

# SPASE metadata registry for the ESA Heliophysics missions

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Support Archive Scientist  
Telespazio for ESA

**Cluster Science Archive**  
WELCOME TO THE CLUSTER SCIENCE ARCHIVE  
The Cluster Science Archive provides access to all science and support data of the on-orbit Cluster (2001-) and Double Star (2004-2006) missions. For each instrument on these missions, detailed documentation is available. Users are warmly invited to read the 'Recommendations' provided in the User Guide and Calibration Report of each instrument.

**LATEST NEWS**  
Data Mining: link  
Search for intervals from the whole mission that match the ranges of 95 key parameters - see link above. Plus...

2022-09-13 13:39:09 ESA Team

**Solar Orbiter Archive**  
WELCOME TO THE SOLAR ORBITER ARCHIVE  
Solar Orbiter is a joint ESA-NASA collaboration that will address the central question of heliophysics: How does the Sun create and control the heliosphere? This primary, overarching scientific objective can be broken down into four interrelated scientific questions:

- How and where do the solar wind plasma and magnetic field originate in the corona?
- How do solar transients drive heliospheric variability?
- How do solar eruptions produce energetic particle radiation that fills the heliosphere?
- How does the solar dynamo work and drive connections between the Sun and the heliosphere?

**TOP FEATURES**  
SEARCH Search through all SOAR data.  
ADDITIONAL SCIENCE DATA INFORMATION Further information and documentation on the Science data production provided by the instrument teams. Use the data in these pages to better understand the Science data in the archive.  
HELP Comprehensive guide to all aspects of using the Solar Orbiter Archive.

**ESA Soho Science Archive**  
Home Search SSA Help  
Latest Sun images  
LASO C2, LASO C1, EIT 171, EIT 95, EIT 284

**Soho Science Archive**  
SOHO (Solar Heliospheric Observatory) is a space-based observatory, viewing and investigating the Sun from its deep core, through its outer atmosphere - the corona - and the domain of the solar wind, out to a distance ten times beyond the Earth's orbit. SOHO is designed to study the internal structure of the Sun, its extensive outer atmosphere and the origin of the solar wind, the stream of highly ionized gas that flows continuously outward through the Solar System. This space-based Observatory is viewing the Sun from its deep core, through its outer atmosphere - the 'corona' - and the domain of the solar wind, out to a distance ten times beyond the Earth's orbit.

**ABOUT THE ARCHIVE**  
SOHO Science Archive The new web-based SOHO archive from ESA provides an easy access to the all the Soho generated datasets, providing access to all the science legacy and new data from this mission using a user-friendly interface. This new archive make use of standard protocols to query and retrieve data to it allows upon the creation of scripts to access the data.

**Heliophysics Archive**  
HOME | FTP Log In | ESA

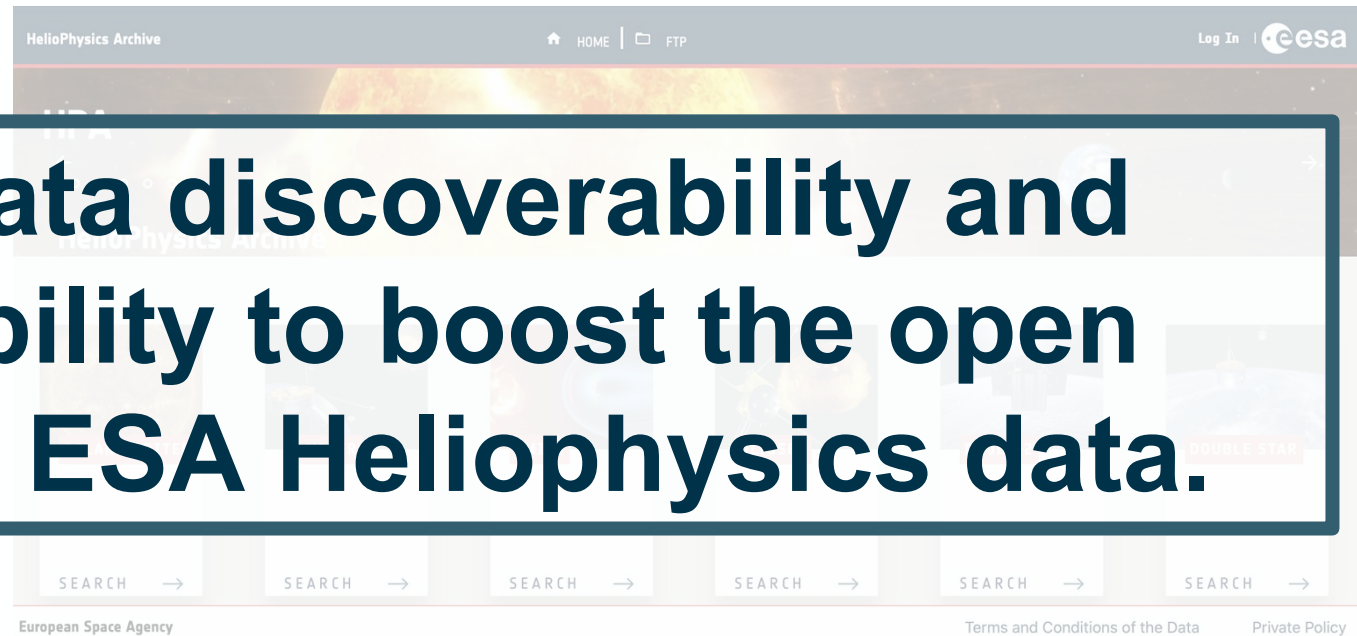
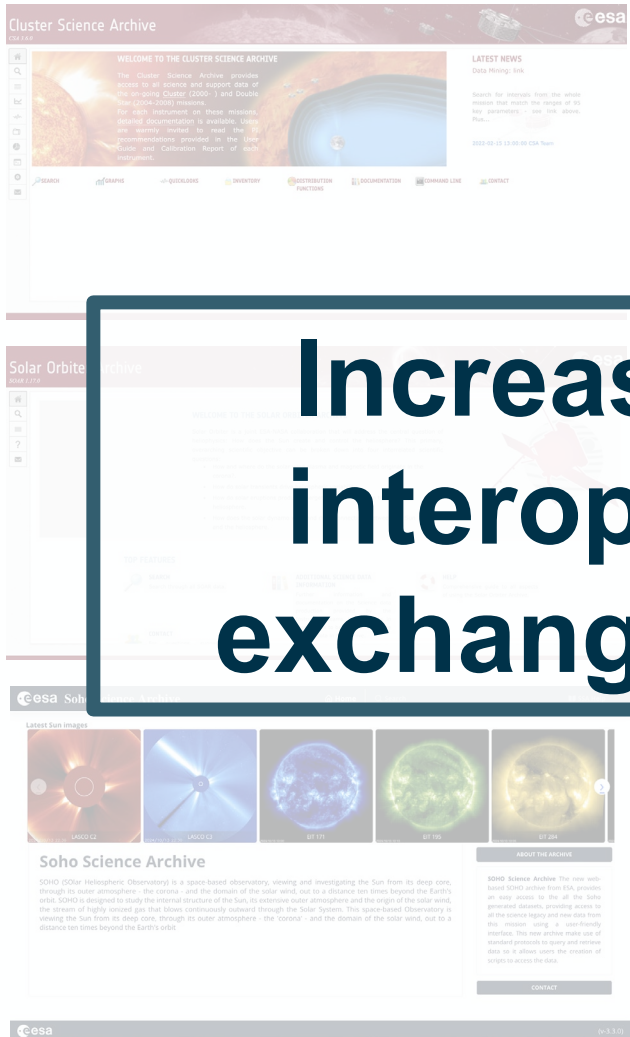
**HPA**  
Heliophysics Archive

**SOLAR ORBITER** **CLUSTER** **SMILE** **ULYSSES** **PROBA-2** **DOUBLE STAR**

SEARCH →

European Space Agency Terms and Conditions of the Data Private Policy

# Momentum: ESAC Science Data Centre's (ESDC) priorities



**Increase data discoverability and interoperability to boost the open exchange of ESA Heliophysics data.**



## In operations:

- Making datasets, metadata, data visualisation and other advanced tools for individual missions in their respective archives (e.g, SSA, CSA, SOAR, ...).
- Making documents necessary to understand the data available on cosmos esa website (e.g., <https://www.cosmos.esa.int/web/soar/instrument-documentation> or <https://www.cosmos.esa.int/web/csa/documentation>)


## In development:

- Making main Heliophysics Archive (HPA) including missions in operations + legacy and future missions.
- Making heliophysics datasets findable and citable:
  - Producing DOI for instruments onboard ESA heliophysics missions (done);
  - Producing DOI for each dataset (ongoing);
  - Heliophysics Datasets descriptions using SPASE model (ongoing).

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  - Heliophysics Datasets descriptions using SPASE model (ongoing). 
    - Starting with Solar Orbiter insitu instruments / dataset level.

# Available metadata at ESA Archives: where to find it?



EUROPEAN SPACE AGENCY SCIENCE & TECHNOLOGY SIGN IN

## Solar Orbiter Archive

SOAR 1.17.0

RESULTS #1 X

science (15)

Download selected Download all

Item Id	Level	Descriptor	Begin Time	End Time
<input checked="" type="checkbox"/> solo_L2_mag-rtn-normal_20240307	L2	mag-rtn-normal	2024-03-07T00:00:00.0	2024-03-08
<input type="checkbox"/> solo_L2_mag-rtn-burst_20240307	L2	mag-rtn-burst	2024-03-07T00:00:00.0	2024-03-08
<input type="checkbox"/> solo_L2_mag-rtn-normal-1-minute_20240307	L2	mag-rtn-normal-1-minute	2024-03-07T00:00:00.0	2024-03-08
<input type="checkbox"/> solo_L2_mag-srf-burst_20240307	L2	mag-srf-burst	2024-03-07T00:00:00.0	2024-03-08
<input type="checkbox"/> solo_L2_mag-srf-normal_20240307	L2	mag-srf-normal	2024-03-07T00:00:00.0	2024-03-08
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<input type="checkbox"/> solo_L2_mag-rtn-normal-1-minute_20240308	L2	mag-rtn-normal-1-minute	2024-03-08T00:00:00.0	2024-03-09

1 of 1 Page size: 100 Displaying 1-15 of 15

SOLO\_L2\_MAG-RTN-NORMAL\_20240307

Science CDF Details Variable Details Repository Files

Project	Solar Orbiter
Source Name	SOL-O>Solar Orbiter
Discipline	Space Physics>Interplanetary Studies
Data Type	L2>Level 2 Calibrated Data
Descriptor	MAG>Magnetometer
Data Version	01
PI Name	T. Horbury
PI Affiliation	The Blackett Laboratory, Imperial College London
Mission group	Solar Orbiter
Logical source	solo_L2_mag-rtn-normal
Logical File ID	solo_L2_mag-rtn-normal_20240307_V01
Logical Source Description	Solar Orbiter Magnetometer Level 2 Normal Mode Data in RTN coordinates
SOOP Type	NA
Rules of use	Publication quality. Take note of Quality Flag and refer to SOL-MAG-DPDD for exceptions
Generated by	The Blackett Laboratory, Imperial College London
Generation date	2024-07-11T10:14:46
Data Product	RTN > Data in RTN coordinates

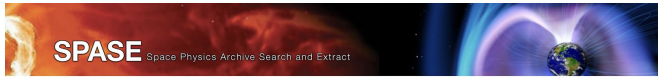
A dataset provided by the European Space Agency

Name	MAG, Solar Orbiter magnetometer
Mission	Solar Orbiter
URL	<a href="http://soar.esac.esa.int/">http://soar.esac.esa.int/</a>
DOI	<a href="https://doi.org/10.5270/esa-ux7y520">https://doi.org/10.5270/esa-ux7y520</a>
Abstract	The Solar Orbiter MAG magnetometer is a high performance dual fluxgate instrument, with data rates up to 128 vectors/s from each sensor. Each sensor has a noise level of around 5pT at 1Hz, allowing access to the ion kinetic regime and, near perihelion, access to electron kinetic phenomena at tens of Hz. Significant signals from spacecraft subsystems and other instruments can be present in the raw data. Extensive cleaning is undertaken to remove as much of the artificial signals as possible, resulting in what is normally a very high quality data set, but some artifacts are present on occasion.
Description	Level 2 data files contain the best estimates of the magnetic field and have signals from the spacecraft and other instrument removed; flags within the files indicate the quality of the data as a function of time. Normal mode data coverage is nearly complete. Burst mode coverage varies from a few minutes a day to complete, depending on available telemetry. Level 0 and 1 data files include data from both onboard and outboard sensors.
Publication	Horbury, T.S., et al., The Solar Orbiter magnetometer, A&A, 642, A1, <a href="https://doi.org/10.1051/0004-6361/201937257">https://doi.org/10.1051/0004-6361/201937257</a>
Temporal Coverage	2020-02-11L..
Mission Description	Solar Orbiter is a mission of international collaboration between ESA and NASA. It explores the Sun and the heliosphere from close up and out of the ecliptic plane. Launched on 10 February 2020, it aims to address the overarching science question: how does the Sun create and control the Heliosphere – and why does solar activity change with time? To answer it, the Solar Orbiter spacecraft is cruising to a unique orbit around the Sun, eventually reaching a minimum perihelion of 0.28 AU, and performing measurements out of the ecliptic plane: reaching 18° heliographic latitude during its nominal mission phase, and above 30° during its extended mission phase. It carries six remote sensing instruments to observe the Sun and the solar corona, and four in-situ instruments to measure the solar wind, its thermal and energetic particles, and electromagnetic fields. Müller, D., Marsden, R.G., St. Cyr, O.C., et al., The Solar Orbiter mission: science overview, A&A, 642, A1, 2020; DOI: <a href="https://doi.org/10.1051/0004-6361/202036467">https://doi.org/10.1051/0004-6361/202036467</a>
Creator Contact	Tim Horbury, Principal Investigator, Imperial College London UK; <a href="mailto:thorbury@imperial.ac.uk">thorbury@imperial.ac.uk</a>
Publisher And Registrant	European Space Agency
Credit Guidelines	When publishing any works related to this experiment, please cite the DOI as <a href="https://doi.org/10.5270/esa-ux7y520">https://doi.org/10.5270/esa-ux7y520</a> .

- Metadata currently available in SOAR (Solar Orbiter Archive) are integrated in CDFs and FITS files, thus associated with data files – ISTP and IAU compliancy.
- Instruments metadata are made available in ESDC cosmos webpage, <https://www.cosmos.esa.int/web/esdc/doi/heliophysics>
- Unlike planetary datasets, documentation is not also associated to XML/JSON descriptions



# Starting with SPASE metadata descriptions



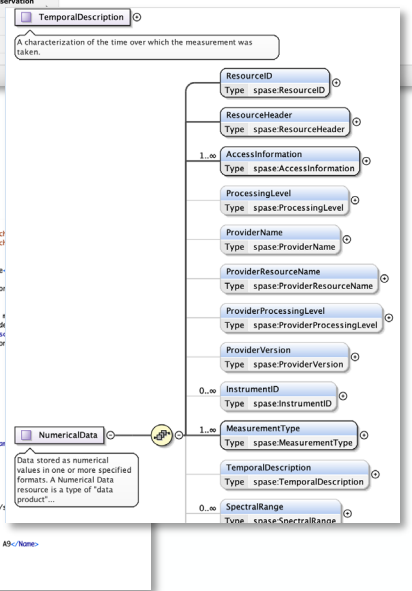
1. Get to know what SPASE is (Information Model).

2. Get involved with the SPASE Metadata Working Group – subscribing its mailing list!

3. Check what has been done to describe ESA missions datasets.

4. Understand the SPASE rules to obey when describing a dataset.

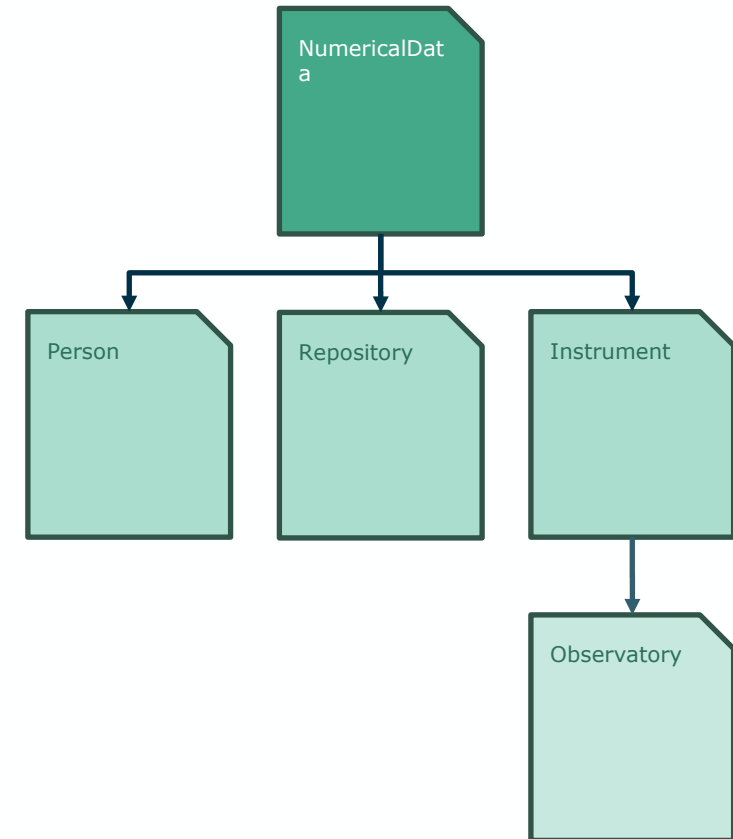
5. Mapping from ESA metadata to SPASE model attributes.



In general, solar orbiter instrument datasets metadata is available within CDFs / SOAR.

## (!) Dependencies within NumericalData Description:

- ResourceHeader>Contact
  - Person Descriptions (e.g., MM, PS, MetaData Contact, PIs, ...).
- AccessInformation
  - RepositoryID Description (e.g., ESDC).
  - InstrumentID Description (e.g., SolarOrbiter/MAG),
    - which needs ObservatoryID Description (e.g., SolarOrbiter).





## (!) SPASE NumericalData>ResourceHeader>Description\* Attribute:

Full descriptions required (learning about the instrument and...) reading documentation produced by the team (e.g., DPDD – Data Product Description Document) to get detailed information (e.g., non-constant cadence for the same dataset).

\*A narrative explanation with detail appropriate for the item it describes. For example, a description of data resource 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 the resource.

### NumericalData

```
<Version>2.6.1</Version>
<NumericalData>
  <ResourceID>spase://ESA/NumericalData/SolarOrbiter/MAG/Level2/R
  TN/Burst/VariableCadence</ResourceID>
  <ResourceHeader>
    <ResourceName>Solar Orbiter Magnetometer (MAG), Magnetic Field,
    Radial-Tangential-Normal (RTN) coordinates, Burst Mode, Level 2, Variable
    Cadence Data</ResourceName>
    <ReleaseDate>2024-10-01T12:00:00.00Z</ReleaseDate>
    <Description>This data set contains Solar Orbiter Magnetometer
    (MAG) Magnetic Field measurements, in Radial-Tangential-Normal (RTN)
    coordinates, using Burst Mode, Level 2 (L2), with variable cadence
    (baseline is 64 vectors/s). Publication quality. Take note of Quality Flag and
    refer to SOL-MAG-DPDD for exceptions</Description>
    <Acknowledgement>Solar Orbiter magnetometer data was provided
    by Imperial College London and supported by the UK Space
    Agency.</Acknowledgement>
    <Contact>
      <PersonID>spase://ESA/Person/Timothy.S.Horbury</PersonID>
      <Role>PrincipalInvestigator</Role>
    </Contact>
  ...

```

- MetadataContact for ESA Heliophysics missions is set to be the archive science lead.
- ESA defined as responsible entity, use of ESA/Person instead of SMWG/Person.
- Mirroring ESA metadata SPASE description at ESDC-ESAC-ESA-INT GitHub.
- Instrument Teams are required to review the SPASE metadata descriptions produced by the Archive Scientists, but not (yet?) producing them.

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<NumericalData>
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  TN/Burst/VariableCadence</ResourceID>
  <ResourceHeader>
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  <Contact>
    <PersonID>spase://ESA/Person/Timothy.S.Horbury</PersonID>
    <Role>PrincipalInvestigator</Role>
  </Contact>
  <Contact>
    <PersonID>spase://ESA/Person/Arnaud.Masson </PersonID>
    <Role>MetadataContact</Role>
  </Contact>
```

Shing: “SPASE is a living model”

– it really is!

New feature: ESA defined as responsible entity:

- use of ESA/Person instead of SMWG/Person.

SPASE group defined good practices as proposed by ESDC.

- ResourceID vs Cadence (especially when Cadence is variable):

“In resourceID, in the case of variable cadences we will use “VariableCadence” to indicate.

In the temporal description itself we will use the min/max and leave the cadence value empty or fill in with most commonly occurring cadence.

Also, elaborate on the variable cadence in the SPASE description field.”

- Associated documentation to the mission and instruments available in the Archive having a SPASE metadata description.
- In a near future, require SPASE descriptions to be produced by the Instrument Teams (knowledge of the instrument and produced datasets and their caveats).
- Coordination between ESA Space Weather Office and ESA Data Centre (ESDC)/HPA.

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Thank you  
for your attention!