentric Equatorial Inertial - A coordinate system where the Z axis is along Earth's spin vector, positive northward. X axis points towards the first point of Aries (from the Earth towards the Sun at the vernal equinox). See Russell, 1971

General Contact — Item

An individual who can provide information on a range of subjects or who can direct you to a domain expert.

GEO — Item

Geographic - geocentric corotating - A coordinate system where the Z axis is along Earth's spin vector, positive northward. X axis lies in Greenwich meridian, positive towards Greenwich. See Russell, 1971.

Geomagnetic Storm — Item

A magnetospheric disturbance typically defined by variations in the horizontal component of the Earth's surface magnetic field. The variation typically starts with a field enhancement associated with a solar wind pressure pulse and continues with a field depression associated with an enhancement of the diamagnetic magnetospheric ring current.

GIF — Item

Graphic Interchange Format (GIF) first introduced in 1987 by CompuServe. GIF uses LZW compression and images are limited to 256 colours.

Granule — Container

An accessible portion of another resource. The ParentID of a Granule resource must be a NumericalData resource. The attributes of a Granule supersede the corresponding attributes in the NumericalData resource.

Sub-elements:

- Parent ID
- Release Date
- Resource ID
- Start Date
- Stop Date
- URL

GSE — Item

Geocentric Solar Ecliptic - A coordinate system where the X axis is from Earth to Sun. Z axis is normal to the ecliptic, positive northward. See Russell, 1971.

GSEQ — Item

Geocentric Solar Equatorial - A coordinate system where the X axis is from Earth to Sun. Y axis is parallel to solar equatorial plane. Z axis is positive northward. See Russell, 1971

GSM — Item

Geocentric Solar Magnetospheric - A coordinate system where the X axis is from Earth to Sun, Z axis is northward in a plane containing the X axis and the geomagnetic dipole axis. See Russell, 1971

GZIP — Item

An open standard algorithm distributed by GHU based on LZ77 and Huffman coding. See <http://www.gnu.org/software/gzip/gzip.html> or <http://www.gzip.org/>

H — Item

TheHierarchical Data Format

HAE — Item

Heliocentric Aries Ecliptic - A coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis is positive towards the first point of Aries (from Earth to Sun at vernal equinox). Same as SE below. See Hapgood, 1992.

Hard X-rays — Item

Photons with a wavelength range: 0.001 to 0.1 nm

HDF — Item

Hierarchical Data Format

HDF 4 — Item

Hierarchical Data Format, Version 4

HDF 5 — Item

Hierarchical Data Format, Version 5

Heat Flux — Item

Flow of thermal energy through a gas or plasma; typically computed as third moment of a distribution function.

HEE — Item

Heliocentric Earth Ecliptic - A coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis points from Sun to Earth. See Hapgood, 1992

HEEQ — Item

Heliocentric Earth Equatorial - A coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X axis is generally Earthward in the plane defined by the Z axis and the Sun-Earth direction. See Hapgood, 1992.

Heliosphere — Enumeration

The solar atmosphere extending roughly from the outer corona to the edge of the solar plasma at the heliopause separating primarily solar plasma from interstellar plasma.

Allowed Values:

- Inner
- Near Earth
- Outer
- Remote 1AU

HG — Item

Heliographic - A heliocentric rotating coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X, Y axes rotate with a 25.38 day period. The zero longitude (X axis) is defined as the longitude that passed through the ascending node of the solar equator on the ecliptic plane on 1 January, 1854 at 12 UT. See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>

HGI — Item

Heliographic Inertial - A heliocentric coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X axis is along the intersection line between solar equatorial and ecliptic planes. The X axis was positive at SE longitude of 74.367 deg on Jan 1, 1900. (See SE below.) See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>

High — Numeric

The largest value within a range of possible values.

High Latitude — Item

The region located poleward of 60 degrees of latitude.

HTML — Item

A text file containing structured information represented in the HyperText Mark-up Language (HTML). See <http://www.w3.org/MarkUp/>

IDFS — Item

Instrument Data File Set (IDFS) is a set of files written in a prescribed format which contain data, timing data, and meta-data. IDFS was developed at Southwest Research Institute (SwRI).

IDL — Item

Interactive Data Language (IDL) save set. IDL is a proprietary format.

Image Intensity — Item

Measurements of the two-dimensional distribution of the intensity of photons from some region or object such as the Sun or the polar auroral regions; can be in any wavelength band, and polarized, etc.

Imager — Item

An instrument which samples the radiation from an area at one or more spectral ranges emitted or reflected by an object.

Information URL — Container

Attributes of the method of acquiring additional information.

Sub-elements:

Description
Name
URL

Infrared — Item

Photons with a wavelength range: 760 to 1.00x10^6 nm

Inner — Item

The region of the heliosphere extending radially out from the "surface" of the Sun to 1 AU.

Input Resource ID — Text

The resource identifier for a resource which was used to generate this resource.

Instrument — Container

A device which is used to sense and parameterize a physical phenomenon.

Sub-elements:

Caveats
Instrument Type
Investigation Name
Observatory ID
Resource Header
Resource ID

Instrument ID — Text

The identifier of an Instrument resource.

Instrument Region — Enumeration

The portion of space occupied by the instrument at the time of an observation. A region is distinguished by certain natural features or physical characteristics.

Allowed Values:

Earth
Earth.Magnetosheath
Earth.Magnetosphere
Earth.Magnetosphere.Magnetotail
Earth.Magnetosphere.Main
Earth.Magnetosphere.Polar
Earth.Magnetosphere.Radiation Belt
Earth.Near Surface
Earth.Near Surface.Atmosphere
Earth.Near Surface.Auroral Region
Earth.Near Surface.Ionosphere
Earth.Surface
Heliosphere
Heliosphere.Inner
Heliosphere.Near Earth
Heliosphere.Outer

Heliosphere.Remote 1AU
Sun
Sun.Chromosphere
Sun.Corona
Sun.Interior
Sun.Photosphere
Sun.Transition Region

Instrument Type — Enumeration

A characterization of an integrated collection of software and hardware containing one or more sensors and associated controls used to produce data on an environment.

Allowed Values:

Antenna
Channeltron
Double Sphere
Electron Drift Instrument
Electrostatic Analyser
Energetic Particle Instrument
Faraday Cup
Flux Feedback
Fourier Transform Spectrograph
Imager
Langmuir Probe
Long Wire
Magnetometer
Mass Spectrometer
Microchannel Plate
Monopole
Particle Correlator
Quadrispherical Analyser
Radar
Resonance Sounder
Search Coil
Spacecraft Potential Control
Spectral Power Receiver
Spectrometer
Waveform Receiver

Integral — Item

The summation of values over a given area or range.

Intensity — Item

The amount of energy transmitted by electromagnetic radiation, for example, the number of photons arriving in a given time.

Interior — Item

The region inside the body which is not visible from outside the body.

Interplanetary Shock — Item

A shock propagating generally antisunward through the slower solar wind, often seen in front of CME-associated plasma clouds.

Investigation Name — Text

The name given to the contract or engagement which enabled the data to be produced. Each investigation is associated with a Principal Investigator or Guest Investigator who was responsible for the original proposal. For single PI missions each major subsystem having its own identified Team Leader may also be classed as an "Investigation" for the purposes of data archiving.

Ion — Item

An atom that has acquired a net electric charge by gaining or losing one or more electrons.(Note: Z>2)

Ion Composition	Item

In situ measurements of the relative flux or density of electrically charged particles in the space environment. May give simple fluxes, but full distribution functions are sometimes measured.

Ionosphere	Item

The charged or ionized gases surrounding a body that are nominally bound to the body by virtue of the gravitational attraction..

Irradiance	Item

A radiometric term for the power of electromagnetic radiation at a surface, per unit area. "Irradiance" is used when the electromagnetic radiation is incident on the surface. The SI unit of irradiance is watts per square meter (W·m-2).

J2000	Item

An astronomical coordinate system which uses the mean equator and equinox of Julian date 2451545.0 TT (Terrestrial Time), or January 1, 2000, noon TT. (aka J2000) to define a celestial reference frame.

JPEG	Item

A binary format for still images defined by the Joint Photographic Experts Group

Keyword	Text

A word or phrase that is relevant to the resource but does not exist in other documentary information.

Langmuir Probe	Item

A monopole antenna associated with an instrument. The instrument applies a potential to the antenna which is swept to determine the voltage/current characteristic. This provides information about the plasma surrounding the probe and spacecraft.

LGM	Item

Local Geomagnetic - A coordinate system used mainly for Earth surface or near Earth surface magnetic field data. X axis northward from observation point in a geographic meridian. Z axis downward towards Earth's center. In this system, H (total horizontal component) = SQRT (Bx**2 + By**2) and D (declination angle) = arctan (By/Bx)

Line Depth	Item

In spectra, a measure of the amount of absorption for a particular wavelength or frequency in the spectrum

Line of Sight	Item

The line of sight is the line that connects the observer with the observed object. This expression is often used with measurements of Doppler velocity and magnetic field in magnetograms, where only the component of the vector field directed along the line of sight is measured.

Linear	Item

Relative to polarization, confinement of the E-field vector to a given plane

Long Wire	Item

A dipole antenna whose active (sensor) elements are two wires deployed in the equatorial plane on opposite sides of a spinning spacecraft, and whose length is several times greater than the spacecraft diameter.

Low	Numeric

The smallest value within a range of possible values.

Low Latitude	Item

The region located at or anti-poleward of 60 degrees of latitude.

MAG	Item

Geomagnetic - geocentric. Z axis is parallel to the geomagnetic dipole axis, positive north. X is in the plane defined by the Z axis and the Earth's rotation axis. If N is a unit vector from the Earth's center to the north geographic pole, the signs of the X and Y axes are given by Y = N x Z, X = Y x Z.. See Russell, 1971, and <http://cdpp.cnes.fr/00428.pdf>

Magnetic Item

The physical attribute attributed to a magnet or its equivalent.

Magnetic Field Item

Measurements of magnetic field vectors (sometimes not all components) as time series; can be space- or ground-based. Also, [Zeeman splitting, etc. based]: A region of space near a magnetized body where magnetic forces can be detected [as measured by methods such as Zeeman splitting, etc.]

Magnetogram Item

Measurements of the vector or line-of-sight magnetic field determined from remote sensing measurements of the detailed structure of spectral lines, including their splitting and polarization. ("Magnetogram.")

Magnetometer Item

An instrument which measures the ambient magnetic field.

Magnetopause Crossing Item

A crossing of the interface between the shocked solar wind in the magnetosheath and the magnetic field and plasma in the magnetosphere.

Magnetosheath Item

The region between the bow shock and the magnetopause, characterized by very turbulent plasma.

Magnetosphere Enumeration

The region of space above the atmosphere or surface of the planet, and bounded by the magnetopause, that is under the direct influence of the planet's magnetic field.

Allowed Values:

Magnetotail
Main
Polar
Radiation Belt

Magnetotail Item

The region on the night side of the body where the magnetic filed is stretched backwards by the force of the solar wind. For Earth, the magnetotail begins at a night-side radial distance of 10 Re (X > -10Re).

Magnitude Item

A measure of the strength or size of a vector quantity.

Main Item

The region of the magnetosphere where the magnetic field lines are closed, but does not include the gaseous region gravitationally bound to the body.

Mass Item

The measure of inertia (mass) of individual objects (e.g., aerosols).

Mass Density Item

The mass of particles per unit volume.

Mass Spectrometer Item

An instrument which distinguishes chemical species in terms of their different isotopic masses.

MATLAB_4 Item

MATLAB Workspace save set, version 4. MAT-files are double-precision, binary, MATLAB format files. MATLAB is a proprietary product of The MathWorks.

MATLAB_6 Item

MATLAB Workspace save set, version 6. MAT-files are double-precision, binary, MATLAB format files. MATLAB is a proprietary product of The MathWorks.

MATLAB_7 Item

MATLAB Workspace save set, version 7. MAT-files are double-precision, binary, MATLAB format files. Version 7 includes data compression and Unicode encoding. MATLAB is a proprietary product of The MathWorks.

Measured Container

Attributes of observations obtained from an instrument or sensor.

Sub-elements:

Field
Mixed
Particle
Photon

Measurement Type Enumeration

A characterization of the quantitative assessment of a phenomenon.

Allowed Values:

Activity Index
Charged Particle Flux
Dopplergram
Dynamic Spectra
Electric Field
Energetic Particles
Image Intensity
Ion Composition
Irradiance
Magnetic Field
Magnetogram
Neutral Atom Images
Neutral Gas
Profile
Radiance
Radio and Plasma Waves
Radio Soundings
Thermal Plasma

MFA Item

Magnetic Field Aligned - A coordinate system spacecraft-centered system with Z in the direction of the ambient magnetic field vector. X is in the plane defined by Z and the spacecraft-Sun line, positive sunward. See <http://cdpp.cnes.fr/00428.pdf>

Microchannel Plate Item

An instrument used for the detection of elementary particles, ions, ultraviolet rays and soft X-rays constructed from very thin conductive glass capillaries.

Microwave Item

Photons with a wavelength range: 1.00x10^6 to 1.50x10^7 nm

Mixed Text

A measured observation which is derived from a combination of two or more individual measurements.

Mode Amplitude Item

In helioseismology the magnitude of oscillation of waves of a particular geometry.

Molecule Item

A group of atoms so united and combined by chemical affinity that they form a complete, integrated whole, being the smallest portion of any particular compound that can exist in a free state

Moment Item

Parameters determined by integration over a distribution function convolved with a power of velocity.

MPEG Item

A digital format for movies defined by the Motion Picture Experts Group

Name Text

A language unit by which a person or thing is known.

NCAR Item

The National Center for Atmospheric Research (NCAR) format. A complete description of that standard is given in appendix C of the "Report on Establishment & Operation of the Incoherent-Scatter Data Base", dated August 23, 1984, obtainable from NCAR, P.O. Box 3000 Boulder, Colorado 80307-3000.

Near Earth Item

The heliospheric region near the Earth which extends to and includes the area near the L1 and L2 Lagrange point.

Near Surface Enumeration

The gaseous and possibly ionized environment of a body extending from the surface to some specified altitude. For the Earth, this altitude is 2000 km.

Allowed Values:

Atmosphere
Auroral Region
Ionosphere

NetCDF Item

Unidata Program Center's Network Common Data Form (NetCDF). A self-describing data portable data format for array-oriented data access. See <http://my.unidata.ucar.edu/content/software/netcdf>

Neutral Item

Either a particle, an object, or a system that has a net electric charge of zero

Neutral Atom Images Item

Measurements of neutral atom fluxes as a function of look direction; often related to remote energetic charged particles that lose their charge through charge-exchange and then reach the detector on a line.

Neutral Gas Item

Measurements of neutral atomic and molecular components of a body and its surrounding environments.

Nightside Item

Anti-Sunward of a dawn-dusk meridian, either on the surface of, or above, some reference body.

None Item

A lack or absence of anything.

Number Density Item

The number of particles per unit volume.

Numerical Data — Container

Data stored as numerical values in a specified format.

Sub-elements:

- Access Information
- Caveats
- Input Resource ID
- Instrument ID
- Instrument Region
- Keyword
- Measurement Type
- Observed Region
- Physical Parameter
- Provider Processing Level
- Provider Resource Name
- Provider Version
- Resource Header
- Resource ID
- Spectral Range
- Temporal Description

Observatory — Container

The host (spacecraft, network, facility) for instruments making observations.

Sub-elements:

- Observatory Group
- Resource Header
- Resource ID

Observatory Group — Text

A set of programmatically related observatories. The value is taken from an approved list of observatory group names.

Observatory ID — Text

The identifier of an Observatory resource.

Observed Region — Enumeration

The portion of space measured by the instrument at the time of an observation. A region is distinguished by certain natural features or physical characteristics. It is the location of the observatory for in situ data, the location or region sensed by remote sensing observatories and the location-of-relevance for parameters that are derived from observational data.

Allowed Values:

- Earth
- Earth.Magnetosheath
- Earth.Magnetosphere
- Earth.Magnetosphere.Magnetotail
- Earth.Magnetosphere.Main
- Earth.Magnetosphere.Polar
- Earth.Magnetosphere.Radiation Belt
- Earth.Near Surface
- Earth.Near Surface.Atmosphere
- Earth.Near Surface.Auroral Region
- Earth.Near Surface.Ionosphere
- Earth.Surface
- Heliosphere
- Heliosphere.Inner
- Heliosphere.Near Earth
- Heliosphere.Outer
- Heliosphere.Remote 1AU
- Sun
- Sun.Chromosphere
- Sun.Corona
- Sun.Interior
- Sun.Photosphere

Sun.Transition Region

Offline — Text

Not directly accessible electronically. This includes resources which may to be moved to an online status in response to a given request.

Sub-elements:

Medium

Online — Item

Directly accessible electronically.

Open — Item

Access is granted to everyone.

Optical — Item

Photons with a wavelength range: 380 to 760 nm

Organization Name — Text

A unit within a company or other entity (e.g., Government agency or branch of service) within which many projects are managed as a whole.

Orientation — Enumeration

The direction within a coordinate system.

Allowed Values:

H
Phi
R
Theta
X
Y
Z

Other — Text

Values, such as flags, that are not time tags, location data or measured or derived parameters.

Outer — Item

The region of the heliosphere from, but not including, 1 AU to the farthest extent of the heliosphere (heliopause).

Parallel — Item

Having the same direction as a given direction

Parameter Key — Text

The name or identfier which can be used to access the parameter in the resource. The associated value is dependent on the service used to access the resource.

Parent ID — Text

The resource identifier for a resource that a resource is a part of. The resource inherits the attributes of the referenced resource. Attributes defined in the resource override attributes of the parent in the manner perscribed by the containing resource.

Particle — Container

A description of the types of particles observed in the measurement. This includes both direct observations and inferred observations.

Sub-elements:

Atomic Number
Azimuthal Angle Range
Energy Range
Particle Qualifier
Particle Quantity
Particle Type

Polar Angle Range

Particle Correlator — Item

An instrument which correlates particle flux to help identify wave/particle interactions.

Particle Qualifier — Enumeration

Characterizes the directional and statistical aspects of the particle observation.

Allowed Values:

- Average
- Component
- Deviation
- Differential
- Fit
- Integral
- Magnitude
- Moment
- Parallel
- Peak
- Perpendicular
- Ratio
- Variance
- Vector

Particle Quantity — Enumeration

A characterization of the physical properties of the particle.

Allowed Values:

- Alfven Mach Number
- Average Charge State
- Counts
- Flux
- Heat Flux
- Mass
- Mass Density
- Number Density
- Phase-Space Density
- Plasma Beta
- Pressure
- Sonic Mach Number
- Temperature
- Thermal Speed
- Velocity

Particle Type — Enumeration

A characterization of the kind of particle observed by the measurement.

Allowed Values:

- Aerosol
- Alpha Particle
- Dust
- Electron
- Ion
- Molecule
- Neutral
- Proton

PDF — Item

A document expressed in the Portable Document Format (PDF) as defined by Adobe.

Peak — Item

The maximum value for the quantity in question, over a period of time which is usually equal to the cadence.

Perpendicular — Item

At right angles to a given direction.

Person — Container

An individual human being.

Sub-elements:

- Address
- Email
- Organization Name
- Person Name
- Phone Number
- Release Date
- Resource ID

Person ID — Text

The identifier assigned to a Person description.

Person Name — Text

The words used to address an individual.

Phase-Space Density — Item

The number of particles per unit volume in the six-dimensional space of position and velocity.

Phenomenon Type — Enumeration

The characteristics or categorization of an event type.

Allowed Values:

- Aurora
- Bow Shock Crossing
- Coronal Mass Ejection
- Energetic Solar Particle Event
- Forbush Decrease
- Geomagnetic Storm
- Interplanetary Shock
- Magnetopause Crossing
- Solar Flare
- Solar Wind Extreme
- Statistics

Phi — Item

The component of a vector in a sperical coordinate system in the direction of the angle between the x-axis and the line from the origin to the measured point.

Phone Number — Text

The symbols and numerals required to contact an individual by telephone. The string may contain punctuation marks such as dash (-) or dot (.) to separate fields within the string.

Photon — Container

Photon (radio through gamma-rays): the fundamental particle or quantum of electromagnetic radiation (radiant energy)

Sub-elements:

- Frequency Range
- Photon Qualifier
- Photon Quantity

Photon Qualifier — Enumeration

Characterizes the directional and statistical aspects of the photon observation.

Allowed Values:

- Average
- Circular
- Line of Sight
- Linear
- Peak

Stoke's Parameters
Variance
Vector

Photon Quantity — Enumeration

A characterization of the physical properties of the photon.

Allowed Values:

Emissivity
Equivalent Width
Flux
Intensity
Line Depth
Magnetic Field
Mode Amplitude
Polarization
Stoke's Parameters
Velocity

Photosphere — Item

The atmospheric layer of the Sun or a star from which continuum radiation, especially optical, is emitted to space. For the Sun, the photosphere is about 500 km thick.

Physical Parameter — Container

A container of information regarding a parameter whose values are part of the product. Every product contains or can be related to one or more parameters.

Sub-elements:

Cadence
Caveats
Coordinate System
Description
Dimension
Measured
Name
Parameter Key
Support
Units
Units Conversion

Plasma Beta — Item

The ratio of the plasma pressure to the magnetic pressure.

PNG — Item

A digital format for still images. Portable Network Graphics (PNG)

Polar — Item

The region near the pole of a body. For a magnetosphere the polar region is the area where magnetic field lines are open and includes the aural zone.

Polar Angle — Item

The angle between the Z axis and the given vector direction.

Polar Angle Range — Container

The range of possible polar angles for a group of energy observations. Defaults units are degrees.

Sub-elements:

Bin
High
Low
Units

Polarization — Item

Direction of the electric vector of an electromagnetic wave. The wave can be linearly polarized in any direction perpendicular to the direction of travel, circularly polarized (clockwise or counterclockwise), unpolarized, or mixtures of the above.

Positional — Container

The specification of the location of an object or measurement within a reference coordinate system. The position is usually expressed as a set of values corresponding to the location along a set of orthogonal axes together with the date/time of the observation.

Sub-elements:

Orientation

Potential — Item

A field which obeys Laplace's Equation.

Poynting Flux — Item

The rate of energy transport per unit area per steradian.

Pressure — Item

The force per unit area exerted by a particle distribution or field.

Principal Investigator — Item

An individual who is the administrative and scientific lead for an investigation.

Profile — Item

Measurements of a quantity as a function of height above an object such as the limb of a body.

Project Scientist — Item

An individual who is an expert in the phenomenon and related physics explored by the project. A project scientist may also have a managerial role within the project.

Proton — Item

An elementary particle that is a constituent of all atomic nuclei, that carries a positive charge numerically equal to the charge of an electron, and that has a mass of 1.673 x 10**(-24) gram.

Provider ID — Item

The identifier for a Contact resource for the person or organization who provided the resource.

Provider Processing Level — Text

The provider specific classification of the processing performed on the product.

Provider Release Date — Date

The date the product was made available by the provider. The Provider Release Date is relevant only to the product life-cycle of the provider.

Provider Resource Name — Text

A short textual description of a resource used by the provider which may be used to identify a resource.

Provider Version — Text

Describes the release or edition of the product used by the provider. The formation rule may vary between providers. It is intended to aid in queries to the provider regarding the product.

Quadrispherical Analyser — Item

An instrument used for the 3-D detection of plasma, energetic electrons and ions, and for positive-ion composition measurements.

QuickTime — Item

A format for digital movies, as defined by Apple Computer. See <http://developer.apple.com/quicktime/>

R — Item

The component of a vector along in the radial direction in a spherical system.

Radar — Item

An instrument which uses radar to obtain an image of an object.

Radiance — Item

A radiometric measurement that describe the amount of electromagnetic radiation that passes through or is emitted from a particular area, and falls within a given solid angle in a specified direction. They are used to characterize both emission from diffuse sources and reflection from diffuse surfaces. The SI unit of radiance is watts per steradian per square meter (W·sr-1·m-2).

Radiation Belt — Item

The region within a magnetosphere where high-energy particles could potentially be trapped in a magnetic field.

Radio and Plasma Waves — Item

Measurements of electric and/or magnetic fields using electric or magnetic antennas at frequencies anywhere between the spacecraft spin frequency and the characteristic frequencies of the ambient plasma. The output can be waveform, power spectral density, or other statistical parameters.

Radio Frequency — Item

Photons with a wavelength range: 100,000 to 1.00x10^11 nm

Radio Soundings — Item

Measurements of plasma density, magnetic field and possibly other parameters of the space environment by active probing of the plasma by radio waves.

Ratio — Item

The relative magnitudes of two quantities.

Registry — Container

A location or facility where resources are cataloged.

Sub-elements:

Resource Header
Resource ID

Relative End Date — Time

An indication of the nominal end date relative to the present.

Release Date — Date

The point in time when an item is made available.

Remote 1AU — Item

The heliospheric region near the Earth's orbit, but exclusive of the region near the Earth.

Repository — Container

A location or facility where resources are stored.

Sub-elements:

Resource Header
Resource ID

Resonance Sounder — Item

A combination of a radio receiver and a pulsed transmitter used to study the plasma surrounding a spacecraft by identifying resonances or cut-offs (of the wave dispersion relation), whose frequencies are related to the ambient plasma density and magnetic field. When the transmitter is off it is essentially a high frequency-resolution spectral power receiver.

Resource Header — Container

Attributes of a resource which pertain to the provider of the resource and descriptive information about the resource.

Sub-elements:

Acknowledgement
Alternate Name
Association ID
Contact
Description
Information URL
Release Date
Resource Name

Resource ID — Text

A Resource ID is a URI that has the form "scheme://authority/path" where "scheme" is "spase" for those resources administered through the SPASE framework, "authority" is the unique identifier for the resource provider registered within the SPASE framework and "path" is the unique identifier of the resource within the context of the "authority". The resource ID must be unique within the SPASE framework.

Resource Name — Text

A short textual description of a resource which may be useful when read by a person.

Restricted — Item

Access to the product is regulated and requires some form of identification.

Role — Enumeration

The assigned or assumed function or position of an individual.

Allowed Values:

Co-Investigator
Data Producer
General Contact
Principal Investigator
Project Scientist
Scientist
Team Leader
Team Member
Technical Contact

RTF — Item

Rich Text Format (RTF). Structured information as defined by Microsoft.

RTN — Item

Radial Tangential Normal. Typically centered at a spacecraft. Used for IMF and plasma V vectors. R (radial) axis is radially away from the Sun, T (tangential) axis is normal to the plane formed by R and the Sun's spin vector, positive in the direction of planetary motion. N (normal) is R x T.

SC — Item

Spacecraft - A coordinate system defined by the spacecraft geometry and/or spin. Often has Z axis parallel to spacecraft spin vector. X and Y axes may or may not corotate with the spacecraft. See SR and SR2 below.

Scientist — Item

An individual who is an expert in the phenomenon and related physics represented by the resource.

SE — Item

Solar Ecliptic - A heliocentric coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis is positive towards the first point of Aries (from Earth to Sun at vernal equinox). Same as HAE above. See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>

Search coil — Item

A loop of wire used to determine the time variation of the magnetic flux threading the loop by measurement of the electric potential difference induced between the ends of the wire.

Service — Container

A location or facility that can perform a well defined task.

Sub-elements:

Access URL
Resource Header
Resource ID

SGI — Item

Binary data compatible with Silicon Graphic platforms.

Size — Count

The physical dimensions, proportions, magnitude, or extent of an object..

SM — Item

Solar Magnetic - A geocentric coordinate system where the Z axis is northward along Earth's dipole axis, X axis is in plane of z axis and Earth-Sun line, positive sunward. See Russell, 1971.

Soft X-rays — Item

Range: 0.1 <= x < 10 nm; Conventional abbreviation: XUV

Solar Flare — Item

An explosive event in the Sun's atmosphere which produces electromagnetic radiation across the electromagnetic spectrum at multiple wavelengths from long-wave radio to the shortest wavelength gamma rays.

Solar Wind Extreme — Item

Intervals of unusually large or small values of solar wind attributes such as flow speed and ion density.

Sonic Mach Number — Item

The ratio of the bulk flow speed to the speed of sound in the medium.

Spacecraft Potential Control — Item

An instrument to control the electric potential of a spacecraft with respect to the ambient plasma by emitting a variable current of positive ions.

SPASE — Container

Space Physics Archive Search and Extract (SPASE). The outermost container or envelope for SPASE metadata. This indicates the start of the SPASE metadata.

Sub-elements:

Catalog
Display Data
Granule
Instrument
Numerical Data
Observatory
Person
Registry
Repository
Service
Version

Spatial Range — Item

A description, in an appropriate coordinate system, of the positions of the elements of an image; may be done using a reference and relative positions, or with bins giving the description of a 2-D grid.

Spectral Power Receiver — Item

A radio receiver which determines the power spectral density of the electric or magnetic field, or both, at one or more frequencies.

Spectral Range — Enumeration

The general term used to describe wavelengths or frequencies within a given span of values for those quantities.

Allowed Values:

- Gamma Rays
- Hard X-rays
- Infrared
- Microwave
- Optical
- Radio Frequency
- Ultraviolet
- X-Rays

Spectrometer — Item

An instrument that measures the component wavelengths of light or other electromagnetic radiation into its component wavelengths.

Spectrum — Item

Measurements of the intensity of radiation as a function of frequency or wavelength.

Spherical — Item

A system of curvilinear coordinates characterized by an azimuthal angle (longitude), a polar angle (latitude), and a distance (radius) from a point to the origin.

SR — Item

Spin Reference - A special case of a Spacecraft (SC) coordinate system for a spinning spacecraft. Z is parallel to the spacecraft spin vector. X and Y rotate with the spacecraft. See <http://cdpp.cnes.fr/00428.pdf>

SR2 — Item

Spin Reference 2 - A special case of a Spacecraft (SC) coordinate system for a spinning spacecraft. Z is parallel to the spacecraft spin vector. X is in the plane defined by Z and the spacecraft-Sun line, positive sunward. See <http://cdpp.cnes.fr/00428.pdf>

SSE — Item

Spacecraft Solar Ecliptic - A coordinate system used for deep space spacecraft, for example Helios. - X axis from spacecraft to Sun. Z axis normal to ecliptic plane, positive northward. Note: Angle between normals to ecliptic and to Helios orbit plane ~ 0.25 deg.

Start Date — Date

The specification of a starting point in time.

Statitics — Item

Measurements of attributes of a sample from a population.

Stoke's Parameters — Item

The four coordinates (usually called I, Q, U, and V) relative to a particular basis for the representation of the polarization state of an electromagnetic wave propagating through space.

Sun — Enumeration

The star upon which our solar system is centered.

Allowed Values:

- Chromosphere
- Corona
- Interior
- Photosphere
- Transition Region

Support — Container

Information useful in understanding the context of an observation, typically observed or measured coincidentally with a physical observation.

Sub-elements:

Other
Positional
Temporal

Surface — Item

The outermost area of a solid object.

Team Leader — Item

An individual who is the scientific and administrative lead for an investigation.

Team Member — Item

An individual who is a major participant in an investigation.

Technical Contact — Item

An individual who can provide specific information with regard to the resource or supporting software

Temperature — Item

A measure of the kinetic energy of random motion with respect to the average. Temperature is properly defined only for an equilibrium particle distribution (Maxwellian distribution).

Temporal — Text

Pertaining to time.

Temporal Description — Container

A characterization of the time over which the measurement was taken.

Sub-elements:

Cadence
Exposure
Time Span

TeX — Item

A document expressed in the typesetting language TeX originally defined by Donald Knuth.

Text — Item

ASCII text

Thermal Plasma — Item

Measurements of the plasma in the energy regime where the most of the plasma occurs. May be the basic fluxes in the form of distribution functions or the derived bulk parameters (density, flow velocity, etc.).

Thermal Speed — Item

For a Maxwellian distribution, the difference between the mean speed and the speed within which ~69% (one sigma) of all the members of the speed distribution occur.

Theta — Item

The component of a vector in a sperical coordinate system in the direction of the angle between the z-axis and the line from the origin to the measured point. In a cylindical coordinate system it is the angle between the x-axis and the line from the origin to the point.

TIFF — Item

A binary format for still pictures. Tagged Image Format File (TIFF). Originally developed by Aldus and now controlled by Adobe.

Time Span — Container

The duration of an interval in time.
Sub-elements:
End Date
Relative End Date
Start Date

Transition Region Item

A very narrow (<100 km) layer between the chromosphere and the corona where the temperature rises abruptly from about 8000 to about 500,000 K.

UDF Item

Universal Data Format (UDF). The Optical Technology Storage Association's Universal Disk Format, based on ISO 13346. See <http://www.osta.org/specs/index.htm>

Ultraviolet Item

Photons with a wavelength range: 10 to 400 nm

Uncalibrated Item

Duplicate data are removed from the data stream and data are time ordered. Values are not adjusted for any potential biases or external factors.

Unicode Item

Text in multi-byte Unicode format.

Units Text

A description of the standardized measurement increments in which a value is specified. The description is represented as a mathematical phrase. Individual units within the phrase must conform to the International System of Units (SI) which is maintained by BIPM (Bureau International des Poids et Mesures. See <http://www.bipm.fr/>). The symbol associated with a unit should be used in the phrase. Within the phrase the circumflex (^) is used to indicate a power, a star (*) is used to indicate multiplication and a slash (/) division. When symbols are not separated by a mathematical operator, multiplication is assumed. Symbols for base units can be found at: <http://www.bipm.fr/en/si/si_brochure/chapter2/2-1/#symbols> and those for common derived units can be found at: <http://www.bipm.fr/en/si/derived_units/2-2-2.html>

Units Conversion Text

The multiplicative factor for converting a unit into International System of Units (SI) units. The factor is expressed in the form "number > x", where "number" is a numerical value and "x" is the appropriate SI units. The basic SI units are Enumerated: m (meter), N (newton), kg (kilogram), Pa (pascal), s (second), Hz (hertz), A (ampere), V (volt), K (kelvin), W (watt), rad (radian), J (joule), sr (steradian), C (coulomb), T (tesla), ohm (ohm), mho (mho or seimens), H (henry), and F (farad). Two useful units which are not SI units are: degree (angle), and unitless (no units). An example is: "1.0E-5>T" which converts the units, presumable nT, to tesla. Another example is: "1.0e-1>km/s" which converts a velocity expressed in meters per second to kilometers per second.

URL Text

Uniform Resource Locator (URL) is the global address of documents and other resources on the World Wide Web. The first part of the address indicates what protocol to use, and the second part specifies the IP address or the domain name where the resource is located followed by the pathname of the resource. A URL is specified in the form protocol://server.domain.name:port/pathname. Example protocols are HTTP or FTP, server domain name is the Internet name.

Variance Item

A measure of dispersion of a set of data points around their mean value. The expectation value of the squared deviations from the mean.

Vector Item

A quantity having both magnitude and direction, e.g. displacement, velocity, acceleration and force.

Velocity	Item

Rate of change of position. Also used for the average velocity of a collection of particles, also referred to as "bulk velocity".

Version	Text

Indicates the release identifier. When used to indicate the release of the SPASE data model, it is a in the form Major.Minor.Fix where Major: A significant change in the architecture of the model or rewrite of the implementation. This includes major changes in design or implementation language. This number starts at 0 (zero). Minor: An addition of terms or features that require changes in documentation/external API. This number starts at 0 (zero). Fix: Any change that doesn't require documentation/external API changes. This number starts at 0 (zero).

VOTable	Item

A proposed XML standard designed as a flexible storage and exchange format for tabular data.

Waveform Receiver	Item

A radio receiver which outputs the value of one or more components of the electric and/or magnetic field as a function of time.

Wavelength	Item

The distance between successive points of equal amplitude and phase on a wave (for example, crest to crest or trough to trough)

Wavenumber	Item

A quantity that is inversely proportional to the wavelength of a wave.

X	Item

The component of a vector along the X-axis in a cartessian coordinate system.

X-Rays	Item

Photons with a wavelength range: 0.001 <= x < 10 nm

XDR	Item

Binary data in the eXternal Data Representation (XDR) format. See RFC 1014 <http://www.faqs.org/rfcs/rfc1014.html>

XML	Item

eXtensible Mark-up Language (XML). A structured format for representing information. See <http://www.w3.org/XML/>

Y	Item

The component of a vector along the Y-axis in a cartessian coordinate system.

Z	Item

The component of a vector along the Z-axis in a cartessian coordinate system.

ZIP	Item

An open standard for compression which is a variation of the LZW method and was originally used in the PKZIP utility.

8. Enumeration of Selected Quantities

Lists are either "open" or "closed". The items in a "closed" list are determined by the SPASE model and definitions of each item is in the SPASE data dictionary. The items in an "open" list are determined by an external control authority. The URL for the control authority is indicated in the definition of each "open" list.

Access Rights List — Identifier

Term	Definition
Open	Access is granted to everyone.
Restricted	Access to the product is regulated and requires some form of identification.

Availability List — Identifier

Term	Definition
Offline	Not directly accessible electronically. This includes resources which may to be moved to an online status in response to a given request.
Online	Directly accessible electronically.

Coordinate Representation List — Closed

Term	Definition
Cartesian	A coordinate system in which the position of a point is determined by its distance from two or three mutually perpendicular axes.
Cylindrical	A system of curvilinear coordinates in which the position of a point in space is determined by its perpendicular distance from a given line, its distance from a selected reference plane perpendicular to this line, and its angular distance from a selected reference line when projected onto this plane.
Spherical	A system of curvilinear coordinates characterized by an azimuthal angle (longitude), a polar angle (latitude), and a distance (radius) from a point to the origin.

Coordinate System Name List — Closed

Identifiers for coordinate systems in which the position, direction or observation has been expressed.

Term	Definition
CGM	Corrected Geomagnetic - A coordinate system from a spatial point with GEO radial distance and geomagnetic latitude and longitude, follow the epoch-appropriate IGRF/DGRF model field vector through to the point where the field line crosses the geomagnetic dipole equatorial plane. Then trace the dipole magnetic field

	vector Earthward from that point on the equatorial plane, in the same hemisphere as the original point, until the initial radial distance is reached. Designate the dipole latitude and longitude at that point as the CGM latitude and longitude of the original point. See <http://nssdc.gsfc.nasa.gov/space/cgm/cgmm_des.html>
DM	Dipole Meridian - A coordinate system centered at the observation point. Z axis is parallel to the Earth's dipole axis, positive northward. X is in the plane defined by Z and the line linking the observation point with the Earth's center. Y is positive eastward. See <http://cdpp.cnes.fr/00428.pdf>
GEI	Geocentric Equatorial Inertial - A coordinate system where the Z axis is along Earth's spin vector, positive northward. X axis points towards the first point of Aries (from the Earth towards the Sun at the vernal equinox). See Russell, 1971
GEO	Geographic - geocentric corotating - A coordinate system where the Z axis is along Earth's spin vector, positive northward. X axis lies in Greenwich meridian, positive towards Greenwich. See Russell, 1971.
GSE	Geocentric Solar Ecliptic - A coordinate system where the X axis is from Earth to Sun. Z axis is normal to the ecliptic, positive northward. See Russell, 1971.
GSEQ	Geocentric Solar Equatorial - A coordinate system where the X axis is from Earth to Sun. Y axis is parallel to solar equatorial plane. Z axis is positive northward. See Russell, 1971
GSM	Geocentric Solar Magnetospheric - A coordinate system where the X axis is from Earth to Sun, Z axis is northward in a plane containing the X axis and the geomagnetic dipole axis. See Russell, 1971
HAE	Heliocentric Aries Ecliptic - A coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis is positive towards the first point of Aries (from Earth to Sun at vernal equinox). Same as SE below. See Hapgood, 1992.
HEE	Heliocentric Earth Ecliptic - A coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis points from Sun to Earth. See Hapgood, 1992
HEEQ	Heliocentric Earth Equatorial - A coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X axis is generally Earthward in the plane defined by the Z axis and the Sun-Earth direction. See Hapgood, 1992.
HG	Heliographic - A heliocentric rotating coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X, Y axes rotate with a 25.38 day period. The zero longitude (X axis) is defined as the longitude that passed through the ascending node of the

	solar equator on the ecliptic plane on 1 January, 1854 at 12 UT. See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>
HGI	Heliographic Inertial - A heliocentric coordinate system where the Z axis is normal to the solar equatorial plane, positive northward. X axis is along the intersection line between solar equatorial and ecliptic planes. The X axis was positive at SE longitude of 74.367 deg on Jan 1, 1900. (See SE below.) See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>
J2000	An astronomical coordinate system which uses the mean equator and equinox of Julian date 2451545.0 TT (Terrestrial Time), or January 1, 2000, noon TT. (aka J2000) to define a celestial reference frame.
LGM	Local Geomagnetic - A coordinate system used mainly for Earth surface or near Earth surface magnetic field data. X axis northward from observation point in a geographic meridian. Z axis downward towards Earth's center. In this system, H (total horizontal component) = SQRT (Bx**2 + By**2) and D (declination angle) = arctan (By/Bx)
MAG	Geomagnetic - geocentric. Z axis is parallel to the geomagnetic dipole axis, positive north. X is in the plane defined by the Z axis and the Earth's rotation axis. If N is a unit vector from the Earth's center to the north geographic pole, the signs of the X and Y axes are given by Y = N x Z, X = Y x Z.. See Russell, 1971, and <http://cdpp.cnes.fr/00428.pdf>
MFA	Magnetic Field Aligned - A coordinate system spacecraft-centered system with Z in the direction of the ambient magnetic field vector. X is in the plane defined by Z and the spacecraft-Sun line, positive sunward. See <http://cdpp.cnes.fr/00428.pdf>
RTN	Radial Tangential Normal. Typically centered at a spacecraft. Used for IMF and plasma V vectors. R (radial) axis is radially away from the Sun, T (tangential) axis is normal to the plane formed by R and the Sun's spin vector, positive in the direction of planetary motion. N (normal) is R x T.
SC	Spacecraft - A coordinate system defined by the spacecraft geometry and/or spin. Often has Z axis parallel to spacecraft spin vector. X and Y axes may or may not corotate with the spacecraft. See SR and SR2 below.
SE	Solar Ecliptic - A heliocentric coordinate system where the Z axis is normal to the ecliptic plane, positive northward. X axis is positive towards the first point of Aries (from Earth to Sun at vernal equinox). Same as HAE above. See <http://nssdc.gsfc.nasa.gov/space/helios/coor_des.html>
SM	Solar Magnetic - A geocentric coordinate system where the Z axis is northward along Earth's dipole axis, X axis

	is in plane of z axis and Earth-Sun line, positive sunward. See Russell, 1971.
SR	Spin Reference - A special case of a Spacecraft (SC) coordinate system for a spinning spacecraft. Z is parallel to the spacecraft spin vector. X and Y rotate with the spacecraft. See <http://cdpp.cnes.fr/00428.pdf>
SR2	Spin Reference 2 - A special case of a Spacecraft (SC) coordinate system for a spinning spacecraft. Z is parallel to the spacecraft spin vector. X is in the plane defined by Z and the spacecraft-Sun line, positive sunward. See <http://cdpp.cnes.fr/00428.pdf>
SSE	Spacecraft Solar Ecliptic - A coordinate system used for deep space spacecraft, for example Helios. - X axis from spacecraft to Sun. Z axis normal to ecliptic plane, positive northward. Note: Angle between normals to ecliptic and to Helios orbit plane ~ 0.25 deg.

Earth List — Closed

Term	Definition
Magnetosheath	The region between the bow shock and the magnetopause, characterized by very turbulent plasma.
Magnetosphere	The region of space above the atmosphere or surface of the planet, and bounded by the magnetopause, that is under the direct influence of the planet's magnetic field.
Near Surface	The gaseous and possibly ionized environment of a body extending from the surface to some specified altitude. For the Earth, this altitude is 2000 km.
Surface	The outermost area of a solid object.

Encoding List — Closed

Identifier for unambiguous rules that establishes the representation of information within a file.

Term	Definition
ASCII	A sequence of characters that adheres to American Standard Code for Information Interchange (ASCII) which is an 7-bit character-coding scheme.
Base64	A data encoding scheme whereby binary-encoded data is converted to printable ASCII characters. It is defined as a MIME content transfer encoding for use in internet e-mail. The only characters used are the upper- and lower-case Roman alphabet characters (A–Z, a–z), the numerals (0–9), and the "+" and "/" symbols, with the "=" symbol as a special suffix (padding) code.
BZIP2	An open standard algorithm by Julian Seward using Burrows-Wheeler block sorting and Huffman coding. See <http://www.bzip.org/>
GZIP	An open standard algorithm distributed by GHU based on LZ77 and Huffman coding. See <http://www.gnu.org/software/gzip/gzip.html> or <http://www.gzip.org/>

None	A lack or absence of anything.
Unicode	Text in multi-byte Unicode format.
ZIP	An open standard for compression which is a variation of the LZW method and was originally used in the PKZIP utility.

Field Component List — Closed

Identifiers for components of a coordinate system which can be associated with a Field Quantity.

Field Qualifier List — Closed

Identifiers for terms which can be associated with a Field Quantity.

Term	Definition
Average	The statistical mean; the sum of a set of values divided by the number of values in the set.
Component	A part of a multi-part entity, e.g., the components of a vector.
Deviation	The difference between an observed value and the expected value of a quantity.
Magnitude	A measure of the strength or size of a vector quantity.
Peak	The maximum value for the quantity in question, over a period of time which is usually equal to the cadence.
Perpendicular	At right angles to a given direction.
Variance	A measure of dispersion of a set of data points around their mean value. The expectation value of the squared deviations from the mean.
Vector	A quantity having both magnitude and direction, e.g. displacement, velocity, acceleration and force.

Field Quantity List — Closed

Identifiers for the physical attribute of the field.

Term	Definition
Cross Spectrum	The Fourier transform of the cross correlation of two physical or empirical observations.
Electric	The physical attribute that exerts an electrical force.
Magnetic	The physical attribute attributed to a magnet or its equivalent.
Potential	A field which obeys Laplace's Equation.
Poynting Flux	The rate of energy transport per unit area per steradian.

Format List — Closed

Identifiers for data organized according to preset specifications.

Term	Definition
AVI	Audio Video Interleave (AVI) a digital format for movies that conforms to the Microsoft Windows Resource Interchange File Format (RIFF).
Binary	A direct representation of the bits which may be stored in memory on a computer.
CDF	Common Data Format (CDF). A binary storage format

	developed at Goddard Space Flight Center (GSFC).
CEF	Cluster Exchange Format (CEF) is a self-documenting ASCII format designed for the exchange of data. There are two versions of CEF which are not totally compatible.
CEF 1	Cluster Exchange Format (CEF), version 1, is a self-documenting ASCII format designed for the exchange of data. The metadata contains information compatible with the ISTP recommendations for CDF.
CEF 2	Cluster Exchange Format (CEF), version 2, is a self-documenting ASCII format designed for the exchange of data and introduced for Cluster Active Archive. Compared to version 1, the metadata description of vectors and tensors is different.
FITS	Flexible Image Transport System (FITS) is a digital format primarily designed to store scientific data sets consisting of multi-dimensional arrays (1-D spectra, 2-D images or 3-D data cubes) and 2-dimensional tables containing rows and columns of data.
GIF	Graphic Interchange Format (GIF) first introduced in 1987 by CompuServe. GIF uses LZW compression and images are limited to 256 colours.
HDF	Hierarchical Data Format
HDF 4	Hierarchical Data Format, Version 4
HDF 5	Hierarchical Data Format, Version 5
HTML	A text file containing structured information represented in the HyperText Mark-up Language (HTML). See <http://www.w3.org/MarkUp/>
IDFS	Instrument Data File Set (IDFS) is a set of files written in a prescribed format which contain data, timing data, and meta-data. IDFS was developed at Southwest Research Institute (SwRI).
IDL	Interactive Data Language (IDL) save set. IDL is a proprietary format.
JPEG	A binary format for still images defined by the Joint Photographic Experts Group
MATLAB_4	MATLAB Workspace save set, version 4. MAT-files are double-precision, binary, MATLAB format files. MATLAB is a proprietary product of The MathWorks.
MATLAB_6	MATLAB Workspace save set, version 6. MAT-files are double-precision, binary, MATLAB format files. MATLAB is a proprietary product of The MathWorks.
MATLAB_7	MATLAB Workspace save set, version 7. MAT-files are double-precision, binary, MATLAB format files. Version 7 includes data compression and Unicode encoding. MATLAB is a proprietary product of The MathWorks.
MPEG	A digital format for movies defined by the Motion Picture Experts Group
NCAR	The National Center for Atmospheric Research (NCAR) format. A complete description of that standard is given in appendix C of the "Report on Establishment &

	Operation of the Incoherent- Scatter Data Base", dated August 23, 1984, obtainable from NCAR, P.O. Box 3000 Boulder, Colorado 80307-3000.
NetCDF	Unidata Program Center's Network Common Data Form (NetCDF). A self-describing data portable data format for array-oriented data access. See <http://my.unidata.ucar.edu/content/software/netcdf>
PDF	A document expressed in the Portable Document Format (PDF) as defined by Adobe.
PNG	A digital format for still images. Portable Network Graphics (PNG)
QuickTime	A format for digital movies, as defined by Apple Computer. See <http://developer.apple.com/quicktime/>
Text	ASCII text
TIFF	A binary format for still pictures. Tagged Image Format File (TIFF). Originally developed by Aldus and now controlled by Adobe.
UDF	Universal Data Format (UDF). The Optical Technology Storage Association's Universal Disk Format, based on ISO 13346. See <http://www.osta.org/specs/index.htm>
VOTable	A proposed XML standard designed as a flexible storage and exchange format for tabular data.
XML	eXtensible Mark-up Language (XML). A structured format for representing information. See <http://www.w3.org/XML/>

Heliosphere List — Closed

Identifiers for regions of the solar atmosphere which extends roughly from the inner corona to the edge of the solar plasma at the heliopause separating primarily solar plasma from interstellar plasma.

Term	Definition
Inner	The region of the heliosphere extending radially out from the "surface" of the Sun to 1 AU.
Near Earth	The heliospheric region near the Earth which extends to and includes the area near the L1 and L2 Lagrange point.
Outer	The region of the heliosphere from, but not including, 1 AU to the farthest extent of the heliosphere (heliopause).
Remote 1AU	The heliospheric region near the Earth's orbit, but exclusive of the region near the Earth.

Instrument Type List — Closed

Identifiers for the type of experiment the instrument performs. This is the technique of observation.

Term	Definition
Antenna	A sensor used to measure electric potential.
Channeltron	An instrument that detects electrons, ions, and UV-radiation, according to the principle of a secondary emission multiplier. It is typically used in electron spectroscopy and mass spectrometry.
Double Sphere	A dipole antenna of which the active (sensor) elements

	are small spheres located at the ends of two wires deployed in the equatorial plane, on opposite sides of a spinning spacecraft.
Electron Drift Instrument	An active experiment to measure the electron drift velocity based on sensing the displacement of a weak beam of electrons after one gyration in the ambient magnetic field.
Electrostatic Analyser	An instrument which uses charged plates to analyze the mass, charge and kinetic energies of charged particles which enter the instrument.
Energetic Particle Instrument	An instrument that measures fluxes of charged particles as a function of time, direction of motion, mass, charge and/or species
Faraday Cup	An instrument consisting of an electrode from which electrical current is measured while a charged particle beam (electrons or ions) impinges on it. Used to determine energy spectrum and sometimes ion composition of the impinging particles.
Flux Feedback	A search coil whose bandwidth and signal/noise ratio are increased by the application of negative feedback at the sensor (flux) level by driving a collocated coil with a signal from the preamplifier.
Fourier Transform Spectrograph	An instrument that determines the spectra of a radiative source, using time-domain measurements and a Fourier transform.
Imager	An instrument which samples the radiation from an area at one or more spectral ranges emitted or reflected by an object.
Langmuir Probe	A monopole antenna associated with an instrument. The instrument applies a potential to the antenna which is swept to determine the voltage/current characteristic. This provides information about the plasma surrounding the probe and spacecraft.
Long Wire	A dipole antenna whose active (sensor) elements are two wires deployed in the equatorial plane on opposite sides of a spinning spacecraft, and whose length is several times greater than the spacecraft diameter.
Magnetometer	An instrument which measures the ambient magnetic field.
Mass Spectrometer	An instrument which distinguishes chemical species in terms of their different isotopic masses.
Microchannel Plate	An instrument used for the detection of elementary particles, ions, ultraviolet rays and soft X-rays constructed from very thin conductive glass capillaries.
Particle Correlator	An instrument which correlates particle flux to help identify wave/particle interactions.
Quadrispherical Analyser	An instrument used for the 3-D detection of plasma, energetic electrons and ions, and for positive-ion composition measurements.
Radar	An instrument which uses radar to obtain an image of an object.

Resonance Sounder	A combination of a radio receiver and a pulsed transmitter used to study the plasma surrounding a spacecraft by identifying resonances or cut-offs (of the wave dispersion relation), whose frequencies are related to the ambient plasma density and magnetic field. When the transmitter is off it is essentially a high frequency-resolution spectral power receiver.
Search Coil	A loop of wire used to determine the time variation of the magnetic flux threading the loop by measurement of the electric potential difference induced between the ends of the wire.
Spacecraft Potential Control	An instrument to control the electric potential of a spacecraft with respect to the ambient plasma by emitting a variable current of positive ions.
Spectral Power Receiver	A radio receiver which determines the power spectral density of the electric or magnetic field, or both, at one or more frequencies.
Spectrometer	An instrument that measures the component wavelengths of light or other electromagnetic radiation into its component wavelengths.
Waveform Receiver	A radio receiver which outputs the value of one or more components of the electric and/or magnetic field as a function of time.

Magnetosphere List — Closed

Term	Definition
Magnetotail	The region on the night side of the body where the magnetic filed is stretched backwards by the force of the solar wind. For Earth, the magnetotail begins at a night-side radial distance of 10 Re (X > -10Re).
Main	The region of the magnetosphere where the magnetic field lines are closed, but does not include the gaseous region gravitationally bound to the body.
Polar	The region near the pole of a body. For a magnetosphere the polar region is the area where magnetic field lines are open and includes the aural zone.
Radiation Belt	The region within a magnetosphere where high-energy particles could potentially be trapped in a magnetic field.

Measurement Type List — Closed

Identifiers for the method of making an estimated value of a quantity that forms the basis of an observaton.

Term	Definition
Activity Index	An indication, derived from one or more measurements, of the level of activity of an object or region, such as sunspot number, F10.7 flux, Dst, or the Polar Cap Indices.
Charged Particle Flux	Measurements of fluxes of charged or ionized particles at above thermal energies, including relativistic particles of

	solar and galactic origin. May give simple fluxes, but more complete distributions are sometimes possible. Composition measurements may also be made.
Dopplergram	A map or image depicting the spatial distribution of line-of-sight velocities of the observed object.
Dynamic Spectra	A three-dimensional representation of successive spectra which allows time evolution to be clearly seen. Time is plotted along the abscissa, frequency (or particle energy) along the ordinate, and the spectral power density (or differential particle flux) is represented by different shades of grey, or color. This representation is also known as a spectrogram.
Electric Field	Measurements of electric field vectors (sometimes not all components) as a time series.
Energetic Particles	Pieces of matter that are moving very fast. Energetic particles include protons, electrons, neutrons, neutrinos, the nuclei of atoms, and other sub-atomic particles.
Image Intensity	Measurements of the two-dimensional distribution of the intensity of photons from some region or object such as the Sun or the polar auroral regions; can be in any wavelength band, and polarized, etc.
Ion Composition	In situ measurements of the relative flux or density of electrically charged particles in the space environment. May give simple fluxes, but full distribution functions are sometimes measured.
Irradiance	A radiometric term for the power of electromagnetic radiation at a surface, per unit area. "Irradiance" is used when the electromagnetic radiation is incident on the surface. The SI unit of irradiance is watts per square meter (W·m-2).
Magnetic Field	Measurements of magnetic field vectors (sometimes not all components) as time series; can be space- or ground-based. Also, [Zeeman splitting, etc. based]: A region of space near a magnetized body where magnetic forces can be detected [as measured by methods such as Zeeman splitting, etc.]
Magnetogram	Measurements of the vector or line-of-sight magnetic field determined from remote sensing measurements of the detailed structure of spectral lines, including their splitting and polarization. ("Magnetogram.")
Neutral Atom Images	Measurements of neutral atom fluxes as a function of look direction; often related to remote energetic charged particles that lose their charge through charge-exchange and then reach the detector on a line.
Neutral Gas	Measurements of neutral atomic and molecular components of a body and its surrounding environments.
Profile	Measurements of a quantity as a function of height above an object such as the limb of a body.
Radiance	A radiometric measurement that describe the amount of electromagnetic radiation that passes through or is emitted from a particular area, and falls within a given

	solid angle in a specified direction. They are used to characterize both emission from diffuse sources and reflection from diffuse surfaces. The SI unit of radiance is watts per steradian per square meter (W·sr-1·m-2).
Radio and Plasma Waves	Measurements of electric and/or magnetic fields using electric or magnetic antennas at frequencies anywhere between the spacecraft spin frequency and the characteristic frequencies of the ambient plasma. The output can be waveform, power spectral density, or other statistical parameters.
Radio Soundings	Measurements of plasma density, magnetic field and possibly other parameters of the space environment by active probing of the plasma by radio waves.
Thermal Plasma	Measurements of the plasma in the energy regime where the most of the plasma occurs. May be the basic fluxes in the form of distribution functions or the derived bulk parameters (density, flow velocity, etc.).

Near Earth List — Closed

Near Surface List — Closed

Term	Definition
Atmosphere	The neutral gases surrounding a body that extends from the surface and is bound to the body by virtue of the gravitational attraction.
Auroral Region	The region in the atmospheric where electrically-charged particles bombarding the upper atmosphere of a planet in the presence of a magnetic field produce an opitcal phenomenum.
Ionosphere	The charged or ionized gases surrounding a body that are nominally bound to the body by virtue of the gravitational attraction..

Observatory Group List — Open

For a current list see Identifiers for programmatically related observatories. The value is taken from an approved list of observatory group names. See <http://www.igpp.ucla.edu/spase/> for the list.

Observatory Name List — Open

For a current list see Identifiers for a location or platform. An observatory may be part of an observatory group. The value is taken from an approved list of observatory names. See <http://www.igpp.ucla.edu/spase/> for the list.

Orientation List — Closed

Term	Definition

H	TheHierarchical Data Format
Phi	The component of a vector in a sperical coordinate system in the direction of the angle between the x-axis and the line from the origin to the measured point.
R	The component of a vector along in the radial direction in a spherical system.
Theta	The component of a vector in a sperical coordinate system in the direction of the angle between the z-axis and the line from the origin to the measured point. In a cylindical coordinate system it is the angle between the x-axis and the line from the origin to the point.
X	The component of a vector along the X-axis in a cartessian coordinate system.
Y	The component of a vector along the Y-axis in a cartessian coordinate system.
Z	The component of a vector along the Z-axis in a cartessian coordinate system.

Particle Qualifier List — Closed

Identifiers for terms which can be associated with a Particle Quantity.

Term	Definition
Average	The statistical mean; the sum of a set of values divided by the number of values in the set.
Component	A part of a multi-part entity, e.g., the components of a vector.
Deviation	The difference between an observed value and the expected value of a quantity.
Differential	The ratio of the intensity of radiant energy scattered in a given direction to the incident irradiance and thus has dimensions of area per unit solid angle.
Fit	Values that make an model agree with the data.
Integral	The summation of values over a given area or range.
Magnitude	A measure of the strength or size of a vector quantity.
Moment	Parameters determined by integration over a distribution function convolved with a power of velocity.
Parallel	Having the same direction as a given direction
Peak	The maximum value for the quantity in question, over a period of time which is usually equal to the cadence.
Perpendicular	At right angles to a given direction.
Ratio	The relative magnitudes of two quantities.
Variance	A measure of dispersion of a set of data points around their mean value. The expectation value of the squared deviations from the mean.
Vector	A quantity having both magnitude and direction, e.g. displacement, velocity, acceleration and force.

Particle Quantity List — Closed

Term	Definition
Alfven Mach Number	The ratio of the bulk flow speed to the Alfven speed.

Average Charge State	A measure of the composite deficit (positive) or excess (negative) of electrons with respect to protons.
Counts	An enumeration of the number of detection events occurring in a particle detector per unit time or over detector accumulation times.
Flux	In radiation studies, this refers to the amount of radiant energy passing through a unit area
Heat Flux	Flow of thermal energy through a gas or plasma; typically computed as third moment of a distribution function.
Mass	The measure of inertia (mass) of individual objects (e.g., aerosols).
Mass Density	The mass of particles per unit volume.
Number Density	The number of particles per unit volume.
Phase-Space Density	The number of particles per unit volume in the six-dimensional space of position and velocity.
Plasma Beta	The ratio of the plasma pressure to the magnetic pressure.
Pressure	The force per unit area exerted by a particle distribution or field.
Sonic Mach Number	The ratio of the bulk flow speed to the speed of sound in the medium.
Temperature	A measure of the kinetic energy of random motion with respect to the average. Temperature is properly defined only for an equilibrium particle distribution (Maxwellian distribution).
Thermal Speed	For a Maxwellian distribution, the difference between the mean speed and the speed within which ~69% (one sigma) of all the members of the speed distribution occur.
Velocity	Rate of change of position. Also used for the average velocity of a collection of particles, also referred to as "bulk velocity".

Particle Type List — Closed

Identifiers for the characterization of the kind of particle observed by the measurement.

Term	Definition
Aerosol	A suspension of fine solid or liquid particles in gas.
Alpha Particle	A positively charged nuclear particle that consists of two protons and two neutrons.
Dust	Free microscopic particles of solid material.
Electron	An elementary particle consisting of a charge of negative electricity equal to about 1.602 x 10**(-19) Coulomb and having a mass when at rest of about 9.109534 x 10**(-28) gram.
Ion	An atom that has acquired a net electric charge by gaining or losing one or more electrons.(Note: Z>2)
Molecule	A group of atoms so united and combined by chemical affinity that they form a complete, integrated whole, being the smallest portion of any particular compound that can exist in a free state
Neutral	Either a particle, an object, or a system that has a net

	electric charge of zero
Proton	An elementary particle that is a constituent of all atomic nuclei, that carries a positive charge numerically equal to the charge of an electron, and that has a mass of 1.673 x 10**(-24) gram.

Phenomenon Type List — Closed

Identifiers for the characteristics or categorization of an observation. Note: Joe King to provide.

Term	Definition
Bow Shock Crossing	A crossing of the boundary between the undisturbed (except for foreshock effects) solar wind and the shocked, decelerated solar wind of the magnetosheath.
Coronal Mass Ejection	A solar event which involves a burst of plasma which is ejected from the Sun into the interplanetary medium.
Energetic Solar Particle Event	An enhancement of interplanetary fluxes of energetic ions accelerated by interplanetary shocks and/or solar flares.
Forbush Decrease	A rapid decrease in the observed galactic cosmic ray intensity following the passage of an outwardly convecting interplanetary magnetic field disturbance, such as those associated with large CME's, that sweep some galactic cosmic rays away from Earth.
Geomagnetic Storm	A magnetospheric disturbance typically defined by variations in the horizontal component of the Earth's surface magnetic field. The variation typically starts with a field enhancement associated with a solar wind pressure pulse and continues with a field depression associated with an enhancement of the diamagnetic magnetospheric ring current.
Interplanetary Shock	A shock propagating generally antisunward through the slower solar wind, often seen in front of CME-associated plasma clouds.
Magnetopause Crossing	A crossing of the interface between the shocked solar wind in the magnetosheath and the magnetic field and plasma in the magnetosphere.
Solar Flare	An explosive event in the Sun's atmosphere which produces electromagnetic radiation across the electromagnetic spectrum at multiple wavelengths from long-wave radio to the shortest wavelength gamma rays.
Solar Wind Extreme	Intervals of unusually large or small values of solar wind attributes such as flow speed and ion density.

Photon Qualifier List — Closed

Identifiers for terms which can be associated with a Photon Quantity.

Term	Definition
Average	The statistical mean; the sum of a set of values divided by the number of values in the set.
Circular	Relative to polarization, right-hand circularly polarized light is defined such that the electric field is rotating clockwise as seen by an observer towards whom the

	wave is moving. Left-hand circularly polarized light is defined such that the electric field is rotating counterclockwise as seen by an observer towards whom the wave is moving. The polarization of magnetohydrodynamic waves is specified with respect to the ambient mean magnetic field : right-hand polarized waves have a transverse electric field component which turns in a right-handed sense (that of the gyrating electrons) around the magnetic field.
Line of Sight	The line of sight is the line that connects the observer with the observed object. This expression is often used with measurements of Doppler velocity and magnetic field in magnetograms, where only the component of the vector field directed along the line of sight is measured.
Linear	Relative to polarization, confinement of the E-field vector to a given plane
Peak	The maximum value for the quantity in question, over a period of time which is usually equal to the cadence.
Stoke's Parameters	The four coordinates (usually called I, Q, U, and V) relative to a particular basis for the representation of the polarization state of an electromagnetic wave propagating through space.
Variance	A measure of dispersion of a set of data points around their mean value. The expectation value of the squared deviations from the mean.
Vector	A quantity having both magnitude and direction, e.g. displacement, velocity, acceleration and force.

Photon Quantity List — Closed

Identifiers for the characterization of the physical properties of the photon.

Term	Definition
Emissivity	The ratio of radiant energy from a material to that from a blackbody at the same kinetic temperature
Equivalent Width	The area of the spectral line profile divided by the peak height or depth.
Flux	In radiation studies, this refers to the amount of radiant energy passing through a unit area
Intensity	The amount of energy transmitted by electromagnetic radiation, for example, the number of photons arriving in a given time.
Line Depth	In spectra, a measure of the amount of absorption for a particular wavelength or frequency in the spectrum
Magnetic Field	Measurements of magnetic field vectors (sometimes not all components) as time series; can be space- or ground-based. Also, [Zeeman splitting, etc. based]: A region of space near a magnetized body where magnetic forces can be detected [as measured by methods such as Zeeman splitting, etc.]
Mode Amplitude	In helioseismology the magnitude of oscillation of waves of a particular geometry.

Polarization	Direction of the electric vector of an electromagnetic wave. The wave can be linearly polarized in any direction perpendicular to the direction of travel, circularly polarized (clockwise or counterclockwise), unpolarized, or mixtures of the above.
Stoke's Parameters	The four coordinates (usually called I, Q, U, and V) relative to a particular basis for the representation of the polarization state of an electromagnetic wave propagating through space.
Velocity	Rate of change of position. Also used for the average velocity of a collection of particles, also referred to as "bulk velocity".

Processing Level List — Closed

Identifiers to characterize the amount and type of manipulation which has been applied to the sampled data.

Term	Definition
Calibrated	Data wherein sensor outputs have been convolved with instrument response function, often irreversibly, to yield physical parameter values.
Uncalibrated	Duplicate data are removed from the data stream and data are time ordered. Values are not adjusted for any potential biases or external factors.

Region List — Closed

Term	Definition
Earth	The third planet from the sun in our solar system.
Heliosphere	The solar atmosphere extending roughly from the outer corona to the edge of the solar plasma at the heliopause separating primarily solar plasma from interstellar plasma.
Sun	The star upon which our solar system is centered.

Repository Name List — Open

For a current list see Identifiers for the location or facility where the product is stored. The repository name is selected from a list of established repositories. See <http://www.igpp.ucla.edu/spase/> for the list.

Role List — Closed

Term	Definition
Co-Investigator	An individual who is a scientific peer and major participant for an investigation.
Data Producer	An individual who generated the resource and is familiar with its provenance.
General Contact	An individual who can provide information on a range of subjects or who can direct you to a domain expert.

Principal Investigator	An individual who is the administrative and scientific lead for an investigation.
Project Scientist	An individual who is an expert in the phenomenon and related physics explored by the project. A project scientist may also have a manageral role within the project.
Scientist	An individual who is an expert in the phenomenon and related physics represented by the resource.
Team Leader	An individual who is the scientific and administrative lead for an investigation.
Team Member	An individual who is a major participant in an investigation.
Technical Contact	An individual who can provide specific information with regard to the resource or supporting software

Spectral Range List — Closed

Identifiers for names associated with wavelengths. Based on the ISO 21348 Solar Irradiance Standard. Additions have been made to extend the frequency ranges to include those used in space physics. Those additions are indicated in blue text. The "Total Solar Irradiance" category has not been included since it is a type of measurement and not a specific spectral range. See Appendix A - Comparison of Spectrum Domains for a comparison of the spectral ranges with other systems.

Term	Definition
Gamma Rays	Photons with a wavelength range: 0.00001 to 0.001 nm
Hard X-rays	Photons with a wavelength range: 0.001 to 0.1 nm
Infrared	Photons with a wavelength range: 760 to 1.00x10^6 nm
Microwave	Photons with a wavelength range: 1.00x10^6 to 1.50x10^7 nm
Optical	Photons with a wavelength range: 380 to 760 nm
Radio Frequency	Photons with a wavelength range: 100,000 to 1.00x10^11 nm
Ultraviolet	Photons with a wavelength range: 10 to 400 nm
X-Rays	Photons with a wavelength range: 0.001 <= x < 10 nm

Sun List — Closed

Term	Definition
Chromosphere	The region of the Sun's (or a star's) atmosphere above the temperature minimum and below the Transition Region. The solar chromosphere is approximately 400 km to 2100 km above the photosphere, and characterized by temperatures from 4500 - 28000 K.
Corona	The outermost atmospheric region of the Sun or a star, characterized by ionization temperatures above 10^5 K. The solar corona starts at about 2100 km above the photosphere; there is no generally defined upper limit.
Interior	The region inside the body which is not visible from outside the body.
Photosphere	The atmospheric layer of the Sun or a star from which continuum radiation, especially optical, is emitted to space. For the Sun, the photosphere is about 500 km

	thick.
Transition Region	A very narrow (<100 km) layer between the chromosphere and the corona where the temperature rises abruptly from about 8000 to about 500,000 K.

Support List	Closed

9. Appendix A - Comparison of Spectrum Domains

Electromagnetic Spectrum Domains

(all wavelengths given in nanometers)

Band	Wavelength [ISO 21348]		Wavelength [EGSO]		Wavelength [VSO]	
	min	max	min	max	min	max
Gamma	0.00001	0.001	-	0.025		
X	0.001	10	0.025	10	0.02	15
HXR	0.001	0.1	0.025	0.25	0.02	1
SXR[1]	0.1	10	0.25	10	1	10
EUV	10	121	10	90	10	100
UV	100	400	90	320	90	380
Visible	380	760	320	700	350	1000
IR	760	10^6	700	10^6	700	$3.5*10^5$
Near IR	760	1400	700	$25*10^2$	700	
Mid IR	1400	3000	$25 \cdot 10^2$	$5 \cdot 10^4$		
Far IR	3000	10^6	$5 \cdot 10^4$	10^6	$3.5*10^5$	
Microwaves	10^6	$1.5*10^7$	10^6	10^9		
Radio	10^5	10^{11}	10^9	-	10^7	10^9

1 Also called “XUV” in ISO 21348

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http://www.sunspot.noao.edu/sunspot/pr/glossary.html

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http://www.pgd.hawaii.edu/eschool/glossary.htm

International System of Units (SI)
http://www.bipm.fr/en/si
Base units: http://www.bipm.fr/en/si/si_brochure/chapter2/2-1/#symbols
and those for Common derived units: http://www.bipm.fr/en/si/derived_units/2-2-2.html

ISO 8601:2004 - Date Format
http://en.wikipedia.org/wiki/ISO_8601
- or -
http://www.iso.ch/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=40874
- or -
http://www.iso.org/iso/en/prods-services/popstds/datesandtime.html

RFC 3339 - Date and Time on the Internet
The basis for the ISO 8601 standard. http://www.ietf.org/rfc/rfc3339.txt

RFC 1014 - XDR: External Data Representation standard
http://www.faqs.org/rfcs/rfc1014.html

11. Index

12. Change History

0.99.1		
2005-06-23	T.King	Removed duplicate entries; added Chris Harvey's definitions for Electron Drift; Particle Correlator and Spacecraft Potential Control
0.99.2		
2005-07-07	T.King	Corrected "Numerical Data" entry under Product
0.99.3		
2005-08-03	T.King	Added definitions supplied by J. Thieman, C. Harvey and T.King; Significant revision of document as suggested by Joe Hourcle
0.99.4		
2005-08-08	T.King	Restructured the taxonomy of elements to match the one suggested by A. Roberts; added definitions for new elements introduced in the new taxonomy
0.99.5		
2005-08-26	T.King	Clarified some definitions and corrected typographical errors based on comments from J. Thieman and J. Hourcle; changed data types of "Integer" to "Count" and "Double" to "Numeric"; added document elements to product resources; added catalog, display data to top list; included region descriptions from J. King with additions suggested by K. Reardon; and parameters losely based on a model proposed by A.Roberts
0.99.6		
2005-09-07	T.King	Corrected the inclusion of Atmosphere-Ionosphere regions into the Magnetosphere; changed Surface to Ground; removed Body and references to it; added Spherical and Cartesian under Position; remove Ratio (Numerator and Denominator); change Upper Latitude to High Latitude, Lower to Low; introduced "Photon Context" and "Particle Context" as replacements for "Independent Varaible"; removed "Provider" and "Manufacture" resources and replaced with ID pointers
0.99.7		
2005-09-08	T.King	Under Parameter add Description, Tensor Order; Change Photon Context and Particle Context to Independent Variable; Move Wavelength and Wave Number under Photon Independent Variable; Drop Speed from Particle Independent Variable; Move Polar Angle under Particle Independent Variable; Add Analysis Method under Field/Electric and Field/Magnetic; Add Wave Form, Spectra etc. under Analysis Method; Add Near 1AU under Heliosphere; Add Body under Atmosphere-Ionosphere, Magnetosphere and Ground; Add all planets + Moon under Body; Update definition of Magnetotail, etc. to be generic, add Earth examples; Change "Acceptable abbreviation" to "Conventional abbreviation" since abbreviations are not supported in the model
0.99.8		
2005-11-03	T.King	General clean-up and alignment with the schema agreed

		upon at the APL meeting (Nov 2-4, 2005)
0.99.9		
2005-11-18	T.King, A. Roberts	Incorporate comments from consortium members on the "final" draft before the release of version 1.0
1.0.0		
2005-11-22	T.King, and others	Incorporate comments from consortium members on the "final" draft before the release of version 1.0; Added Phenomenom Type list and defined terms in the list
1.0.1		
2006-01-03	T.King	Changes in value type for elements: Exposure, InputResourceID, RepositoryName, Size; Added elements: Pressure
1.0.2		
2006-03-07	T.King	Added "Project Scientist" to dictionary and "Role"; Added "Caveats" under "Instrument"; Added "Repository" resource class; Added "Registry" resource class
1.0.3		
2006-04-27	T.King	Added "Earth" as a enumeration with "Magnetosphere" as a member; changed "Observed Region" and "Instrument Region" to enumerations; changed defnition of "Item" to indicate it is a value of an enumeration; Move "Access Rights" under "Access Information"; Made "Acknowledgement optional; change "HF Radar" to "Radar"; added "NCAR" as a "Format"; dropped N, Z, Q from dictionary; Moved Mass and Size under "Particle Physical Quantity" and changed to type item; added "Near Earth" under "Heliosphere" and added "Outside Bowshock" and "Orbital" under "Near Earth"; changed "Spectral Range Name" to "Spectral Range" for consistency; correct links to "Stoke's Parameters"
1.1.0		
2006-08-31	T.King	Removed "Orbital"; modified definition of "Near Earth"; changed "Instrument type" to allow multiple occurences; made data type of "Mixed" text; added "Service" resource class; updated description of "Resource ID"; Added MAT_4, MAT_6, MAT_7 and VOTable as a Format; Added J2000 as a coordinate system; Added Base64 as an Encoding.; Added Parent ID, Energy Range, Frequency Range, Azimuthal Angle Range, Polar Angle Range, Atomic Number Range, Integral, Differential, Low and High.; Remove Coordinate System from Particle Physical Parameter; Updated Pressure definition; Add ObservatoryID under Instrument; Remove Observatory ID from Numerical Data and Display Data; Changed definition of Investigation Name; Remove Access Right from Display Data; Change Repository Name to Respoisotry ID under Access Information; Added Granule; Added Parameter Key under Physical Parameter; Add Release Date to Resource Header, Person, and Granule.; Changed "alias" to "alternate name".; Removed "Intrument Name" and "Observatory Name"; Add ChargeState to Particle Quantity; Add Field Component container; Add Statistics to Phenomenum Type.