

The Virtual Observatory. A new open data-based framework for new science

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Astronomy ESFRI & Research Infrastructure Cluster
ASTERICS - 653477



CENTRO DE ASTROBIOLOGÍA
ASOCIADO AL NASA ASTROBIOLOGY INSTITUTE



GOBIERNO
DE ESPAÑA



CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



Instituto Nacional de
Técnica Aeroespacial



Information sharing in Astrophysics



open data charter

Principles



1. Open by Default



2. Timely and Comprehensive



3. Accessible and Usable



4. Comparable and Interoperable



5. For Improved Governance and Citizen Engagement



6. For Inclusive Development and Innovation

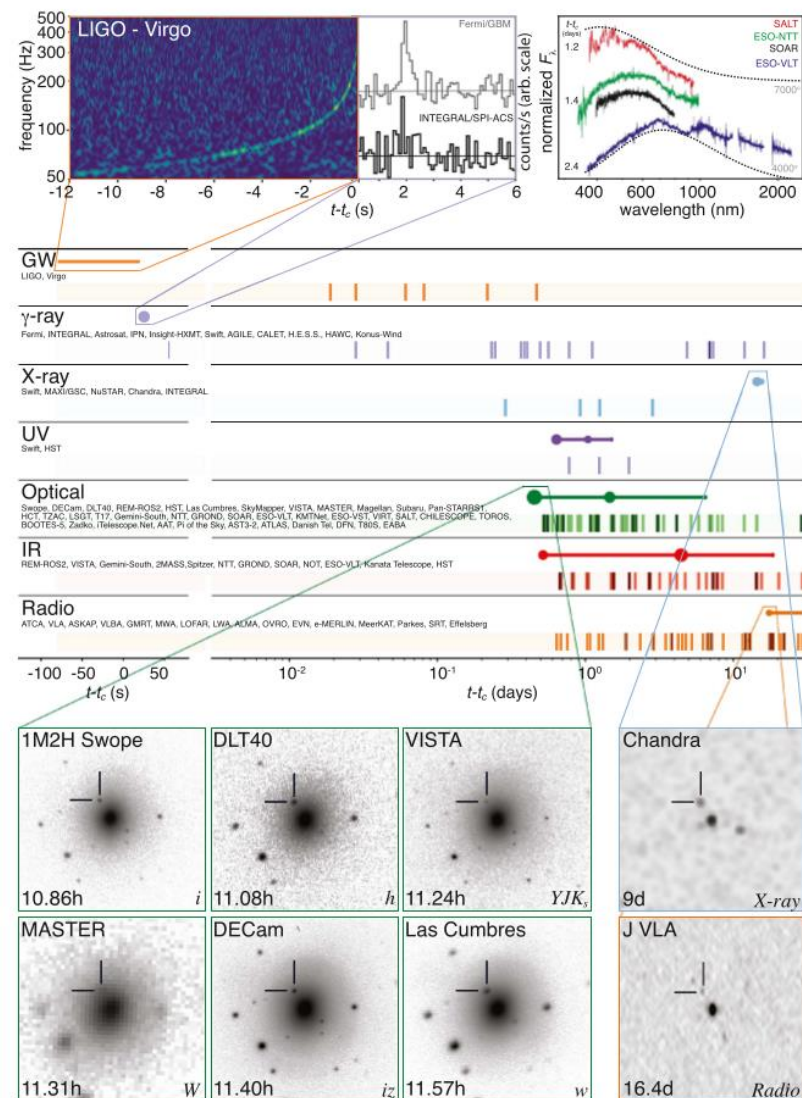
Interoperability in Astronomy



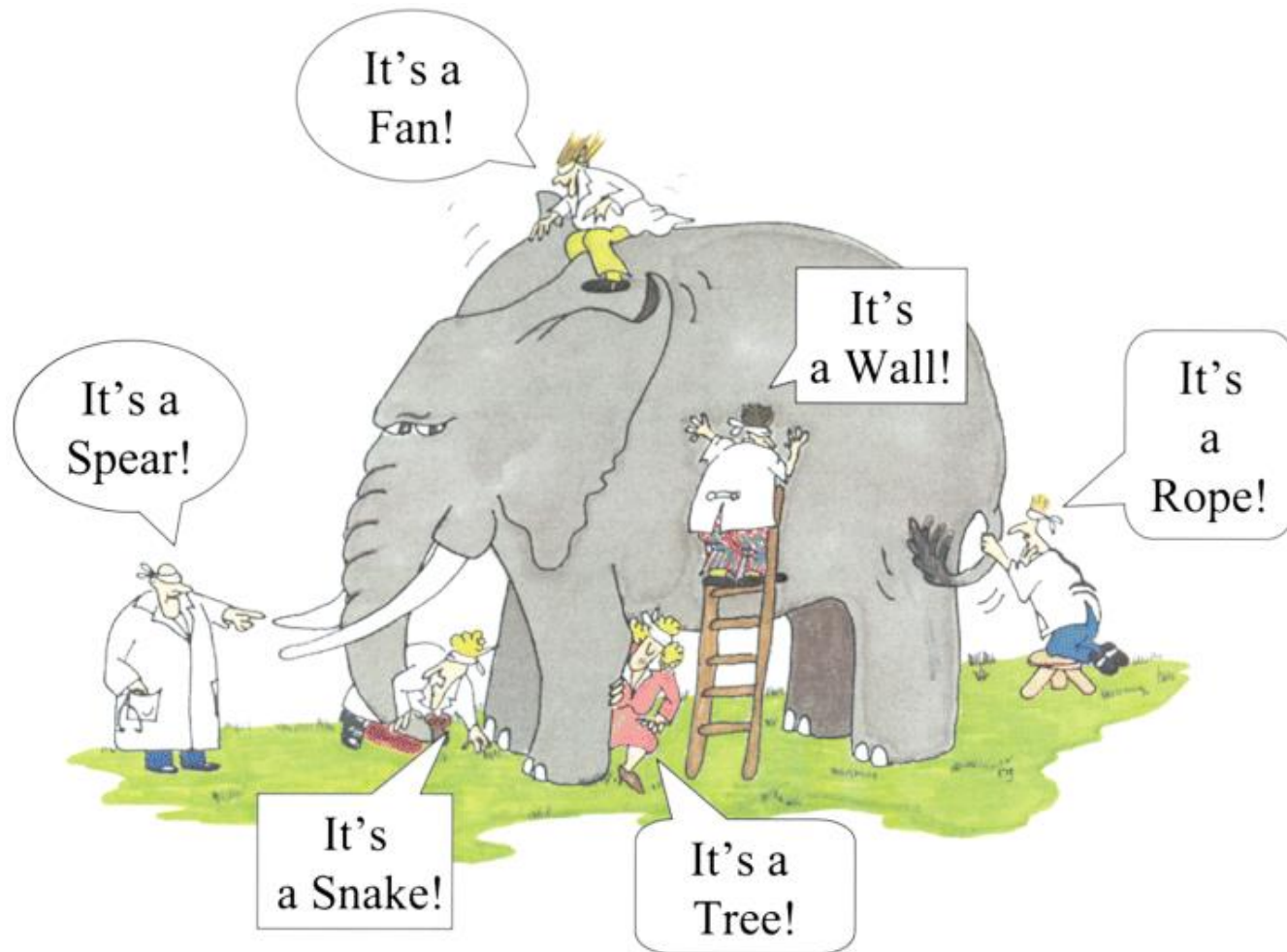
GW170817

THE ASTROPHYSICAL JOURNAL LETTERS, 848:L12 (59pp), 2017 October 20

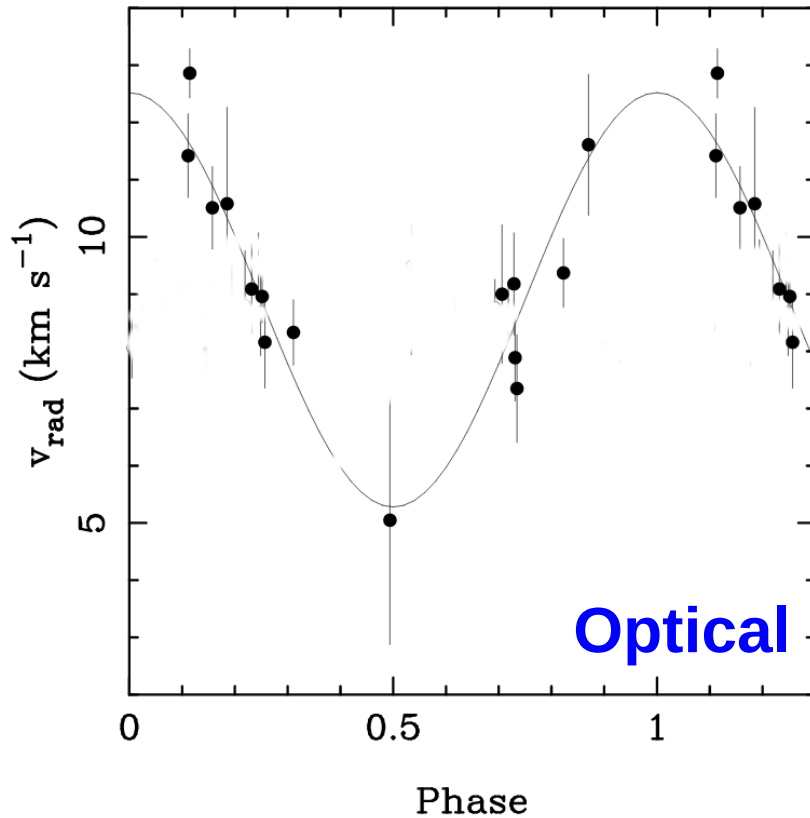
Abbott et al.



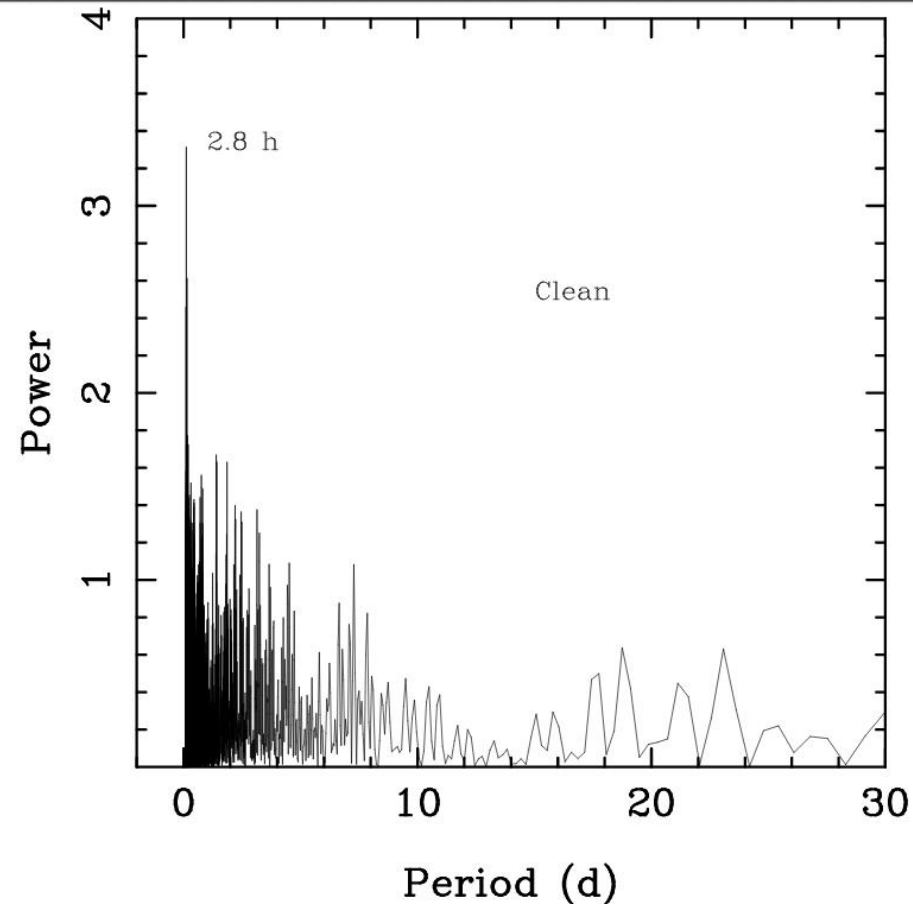
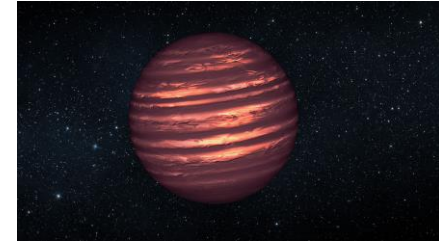
Multi- λ Astronomy



Multi- λ Astronomy

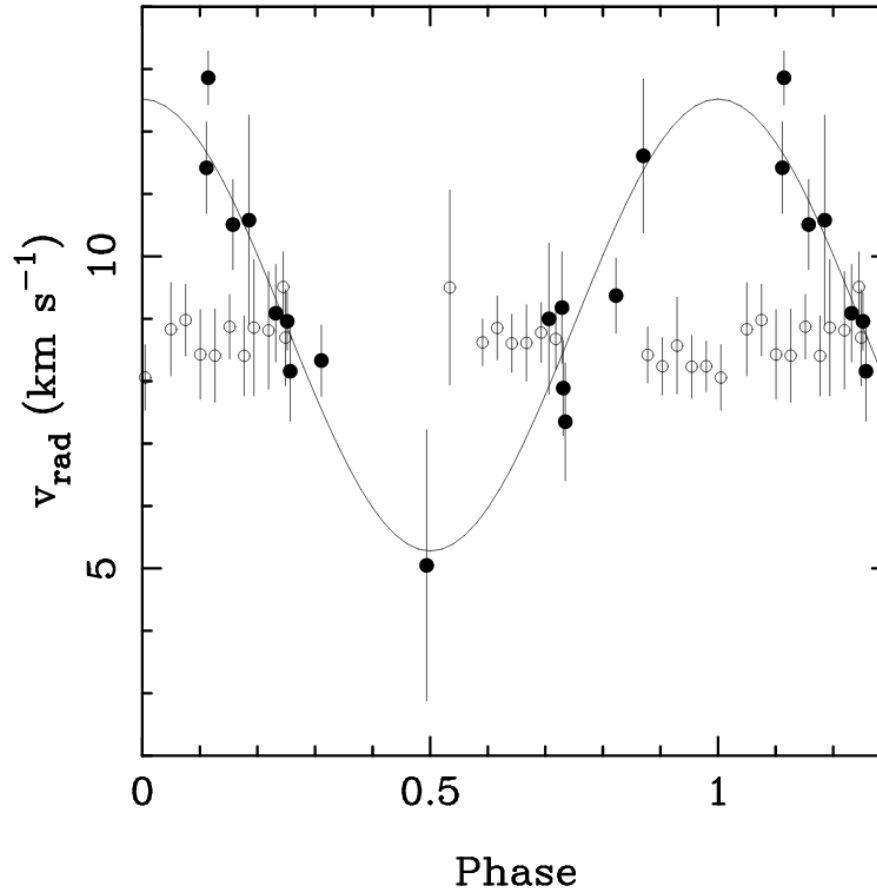


LP 944-20



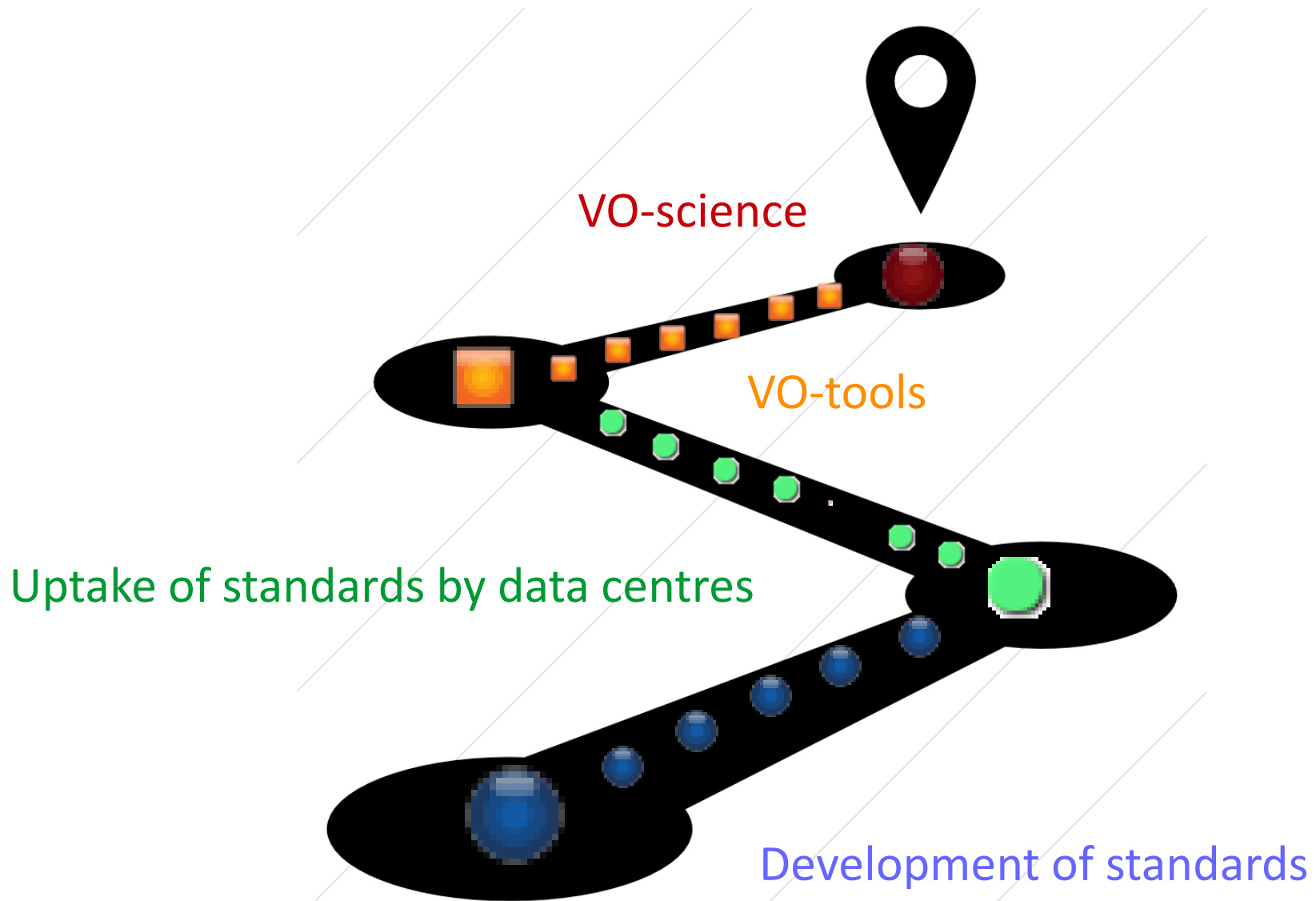
14 nights converging 841 days
Period: 2.5 – 3.7 hours

Multi- λ Astronomy



IR data rules out the planetary hypothesis

The Virtual Observatory roadmap

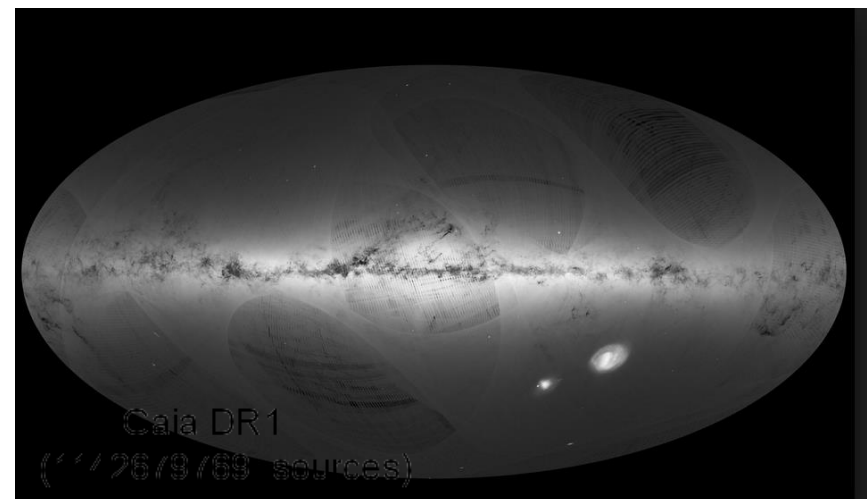


VO-tools: New tools for new science

The screenshot shows the 'Table Access Protocol (TAP) Query' window. The title bar is circled in red. The interface includes a menu bar (Window, TAP, Edit, Interop, Help) and a toolbar. Below the toolbar are tabs for 'Select Service', 'Use Service', 'Resume Job', and 'Running Jobs'. The 'Select Service' tab is active, showing a 'Metadata' section with a 'Find:' field and a tree view of services. The 'Service Capabilities' section is also visible, with 'Query Language' set to 'ADQL-2.0' (circled in red). The 'ADQL Text' section shows a query:

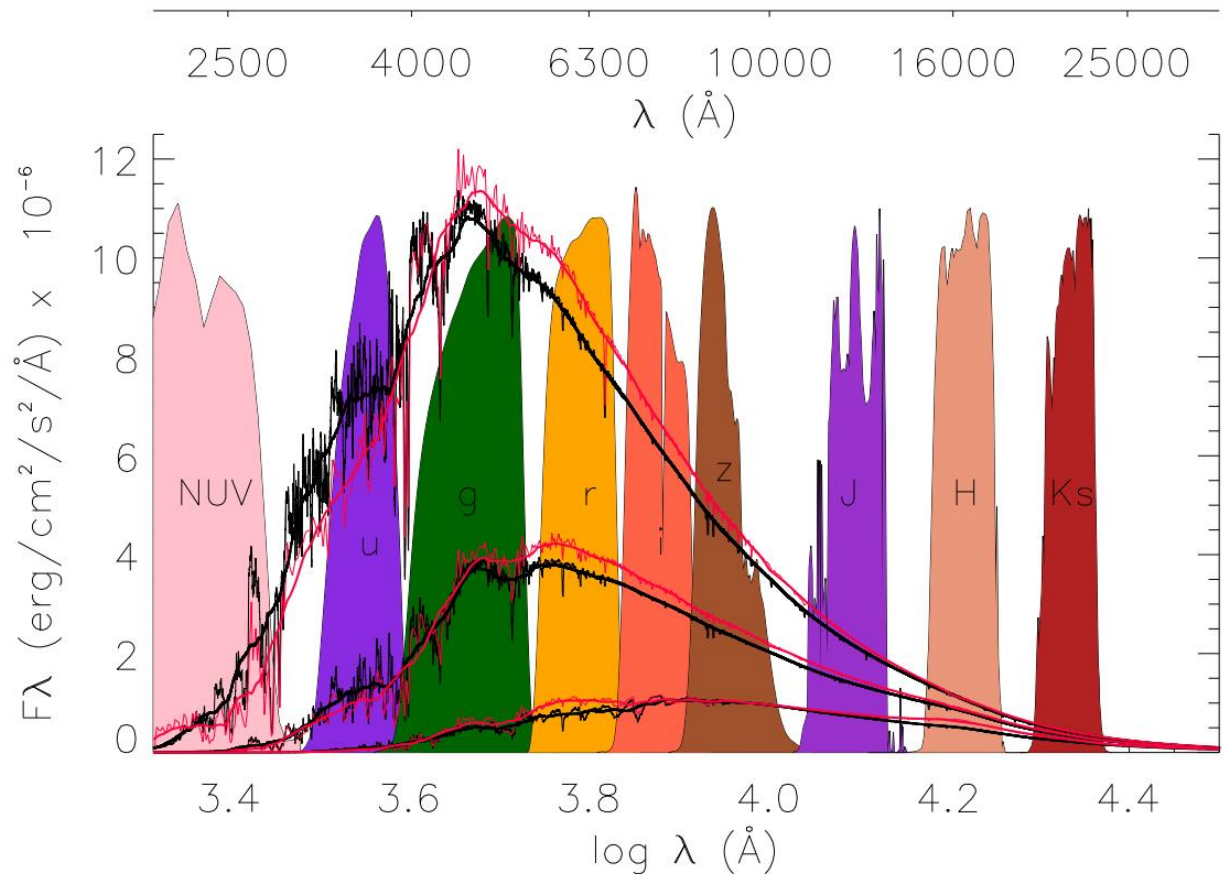
```
SELECT crossmatch_positional(
'public','hipparcos',
'gaiadr1','gaia_source',
1.0,
'xmatch_hipparcos_gaia')
FROM dual;
```

The screenshot shows the 'CDS X-Match Service' interface. It has tabs for 'X-match', 'Tables management', and 'Documentation'. The 'X-match' tab is active, showing a 'Choose tables to cross-match' section. There are two input fields for table names, each with a red 'X' icon. Below the input fields are buttons for 'VizieR', 'SIMBAD', and 'My store'. A 'Show options' button is also present. At the bottom, there is a 'Begin the X-Match' button.



VO-tools: New tools for new science

Parameter estimation of thousands of objects from SED fitting.



VO-tools: New tools for new science

Filter: uJAVA

Filter: J0378

Filter: J0395

Filter: J0410

Filter: J0430

8.01"

8.01"

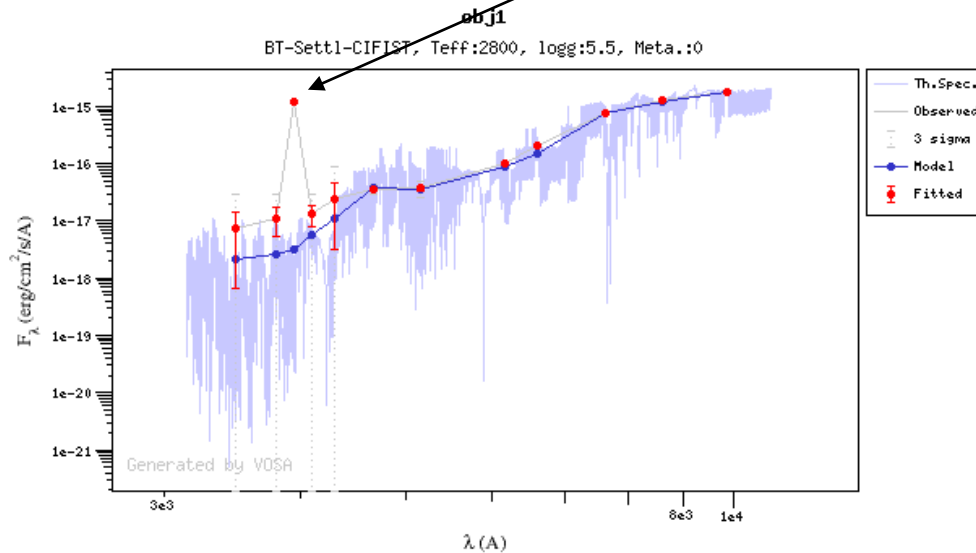
8.01"

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8.01"



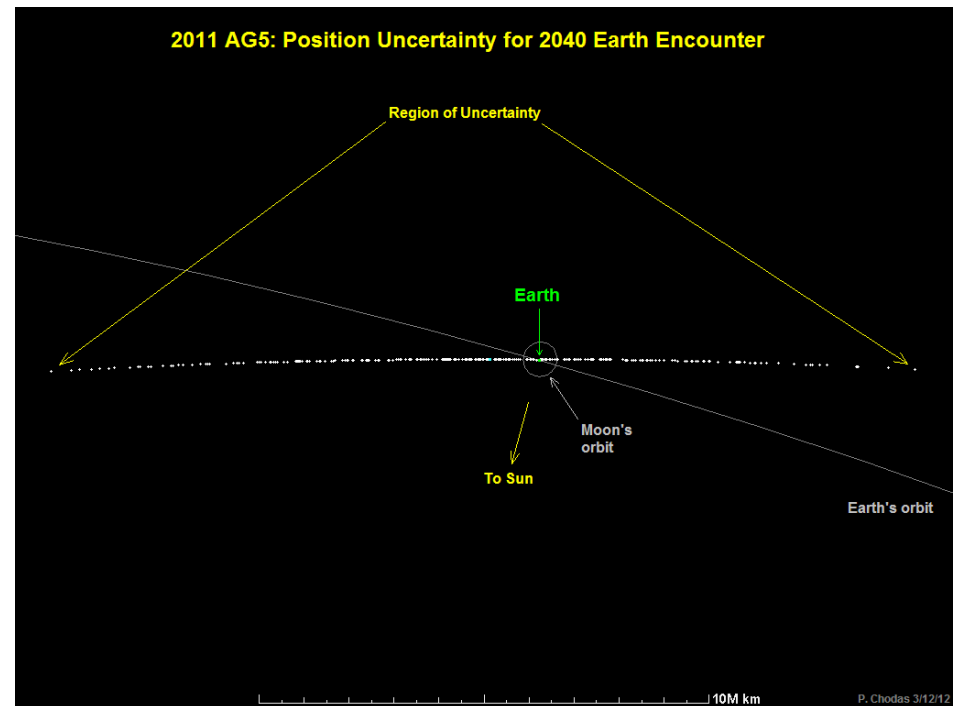
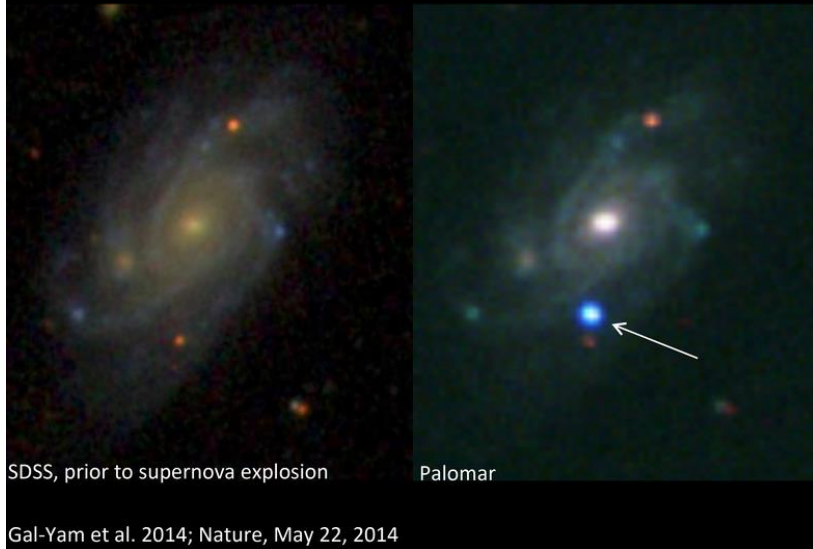
Brown dwarf flare



VO-tools: New tools for new science

“Tell me everything that is known about this object”.

SN 2013cu (iPTF13ast)



VO-science: Not an idea. A reality

 **adsbeta** Feedback ID ORCID Le

QUICK FIELD: [Author](#) [First Author](#) [Abstract](#) [Year](#) [Fulltext](#) [All Search Terms](#)

(full:"Virtual Observatory" AND year:2000-2018 AND year:2000-2015) ✕ 🔍

Your search returned **1,951** results

Property ✱ [+property:refereed](#) Collection ✱ [+astronomy](#) sort: [Date desc](#) 🔗

▼ AUTHORS

- [Solano, E](#) 50
- [Rauch, T](#) 31
- [Zhao, Y](#) 30
- [Barrado, D](#) 27
- [Lee, J](#) 27

more

▼ COLLECTIONS

☐ Hide highlights ☐ Show abstracts

1 ☐ 2015MNRAS.454.4054B 2015/12 cited: 4 📄 📋 📁
[Spectrophotometric characterization of high proper motion sources from WISE](#)
Beamín, J. C.; Ivanov, V. D.; Minniti, D. and 7 more
and compare to stellar models we used the [Virtual Observatory](#) SED analyzer (VOSA; Bayo et al. 2008), fitting

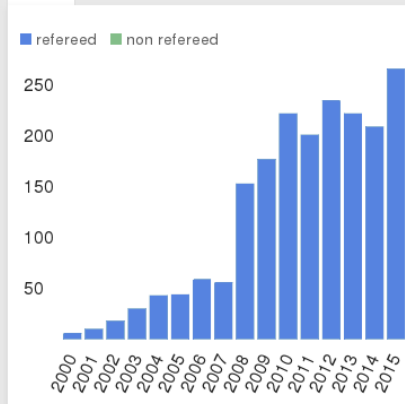
2 ☐ 2015MNRAS.454.3577M 2015/12 cited: 4 📄 📋 📁
[A deep look at the nuclear region of UGC 5101 through high angular resolution mid-IR data](#)
Aretxaga, I. and 13 more
[Virtual Observatory](#) (VO). The image was obtained with COMICS on

cited: 16 📄 📋 📁
finders and their connection with theoretical models

0 selected

[Years](#) [Citations](#) [Reads](#)

■ refereed ■ non refereed



Year	Refereed	Non-refereed
2000	10	0
2001	15	0
2002	20	0
2003	25	0
2004	30	0
2005	35	0
2006	40	0
2007	45	0
2008	50	0
2009	60	0
2010	75	0
2011	90	0
2012	100	0
2013	110	0
2014	120	0
2015	130	0

method measurements analysis relation cluster observatory detected range observations
more stellar objects range observations
large stars present software two
photometric new sources sigma ngc1333
distribution galaxies survey data mass sample
teff telescope slant feh including
based study ebv binary
lambda provide variables model find half period
simulation variables system camera
different

VO and cutting-edge astronomy

IVOA Standing Committee on Science Priorities (CSP)

Terms of Reference (2015-):

Motivation and Objectives:

The Virtual Observatory (VO) is designed to enable new scientific research via interoperability of astronomy resources (data and software) around the world. Scientific prioritisation of IVOA activities is essential to ensure that the development and operations of the Virtual Observatory (VO) are relevant to the research needs of the astronomy community. The primary objective of this Committee is to identify the high level scientific requirements for the VO of major astronomy projects and of the wider astronomy community as input to the setting of priorities for IVOA. The Committee's activities around the collection of requirements are intended to provide a high level entry point for major astronomy projects to interact with IVOA, and are also astronomy projects being “participants in”, rather than “customers of” the IV



VO and cutting-edge astronomy

Program

Session	Speaker	Title	Media
Tuesday May 10			
Session 5	Session chair: Mark Allen		
9h00 - 9h10	Introduction to the Focus Sessions	Mark Allen	pdf
9h10 - 9h30	Introduction to the VO standards process	Matthew Graham	pptx
9h30 - 10h00	SKA South Africa & MeerKAT	Russ Taylor	pdf
10h00 - 10h30	LSST	David Ciardi	pdf
Session 6	Session chair: Pepi Fabbiano		
11h00 - 11h20	ASTERICS - CTA: the Cherenkov Telescope Array	Mathieu Servillat	pdf
11h20 - 11h50	ASKAP	Jessica Chapman	pptx
11h50 - 12h20	FAST	Prof. Ming Zhu	pdf
12h20 - 12h30	Discussion	All	
Wednesday May 11			
Session 9	Session Chair: K. Polsterer		
9h00 - 9h20	ESA Euclid and Gaia	Bruno Merin	pdf
9h20 - 9h40	JWST	Tom Donaldson	pdf
9h40 - 10h00	ASTERICS - EGO/VIRGO/Gravitational Waves	Giuseppe Greco	pdf
10h00 - 10h30	Discussion	All	
Session 10	Splinter Discussions		
11h00 - 12h30	Discussion session with invited speakers on identification of large project needs		

VO and cutting-edge astronomy



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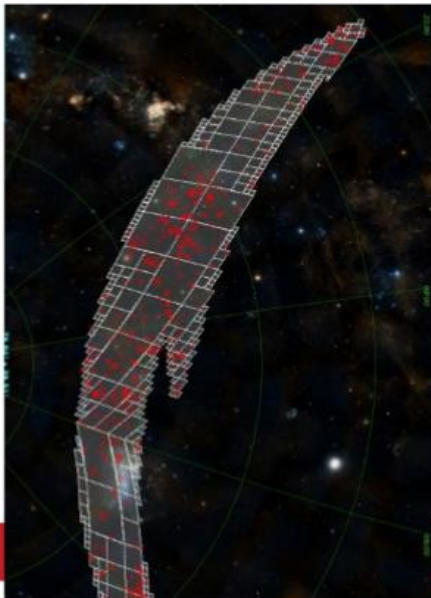
Data Access, Discovery and Interoperability (DADI)

- **Goal:** Make ESFRI and pathfinder data available in the VO framework.
 - Adapt VO framework to ESFRI needs
 - Train and support astronomical community in VO science.
-
- **ESFRI projects:** Both VO-consumers and VO-actors

Adapt VO framework to ESFRI needs



ASTERICS fostered
use of VO for grav
wave EM follow-up



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ASTERICS DADI connections: gravitational waves

Skymap Viewer

A sky atlas for understanding LIGO-Virgo skymaps. Help [here](#), or watch a [video about Skymap Viewer](#). Plenty simulated skymaps [here](#). If you do not see the big dark sky map, look below and widen your browser. Zoom with the + and - at the right of the sky.



LIGO-Virgo Skymaps

This is skymap
GW150914:LAL1.
50% area = 148.0 sq deg
90% area = 516.4 sq deg



Show Weighted Galaxies (or [table](#)).

Time and Place

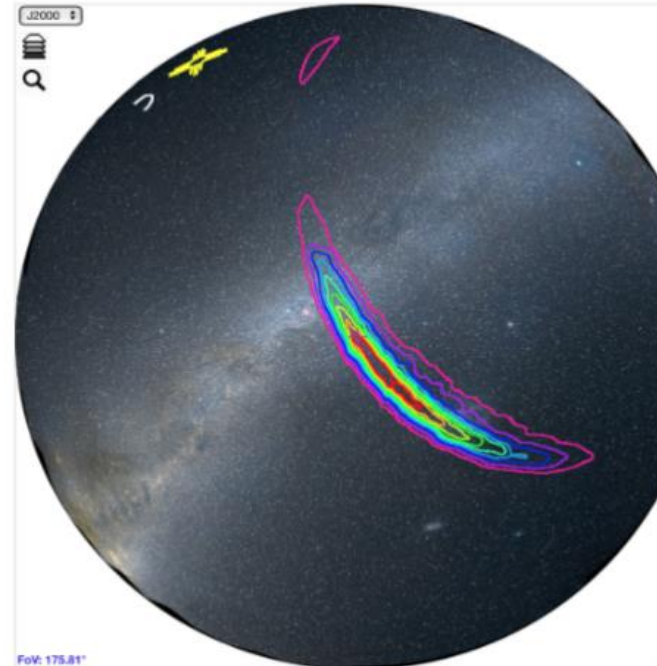
Universal time
2015-09-14T09:50:45 [Now](#)
E Longitude [east](#) [lon](#) Latitude [lat](#)
[Show Sky](#)
Sun = and = Moon

Catalog Sources

Click the Layers icon to switch on catalogs.
If you click on the sources on the sky, information
will appear here with links to Simbad and NED.

Zoomable Multiwavelength Sky

Zoom in on the sky with the mouse or the +/-
keys on the right of the plot. To enhance the image



M. Allen

Train and support astronomical community

- **Goal:** Become familiar with VO-tools and VO-science



- Madrid.
Dec'15



- Strasbourg. Nov'16



- Madrid. Nov'17

**145 participants from 15 European countries.
Not restricted to project's partners.
Material used in national schools in Spain,
Italy, Greece and Poland.**

Summary

- The Virtual Observatory is a science-driver and THE way to work with archive data.
- In optimal agreement with the goals of the Open Universe Initiative:
 - *“Stimulate a dramatic increase of the utilization of space science data, extending the potential of scientific discovery to new participants in all parts of the world”.*