

Observation Facilities in the VO

B. Cecconi (1), L. Debisschop (1)
M. Louys, (2), E. Perret (2),

(1) Observatoire de Paris, Meudon, France;

(2) CDS, Strasbourg, France



Why

- **ObsTAP / EPN-TAP** have “instrument_host_name” or “facility” keywords.
Standard nomenclature needed for efficient data mining
- The same is applicable for target names:
EPNcore is requiring the use of IAU names for solar system bodies.
- No official nomenclature/standard for “observation facilities” names.

Observation Facilities

- Need for a *standard nomenclature* for observation facilities (observatories, spacecraft...) and instruments (telescopes, experiments, instruments).
- Use cases
 - data discovery: EPN-TAP, ObsTAP
 - data tagging: VizieR
- Several lists identified (some have several hundred items).
- Merging is complex (by hand or programmatically)

Some of the available lists

List	Facility Type	number of Records
NSSDC	space	1571
NASA/NAIF	space	307
NASA/PDS	space	228
SPASE	space + ground	215
SANA	space	1513
AAS	ground	563
Harvard/ADS	ground	256
IRAF	ground	28
IAU/MPC	ground	2335
Xephem	ground	461
WMO/Oscar	space	683
WISERep (telescopes)	ground	108
Astroweb	space + ground	375
WikiData	space + ground	5177

More: <https://github.com/ejn-vespa/FacilityList/tree/master/data>

Previous works

- Fuzzy-logic tool for matching lists, developed by Graz team (EPN2020RI project):
<https://github.com/eptn-vespa/FacilityList>
- Prototype at IMCCE, using their Quaero search engine.
Example:
<https://api.ssodnet.imcce.fr/quaero/1/sso/ACE>
- draft VOFacility (VOResource extension)
- CDS Telescope/Instrument database (*information model*) for VizieR
- NASA/PDS4 *information model*:
observation facility is described by a *context product* with identifier, related products and metadata

Goals

- Use case A: **Data discovery**
 - **step 1:** define what should be stored (observatory/telescope/space mission/spacecraft...), and if relations are needed (e.g., telescope to observatory)
 - **step 2:** match lists and catalogues, build a lookup table with alternate names
 - **step 3:** define maintenance procedure
 - **step 4:** build a name resolver for data discovery clients, or to help provider to select a name
- Use case B: **Data tagging**
 - **step 1:** define model for metadata to be stored and check if mapping is possible with outcome use case A
 - **step 2:** build reference database
 - **step 3:** define maintenance procedure (how to involve facility managers)
 - **step 4:** propose interface for wider use ?

Connecting with WikiData?

- Wikidata = free and open knowledge base
 - => structured data (export in RDF, JSON)
 - (each item has properties + values)
 - => connected with wikipedia, Wiktionary
- Wikidata can be **queried** and **edited** manually, or with API, SPARQL and other tools (e.g., QuickStatements, OpenRefine...)
 - <https://meta.wikimedia.org/wiki/QuickStatements>
 - <https://www.wikidata.org/wiki/Wikidata:Tools/OpenRefine>
- For *Observation Facilities*:
 - many identifiers are already connected
 - model/properties are fuzzy but adequate
 - curation / extension is feasible
 - semantics quality is variable



Wikidata record examples

Item [Discussion](#) [Read](#) [View history](#) [Search Wikidata](#)

Hubble Space Telescope (Q2513)

unmanned space telescope launched into outer space by NASA and ESA in April 1990 [edit](#)

HST | Hubble

[In more languages](#)

Language	Label	Description	Also known as
English	Hubble Space Telescope	unmanned space telescope launched into outer space by NASA and ESA in April 1990	HST Hubble
French	télescope spatial Hubble	télescope spatial	HST Hubble Space Telescope Hubble télescope Hubble Telescope spatial Hubble Large Space Telescope Télescope spatial Hubble
Spanish	telescopio espacial Hubble	telescopio en órbita alrededor de la Tierra lanzado en 1990	HST Telescopio Hubble Telescopio Espacial Hub... Telescopio espacial Hubble TEH Hubble (telescopio)
German	Hubble-Weltraumteleskop	Weltraumteleskop für sichtbares Licht, Ultraviolett- und Infrarotstrahlung	HST Hubble Space Telescope Hubble-Space-Telescope Hubbleteleskop Hubble-Teleskop Hubble

All entered languages

Statements


instance of	space observatory edit
	0 references
	+ add reference

Alias

Property
(Prédicat en SparQL)

Qualifier
(Objet en SparQL)

Wikidata record examples



Item [Discussion](#) Read [View history](#)

Mars Orbiter Mission (Q2156739)

Indian Mars orbiter, launched in 2013 [edit](#)
MOM | Mangalyaan

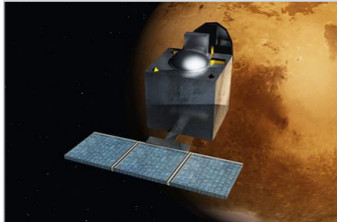
[In more languages](#)
Configure

Language	Label	Description	Also known as
English	Mars Orbiter Mission	Indian Mars orbiter, launched in 2013	MOM Mangalyaan
French	Mangalyaan	No description defined	
Spanish	Mars Orbiter Mission	sonda espacial cuyo lanzamiento fue el 5 de noviembre de 2013	
German	Mars Orbiter Mission	indische Marsmission	

[All entered languages](#)

Statements


instance of [space probe](#) [1 reference](#)

image 

Identifiers

COSPAR ID	2013-060A edit 2 references	+ add value
Encyclopædia Britannica Online ID	topic/Mars-Orbiter-Mission edit 0 references	+ add reference + add value
Freebase ID	/m/0knt6hh edit 1 reference	+ add value
NAIF ID	-3 edit 1 reference	+ add value

Wikidata record examples



WIKIDATA

- Main page
- Community portal
- Project chat
- Create a new Item
- Recent changes
- Random Item
- Query Service
- Nearby
- Help
- Donate

Lexicographical data

Create a new Lexeme

English Not logged in Talk Contributions Create account Log in

Item **Discussion** Read **View history** Search Wikidata

Mount Wilson Observatory (Q466863)

astronomical observatory in Los Angeles County, California [edit](#)

[In more languages](#)

Statements

instance of	astronomical observatory edit
	0 references
	+ add reference
	+ add value

Identifiers

Minor Planet Center observatory code	672 edit
	0 references
	+ add reference
	+ add value

SparQL query example



Wikidata Query Service

Exemples

Assistant de requêtes

Aide

Davantage d'outils

français



```
1 PREFIX schema: <http://schema.org/>
2 PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
3 PREFIX wikibase: <http://wikiba.se/ontology#>
4 PREFIX bd: <http://www.bigdata.com/rdf#>
5 SELECT
6   ?item
7   ?itemLabel
8   (GROUP_CONCAT(DISTINCT ?alias; SEPARATOR="|") AS ?aliases)
9 WHERE
10 {
11   ?item p:P31 ?stat .
12   #item instance of
13   {?stat ps:P31 wd:Q148578 .} # space observatory
14   OPTIONAL {?item skos:altLabel ?alias .}
15   SERVICE wikibase:label { bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en". }
16 }
17 GROUP BY ?item ?itemLabel
```



147 résultats en 1109ms

Code

Télécharger

Lien

item	itemLabel	aliases
wd:Q19764	Astron	
wd:Q48633	Corot	CoRoT Convection Rotation and Planetary Transits CONvection ROTation and planetary Transits Convection, Rotation and planetary Transits CoRoT コロト衛星 COROT space telescope CONvection ROTation and planetary Transits
wd:Q49694	EXOSAT	Sat European X-ray Observatory Satellite

SparQL query example

Search for “Hubble”

Q wd:Q2463	Advanced Composition Explorer	ACE ACE Explorer 71 高級成分探測器
Q wd:Q2513	télescope spatial Hubble	HST HST HST HST HST Hubble Hubble Hubble 허블 HST متلسكوب هابل متلسكوب هابل HST HST HST HST HST HST HST HST Hubble HST مقراب هابل الفضائي تلسكوب هابل Hubble Space Telescope Hubble-teleskopet Hubble Space Telescope Hubble-Space-Telescope Hubble-Teleskop Hubbleteleskop Hubble (telescopio) TEH Telescopio espacial Hubble Telescopio Espacial Hubble Telescopio Hubble Hubble Space Telescope Large Space Telescope télescope Hubble Telescope spatial Hubble Télescope spatial Hubble Hubble-Weltraumteleskop Hubble Space Telescope Telescopio Hubble Telescopio orbitale Hubble Hubble ruimtetelescoop Hubble Space Telescope Hubble-ruimtetelescoop Hubble-telescoop Hubbletelescoop HST Hubble Space Telescope космический телескоп «Хаббл» космический телескоп имени Хаббла КТХ телескоп имени Хаббла Hubbleteleskopet
Q wd:Q14918	ABRIXAS	A Broadband Imaging X-ray All-Sky Survey ABRIXAS A BRoad-band Imaging X-ray All-sky Survey A Broadband Imaging X-ray All-sky Survey
Q wd:Q14951	AGILE	Astrorivelatore Gamma ad Immagini LEggero

Current SparQL query


```
PREFIX schema: <http://schema.org/>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX wikibase: <http://wikiba.se/ontology#>
PREFIX bd: <http://www.bigdata.com/rdf#>
```

```
SELECT
  ?item
  ?itemLabel
  (GROUP_CONCAT(DISTINCT ?Unified_Astro_Thesaurus_ID; SEPARATOR="|") AS ?all_Unified_Astro_Thesaurus_ID)
  (GROUP_CONCAT(DISTINCT ?COSPAR_ID; SEPARATOR="|") AS ?all_COSPAR_ID)
  (GROUP_CONCAT(DISTINCT ?NAIF_ID; SEPARATOR="|") AS ?all_NAIF_ID)
  (GROUP_CONCAT(DISTINCT ?NSSDCA_ID; SEPARATOR="|") AS ?all_NSSDCA_ID)
  (GROUP_CONCAT(DISTINCT ?Minor_Planet_Center_observatory_ID; SEPARATOR="|") AS ?all_Minor_Planet_Center_observatory_ID)
  (GROUP_CONCAT(DISTINCT ?alias; SEPARATOR="|") AS ?aliases)
```

```
WHERE
{
  ?item p:P31 ?stat .
  #item instance of
  {?stat ps:P31 wd:Q148578 .} # space observatory
  UNION {?stat ps:P31 wd:Q40218 .} # spacecraft
  UNION {?stat ps:P31 wd:Q1254933 .} # astronomical observatory
  UNION {?stat ps:P31 wd:Q26540 .} # artificial satellite
  UNION {?stat ps:P31 wd:Q697175 .} # Launch vehicle
  UNION {?stat ps:P31 wd:Q349772 .} # radio interferometer
  UNION {?stat ps:P31 wd:Q2098169 .} # planetary probe
  UNION {?stat ps:P31 wd:Q928667 .} # orbiter
  UNION {?stat ps:P31 wd:Q26529 .} # space probe
  UNION {?stat ps:P31 wd:Q752783 .} # human spaceflight
  UNION {?stat ps:P31 wd:Q2133344 .} # space mission
  UNION {?stat ps:P31 wd:Q5916 .} # spaceflight
  UNION {?stat ps:P31 wd:Q62832 .} # observatory
  UNION {?stat ps:P31 wd:Q35273 .} # optical telescope
  UNION {?stat ps:P31 wd:Q854845 .} # Earth observation satellite
  UNION {?stat ps:P31 wd:Q763288 .} # lander
  UNION {?stat ps:P31 wd:Q15078724 .} # expendable launch vehicle
  UNION {?stat ps:P31 wd:Q389459 .} # Mars rover
  UNION {?stat ps:P31 wd:Q1580082 .} # small satellite
  UNION {?stat ps:P31 wd:Q209363 .} # weather satellite
  #item has part(s) of the class
  UNION {?item wdt:P2670 wd:Q148578 .} # space observatory
  UNION {?item wdt:P2670 wd:Q40218 .} # spacecraft
  UNION {?item wdt:P2670 wd:Q1254933 .} # astronomical observatory
  UNION {?item wdt:P2670 wd:Q26540 .} # artificial satellite
  UNION {?item wdt:P2670 wd:Q697175 .} # Launch vehicle
  UNION {?item wdt:P2670 wd:Q349772 .} # radio interferometer
  UNION {?item wdt:P2670 wd:Q2098169 .} # planetary probe
  UNION {?item wdt:P2670 wd:Q928667 .} # orbiter
  UNION {?item wdt:P2670 wd:Q26529 .} # space probe
  UNION {?item wdt:P2670 wd:Q752783 .} # human spaceflight
  UNION {?item wdt:P2670 wd:Q2133344 .} # space mission
  UNION {?item wdt:P2670 wd:Q5916 .} # spaceflight
  UNION {?item wdt:P2670 wd:Q62832 .} # observatory
  UNION {?item wdt:P2670 wd:Q35273 .} # optical telescope
  UNION {?item wdt:P2670 wd:Q854845 .} # Earth observation satellite
  UNION {?item wdt:P2670 wd:Q763288 .} # lander
  UNION {?item wdt:P2670 wd:Q15078724 .} # expendable launch vehicle
  UNION {?item wdt:P2670 wd:Q389459 .} # Mars rover
  UNION {?item wdt:P2670 wd:Q1580082 .} # small satellite
  UNION {?item wdt:P2670 wd:Q209363 .} # weather satellite
```

```
OPTIONAL {?item wdt:P4466 ?Unified_Astro_Thesaurus_ID .}
OPTIONAL {?item wdt:P247 ?COSPAR_ID .}
OPTIONAL {?item wdt:P8913 ?NSSDCA_ID .}
OPTIONAL {?item wdt:P2956 ?NAIF_ID .}
OPTIONAL {?item wdt:P717 ?Minor_Planet_Center_observatory_ID .}
OPTIONAL {?item skos:altLabel ?alias .}
```

```
SERVICE wikibase:label { bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en". }
}
GROUP BY ?item ?itemLabel
```



```
wd:Q148578 .} # space observatory
s:P31 wd:Q40218 .} # spacecraft
s:P31 wd:Q1254933 .} # astronomical observatory
s:P31 wd:Q26540 .} # artificial satellite
s:P31 wd:Q697175 .} # Launch vehicle
s:P31 wd:Q349772 .} # radio interferometer
s:P31 wd:Q2098169 .} # planetary probe
s:P31 wd:Q928667 .} # orbiter
s:P31 wd:Q26529 .} # space probe
s:P31 wd:Q752783 .} # human spaceflight
s:P31 wd:Q2133344 .} # space mission
s:P31 wd:Q5916 .} # spaceflight
s:P31 wd:Q62832 .} # observatory
s:P31 wd:Q35273 .} # optical telescope
s:P31 wd:Q854845 .} # Earth observation satellite
s:P31 wd:Q763288 .} # lander
s:P31 wd:Q15078724 .} # expendable launch vehicle
s:P31 wd:Q389459 .} # Mars rover
s:P31 wd:Q1580082 .} # small satellite
s:P31 wd:Q209363 .} # weather satellite
```

Fuzzy matching

```
def mon_scorer(q, c):  
    r = fuzz.WRatio(q['Name'], c['itemLabel']) + fuzz.WRatio(q['Name'], c['aliases'])  
    if c['all_NAIF_ID'] != "":  
        if q['ID'] == c['all_NAIF_ID']:  
            r += 500  
        else:  
            r -= 100  
    return r
```

```
def dummy_proc(x):  
    return x
```

```
r = process.extract(e, wikidata, processor=dummy_proc, scorer=mon_scorer)
```

```
[64/268]{'ID': '-48', 'Name': 'HUBBLE SPACE TELESCOPE'}
```

```
640 : {'item': 'http://www.wikidata.org/entity/Q2513', 'itemLabel': 't lescope spatial Hubble', 'all_Unified_Astro_Thesaur  
172 : {'item': 'http://www.wikidata.org/entity/Q163922', 'itemLabel': 'Nuclear Spectroscopic Telescope Array', 'all_Unif  
172 : {'item': 'http://www.wikidata.org/entity/Q2471197', 'itemLabel': 'Hale Telescope', 'all_Unified_Astro_Thesaurus_ID  
172 : {'item': 'http://www.wikidata.org/entity/Q781318', 'itemLabel': 'Australia Telescope Compact Array', 'all_Unified_  
172 : {'item': 'http://www.wikidata.org/entity/Q3556305', 'itemLabel': 'Very Energetic Radiation Imaging Telescope Array
```

```
[65/268]{'ID': '-48', 'Name': 'HST'}
```

```
590 : {'item': 'http://www.wikidata.org/entity/Q2513', 'itemLabel': 't lescope spatial Hubble', 'all_Unified_Astro_Thesaur  
120 : {'item': 'http://www.wikidata.org/entity/Q5391699', 'itemLabel': 'TUGSAT-1', 'all_Unified_Astro_Thesaurus_ID': '',  
120 : {'item': 'http://www.wikidata.org/entity/Q46259364', 'itemLabel': 'ASTERIA', 'all_Unified_Astro_Thesaurus_ID': '',  
120 : {'item': 'http://www.wikidata.org/entity/Q54376', 'itemLabel': 'ASTRO-B', 'all_Unified_Astro_Thesaurus_ID': '', 'a  
120 : {'item': 'http://www.wikidata.org/entity/Q18476542', 'itemLabel': 'Eutelsat 172B', 'all_Unified_Astro_Thesaurus_ID
```

Wikidata

as a knowledge base

- **Proposal:** use Wikidata as our curated knowledge base
- **Data Discovery** use case: *looks good.*
 - => regular extraction into a name resolver database (using SPARQL queries)
 - => curation of metadata directly in Wikidata
 - => name-resolver (e.g., with elastic-search API)
- **Data Tagging** use case: *not good.*

Semantic (property mappings) quality in WikiData probably not adequate.