

# UCD AND TAP SERVICE FOR SOLAR PHYSICS

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Report on work done at Royal Observatory of  
Belgium

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WP4 Tech Forum

# Outline

- Tools for Virtual Observatory in solar physics: findability, accessibility, interoperability
  - First trial for installation of a TAP service at ROB
  - SOLARNET virtual observatory (SVO): another way to get access to data
  - How to link a TAP service and SOLARNET VO
  - How to link a TAP service and a solar web browser: Jhelioviewer
- Collaboration between institutes
- UCD in TAP resource descriptor files and in FITS keywords

# TAP (for now, not EPN-TAP) service at ROB

- Use of DaCHS software
- First trial on
  - Local archive FITS dataset (EUV image from PROBA2/SWAP)
  - Local archive on sunspot number
  - Local catalog for active regions (continuously updated)
  - External database (D-rap indices, proxy for geomagnetic activity)
- Still a lot to learn

The screenshot shows the DaCHS ADQL Query interface. The browser address bar displays 'solrwc2:8077/\_system\_/adq'. The page title is 'ADQL Query'. The 'Parameters' section shows the query: 'SELECT \* from sunspots.dailysunspotnumber'. The 'Result' section indicates 'Matched: 100' and includes buttons for 'Send via SAMP' and 'Quick Plot'. A red box highlights a warning message: 'Query result probably incomplete due to the match limit kicking in. Queries not providing a TOP clause will be furnished with an automatic TOP 2000 by the machinery, so adding a TOP clause with a higher number may help.'

Gdate	Decimaldate	Dailysunspotnumber	Stddev	Numberofobservations	Provisional
1818-01-01	1818.00098	-1	-1.0	0	False
1818-01-02	1818.00403	-1	-1.0	0	False
1818-01-03	1818.00696	-1	-1.0	0	False
1818-01-04	1818.01001	-1	-1.0	0	False
1818-01-05	1818.01196	-1	-1.0	0	False
1818-01-06	1818.01501	-1	-1.0	0	False
1818-01-07	1818.01794	-1	-1.0	0	False
1818-01-08	1818.021	65	10.1999998	1	False
1818-01-09	1818.02295	-1	-1.0	0	False
1818-01-10	1818.026	-1	-1.0	0	False
1818-01-11	1818.02905	-1	-1.0	0	False
1818-01-12	1818.03198	-1	-1.0	0	False
1818-01-13	1818.03406	37	7.69999981	1	False
1818-01-14	1818.03699	-1	-1.0	0	False
1818-01-15	1818.04004	-1	-1.0	0	False
1818-01-16	1818.04199	-1	-1.0	0	False
1818-01-17	1818.04504	77	11.1000004	1	False
1818-01-18	1818.04707	88	12.0000004	1	False

# First trial with DaCHS, first observations

## DaCHS ...

- does TAP, but also SIAP/SSA/Obscore
- Seems to be at first designed for archival data
- Is configurable and capable of homogenizing a lot of your data
- Good response time (from first tests)

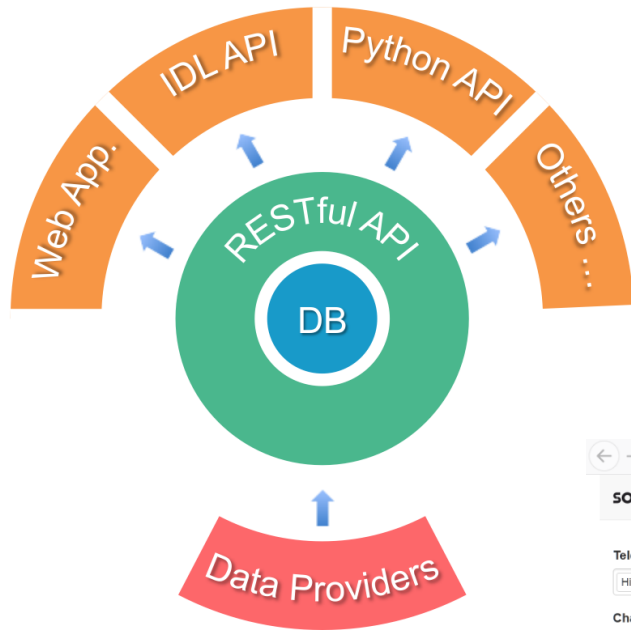
## Still to be learned from our side

- Homogenization requires homogeneity in the resource descriptors → need to learn how to correctly set those parameters
- Not clear *how/if* it treats importing incremental (i.e. live) data.
- Not clear *how/if* it can collect several databases into one service

# Discovery through the VO network

- The resource descriptors immediately give you a documented and standardized service (e.g. TAP)
- ***Aim:*** service must be discoverable through the VO network
- How to improve discoverability for the field of solar physics?
- TAP service for ESAC archive (e.g. Solar Orbiter, PROBA2): researcher go directly to the website
  - There exists a Python library specifically for this TAP service: [sunpy-soar](#)
- VESPA: collection of services
- Link with dedicated tools such as SOLARNET Virtual Observatory

# Design of SOLARNET VO



- The data is hosted on the servers of the data providers.
- metadata are collected into a central searchable database.
- To interface with the database the RESTful API is used
- Easy to develop new tools that interface with the API (web, idl, python, etc,...)

Data providers:  
including high  
resolution telescope,  
later on EST data

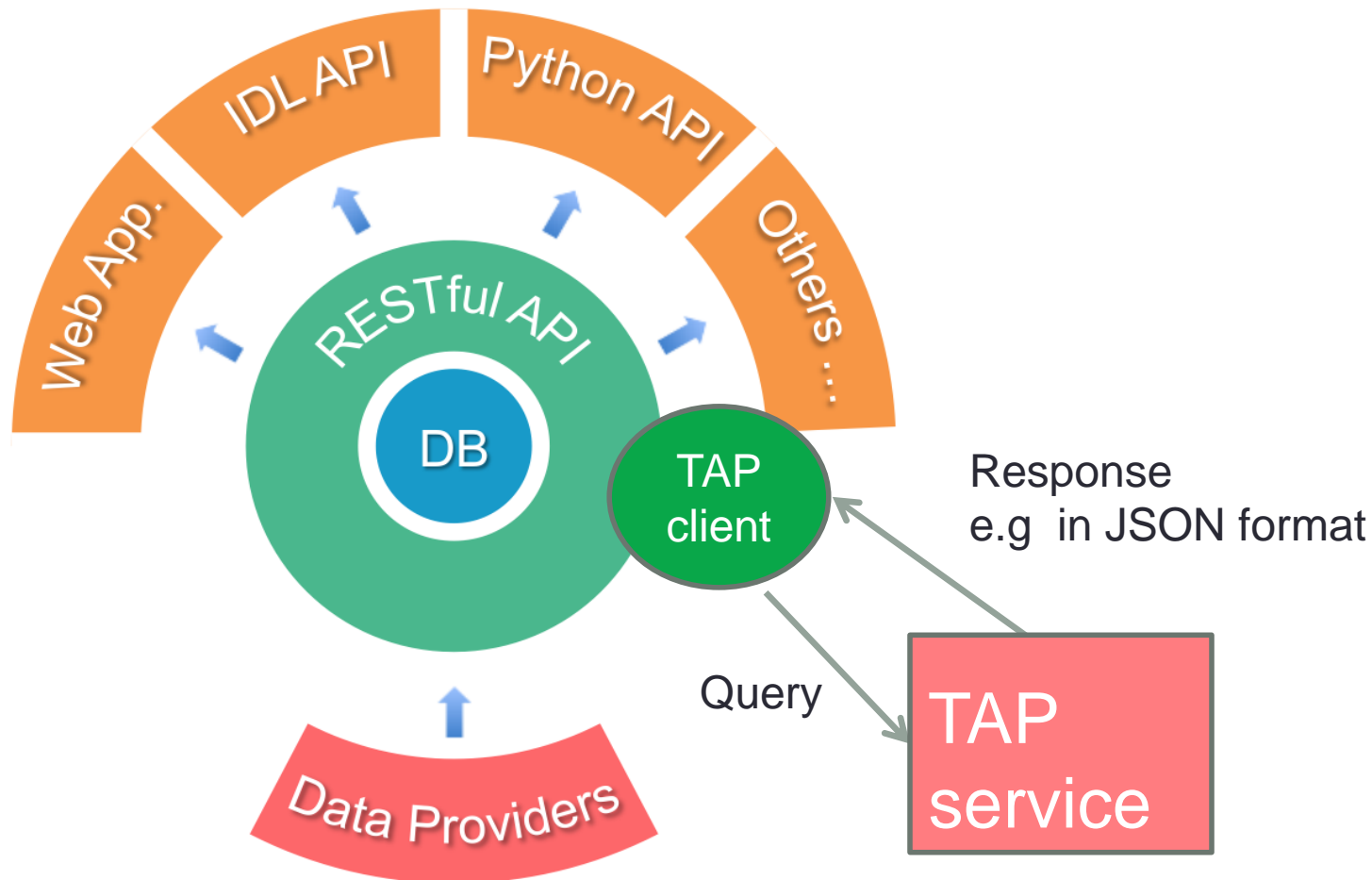
The screenshot shows the SOLARNET web interface at [solarnet.oma.be/SVO/#/dataset](http://solarnet.oma.be/SVO/#/dataset). The page displays a search interface with filters for Telescopes, Characteristics, Tags, and Observation date/wavelength. A table of search results is shown below the filters.

Dataset	# Items	Instrument	Telescope	Characteristics
<input type="checkbox"/> AIA level 1	501672	AIA	SDO	space based, E.U.V., full sun
<input type="checkbox"/> CHROMIS	10	CHROMIS	SST	ground based, spectrograph
<input type="checkbox"/> ChroTel	70199	ChroTel	ChroTel	ground based, E.U.V., full sun
<input type="checkbox"/> CRISP	32	CRISP	SST	ground based, spectrograph, spectropolarimetric data
<input type="checkbox"/> EIT level 0	36470	EIT	SOHO	space based, E.U.V.
<input type="checkbox"/> GRIS level 1	1637	GRIS	GREGOR	ground based, spectrograph
<input type="checkbox"/> HMI magnetogram	50181	HMI	SDO	space based, full sun
<input type="checkbox"/> IBIS	1396	IBIS	DST	ground based, partial sun, spectropolarimetric data
<input type="checkbox"/> ROSA	12639	ROSA	DST	ground based
<input type="checkbox"/> SWAP level 1	1231849	SWAP	PROBA2	space based, E.U.V., full sun
<input type="checkbox"/> Themis	15	Themis	Themis	test, ground based

# VSO (US) versus SOLARNET VO (EU)

- VSO has a similar architecture
- They support RESTful protocol, but also SOAP and recently TAP
- (Communication from Ed Mansky, working on VSO): *In the case of **TAP queries sent to ESA**, we construct the full query following the documentation provided by ESA, and then parse the **JSON results** into our Perl hash to allow easy **combination with SOAP and/or REST results** from other Data Providers. The TAP service provided by ESA is basically a RESTful service.*
- → Idea is to do a similar link within the SOLARNET VO

Aim: Beside the RESTful API, add a TAP client to query a TAP server





# Link between TAP and JHelioviewer, via SAMP protocol

← → ↻ 🏠 soar.esac.esa.int/soar/#results ... 🛡️ ☆ 🗑️ 📄 🌐 ☰

EUROPEAN SPACE AGENCY 📄 SCIENCE & TECHNOLOGY 📄 SAMP registration timed out, please try again SIGN IN

## Solar Orbiter Archive

SOAR 1.4

RESULTS #1 x RESULTS #2 x RESULTS #3 x

science (15681)

SAMP Hub Security

⚠️ The following application, probably running in a browser, is requesting SAMP Hub registration:

Name: SolarOrbiterARChive  
 Origin: http://soar.esac.esa.int  
 URL: http://soar.esac.esa.int/

If you permit this, it may be able to access local files and other resources on your computer.

You should only accept if you have just performed some action in the browser, on a web site you trust, that you expect to have caused this.

Do you authorize connection?

SAMP protocol

Item Id	Level	Des	Instrument	File Form	File Size	Archived Or
solo_L1_eui-hrilya1216-image_20200418T050220245	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26
solo_L1_eui-hrilya1216-image_20200418T045520244	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26 0
solo_L1_eui-hrilya1216-image_20200418T051400246	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26 1
solo_L1_eui-hrilya1216-image_20200418T050240245	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26 1
solo_L1_eui-hrilya1216-image_20200418T045820245	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26 0
solo_L1_eui-hrilya1216-image_20200418T045530245	L1	EUI-IMA	EUI	FITS	222 KB	2021-03-26 0

1 of 157 Page size: 100

Displaying 1-100 of 15681

# Data transfer (Jhelioviewer must be running)

Solar Orbiter Archive

soar.esac.esa.int/soar/#results

EUROPEAN SPACE AGENCY SCIENCE & TECHNOLOGY SIGN IN

## Solar Orbiter Archive

SOAR 1.4

RESULTS #1 RESULTS #2 RESULTS #3 RESULTS #4

science (1381)

Item Id	Level	Descriptor	Begin Time	End Time	Instrument	File For	Size	Date
<input type="checkbox"/> solo_L1_eui-hriev174-image_20201019T202248204	L1	EUI-HRIEUV174-IMAGE	2020-10-19 20:22:48.204	2020-10-20 20:22:48.204	EUI	FITS		
<input type="checkbox"/> solo_L2_eui-hriev174-image_20201019T202248204	L2	EUI-HRIEUV174-IMAGE	2020-10-19 20:22:48.204	2020-10-20 20:22:48.204	EUI	FITS		
<input checked="" type="checkbox"/> solo_L2_eui-hriev174-image_20201019T202300204	L2	EUI-HRIEUV174-IMAGE	2020-10-19 20:23:00.204	2020-10-20 20:23:00.204	EUI	FITS	16 MB	2021-04-12 0
<input type="checkbox"/> solo_L1_eui-hriev174-image_20201019T202300204	L1	EUI-HRIEUV174-IMAGE	2020-10-19 20:23:00.204	2020-10-20 20:23:00.204	EUI	FITS	8 MB	2021-03-24 0
<input type="checkbox"/> solo_L1_eui-hriev174-image_20201019T202312204	L1	EUI-HRIEUV174-IMAGE	2020-10-19 20:23:12.204	2020-10-20 20:23:12.204	EUI	FITS	8 MB	2021-03-24 0
<input type="checkbox"/> solo_L2_eui-hriev174-image_20201019T202312204	L2	EUI-HRIEUV174-IMAGE	2020-10-19 20:23:12.204	2020-10-20 20:23:12.204	EUI	FITS	16 MB	2021-04-12 0

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Send table  
Send products  
4 item(s) selected  
All rows  
Selected rows

# Within JHV: data available as a new layer

ESA JHelioviewer

File View Movie Tools Help

Zoom In Zoom Out Zoom-Fit Actual Size Reset Camera Pan Rotate Axis Track Differential Corona Multiview Projection Annotation SDO Cut-out SAMP

Image Layers

Options > 1/1

2021-04-08T10:43:09 2021-04-10T10:43:09 CR

New Layer Sync

<input type="checkbox"/>	EUI FSI 174	2020-10-21T09:51:00	✓	×	^
<input type="checkbox"/>	EUI HRI-EUV 174	2020-10-19T20:02:36	✓	×	
<input type="checkbox"/>	<b>EUI HRI-EUV 174</b>	2020-10-19T20:33:00	✓	×	
<input checked="" type="checkbox"/>	EUI HRI-EUV 174	2020-10-19T20:23:00	✓	×	
<input checked="" type="checkbox"/>	<b>EUI FSI 174</b>	2020-10-21T09:51:00	✓	×	
<input type="checkbox"/>	Viewpoint	2020-10-19T20:33:00			

Grid

FOV

Difference  None  Running  Base

Opacity 100%

Blend 50%

Slit 0%

Sharpen 100%

Levels 0%

Levels 100%

Color SDO-AIA 171 Å

Channels  Red  Green  Blue

Timeline Layers

New Layer Custom interval

Callisto Radiogram

Timelines

FPS: 0 CR: 2236.54 FOV: 3.42R0 | DO: 0.986au H: --Mm | (ρ,ψ): ( 6.83R☉, +82.97° ) | (φ,θ): ( --°, --° ) | (x,y): ( -1.83°, +813' ) | --DN/s

14:14 12/04/2021

# Collaboration between institutes

- The owner of a VESPA service may put its description file in <https://voparis-gitlab.obspm.fr> (after authorization by Baptiste)
- Homogenization/discussion about:
  - resource descriptor content
  - UCD within resource descriptor

The screenshot shows a web browser window with the URL <https://voparis-gitlab.obspm.fr/vespa/dachs/services>. The page content is a list of subgroups and projects under the 'Subgroups and projects' tab. The table below summarizes the visible data:

Subgroup/Project Name	Repository Count	Other Metrics
CBK-PAN (Warsaw - Poland)	0	0 0 1
DLR (Berlin - Germany)	0	0 0 1
FHNW.CH (Windisch - Switzerland) Repository for FHNW.CH services	1	1 0 2
IASB-BIRA (Brussels - Belgium)	1	1 0 2
IDOC (Orsay - France)	1	1 0 7
IPSL (Paris - France)	3	0 0 2
JacobsUni (Bremen - Germany) DaCHS Resource Descriptors (RDs) for Jacobs Uni VESPA services	0	6 1
OATS (Trieste - Italy)	0	0 0 1
OMP (Toulouse - France)	0	0 0 1
ORB (Brussels - Belgium) <span>Owner</span>	0	0 0 2
PADC (Paris - France) VESPA DaCHS PADC services	2	1 1
SRN (Nançay - France)	1	1 0 1
Tohoku (Sendai - Japan)	1	0 0 1
UCL (London - UK)	1	1 0 2
UPV (Bilboa - Spain) Repository for UPV/EHU services	0	0 0 1

# Why UCD ?

- Support for interoperability, e.g. support for cross-column, or even cross-catalog search in SOLARNET VO
- Not as complete as a data model, but it is a start
- Reference :
  - <http://cdsweb.u-strasbg.fr/UCD/> (UCD1+, 2018)
  - [https://github.com/ivoa-std/UCDList/blob/master/ucd-list-1\\_4.txt](https://github.com/ivoa-std/UCDList/blob/master/ucd-list-1_4.txt) (Nov 2019)
  - Extension for planeto and heliophysics:  
<https://wiki.ivoa.net/internal/IVOA/PlanetaryUCD/SolarSystemUCD-V05.pdf> (also available on zenodo)

# Work done with UCD: review of:

- [FITS keywords](#): link between main FITS keywords & UCD
- [HEK catalog](#): no UCD at the moment in the HEK, first attempt to propose UCD
- [HFC1 catalog](#): UCD in resource descriptor (from the VESPA github repository) : agreement on same combinaison of UCD to use for a quantity
  - Ex: Chain code of a solar feature, could be characterized by
    - *pos.outline* or by *src.morph*
- → [Request for new UCD](#) , complement to assessment study of 2014
- → Discussion group needed on
  - <https://github.com/ivoa-std/UCDList>