A Space and Solar Physics Data Model

from the SPASE Consortium

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Consortium Members:

Augsburg College
      Mark Engebretson, <engebret@augsburg.edu>
      Noel Petit, <petit@augsburg.edu>

California Institute of Technology (CalTech)
      Andrew Davis, <ad@srl.caltech.edu>

Centre de Données de la Physique des Plasmas (CDPP)
      Michel Gangloff, <gangloff@cesr.fr>
      Christopher Harvey, <christopher.harvey@cesr.fr>
      Claude Huc, <claude.huc@cnes.fr>
      Thierry Levoir, <thierry.levoir@cnes.fr>

Istituto Nazionale di Astrofisica (INAF)
      Kevin Reardon, <kreardon@arcetri.astro.it>

Japan Aerospace eXploration Agency (JAXA) - STP/Ehime
      Yasumasa Kasaba, <kasaba@stp.isas.jaxa.jp>
      Ken T. Murata, STP/Ehime, <murata@cite.ehime-u.ac.jp>

Jet Propulsion Laboratory (JPL)
      Dan Crichton, <dan.crichton@jpl.nasa.gov>
      Steven Hughes, <j.steven.hughes@jpl.nasa.gov>

John Hopkins University/Applied Physics Laboratory (JHU/APL)
      Rose Daley, <rose.daley@jhuapl.edu>
      Brand Fortner, <brand.fortner@jhuapl.edu>
      Stu Nylund, <stu.nylund@jhuapl.edu>
      Jon Vandergriff, <jon.vandergriff@jhuapl.edu>
      Michele Weiss, <michele.weiss@jhuapl.edu>

Goddard Space Flight Center (GSFC)
      Dieter Bilitza (RSTX), <bilitza@mail630.gsfc.nasa.gov>
      Bobby Candey, <candey@mail630.gsfc.nasa.gov>
      Carl Cornwell (Aquilent), <carl.cornwell@aquilent.com>
      Joe Gurman, <gurman@grace.nascom.nasa.gov>
      Joe Hourcle (EITI), <oneiros@grace.nascom.nasa.gov>
      Mona Kessel, <kessel@ndadsb-f.gsfc.nasa.gov>
      Joe King, <jking@mail630.gsfc.nasa.gov>
      Terry Kucera, <kucera@stars.gsfc.nasa.gov>
      Bob McGuire, <rmcguire@pop600.gsfc.nasa.gov>
      Lou Reich (CSC), <lreich@pop500.gsfc.nasa.gov>
      Aaron Roberts, <roberts@vayu.gsfc.nasa.gov>
      Don Sawyer, <donald.sawyer@gsfc.nasa.gov>
      Dave Sibeck <dsibeck@pop600.gsfc.nasa.gov>
      Adam Szabo, <aszabo@pop600.gsfc.nasa.gov>
      Jim Thieman (NSSDC), <james.r.thieman@nasa.gov>
      Karen North, <Karen.C.North@nasa.gov>
      Aaron Smith (Aquilent), <aaron.smith@aquilent.com>

Isaac Verghese (Aquilent), <Isaac.Verghese@aquilent.com>
Vasili Rezapkin (Aquilent), <vasili.rezapkin@aquilent.com>

National Aeronautics and Space Administration (NASA) HQ
Joe Bredekamp, <jbredeka@mail.hq.nasa.gov>
Chuck Holmes, <cholmes@mail.hq.nasa.gov>

National Oceanic and Atmospheric Administration (NOAA)
Eric Kihn, <eric.a.kihn@noaa.gov>

QSS Group, Inc.
Ed Bell, <ed.bell@gsfc.nasa.gov>

Rutherford Appleton Laboratory (RAL)
Chris Perry, <c.h.perry@rl.ac.uk>
Phil Richards, <P.J.Richards@rl.ac.uk>

Stanford University
Rick Bogart, <rbogart@stanford.edu>

Southwest Research Institute (SwRI)
Joey Mukherjee, <jmukherjee@swri.org>
Dave Winningham, <david@cluster.space.swri.edu>

University of California, Los Angeles (UCLA)
Steven Joy, <sjoy@igpp.ucla.edu>
Todd King, <tking@igpp.ucla.edu>
Ray Walker, <rwalker@igpp.ucla.edu>

Table of Contents

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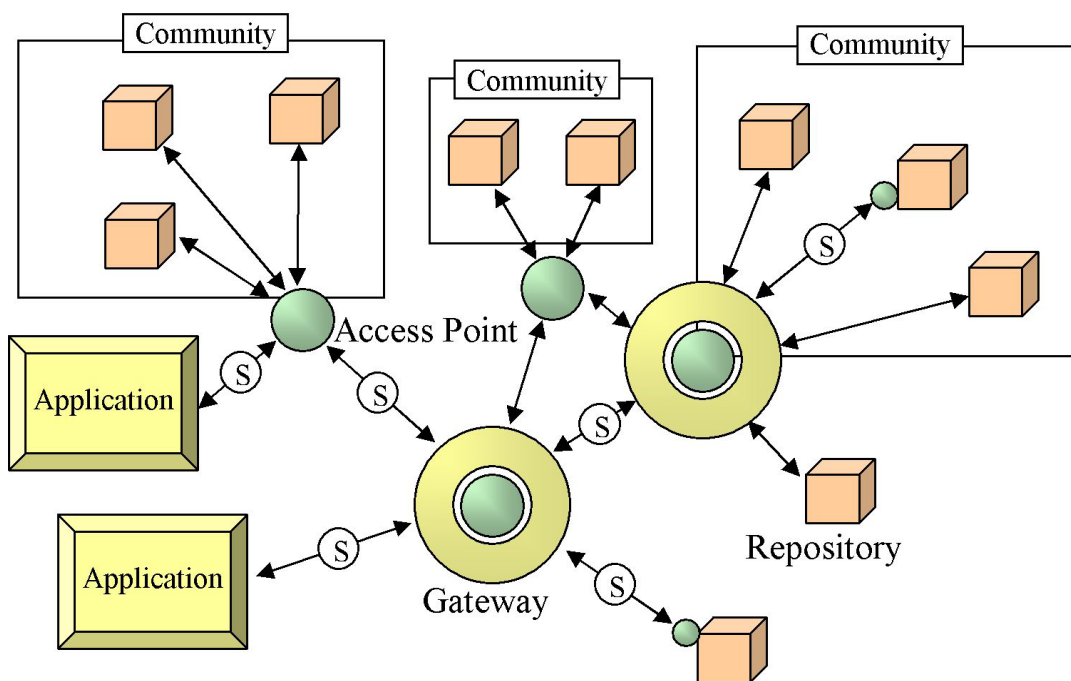
Figure 1: A possible data environment architecture. Information and data flows from Repositories to Applications through Access Points and Gateways. In this model, any Access Point or Gateway may be considered an instance of a Virtual Observatory. The portions of the system using SPASE-Data-Model-based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

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 segment of a Product Descriptor is a description of a physical quantity that the provider wishes to advertise in the product. The Product Descriptor could have just one such segment describing image data as being a full-Sun image in white light, or it could contain many segments 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 (* of A)
|      |       + Resource ID (1)
|      |       + Resource Header (1)
|      |       |       + Resource Name (1)
|      |       |       + Alternate Name (*)
|      |       |       + Release Date (1)
|      |       |       + Expiration Date (0)
|      |       |       + Description (1)
|      |       |       + Acknowledgement (0)
|      |       |       + Contact (+)
|      |       |       |       + Person ID (1)
|      |       |       |       + Role (+)
|      |       |       + Information URL (*)
|      |       |       |       + Name (0)
|      |       |       |       + URL (1)
|      |       |       |       + Description (0)
|      |       |       + Association ID (*)
|      |       |       + Prior ID (*)
|      |       + Access Information (+)
|      |       |       + Repository ID (1)
|      |       |       + Availability (0)
|      |       |       + Access Rights (0)
|      |       |       + Access URL (+)
|      |       |       |       + Name (0)
|      |       |       |       + URL (1)
|      |       |       |       + Description (0)
|      |       |       + Format (1)
|      |       |       + Encoding (0)
|      |       |       + Data Extent (0)
|      |       |       |       + Bytes (1)
|      |       |       |       + Units (0)
|      |       |       |       + Per (0)
|      |       |       + Acknowledgement (0)
|      |       + Provider Resource Name (0)
|      |       + Provider Version (0)
|      |       + Instrument ID (*)
|      |       + Phenomenon Type (1)
|      |       + Time Span (0)
|      |       |       + Start Date (1)
|      |       |       + End Date (1 of B)
```

```
|       |       |       + Relative End Date (1 of B)
|       |       |       + Note (*)
|       |       + Caveats (0)
|       |       + Keyword (*)
|       |       + Input Resource ID (+)
|       + Display Data (* of A)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Expiration Date (0)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (+)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       |       + Prior ID (*)
|       |       + Access Information (+)
|       |       |       + Repository ID (1)
|       |       |       + Availability (0)
|       |       |       + Access Rights (0)
|       |       |       + Access URL (+)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Format (1)
|       |       |       + Encoding (0)
|       |       |       + Data Extent (0)
|       |       |       |       + Bytes (1)
|       |       |       |       + Units (0)
|       |       |       |       + Per (0)
|       |       |       + Acknowledgement (0)
|       |       + Processing Level (0)
|       |       + Provider Resource Name (0)
|       |       + Provider Processing Level (0)
|       |       + Provider Version (0)
|       |       + Instrument ID (*)
|       |       + Measurement Type (+)
|       |       + Temporal Description (0)
|       |       |       + Time Span (1)
|       |       |       |       + Start Date (1)
|       |       |       |       + End Date (1 of B)
|       |       |       |       + Relative End Date (1 of B)
|       |       |       |       + Note (*)
|       |       |       + Cadence (0)
```

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

```
|    |    |    |    + Relative End Date (1 of B)
|    |    |    |    + Note (*)
|    |    |    + Cadence (0)
|    |    |    + Exposure (0)
|    |    + Spectral Range (*)
|    |    + Instrument Region (*)
|    |    + Observed Region (*)
|    |    + Caveats (0)
|    |    + Keyword (*)
|    |    + Input Resource ID (*)
|    |    + 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)
|    |    |    + Structure (0)
|    |    |    |    + Structure Type (1)
|    |    |    |    + Size (0)
|    |    |    |    + Description (0)
|    |    |    |    + Element (*)
|    |    |    |    |    + Name (1)
|    |    |    |    |    + Component (0)
|    |    |    |    |    + Index (1)
|    |    |    |    |    + Parameter Key (0)
|    |    |    + ValidMin (0)
|    |    |    + ValidMax (0)
|    |    |    + FillValue (0)
|    |    |    + Measured (1 of C)
|    |    |    |    + Field (1 of D)
|    |    |    |    |    + Field Qualifier (*)
|    |    |    |    |    + Field Quantity (1)
|    |    |    |    + Particle (1 of D)
|    |    |    |    |    + 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 (1 of D)
|     |     |     |     |     + Photon Qualifier (*)
|     |     |     |     |     + Photon Quantity (1)
|     |     |     |     |     + Frequency Range (0)
|     |     |     |     |     |          + Low (1)
|     |     |     |     |     |          + High (0)
|     |     |     |     |     |          + Units (1)
|     |     |     |     |     |          + Bin (*)
|     |     |     |     |     |          |     + Low (1)
|     |     |     |     |     |          |     + High (1)
|     |     |     |     + Mixed (1 of D)
|     |     |     + Support (1 of C)
|     + Granule (* of A)
|     |     + Resource ID (1)
|     |     + Release Date (1)
|     |     + Expiration Date (0)
|     |     + Parent ID (1)
|     |     + Prior ID (*)
|     |     + URL (1)
|     |     + Start Date (1)
|     |     + Stop Date (1)
|     |     + Checksum (0)
|     |     |     + Hash Value (1)
|     |     |     + Hash Function (1)
|     |     + Data Extent (0)
|     |     |     + Bytes (1)
|     |     |     + Units (0)
|     |     |     + Per (0)
|     + Instrument (* of A)
|     |     + Resource ID (1)
|     |     + Resource Header (1)
|     |     |     + Resource Name (1)
|     |     |     + Alternate Name (*)
|     |     |     + Release Date (1)
|     |     |     + Expiration Date (0)
|     |     |     + Description (1)
|     |     |     + Acknowledgement (0)
|     |     |     + Contact (+)
|     |     |     |     + Person ID (1)
```

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

```
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       |       + Prior ID (*)
|       + Repository (* of A)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Expiration Date (0)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (+)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       |       + Prior ID (*)
|       + Service (* of A)
|       |       + Resource ID (1)
|       |       + Resource Header (1)
|       |       |       + Resource Name (1)
|       |       |       + Alternate Name (*)
|       |       |       + Release Date (1)
|       |       |       + Expiration Date (0)
|       |       |       + Description (1)
|       |       |       + Acknowledgement (0)
|       |       |       + Contact (+)
|       |       |       |       + Person ID (1)
|       |       |       |       + Role (+)
|       |       |       + Information URL (*)
|       |       |       |       + Name (0)
|       |       |       |       + URL (1)
|       |       |       |       + Description (0)
|       |       |       + Association ID (*)
|       |       |       + Prior 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
<?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
<?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:
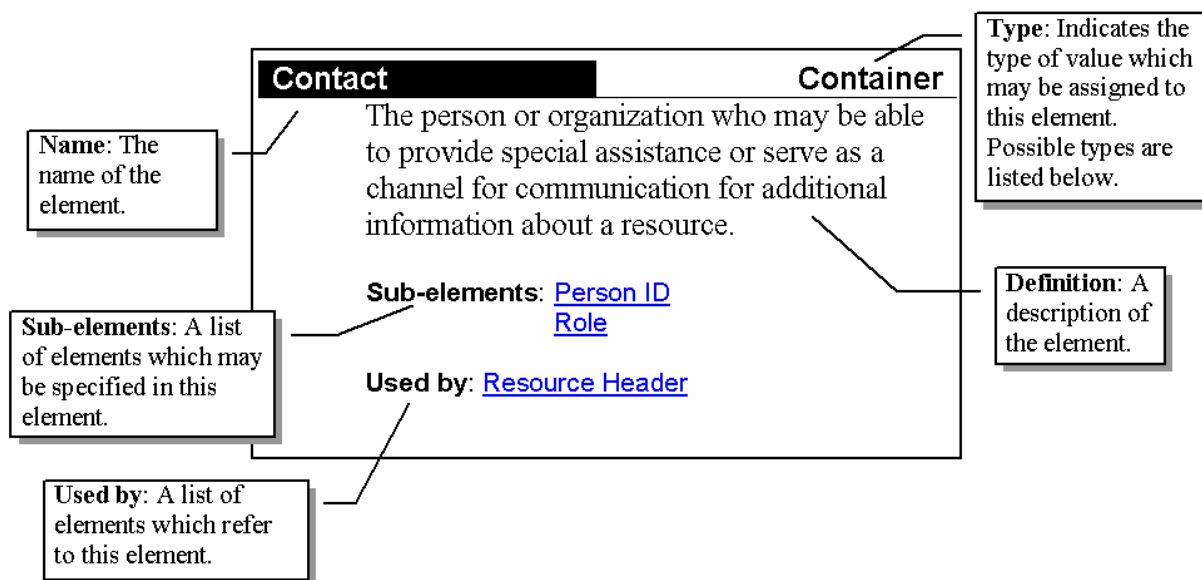
The value associated with an element must be one of the following:

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.

-22-

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
        Data Extent
        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	Container

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.

Array	Item

A sequence of values corresponding to the elements in a rectilinear, n-dimension matrix. Each value can be referenced by a unique index.

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.

Asteroid	Item

A small extraterrestrial body consisting mostly of rock and metal that is in orbit around the sun.

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.

Aurora	Item

An atmospheric phenomenon consisting of bands of light caused by charged solar particles following the earth's magnetic lines of force.

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.

Bytes	Numeric

The number of bytes expressed as a fractional number in the associated units.

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	Item

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.

Checksum   Container

A computed value that is dependent upon the contents of a digital data object. Primarily used to check whether errors or alterations have occurred during the transmission or storage of a data object.
      Sub-elements:
               Hash Function
               Hash Value

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.

Comet   Item

A relatively small extraterrestrial body consisting of a frozen mass that travels around the sun in a highly elliptical orbit.

Component   Enumeration

A part of a multi-part entity, e.g., the components of a vector.
      Allowed Values:
               D

H
Latitude
Longitude
Magnitude
N
R
T
X
Y
Z

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.

D   Item

The declination (D) of a vector with repect to a reference point.

Data Extent   Container

The area of storage in a file system required to store the contents of a resource. The data extent is expressed in unitized bytes.
    Sub-elements:
        Bytes
        Per
        Units

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.

Deputy-PI   Item

An individual who is an administrative or scientific leader for an investigation operting under the supervision of a Princial Investigator.

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

A flux measurement within a given energy and solid-angle range.

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
Processing Level
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.

| Element | Container |

A component or indiviual unit of a multiple value quantity such as an array or vector.
> Sub-elements:
>> Component
>> Index
>> Name
>> Parameter Key

| 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

Ephemeris   Item

The spatial coordinates of a body as a function of time. When used as an Instrument Type it represents the process or methods used to generate spatial coordinates.

Equivalent Width   Item

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

Expiration Date   Date

The point in time when an item is no longer available.

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

Field Qualifier   Enumeration

Characterizes the directional and statistical aspects of the field observation.
        Allowed Values:
                Array
                Average
                Component
                Component.D
                Component.H
                Component.Latitude
                Component.Longitude
                Component.Magnitude
                Component.N
                Component.R
                Component.T
                Component.X
                Component.Y
                Component.Z
                Deviation
                Magnitude
                Peak
                Perpendicular
                Scalar
                Standard Deviation
                Tensor
                Uncertainty
                Variance
                Vector

Field Quantity   Enumeration

The physical attribute of the field.
        Allowed Values:
                Cross Spectrum

Electric
Magnetic
Potential
Poynting Flux

FillValue — Text

A value that indidicates that a qunatity is undefined.

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

The number of particles or energy passing through a unit area in a unit time.

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
Postscript
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:
                Checksum
                Data Extent
                Expiration Date
                Parent ID
                Prior 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

The vertical distance of a point above or below a reference surface, such as sea level. Alternatively, the magnitude of the component of a vector normal to the local vertical direction.

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

Hash Function	Enumeration

 A function or algorithm that converts a digital data object into a hash value. Typically the hash value is small and concise when compared to the digital data object.
> Allowed Values:
>> MD5
>> SHA1
>> SHA256

Hash Value	Text

The value calculated by a hash function, e.g. the message digest of a digital data object.

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.

Index	Sequence

The location of an item in an array or vetor. An index can be multivalued to represent the location in a multidimensional 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:
>> Asteroid
>> Comet
>> 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
>> Jupiter
>> Mars
>> Mercury
>> Neptune
>> Pluto
>> Saturn
>> Sun
>> Sun.Chromosphere
>> Sun.Corona
>> Sun.Interior
>> Sun.Photosphere
>> Sun.Transition Region
>> Uranus
>> Venus

Instrument Status	Item

A quantity directly related to the operation or function of an instrument.

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
Ephemeris
Faraday Cup
Flux Feedback
Fourier Transform Spectrograph
Imager
Langmuir Probe
Long Wire
Magnetometer
Mass Spectrometer
Microchannel Plate
Particle Correlator
Quadrispherical Analyser
Radar
Resonance Sounder
Search Coil
Spacecraft Potential Control
Spectral Power Receiver
Spectrometer
Waveform Receiver

Integral   Item

The summation of values above a given threshold and over area or solid-angle 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

Jupiter	Item

The fifth planet from the sun in our solar system.

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.

Latitude	Item

For spatial points, the angular distance from a meridian normal to the equator. Angles range from +90 to -90 and positive angles are in the direction designated as "North." An alternate range of values is often called "co-latitude" where values range from 0 to +180 as measured from the "north" pole. Also referred to as the zenith angle or "theta".

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.

Longitude	Item

The angle between the meridian of a position vector or measured physical vector (e.g., B, V) and the zero meridian of the coordinate system in which the vector is expressed. Equivalently, the angle between the projection of a position or measured vector into the X-Y plane and X-axis

in the coordinate system in which the vector is expressed. Also referred to as the azimuthal angle or "phi".

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.

Mars	Item

The forth planet from the sun in our solar system.

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.

MD5	Item

Message Digest 5 (MD5) is a 128-bit message digest algorithm created in 1991 by Professor Ronald Rivest.

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
   Ephemeris
   Image Intensity
   Instrument Status
   Ion Composition
   Irradiance
   Magnetic Field
   Magnetogram
   Neutral Atom Images
   Neutral Gas
   Profile
   Radiance
   Radio and Plasma Waves
   Radio Soundings
   Thermal Plasma

Mercury	Item

The first planet from the sun in our solar system.

Metadata Contact	Item

An individual who can affect a change in the metadata describing a resource.

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

N	Item

The component of a vector that is normal to the plane formed by the radial (R) and tangential (T) components.

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

Neptune	Item

The seventh planet from the sun in our solar system.

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 gas.

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.

Note	Text

Information which is useful or important for the understanding of a value or parameter.

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
        Processing Level
        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:

            Asteroid
            Comet
            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
            Jupiter
            Mars
            Mercury
            Neptune
            Pluto
            Saturn
            Sun
            Sun.Chromosphere
            Sun.Corona
            Sun.Interior
            Sun.Photosphere
            Sun.Transition Region
            Uranus
            Venus

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.

Other	Item

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:
        Array
        Average
        Component
        Component.D
        Component.H
        Component.Latitude
        Component.Longitude
        Component.Magnitude
        Component.N
        Component.R
        Component.T
        Component.X
        Component.Y
        Component.Z
        Deviation
        Differential
        Fit
        Integral
        Magnitude
        Moment

Parallel
Peak
Perpendicular
Ratio
Scalar
Standard Deviation
Tensor
Uncertainty
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.

Per	Duration

The time interval over which a characterization applies. For example, the number of bytes generated each day.

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
Substorm

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:
Array
Average
Circular
Line of Sight
Linear
Peak
Scalar
Standard Deviation
Stoke's Parameters
Uncertainty
Variance

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
> > FillValue
> > Measured
> > Name
> > Parameter Key
> > Structure
> > Support
> > Units
> > Units Conversion
> > ValidMax
> > ValidMin

Plasma Beta   Item

The ratio of the plasma pressure to the magnetic pressure.

Pluto   Item

The ninth (sub)planet from the sun in our solar system.

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 | Item

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.

Postscript | Item

A page description programming language created by Adobe Systems Inc. that is a device-independent industry standard for representing text and graphics.

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.

Prior ID | Text

The resource identifier for a resource that is superceeded or replaced by a resource.

Processing Level | Enumeration

The standard classification of the processing performed on the product.
> Allowed Values:
>> Calibrated
>> Raw
>> Uncalibrated

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 manageral 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 in the radial direction from the center of the coordinate 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
          Expiration Date
          Information URL
          Prior ID
          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
          Deputy-PI
          General Contact
          Metadata 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.

Saturn   Item

The sixth planet from the sun in our solar system.

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.

Scalar	Item

A quantity that is completely specified by its magnitude and has no direction.

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.

SHA1	Item

Secure Hash Algorithm (SHA), a 160-bit message digest algorithm developed by the NSA and described in Federal Information Processing Standard (FIPS) publication 180-1.

SHA256	Item

Secure Hash Algorithm (SHA), a 256-bit message digest algorithm developed by the NSA and described in Federal Information Processing Standard (FIPS) publication 180-1.

Size	Sequence

The physical dimensions, proportions, magnitude, or extent of an object. A size can be multivalued to represent any number of dimensions. When size is used to describe a tensor it is the number of elements in the tensor. As such it has a limited set of values. A tensor of rank 1 has a size of 3, rank 2 a size of 9, rank 3 a size of 27 and rank n a size of 3^n.

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.

Standard Deviation	Item

The square root of the average of the squares of deviations about the mean of a set of data. Standard deviation is a statistical measure of spread or variability.

Start Date	Date

The specification of a starting point in time.

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.

Structure	Container

The organization and relationship of individual values within a quantity.
Sub-elements:
        Description
        Element
        Size
        Structure Type

Structure Type	Enumeration

The classification of the organization of a structure.
Allowed Values:
        Array
        Scalar
        Tensor
        Vector

Substorm	Item

A process by which plasma in the magnetotail becomes energized at a fast rate.

Sun	Enumeration

The star upon which our solar system is centered.
Allowed Values:
        Chromosphere
        Corona
        Interior
        Photosphere
        Transition Region

Support	Enumeration

Information useful in understanding the context of an observation, typically observed or measured coincidentally with a physical observation.
Allowed Values:
        Other
        Positional
        Temporal

Surface	Item

The outermost area of a solid object.

T	Item

The component of a vector that is normal to the plane formed by R and the Sun's spin vector.

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	Item

Pertaining to time.

Temporal Description	Container

A characterization of the time over which the measurement was taken.
> Sub-elements:
>> Cadence
>> Exposure
>> Time Span

Tensor	Item

A generalized linear "quantity" or "geometrical entity" that can be expressed as a multi-dimensional array relative to a choice of basis of the particular space on which it is defined.

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.

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
>> Note
>> 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.

Uncertainty	Item

A statistically defined discrepancy between a measured quantity and the true value of that quantity that cannot be corrected by calculation or calibration.

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. Units should be represented by widely accepted representation. For example, units should conform to the International System of Units (SI) which is maintained by BIPM (Bureau International des Poids et Mesures (see <http://www.bipm.fr/>) when appropriate or use tokens like "Re" to represent units of the Radius of the Earth. Within a 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.

Uranus	Item

The eigth planet from the sun in our solar system.

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.

ValidMax	Text

The largest legitmate value.

ValidMin	Text

The smallest legitmate value.

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".

Venus	Item

The second planet from the sun in our solar system.

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

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

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

Availability List	Identifier

Identifiers for indicating the method or service which may be used to access the resource.

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.

Component List	Closed

Identifiers for the axis of coordinate systems.

Term	Definition
D	The declination (D) of a vector with repect to a reference point.
H	The vertical distance of a point above or below a reference surface, such as sea level. Alternatively, the magnitude of the component of a vector normal to the local vertical direction.
Latitude	For spatial points, the angular distance from a meridian normal to the equator. Angles range from +90 to -90 and positive angles are in the direction designated as "North." An alternate range of values is often called "co-latitude" where values range from 0 to +180 as measured from the "north" pole. Also referred to as the zenith angle or "theta".
Longitude	The angle between the meridian of a position vector or measured physical vector (e.g., B, V) and the zero meridian of the coordinate system in which the vector is expressed. Equivalently, the angle between the projection of a position or measured vector into the X-Y plane and X-axis in the coordinate system in which the vector is expressed. Also referred to as the azimuthal angle or "phi".
Magnitude	A measure of the strength or size of a vector quantity.

N	The component of a vector that is normal to the plane formed by the radial (R) and tangential (T) components.
R	The component of a vector in the radial direction from the center of the coordinate system.
T	The component of a vector that is normal to the plane formed by R and the Sun's spin vector.
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.

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

Identifiers for the regions surrounding the Earth.

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
Array	A sequence of values corresponding to the elements in a rectilinear, n-dimension matrix. Each value can be referenced by a unique index.
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.
Scalar	A quantity that is completely specified by its magnitude and has no direction.
Standard Deviation	The square root of the average of the squares of deviations about the mean of a set of data. Standard deviation is a statistical measure of spread or variability.
Tensor	A generalized linear "quantity" or "geometrical entity" that can be expressed as a multi-dimensional array relative to a choice of basis of the particular space on which it is defined.
Uncertainty	A statistically defined discrepancy between a measured quantity and the true value of that quantity that cannot be corrected by calculation or calibration.
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)
Postscript	A page description programming language created by Adobe Systems Inc. that is a device-independent industry standard for representing text and graphics.
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/>

Hash Function List   Closed

Identifiers for functions or algorithms that convert a digital data object into a hash value.

Term	Definition
MD5	Message Digest 5 (MD5) is a 128-bit message digest algorithm created in 1991 by Professor Ronald Rivest.
SHA1	Secure Hash Algorithm (SHA), a 160-bit message digest algorithm developed by the NSA and described in Federal Information Processing Standard (FIPS) publication 180-1.
SHA256	Secure Hash Algorithm (SHA), a 256-bit message digest algorithm developed by the NSA and described in Federal Information Processing Standard (FIPS) publication 180-1.

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
Ephemeris	The spatial coordinates of a body as a function of time. When used as an Instrument Type it represents the process or methods used to generate spatial coordinates.
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

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

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.
Ephemeris	The spatial coordinates of a body as a function of time. When used as an Instrument Type it represents the process or methods used to generate spatial coordinates.
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.
Instrument Status	A quantity directly related to the operation or function of an instrument.

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 gas.
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

Identifiers for heliospheric regions near the earth or within the earth's orbit

Near Surface List   Closed

Identifiers for regions of the gaseous and possibly ionized environment of a body extending from the surface to some specified altitude.

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.

Particle Qualifier List   Closed

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

Term	Definition
Array	A sequence of values corresponding to the elements in a rectilinear, n-dimension matrix. Each value can be referenced by a unique index.
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	A flux measurement within a given energy and solid-angle range.
Fit	Values that make an model agree with the data.
Integral	The summation of values above a given threshold and over area or solid-angle 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.
Scalar	A quantity that is completely specified by its magnitude and has no direction.
Standard Deviation	The square root of the average of the squares of deviations about the mean of a set of data. Standard deviation is a statistical measure of spread or variability.
Tensor	A generalized linear "quantity" or "geometrical entity" that can be expressed as a multi-dimensional array relative to a choice of basis of the particular space on which it is defined.
Uncertainty	A statistically defined discrepancy between a measured quantity and the true value of that quantity that cannot be corrected by calculation or calibration.
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

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

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	The number of particles or energy passing through a unit area in a unit time.
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

Velocity	mean speed and the speed within which ~69% (one sigma) of all the members of the speed distribution occur. 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 $1.602 \times 10^{**}(-19)$ Coulomb and having a mass when at rest of about $9.109534 \times 10^{**}(-28)$ 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 $1.673 \times 10^{**}(-24)$ gram.

Phenomenon Type List   Closed

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

Term	Definition
Aurora	An atmospheric phenomenon consisting of bands of light caused by charged solar particles following the earth's magnetic lines of force.
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.
Substorm	A process by which plasma in the magnetotail becomes energized at a fast rate.

Photon Qualifier List   Closed

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

Term	Definition
Array	A sequence of values corresponding to the elements in a rectilinear, n-dimension matrix. Each value can be referenced by a unique index.
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.

Scalar	A quantity that is completely specified by its magnitude and has no direction.
Standard Deviation	The square root of the average of the squares of deviations about the mean of a set of data. Standard deviation is a statistical measure of spread or variability.
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.
Uncertainty	A statistically defined discrepancy between a measured quantity and the true value of that quantity that cannot be corrected by calculation or calibration.
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.

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	The number of particles or energy passing through a unit area in a unit time.
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

Identifiers for areas of the physical world which may be occupied or observed.

Term	Definition
Asteroid	A small extraterrestrial body consisting mostly of rock and metal that is in orbit around the sun.
Comet	A relatively small extraterrestrial body consisting of a frozen mass that travels around the sun in a highly elliptical orbit.
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.
Jupiter	The fifth planet from the sun in our solar system.
Mars	The forth planet from the sun in our solar system.
Mercury	The first planet from the sun in our solar system.
Neptune	The seventh planet from the sun in our solar system.
Pluto	The ninth (sub)planet from the sun in our solar system.
Saturn	The sixth planet from the sun in our solar system.
Sun	The star upon which our solar system is centered.
Uranus	The eigth planet from the sun in our solar system.
Venus	The second planet from the sun in our solar system.

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

Identifiers for the assigned or assumed function or position of an individual.

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.
Deputy-PI	An individual who is an administrative or scientific leader for an investigation operting under the supervision

of a Princial Investigator.

General Contact	An individual who can provide information on a range of subjects or who can direct you to a domain expert.
Metadata Contact	An individual who can affect a change in the metadata describing a resource.
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 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 1.00×10^6 nm
Microwave	Photons with a wavelength range: 1.00×10^6 to 1.50×10^7 nm
Optical	Photons with a wavelength range: 380 to 760 nm
Radio Frequency	Photons with a wavelength range: 100,000 to 1.00×10^{11} nm
Ultraviolet	Photons with a wavelength range: 10 to 400 nm
X-Rays	Photons with a wavelength range: $0.001 <= x < 10$ nm

Structure Type List — Closed

Identifiers for the classification of the organization of a structure.

Term	Definition
Array	A sequence of values corresponding to the elements in a rectilinear, n-dimension matrix. Each value can be referenced by a unique index.
Scalar	A quantity that is completely specified by its magnitude and has no direction.
Tensor	A generalized linear "quantity" or "geometrical entity" that can be expressed as a multi-dimensional array relative to a choice of basis of the particular space on which it is defined.
Vector	A quantity having both magnitude and direction, e.g. displacement, velocity, acceleration and force.

Sun List   Closed

Identifiers for regions of the star upon which our solar system is centered.

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

Identifiers for the information useful in understanding the context of an observation, typically observed or measured coincedently with a physical observation.

Term	Definition
Other	Values, such as flags, that are not time tags, location data or measured or derived parameters.
Positional	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.
Temporal	Pertaining to time.

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

10. Bibliography

National Solar Observatory Sacramento Peak
http://www.sunspot.noao.edu/sunspot/pr/glossary.html

Terms and Definitions
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.

1.1.1		
Draft	T.King	Changed InstrumentID and Bin to multiple occurrence; Removed enumeration of Component.; Modified definition of Units.;Changed AccessURL to type container.

1.2.0		
Draft	T.King	Added Aurora and Substorm under Phenomenon Type; Added Checksum, Hash Value, Hash Function, MD5 and SHA1, SHA256; Added Note as a term and added Note under Timespan; Added all planets, Comet and Asteroid as regions; Added Data Extent, Bytes and Per to describe the size of a resource; Added Data Extent to Access URL and Granule; Added the ValidMin, ValidMax and FillValue to Physical Parameter; Added Uncertainty and Standard Deviation to qualifiers; Added Expiration Date to Resource Header and Granule; Added Longitude and Latitude to Orientation; Updated Phi and Theta defnitions; Added Ephmereris as an Instrument Type.;Added Sequence as a element type and changes Size to a Sequence.; Defined PriorID and added PriorID to ResourceHeader and Granule.;Changed InstrumentID in DisplayData and NumericalDAta to one or more occurrences.;Added Metadata Contact to Role.;Modified defnitions of H, Flux, Integral and Differential.; Cardinality of Access Information changed from 1 to + (1 or more).;Added Deputy-PI to Roles;Changed cardinality of Caveats under Instrument to optional.;Added Element with members of Name, Index, ParameterKey and Component;Added Element under Dimension.;Removed Orientation.;Made Component and enumeration with the values from Orientation;Added InstrumentStatus to MeasurementType.;Converted Support to an enumeration with Other, Positional and Temporal as members.;Added ProcessingLevel, Removed Theta and Phi; Added Postscript as a Format