



Vocabulary Broker for Open Science

B. Ritschel (Physicist and Data Scientist) berndritschel@yahoo.de,
G. Neher (University of Applied Sciences Potsdam),
T. Iyemori (京都大学)



第4回オープンサイエンスデータ推進ワークショップ
- データマネジメントを中心に -



2017年2月28日-3月1日

World Data System Vocabulary Broker - Proof of Concept

Linking Research Data

[Home](#) |
 [GCMD Keywords](#) |
 [SPASE Keywords](#) |
 [ESPAS Keywords](#) |
 [UAT Keywords](#)

GCMD

- [GCMD Climate Indicators](#)
- [GCMD Solid Earth](#)
- [GCMD Sun-Earth Interactions](#)
- [GCMD Land Surface](#)
- [GCMD Spectral/Engineering](#)
- [GCMD Terrestrial Hydrosphere](#)
- [GCMD Earth Science Services](#)
- [GCMD Oceans](#)
- [GCMD Biosphere](#)
- [GCMD Agriculture](#)
- [GCMD Atmosphere](#)
- [GCMD Paleoclimate](#)
- [GCMD Cryosphere](#)
- [GCMD Human Dimensions](#)
- [GCMD Biological Classification](#)

Magnetic Field

- prefLabel • [Magnetic Field](#)
- definition • Pertaining to the magnetic field generated by the Earth, consisting of both the dipole and non-dipole components.
- narrower
 - [Magnetic Declination](#)
 - [Magnetic Inclination](#)
 - [Geomagnetic Induction](#)
 - [Magnetic Intensity](#)
 - [Magnetic Anomalies](#)
- inScheme • [GCMD Solid Earth](#)
- closeMatch
 - [Magnetic fields](#)
 - [Magnetic Field](#)
 - [Magnetic Field](#)
 - [Magnetic Field](#)
- broader • [Geomagnetism](#)

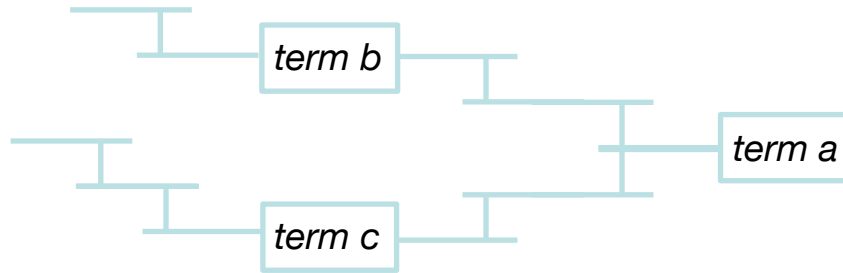
Concept Search

Recent blog posts

Experimental: A magnetic field is the magnetic effect of electric currents and magnetic materials. The magnetic field at any given point is specified by both a direction and a magnitude (or strength); as such it is a vector field. The term is used for two distinct but closely related fields denoted by the symbols B and H, where H is measured in units of amperes per meter (symbol: A·m⁻¹ or A/m) in the SI. B is measured in teslas (symbol:T) and newtons per meter per ampere (symbol: N·m⁻¹·A⁻¹ or N/(m·A)) in the SI. B is most commonly defined in terms of the Lorentz force it exerts on moving electric charges. Magnetic fields can be produced by moving electric charges and the intrinsic magnetic moments of elementary particles associated with a fundamental quantum property, their spin. In special relativity, electric and magnetic fields are two interrelated aspects of a single object, called the electromagnetic tensor; the split of this tensor into electric and magnetic fields depends on the relative velocity of the observer and charge. In quantum physics, the electromagnetic field is quantized and electromagnetic interactions result from the exchange of photons. In everyday life, magnetic fields are most often encountered as a force created by permanent magnets, which pull on ferromagnetic materials such as iron, cobalt, or nickel, and attract or repel other magnets. Magnetic fields are widely used throughout modern technology, particularly in electrical engineering and electromechanics. The Earth produces its own magnetic field, which is important in navigation, and it shields the Earth's atmosphere from solar wind. Rotating magnetic fields are used in both electric motors and generators. Magnetic forces give information about the charge carriers in a material through the Hall effect. The interaction of magnetic fields in electric devices such as transformers is studied in the discipline of magnetic circuits.

Vocabulary Broker Components and Workflow

Search

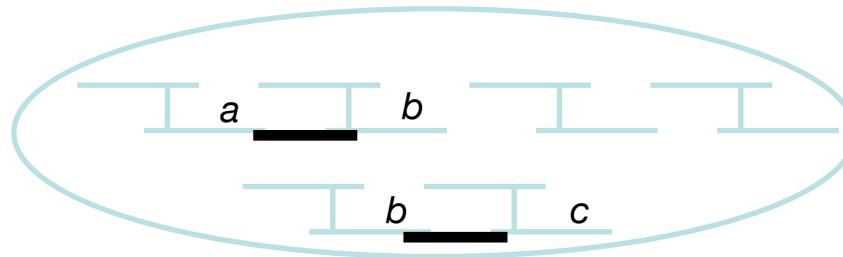


← Term/Keyword
search



Vocabulary
Broker

Mapping

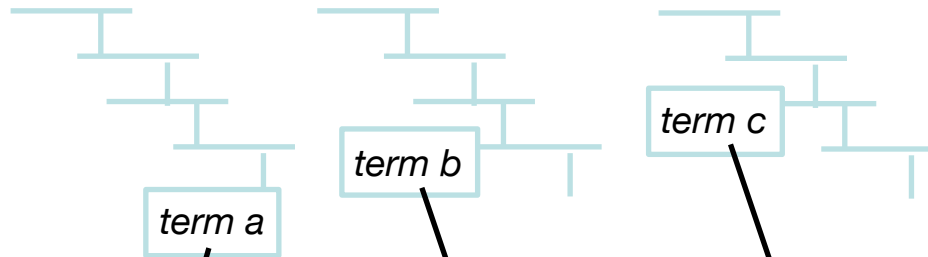


← Vocabulary/Term
mapping



Skotheme

Vocabulary

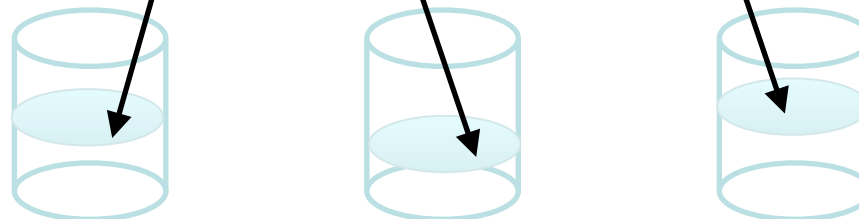


← Vocabulary
design



Protégé

Repository



← Metadata
editing



Editor

workflow



Japanese e-science project

ESPAS EU 7th framework project

IUGONET

Home
IUGONET MDB
Search Help

Browse Data

- Entire Data / Resource
- Registration List to IUGONET MDB
- Resource Type

Browse Service

- Browse Service

UDAS
Iugonet Data Analysis Software

IUGONET

Observed Properties

Filter by

Select Observed Property

Observed Region

Select All Deselect All

Measurand

Select All Deselect All

Project

- Inter-university Upper atmosphere Global Observation NETwork*
- creation of a Metadata DataBase of ground-based observations of the upper atmosphere

Objectives

- Platform to integrate data from thermosphere, ionosphere, plasmasphere & magnetosphere
- Provide unique access to scientific near-earth space data
- Offer Web-based applications and services

www.iugonet.org

www.espas-fp7.eu



Domain Ontology Merging

- FOAF
- BIBO
- GeoNames
- dbPedia
- SPASE

Terminological Ontology Merging

- GCMD Keywords
- GEMET
- SPASE
- PDS
- IVOA

Information model & resources

- ISDC ontology network
- Keyword vocabularies
- GFZ RDF+RDB data, LOD data

Technical implementation

- Drupal CMS, Virtuoso Triple Store
- **Open Semantic Framework OSF**

GFZ ISDC Drupal 7 proof of concept

Search

Search this site

View Edit Track Log Devel

D2RQ

Semantic Web

Keyword Search

Geographical Search

ProductTypes

Projects

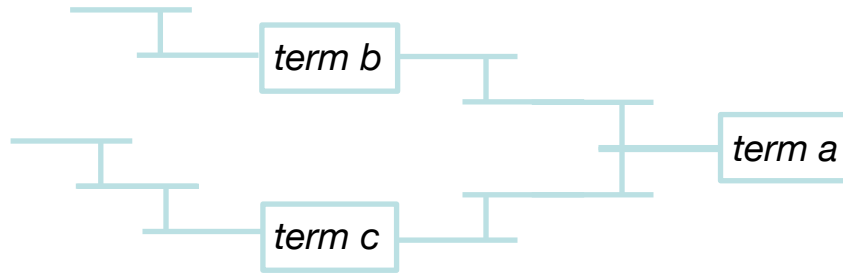
Resources

- Geodetic data
- Magnetic field data
- Atmosphere data

*Linked open Data
<http://lod-cloud.net/>

Vocabulary Broker Components and Workflow

Search

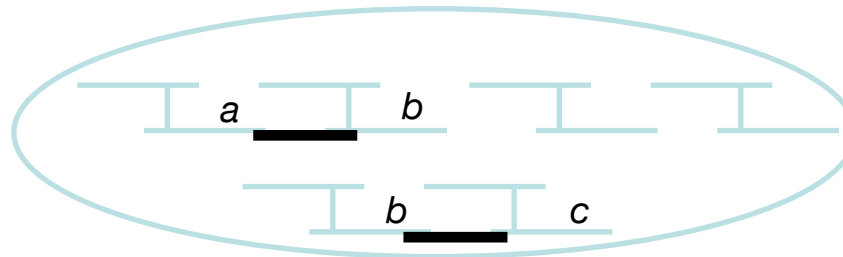


← Term/Keyword
search



Vocabulary
Broker

Mapping

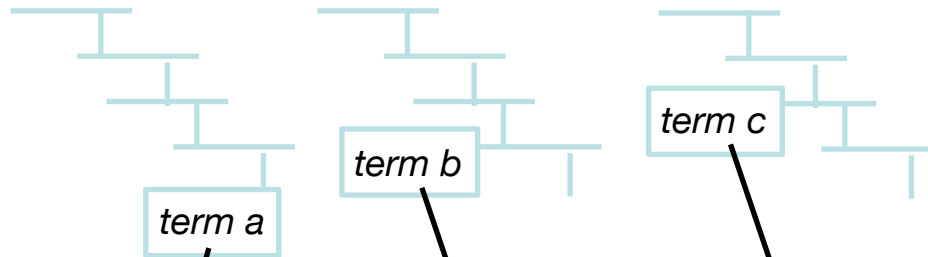


← Vocabulary/Term
mapping



Skotheme

Vocabulary

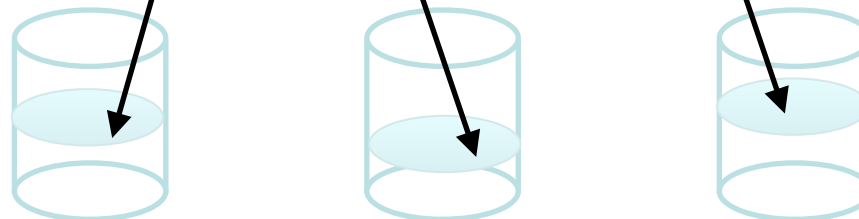


← Vocabulary
design



Protégé

Repository



← Metadata
editing

















Editor

workflow



Global Change Master Directory (GCMD) Keywords

Search By >> **Science Keywords** Instruments Platforms Locations Providers Projects Free text

 <p>AGRICULTURE (2086) agricultural aquatic sciences, agricultural chemicals, agricultural engineering, agricultural plant science, animal commodities show all...</p>	 <p>ATMOSPHERE (9396) aerosols, air quality, altitude, atmospheric chemistry, atmospheric electricity show all...</p>	 <p>BIOLOGICAL CLASSIFICATION (4280) animals/invertebrates, animals/vertebrates, bacteria/archaea, fungi, plants show all...</p>
 <p>BIOSPHERE (8136) ecological dynamics, ecosystems, vegetation show all...</p>	 <p>CLIMATE INDICATORS (677) atmospheric/ocean indicators, biospheric indicators, cryospheric indicators, land surface/agriculture indicators, paleoclimate indicators show all...</p>	 <p>CRYOSPHERE (3264) frozen ground, glaciers/ice sheets, sea ice, snow/ice show all...</p>
 <p>HUMAN DIMENSIONS (4240) boundaries, economic resources, environmental governance/management, environmental impacts, habitat conversion/fragmentation show all...</p>	 <p>LAND SURFACE (6373) erosion/sedimentation, frozen ground, geomorphic landforms/processes, land use/land cover, landscape show all...</p>	 <p>OCEANS (11375) aquatic sciences, bathymetry/seafloor topography, coastal processes, marine environment monitoring, marine geophysics show all...</p>
 <p>PALEOCLIMATE (1613) ice core records, land records, ocean/lake records, paleoclimate reconstructions show all...</p>	 <p>SOLID EARTH (3136) earth gases/liquids, geochemistry, geodetics, geomagnetism, geomorphic landforms/processes show all...</p>	 <p>SPECTRAL/ENGINEERING (3135) gamma ray, infrared wavelengths, lidar, microwave, platform characteristics show all...</p>
 <p>SUN-EARTH INTERACTIONS (442) ionosphere/magnetosphere dynamics, solar activity, solar energetic particle flux, solar energetic particle properties show all...</p>	 <p>TERRESTRIAL HYDROSPHERE (3511) glaciers/ice sheets, ground water, snow/ice, surface water, water quality/water chemistry show all...</p>	

<http://gcmd.nasa.gov/KeywordSearch/Keywords.do?Portal=GCMD&KeywordPath=Parameters|Home&MetadataType=0&Columns=0>

Keyword Categories

- Earth Science
- Earth Science Services
- Data Centers
- Projects
- Instruments/Sensors
- Platforms/Sources
- Locations
- Horizontal Data Resolution
- Vertical Data Resolution
- Temporal Data Resolution
- URL Content Types
- Chronostratigraphic Units

<https://earthdata.nasa.gov/about/gcmd/global-change-master-directory-gcmd-keywords>

*SPASE „allowed values“ Classification

Observatory Region

Enumeration

A spatial location distinguished by certain natural features or physical characteristics where an observatory is located.

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.Equatorial Region
- Earth.Near Surface.Ionosphere
- Earth.Near Surface.Ionosphere.D-Region
- Earth.Near Surface.Ionosphere.E-Region
- Earth.Near Surface.Ionosphere.F-Region
- Earth.Near Surface.Ionosphere.Topside
- Earth.Near Surface.Mesosphere
- Earth.Near Surface.Plasmasphere
- Earth.Near Surface.Polar Cap
- Earth.Near Surface.South Atlantic Anomaly Region

***A Space and Solar Physics Data Model
from the SPASE Consortium**

Version: 2.2.2

Release Date: 2011-02-27

Document Generated: 2012-Feb-28

Top Concept

Concepts
(hierarchically
structured)

Transferred into
SKOS standard



<http://espas.spaceweatherservices.com>

ESPAS Phenomenon

This vocabulary describes the underlying phenomenon for which the observation provides an estimate of its value

Deprecated items: none

Field

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

Ontology server link: <http://ontology.espas-fp7.eu/phenomenon/Field>

Version: 0.1

Date: 2013-05-31 21:30:00.0

narrower:

- <http://ontology.espas-fp7.eu/phenomenon/MagneticField>
- <http://ontology.espas-fp7.eu/phenomenon/Field>

Magnetic Field

Definition: A region of space near a magnetized body where magnetic forces can be detected

Ontology server link: <http://ontology.espas-fp7.eu/phenomenon/MagneticField>

Version: 0.1

Date: 2013-05-31 21:30:00.0

Parent scheme: [phenomenon](#)

broader:

- <http://ontology.espas-fp7.eu/phenomenon/Field>

Ontology server link: <http://ontology.espas-fp7.eu/phenomenon/Field>

Version: 0.1

Date: 2013-05-31 21:30:00.0

broader:

- <http://ontology.espas-fp7.eu/phenomenon/Field>



UNIFIED ASTRONOMY THESAURUS

a community supported, open source project from the American Astronomical Society

- Thesaurus ▾
- Contribute ▾
- Updates
- About ▾
- Contact

HIERARCHICAL BROWSE

Unified Astronom Thesaurus

[expand all](#) | [collapse all](#)

- ▾ Astrophysical processes
 - ▾ Astrophysical magnetism
 - Cosmic magnetic fields theory
 - Emerging flux tubes
 - ▾ Magnetic fields
 - Geomagnetic fields
 - Magnetic anomalies
 - Primordial magnetic fields
- ▾ Gravitation
 - ▾ Celestial mechanics

Magnetic fields

Broader Term(s):
[Astrophysical magnetism](#)

Narrower Term(s):
[Geomagnetic fields](#)
[Magnetic anomalies](#)
[Primordial magnetic fields](#)

[Contribute](#)

ALPHABETICAL BROWSE

- [Magnetic fields](#)
- [Magnetic stars](#)
- [Magnetic variable stars](#)
- [Magnetosphere](#)
- [Magnetospheric radio emissions](#)
- [\[Exoplanets\]](#)
- [Magnitude](#)
- [Main sequence stars](#)
- [Major axis](#)
- [Makemake](#)
- [Maksutov telescopes](#)
- [Manganese stars](#)
- [Mantle](#)
- [Markarian galaxies](#)
- [Mars](#)

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#)

Magnetic fields

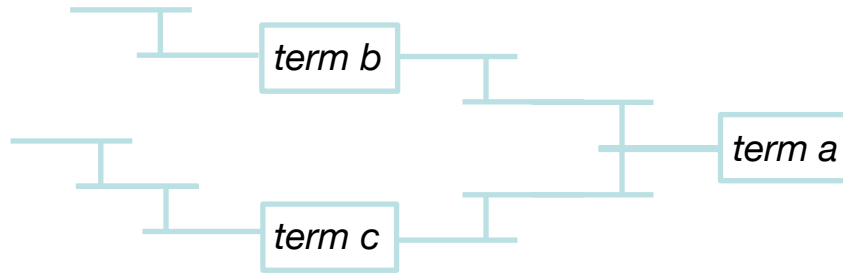
Broader Term(s):
[Astrophysical magnetism](#)

Narrower Term(s):
[Geomagnetic fields](#)
[Magnetic anomalies](#)
[Primordial magnetic fields](#)

[Contribute](#)

Vocabulary Broker Components and Workflow

Search

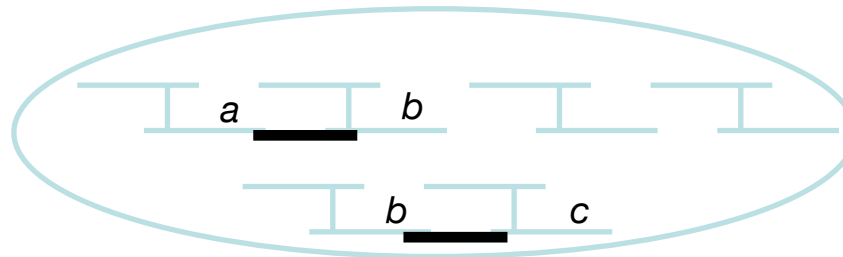


← Term/Keyword
search



Vocabulary
Broker

Mapping

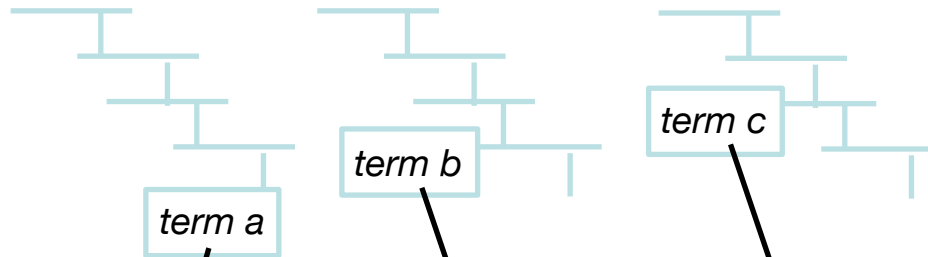


← Vocabulary/Term
mapping



Skotheme

Vocabulary

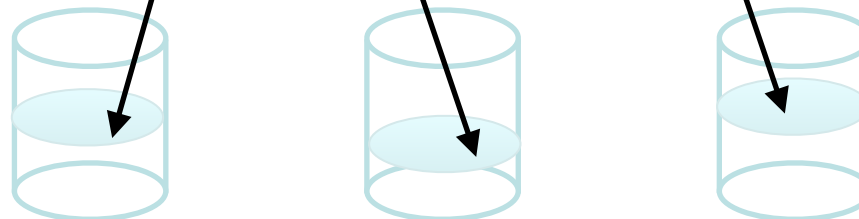


← Vocabulary
design



Protégé

Repository



← Metadata
editing



Editor

workflow ↑

Thesauri* Standard



ISO 2788:1986 

*Controlled vocabulary connected by relations for indexing, tagging and information retrieval

Documentation -- Guidelines for the establishment and development of monolingual thesauri

General information

Number of Pages:

✓ ISO 25964-1:2011

Information and documentation -- Thesauri and interoperability with other vocabularies -- Part 1: Thesauri for information retrieval

More details »

Information Retrieval

✓ ISO 25964-2:2013

Information and documentation -- Thesauri and interoperability with other vocabularies -- Part 2: Interoperability with other vocabularies

More details »

Interoperability with other Vocabularies

requirements of multilingual thesauri.

http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=7776

SKOS Namespace and Vocab.



- Namespace URI
 - <http://www.w3.org/2004/02/skos/core#>
- Vocabulary (excerpt)
 - **skos:Concept** (idea, notion, term)
 - skos:definition (definition)
 - **skos:broader** (broader term)
 - **skos:narrower** (nearer term)
 - skos:prefLabel (preferred string)
 - skos:altLabel (alternate string)
 - **skos:related** (related term (RT))
 - skos:exactMatch (RT in different concept schemes)
 - **skos:closeMatch** (RT in different concept schemes)



- 'Instrument Type'
 - Antenna
 - Channeltron
 - Coronagraph
 - 'Double Sphere'
 - 'Dust Detector'
 - 'Electron Drift Instrument'
 - 'Electrostatic Analyser'
 - 'Energetic Particle Instrument'
 - 'Faraday Cup'
 - 'Flux Feedback'
 - 'Fourier Transform Spectrograph'
 - 'Geiger-Mueller Tube'
 - Imager
 - 'Imaging Spectrometer'
 - Interferometer
 - 'Ion Chamber'
 - 'Ion Drift'
 - 'Langmuir Probe'
 - 'Long Wire'
 - Magnetometer
 - 'Mass Spectrometer'
 - 'Microchannel Plate'
 - 'Multispectral Imager'
 - 'Neutral Atom Imager'
 - 'Neutral Particle Detector'
 - 'Particle Correlator'
 - 'Particle Detector'
 - Photometer
 - Photopolarimeter
 - Platform
 - 'Proportional Counter'
 - 'Quadrisingheral Analyser'
 - Radar
 - Radiometer
 - 'Resonance Sounder'
 - 'Retarding Potential Analyser'
 - Riometer
 - 'Scintillation Detector'
 - 'Search Coil'
 - Sounder
 - 'Spacecraft Potential Control'
 - 'Spectral Power Receiver'
 - Spectrometer
 - 'Time Of Flight'
 - Unspecified
 - 'Waveform Receiver'

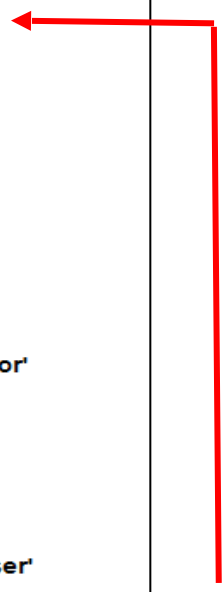
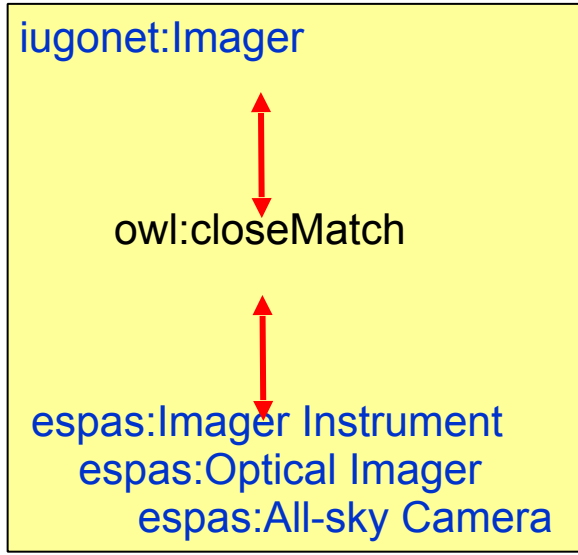
SPASE "allowed values" <=> ESPAS ontology (Collaboration project between ESPAS and IUGONET)

ESPAS Instrument Type

- Asserted Concept Hierarchy: 'ESPAS Instrument Type'
- 'In Situ Sensing Instrument'
 - 'Energetic Particle Detector'
 - Magnetometer
 - 'Resonance Relaxation Sounder'
 - 'Remote Sensing Instrument'
 - 'Active Remote Sensing Instrument'
 - 'GNSS-based Instrument'
 - 'GNSS Dual Frequency Receiver'
 - 'GNSS Radio Occultation Receiver'
 - 'GNSS Scintillation Receiver'
 - Radar
 - 'Coherent Scatter Radar'
 - 'Incoherent Scatter Radar'
 - Sounder
 - Ionosonde
 - 'Passive Remote Sensing Instrument'
 - 'Imager Instrument'
 - 'EUV Imager'
 - 'Optical Imager'
 - 'All-sky Camera'
 - Interferometer
 - 'Fabry-Perot Interferometer'
 - Receiver
 - 'Electric Antenna Receiver'
 - 'Magnetic Antenna Receiver'
 - Riometer
 - RemoteSensorPassive

ESPAS SKOS resource browser:
espas.spaceweatherservices.com

RDF + OWL + SKOS



http://ontology.espas-fp7.eu (http://ontology.espas-fp7.eu)

Active Ontology Entities Classes Object Properties Data Properties Annotation Properties SKOS view Individuals OWLViz DL Query OntoGraf SPARQL Query Ontology Differences

Object property hierarchy: 'has close match'

- topObjectProperty
 - distantMatch
 - 'has member'
 - 'has member list'
 - 'has top concept'
 - 'is in scheme'
 - 'is top concept in scheme'
 - 'is in semantic relation with'
 - 'has broader transitive'
 - 'has narrower transitive'
 - 'has related'
 - 'is in mapping relation with'
 - 'has broader match'
 - 'has close match'
 - 'has exact match'
 - 'has narrower match'
 - 'has related match'

Annotations Usage

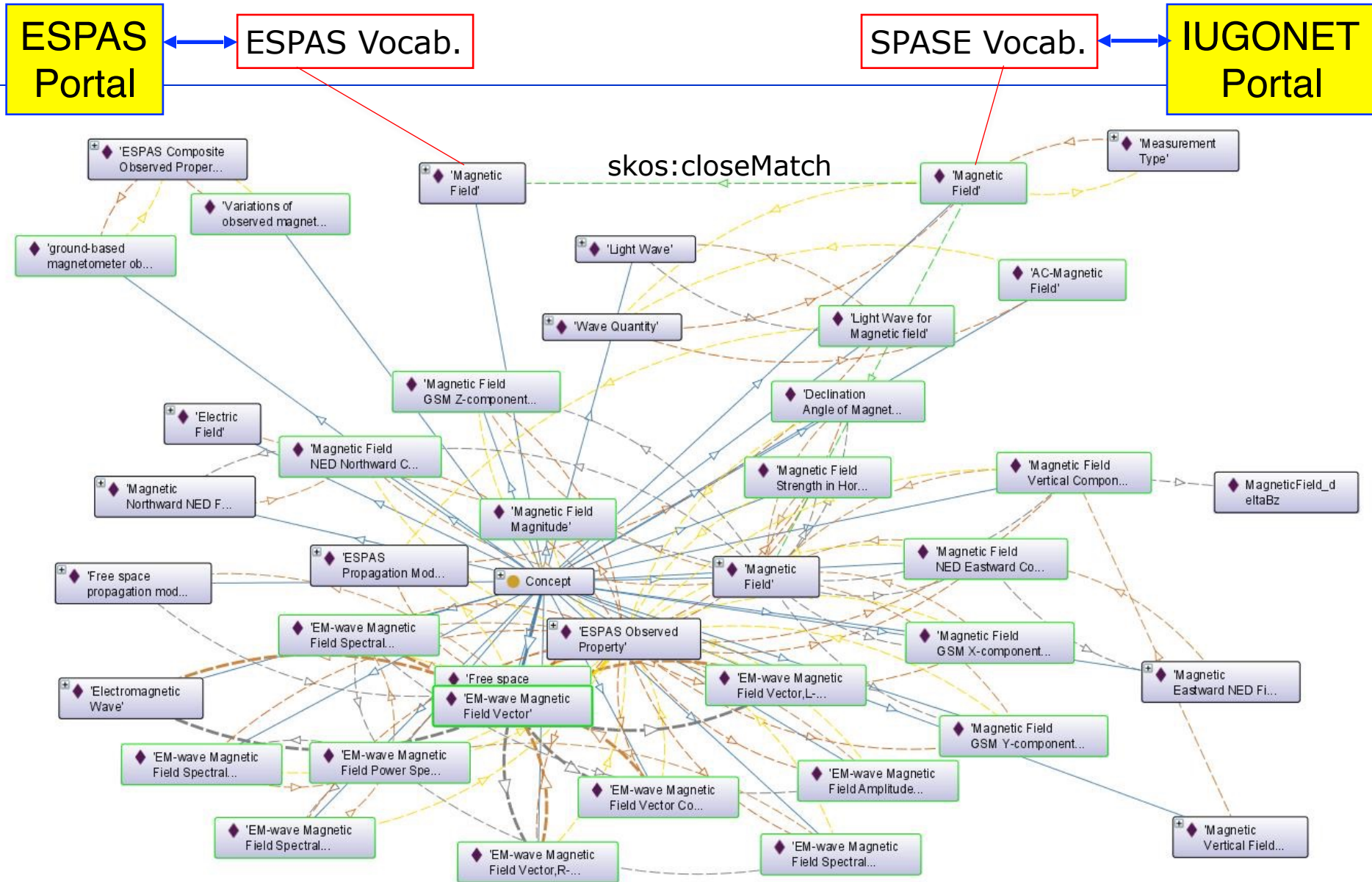
Usage: 'has close match'

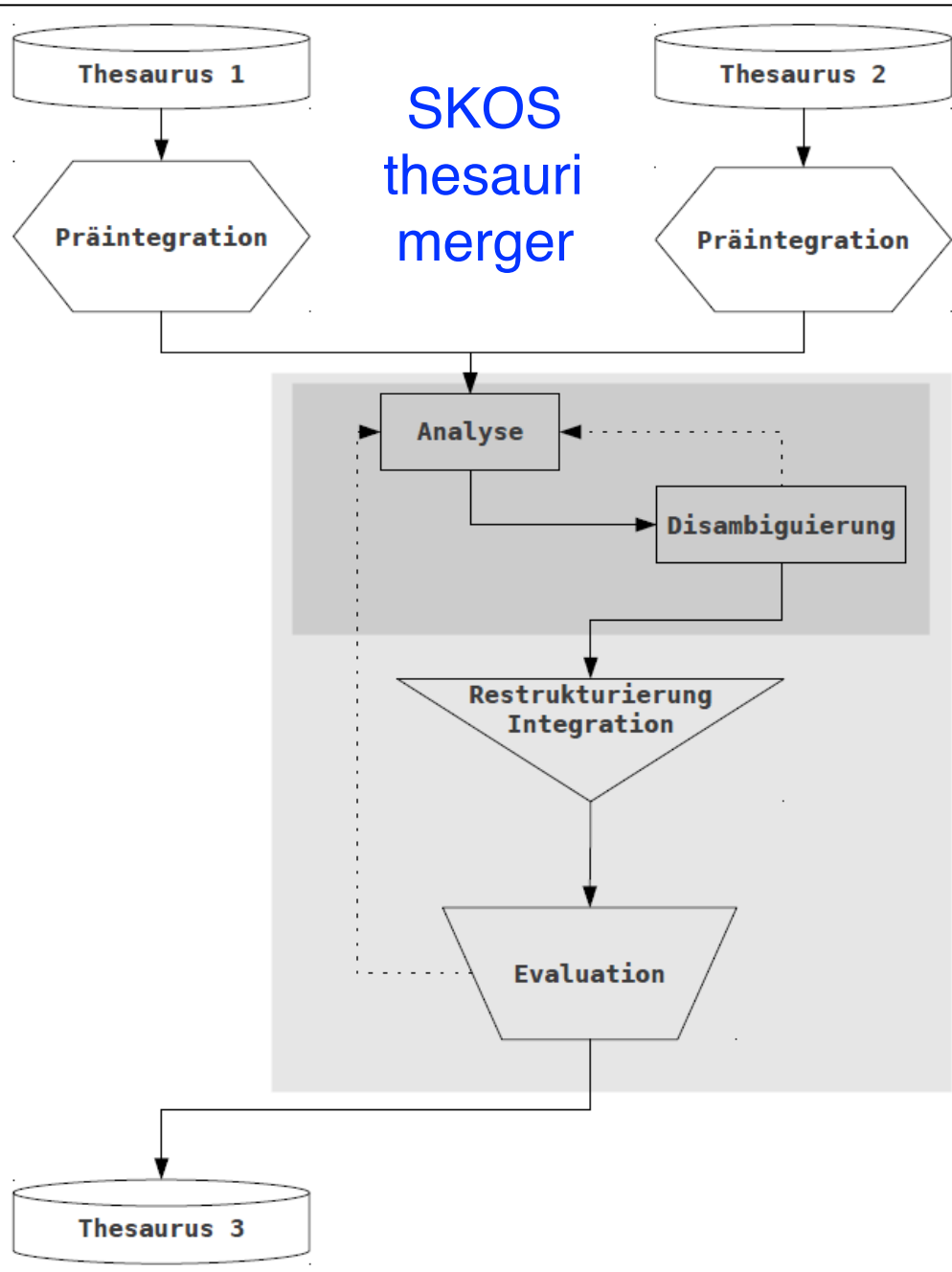
Show: this disjoints

- Ionosphere
 - Ionosphere 'has close match' Ionosphere
- Jupiter
 - Jupiter 'has close match' Jupiter
- 'Langmuir Probe'
 - 'Langmuir Probe' 'has close match' 'Langmuir Probe'
- 'Magnetic Field'
 - 'Magnetic Field' 'has close match' 'Magnetic Field'
 - 'Magnetic Field' 'has close match' 'Magnetic Field'
- Magnetometer
 - Magnetometer 'has close match' Magnetometer
- Mars
 - Mars 'has close match' Mars
- Maximum
 - Maximum 'has close match' Maximum
- Median
 - Median 'has close match' Median
- Mercury
 - Mercury 'has close match' Mercury
- Mesosphere
 - Mesosphere 'has close match' Mesosphere
- Microwave
 - Microwave 'has close match' Microwave
- Minimum
 - Minimum 'has close match' Minimum

Protégé ontology editor, V 4.3

„Magnetic Field“ concept relationships and dependencies in SPASE and ESPAS terminological ontologies

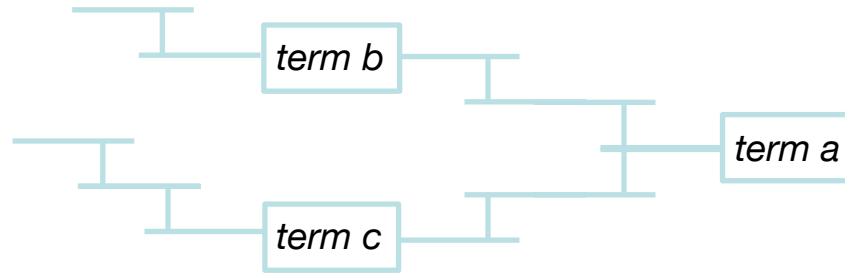




- **ISO 25964-1:2011 - Thesauri for information retrieval**
- **Merging of SKOS Thesauri**
- **Ontology Matching method**
 - syntactic diffs
 - conceptual diffs
 - semiotic diffs
 - terminological diffs
- **Pre-Integration (stop words, normalization (diacritical marks, upper and lower case, stemming))**
- **Lexical analysis (substring comparison, N-Gramm similarity, Term signature)**
- **Structural analysis(Child or parent match technique)**
- **Entity based analysis**

Vocabulary Broker Components and Workflow

Search

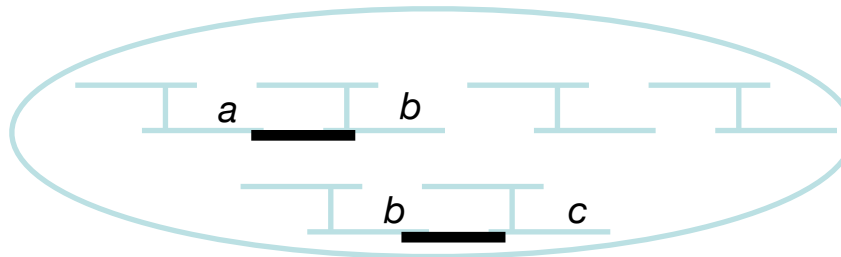


← Term/Keyword
search



Vocabulary
Broker

Mapping

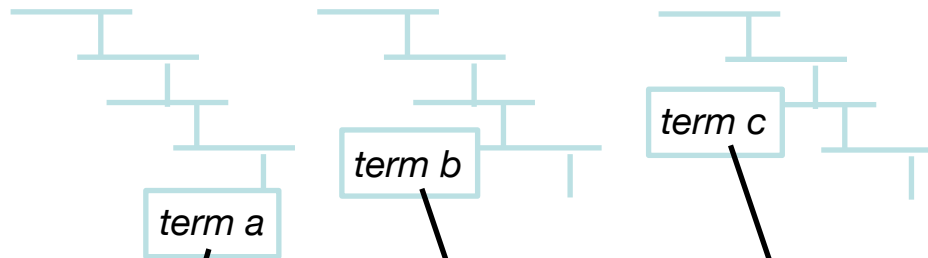


← Vocabulary/Term
mapping



Skotheme

Vocabulary

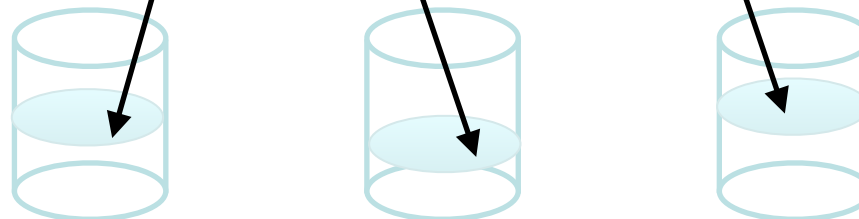


← Vocabulary
design



Protégé

Repository



← Metadata
editing



Editor

workflow



GCMD

- [GCMD Climate Indicators](#)
- [GCMD Solid Earth](#)
- [GCMD Sun-Earth Interactions](#)
- [GCMD Land Surface](#)
- [GCMD Spectral/Engineering](#)
- [GCMD Terrestrial Hydrosphere](#)
- [GCMD Earth Science Services](#)
- [GCMD Oceans](#)
- [GCMD Biosphere](#)
- [GCMD Agriculture](#)
- [GCMD Atmosphere](#)
- [GCMD Paleoclimate](#)
- [GCMD Cryosphere](#)
- [GCMD Human Dimensions](#)
- [GCMD Biological Classification](#)

Magnetic Field

- prefLabel • [Magnetic Field](#)
- definition • [Pertaining to the magnetic field generated by the Earth, consisting of both the dipole and non-dipole components.](#)
- narrower • [Magnetic Declination](#)
- [Magnetic Inclination](#)
- [Geomagnetic Induction](#)
- [Magnetic Intensity](#)
- [Magnetic Anomalies](#)
- inScheme • [GCMD Solid Earth](#)
- closeMatch • [Magnetic fields](#)
- [Magnetic Field](#)
- [Magnetic Field](#)
- [Magnetic Field](#)
- broader • [Geomagnetism](#)

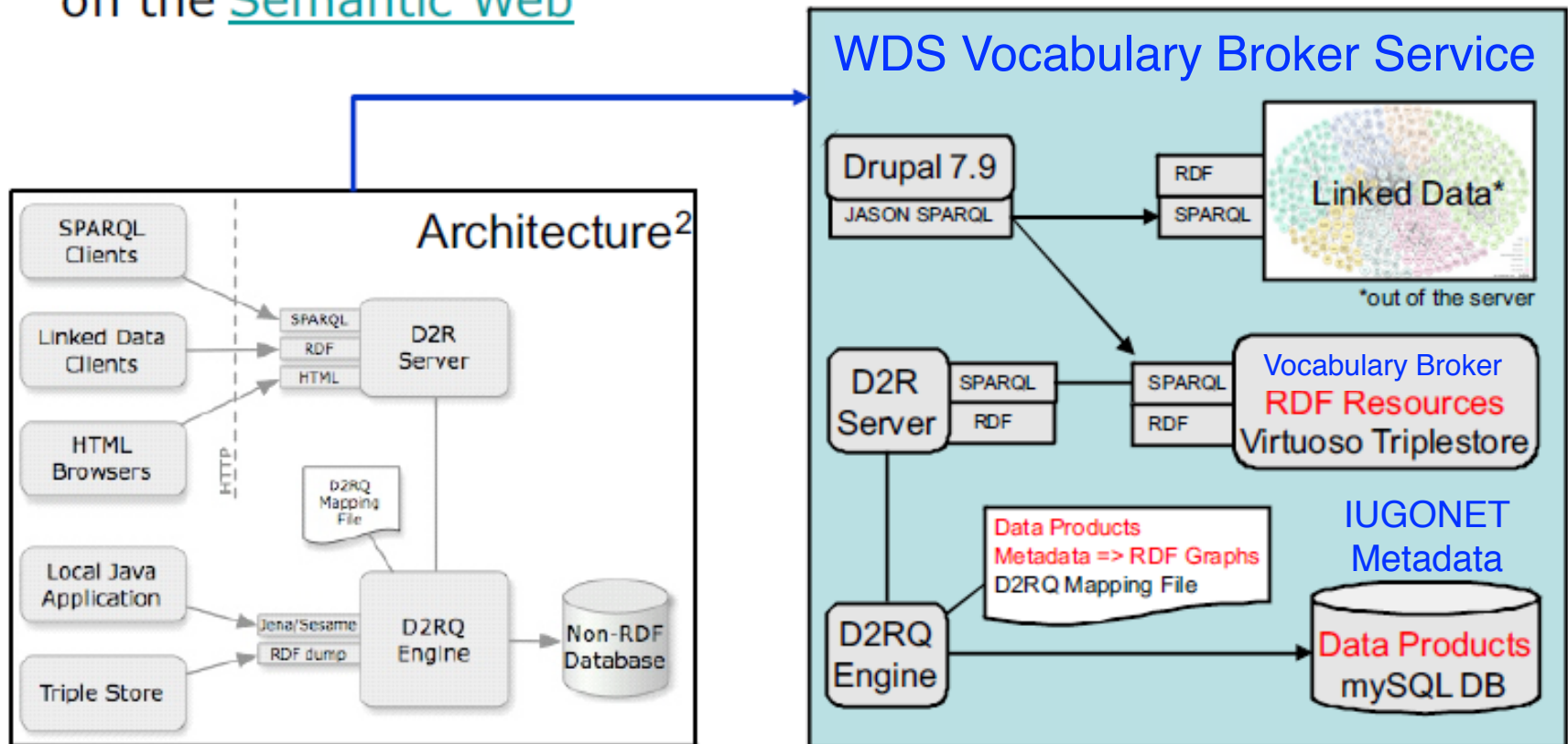
Concept Search

Recent blog posts

Experimental: A magnetic field is the magnetic effect of electric currents and magnetic materials. The magnetic field at any given point is specified by both a direction and a magnitude (or strength); as such it is a vector field. The term is used for two distinct but closely related fields denoted by the symbols B and H, where H is measured in units of amperes per meter (symbol: A·m⁻¹ or A/m) in the SI. B is measured in teslas (symbol:T) and newtons per meter per ampere (symbol: N·m⁻¹·A⁻¹ or N/(m·A)) in the SI. B is most commonly defined in terms of the Lorentz force it exerts on moving electric charges. Magnetic fields can be produced by moving electric charges and the intrinsic magnetic moments of elementary particles associated with a fundamental quantum property, their spin. In special relativity, electric and magnetic fields are two interrelated aspects of a single object, called the electromagnetic tensor; the split of this tensor into electric and magnetic fields depends on the relative velocity of the observer and charge. In quantum physics, the electromagnetic field is quantized and electromagnetic interactions result from the exchange of photons. In everyday life, magnetic fields are most often encountered as a force created by permanent magnets, which pull on ferromagnetic materials such as iron, cobalt, or nickel, and attract or repel other magnets. Magnetic fields are widely used throughout modern technology, particularly in electrical engineering and electromechanics. The Earth produces its own magnetic field, which is important in navigation, and it shields the Earth's atmosphere from solar wind. Rotating magnetic fields are used in both electric motors and generators. Magnetic forces give information about the charge carriers in a material through the Hall effect. The interaction of magnetic fields in electric devices such as transformers is studied in the discipline of magnetic circuits.

D2RQ for mashup of RDBMS with Triple Stores

- D2RQ Platform: accessing relational databases as virtual, read only RDF graphs¹
- D2R Server: tool for publishing content of relational databases on the [Semantic Web](#)



¹<http://d2rq.org/>

²<http://d2rq.org/images/architecture.png>

Applications

- Mashup of near earth space data systems and server, e.g. IUGONET, ESPAS, GFZ ISDC
- Inferring of new cross-domain and trans-disciplinary relationships between geo and space physics phenomena
- Cross-domain mashup of scientific data, appropriate publications and applications
- Integration of scientific and societal data resources for disaster management and decision support objectives
 - e.g. impact studies of space climate and space weather changes to Global Warming and derived challenges for development of future society
- Usage of scientific data, methods and publication for educational purposes
- ...

Demo => <http://wdcosf.kugi.kyoto-u.ac.jp>

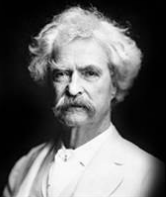


The difference between
the right word and the
almost right word is the
difference between
lightning and a lightning
bug.

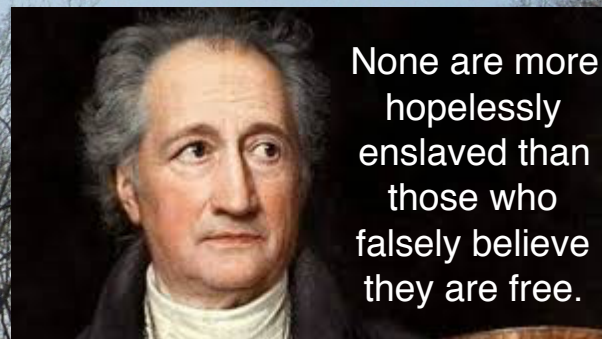
Mark Twain

American Author and Humorist
(1835-1910)

QuoteHD.com



Beware of fake news.



None are more
hopelessly
enslaved than
those who
falsely believe
they are free.

Johann Wolfgang von Goethe
(1749-1832)

ありがとうございました。
質問がありますか。

berndritschel@yahoo.de

Thank you, Questions?