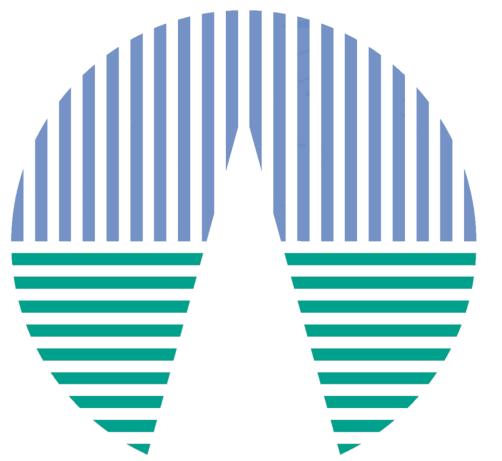


# THE VIRTUAL OBSERVATORY (VO)

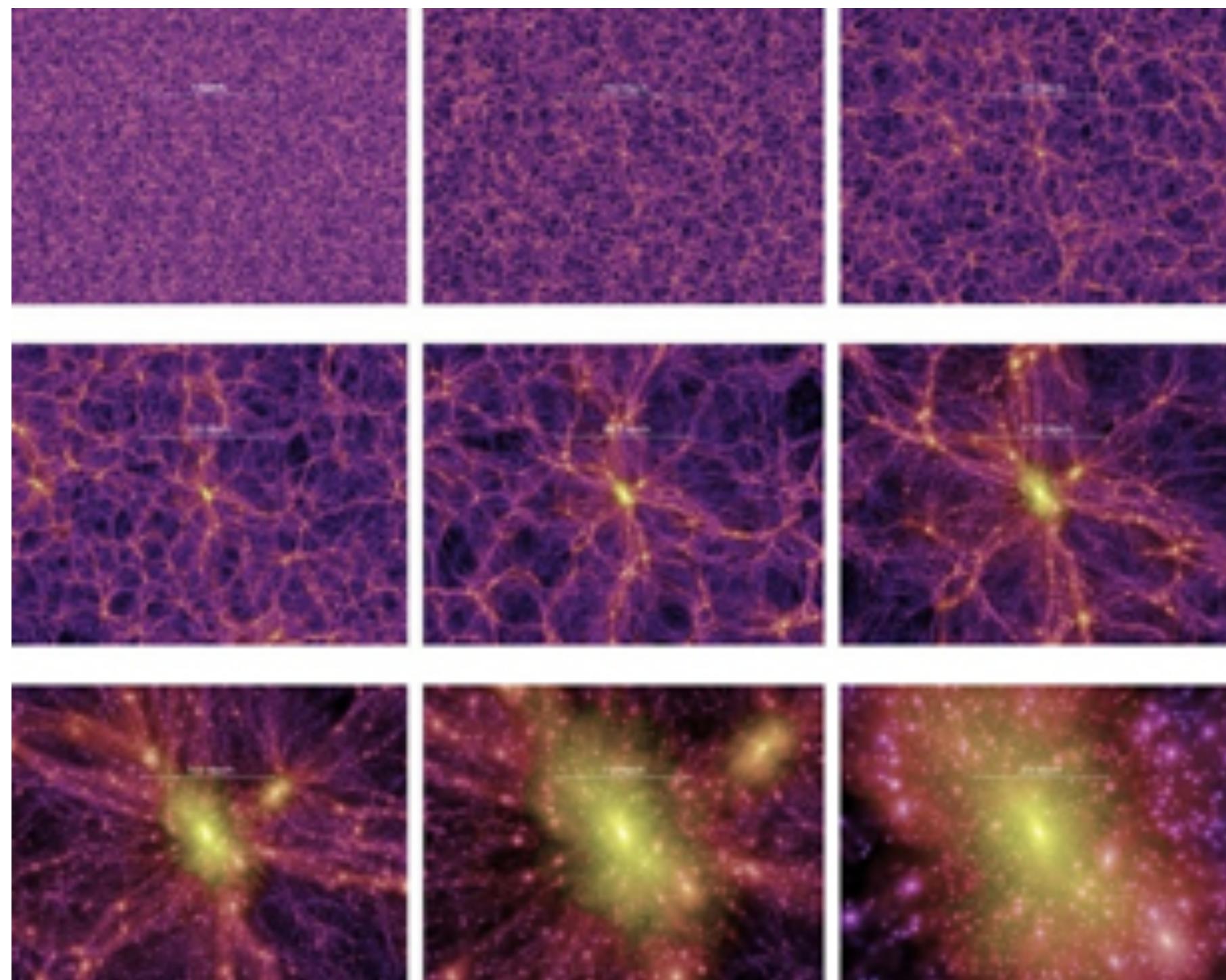
ALBA ALLER EGEA  
CENTRO DE ASTROBIOLOGÍA (CAB, CSIC-INTA)



CENTRO DE ASTROBIOLOGÍA · CAB  
ASOCIADO AL NASA ASTROBIOLOGY PROGRAM



# DATA, DATA, AND MORE DATA!



# ASTRONOMICAL ARCHIVES

esdc

ESDC » Home

- Home
- About ESDC
- Archival Research Visitor Programme
- Newsletter
- Science Archives
- Archive Image Browser
- ESASky
- DOIs
- User Survey Results
- Videos
- Scientific Tutorials
- Publications
- VOspec
- Euro-VO Registry
- Archives User Groups
- Contact Us

**ESAC SCIENCE DATA CENTRE**

ESDC Statistics

Monthly Users (*)  16 879	Monthly Downloaded (*)  101. TB	Archive Total Size  662.2 TB
---	---	--

\* Monthly averages in 2021

**Astronomy Science Archives**

-  cheops
-  esasky
-  exosat

 MIKULSKI ARCHIVE FOR SPACE TELESCOPES

The Mikulski Archive for Space Telescopes is an astronomical data archive focused on the optical, ultraviolet, and near-infrared. MAST hosts data from over a dozen missions like Hubble, Kepler, TESS, and soon JWST.

esa

European Southern Observatory

Public Science User Portal Intranet

Science Users Information > Science Archive Facility

Welcome to the ESO Science Archive Facility

The ESO Science Archive Facility contains data from ESO telescopes at La Silla Paranal Observatory, including the APEX submillimeter telescope on Llano de Chajnantor. In addition, the raw UKIDSS/WFCAM data obtained at the UK Infrared Telescope facility in Hawaii are available.

The Principal Investigators of successful proposals for time on ESO telescopes have exclusive access to their scientific data for the duration of a proprietary period, normally of one year, after which the data becomes available to the community at large. Please read the [ESO Data Access Policy](#) statement for more information, along with the [relevant FAQs](#).

Browsing the archive does not require authentication. Please [acknowledge the use of archive data](#) in any publication.

There are three main ways to access the archive, varying for content and presentation/interface: the usual Raw Data query form, the innovative Science Portal to browse and access science data, the User Portal to access both raw and processed data, and to the ambient condition measurements, if this page.

 SEARCH  MENU

Portal Catalogue Facility

Community Forum

## Missions

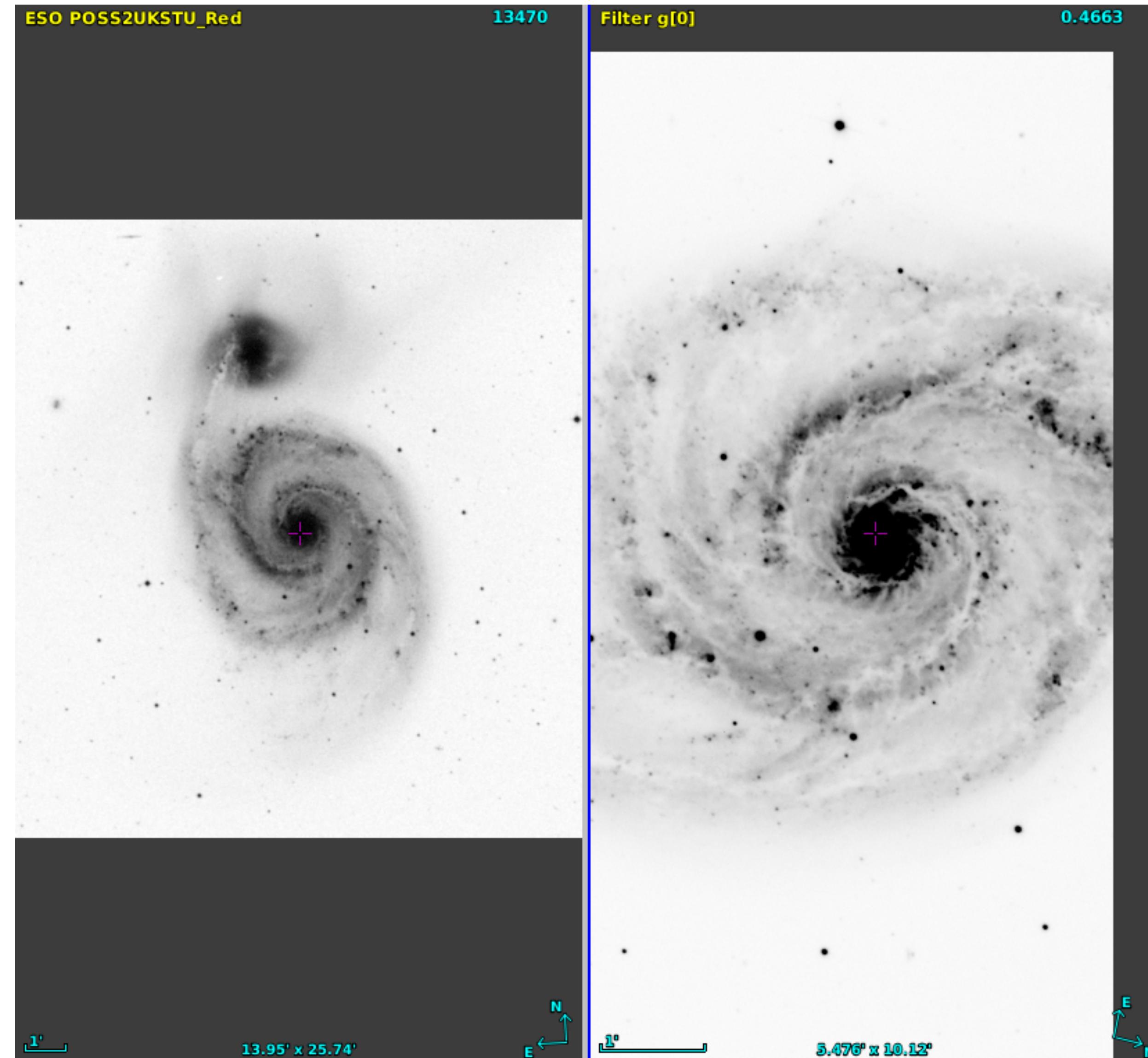
Hubble

Webb

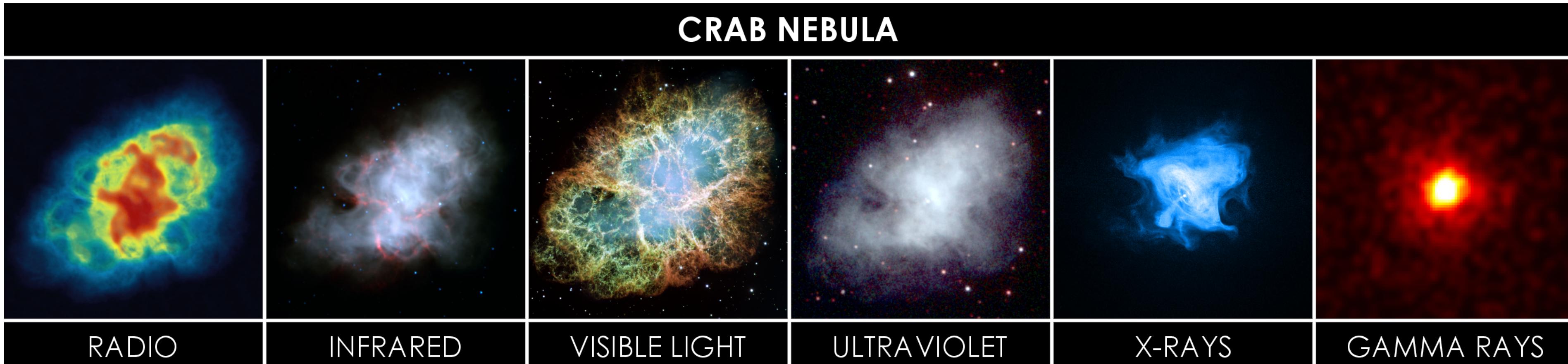
TESS

See All of MAST's  
Missions and Data

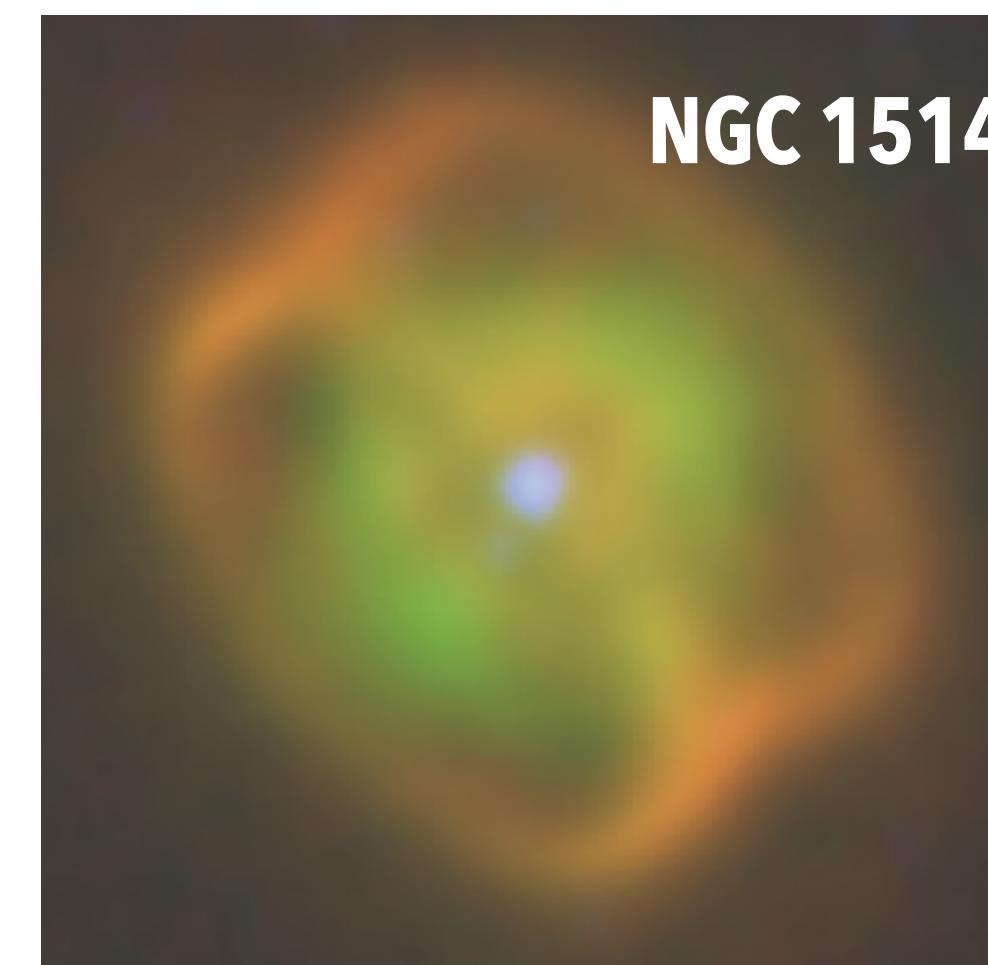
# THE PROBLEM: INTEROPERABILITY



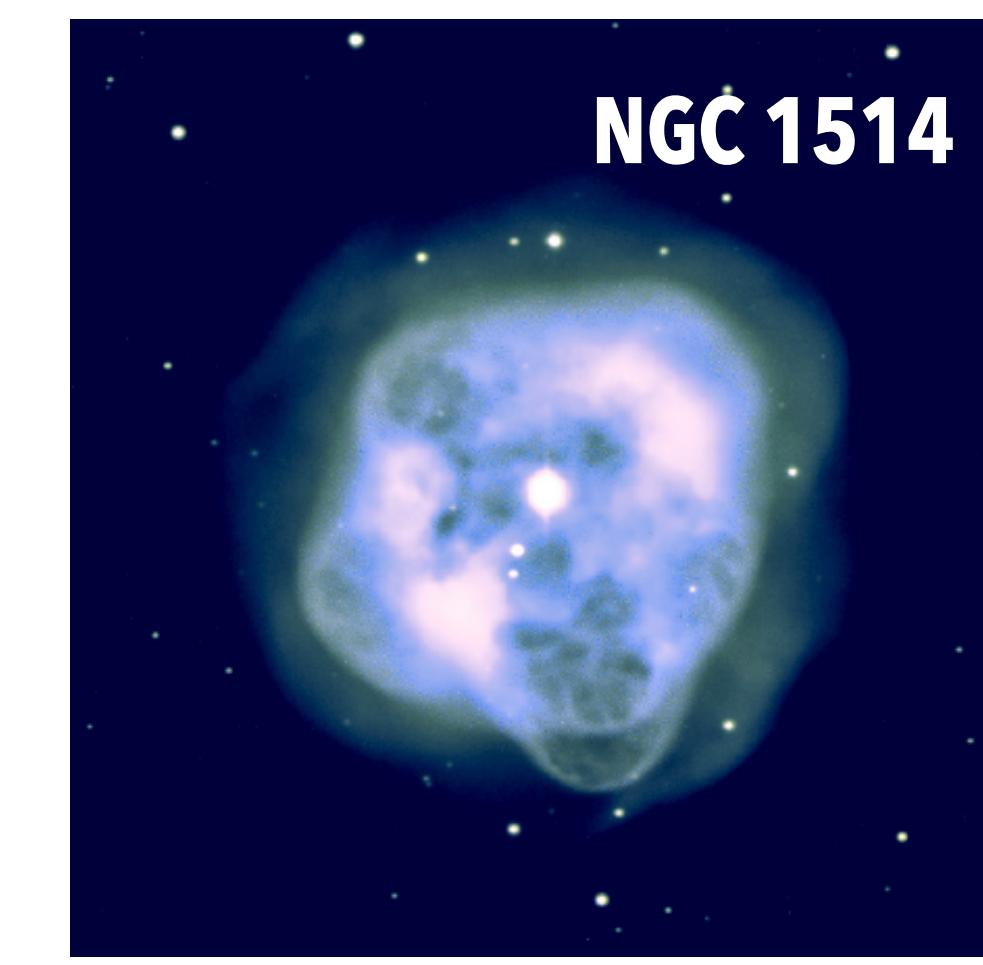
# MULTI-WAVELENGTH ASTRONOMY



Credits: NRAO/AUI and M. Bietenholz; NRAO/AUI and J.M. Uson, T.J. Cornwell (radio); NASA/JPL-Caltech/R. Gehrz / University of Minnesota (infrared); NASA, ESA, J. Hester and A. Loll / Arizona State University (visible); NASA/Swift/E. Hoversten, PSU (ultraviolet); NASA/CXC/SAO/F. Seward et al. (X-rays); NASA/DOE/Fermi LAT/R. Buehler (gamma rays).

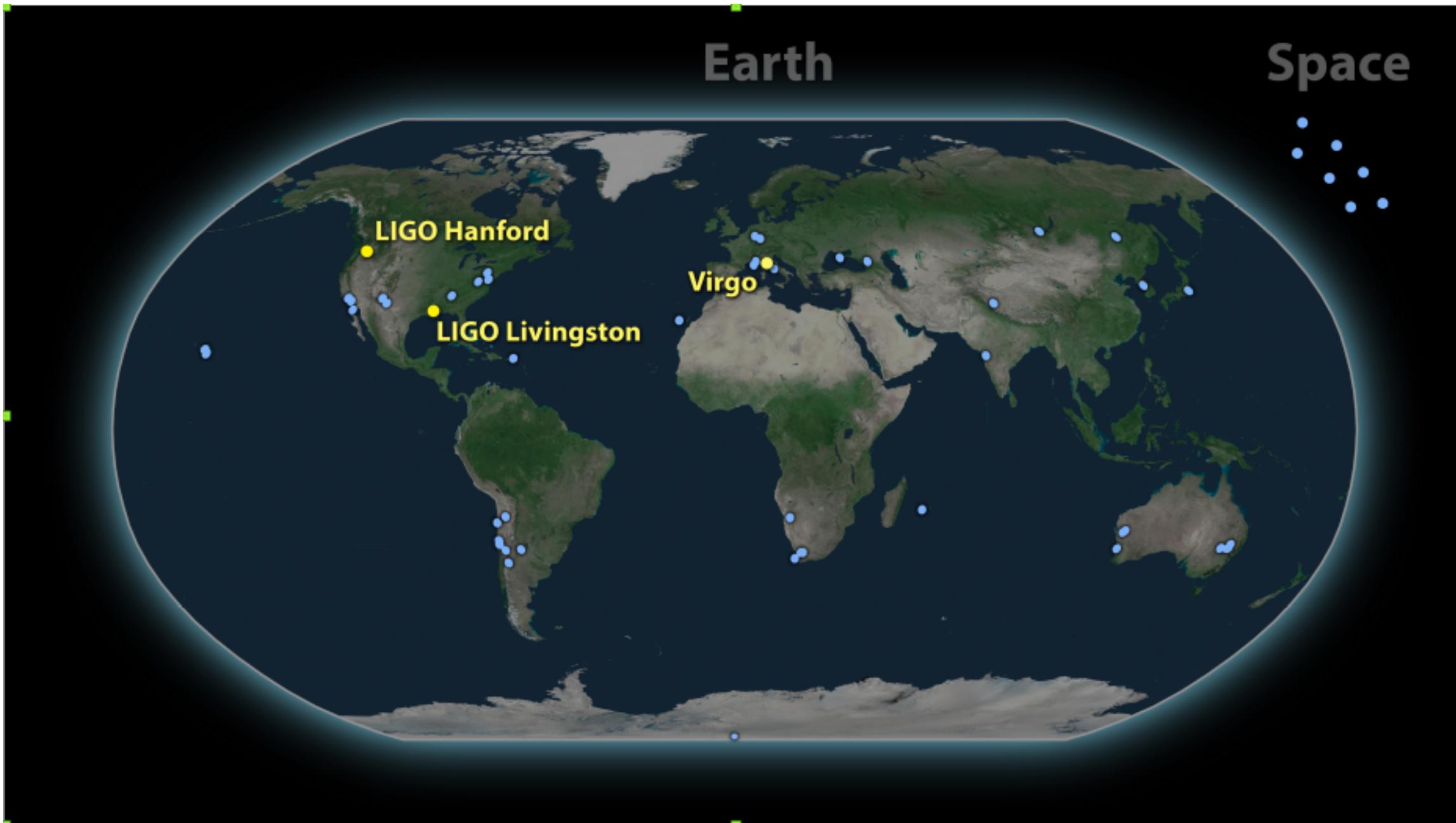


Credits: Ressler et al. 2010



Credits: Jones et al. 2017

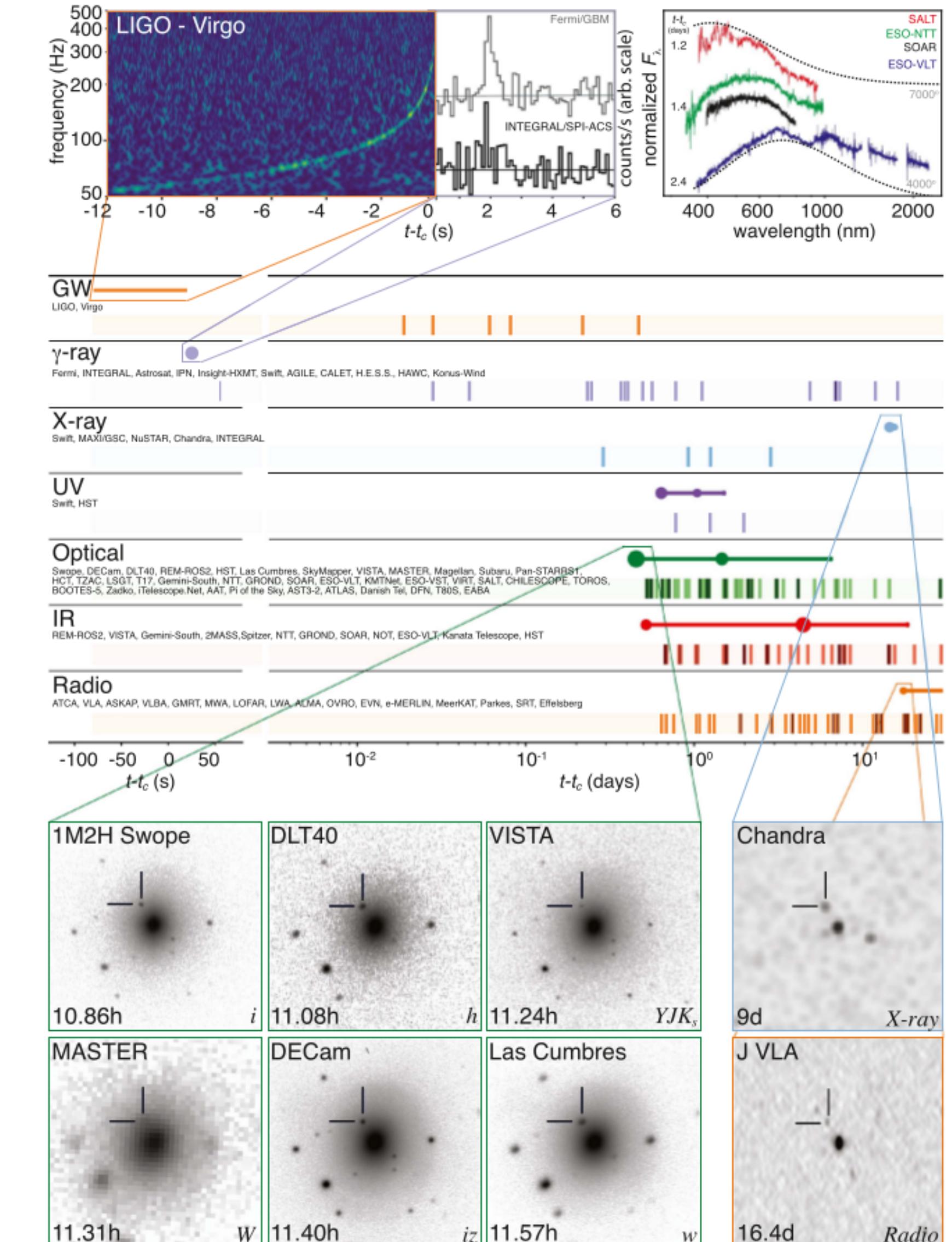
# MULTI-WAVELENGTH ASTRONOMY



GW170817

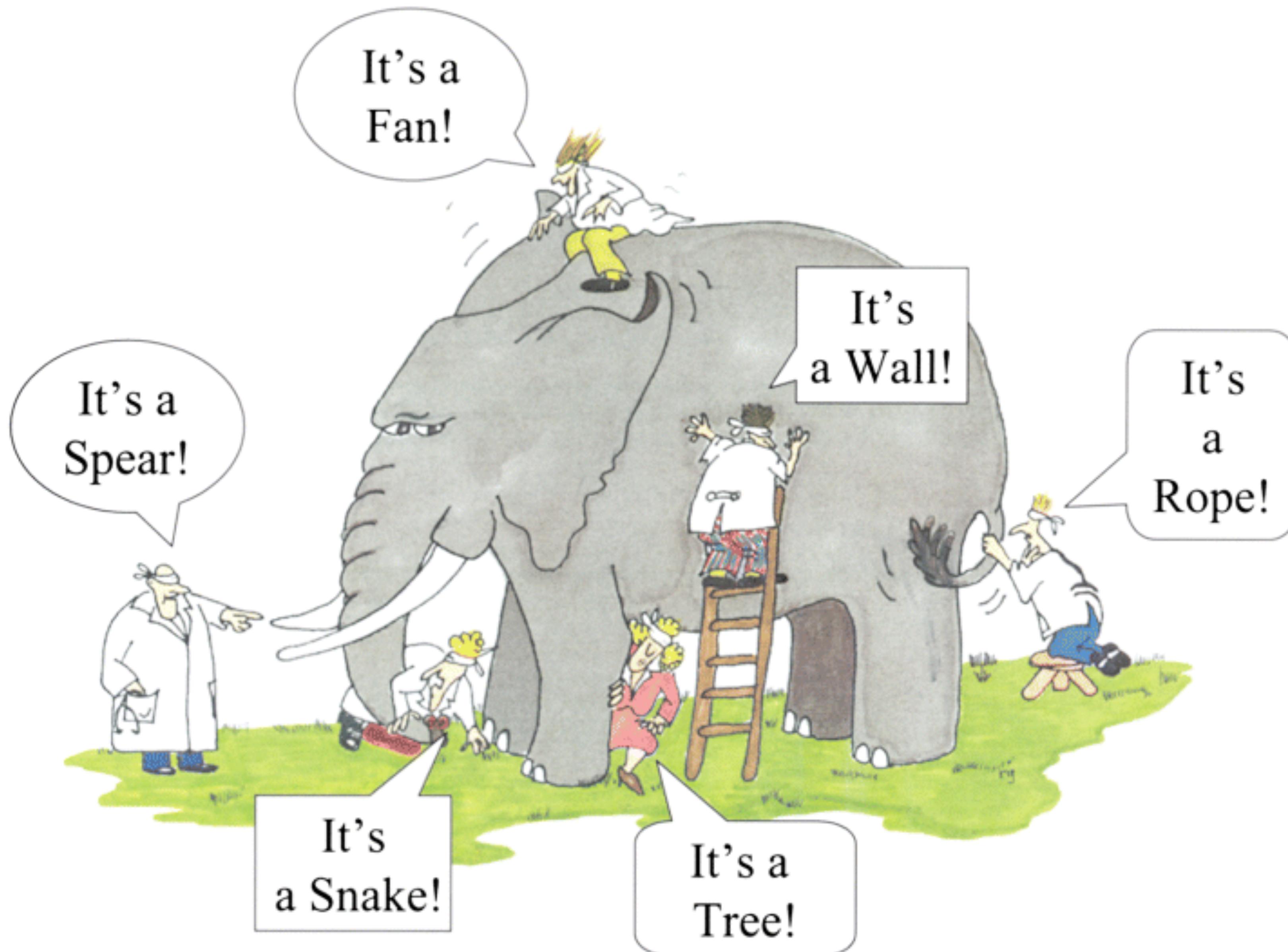
~ 4000 astronomers  
~ 900 groups

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



Abbott et al.

# MULTI-WAVELENGTH ASTRONOMY



# MULTI-WAVELENGTH ASTRONOMY

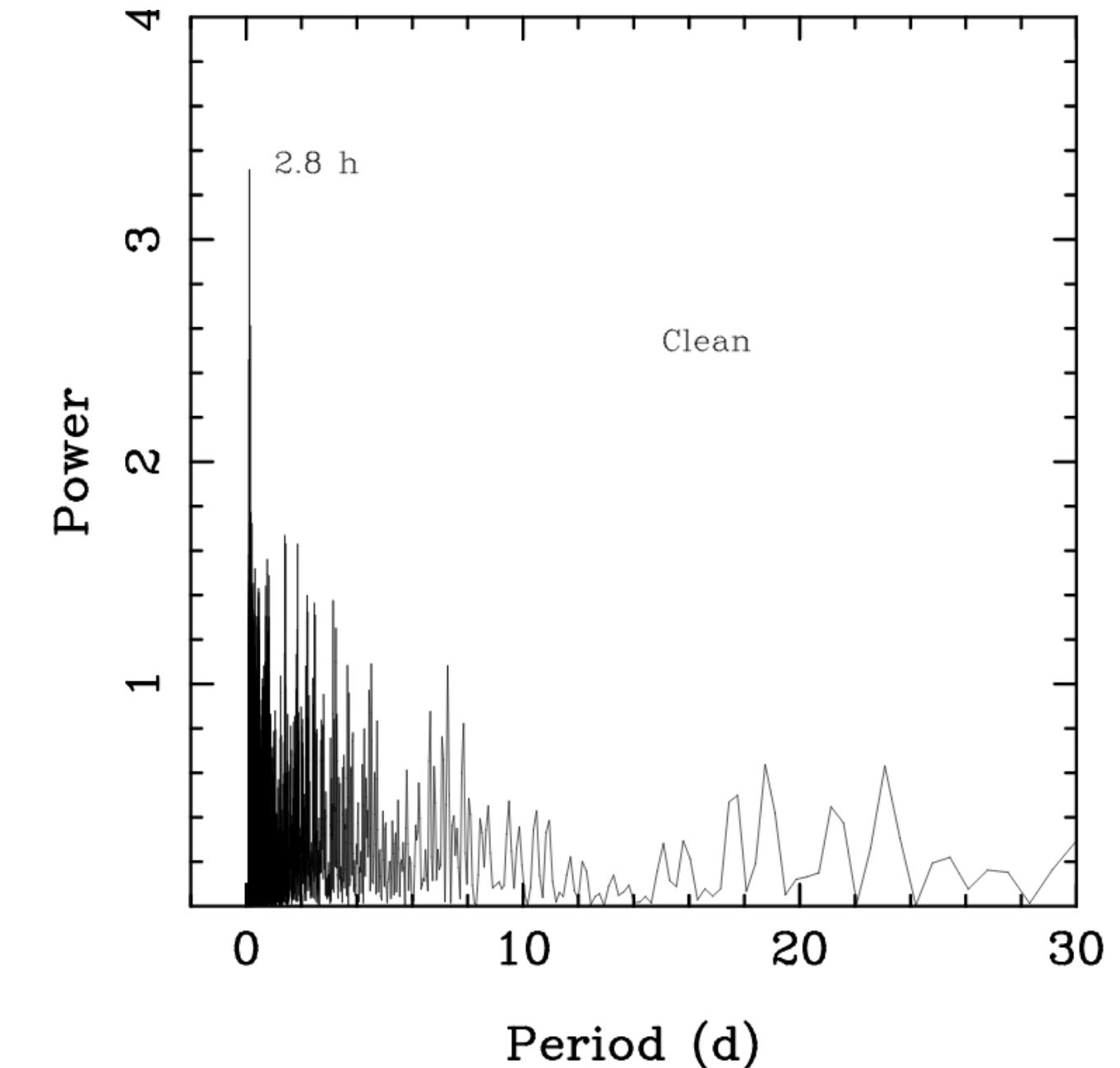
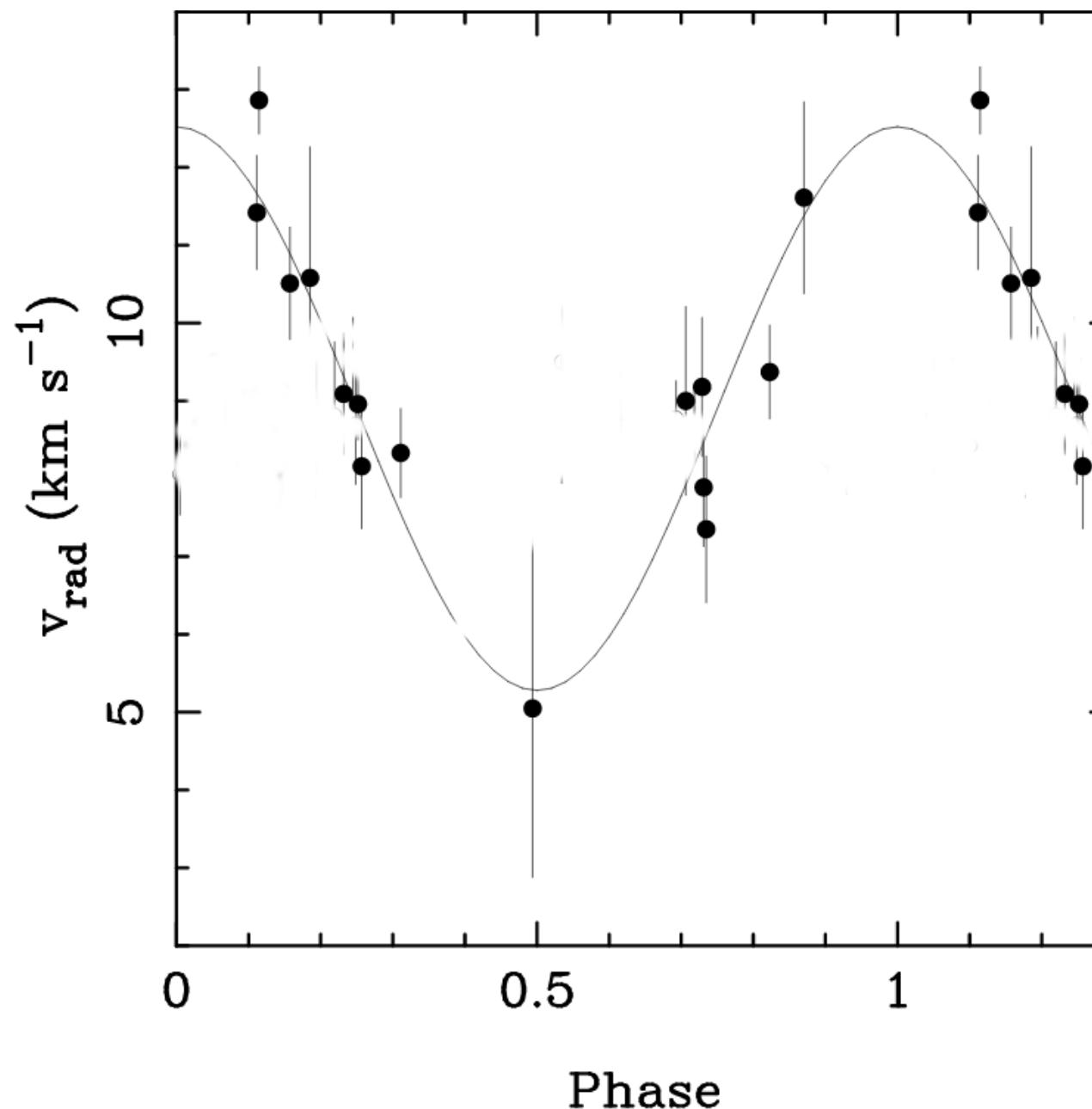
THE ASTROPHYSICAL JOURNAL, 644: L75–L78, 2006 June 10  
© 2006. The American Astronomical Society. All rights reserved. Printed in U.S.A.

## A MULTIWAVELENGTH RADIAL VELOCITY SEARCH FOR PLANETS AROUND THE BROWN DWARF LP 944-20

E. L. MARTÍN,<sup>1,2</sup> E. GUENTHER,<sup>3</sup> M. R. ZAPATERO OSORIO,<sup>4</sup> H. BOUY,<sup>1</sup> AND R. WAINSCOAT<sup>5</sup>

Received 2006 April 10; accepted 2006 April 25; published 2006 May 26

- Optical range (UVES/VLT):**
- 14 nights /841 days
  - Period 2.5 - 3.7h



# MULTI-WAVELENGTH ASTRONOMY

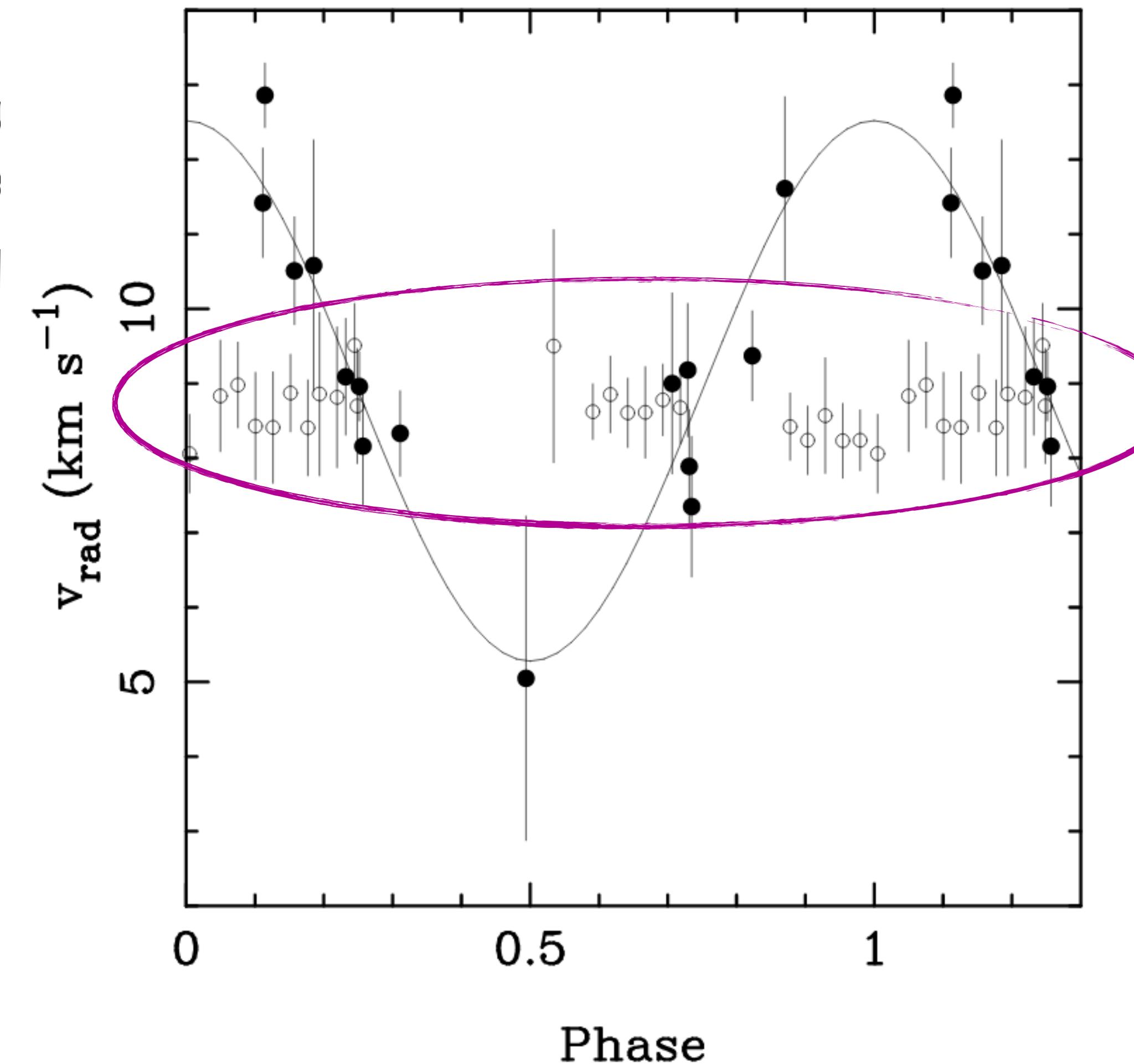
THE ASTROPHYSICAL JOURNAL, 644: L75–L78, 2006 June 10  
© 2006. The American Astronomical Society. All rights reserved. Printed in U.S.A.

## A MULTIWAVELENGTH RADIAL VELOCITY SEARCH FOR PLAN

E. L. MARTÍN,<sup>1,2</sup> E. GUNTHER,<sup>3</sup> M. R. ZAPATERO OSOR

*Received 2006 April 10; accepted 2006 April 25;*

Infrared range



# THE GOAL: MAKING DATA **F.A.I.R**

**F A I R**



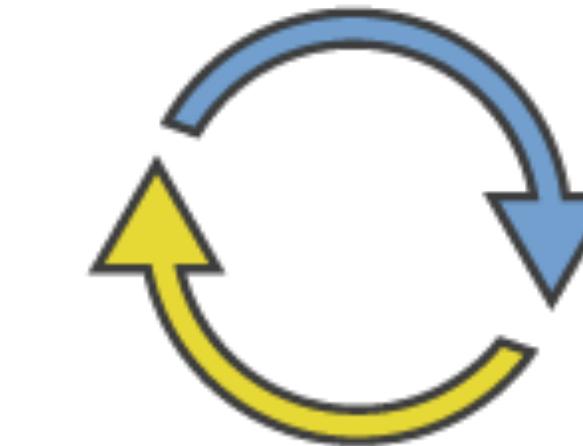
Findable



Accessible



Interoperable



Reusable

# THE INTERNATIONAL VIRTUAL OBSERVATORY ALLIANCE

**Virtual Observatories of the Future**

Caltech campus, Pasadena, Calif., USA  
June 13 - 16, 2000  
<http://astro.caltech.edu/nvoconf>  
Email inquiries: [nvoconf@astro.caltech.edu](mailto:nvoconf@astro.caltech.edu)

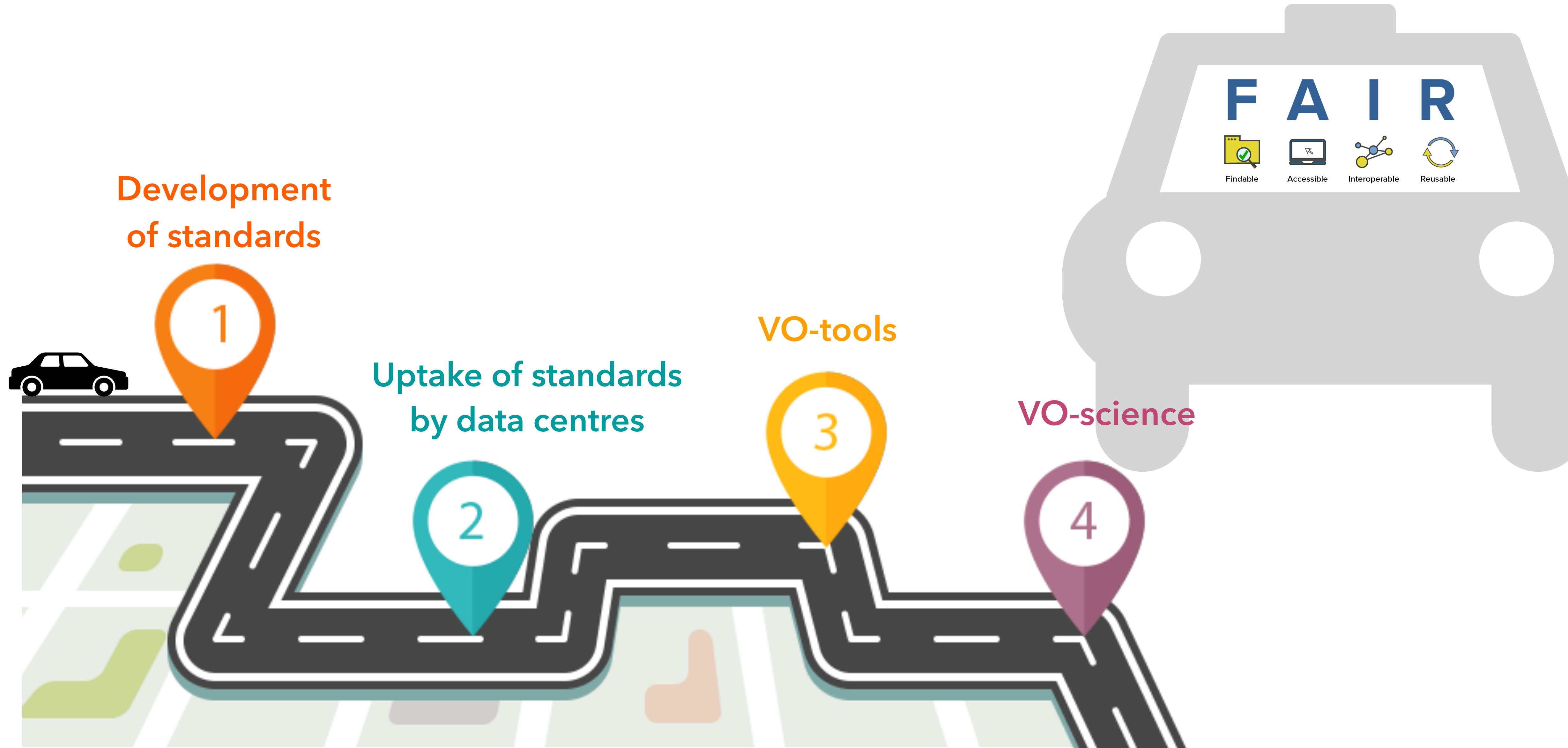
**MPA/ ESO/ MPE Joint Astronomy Conference**

**MINING THE SKY**

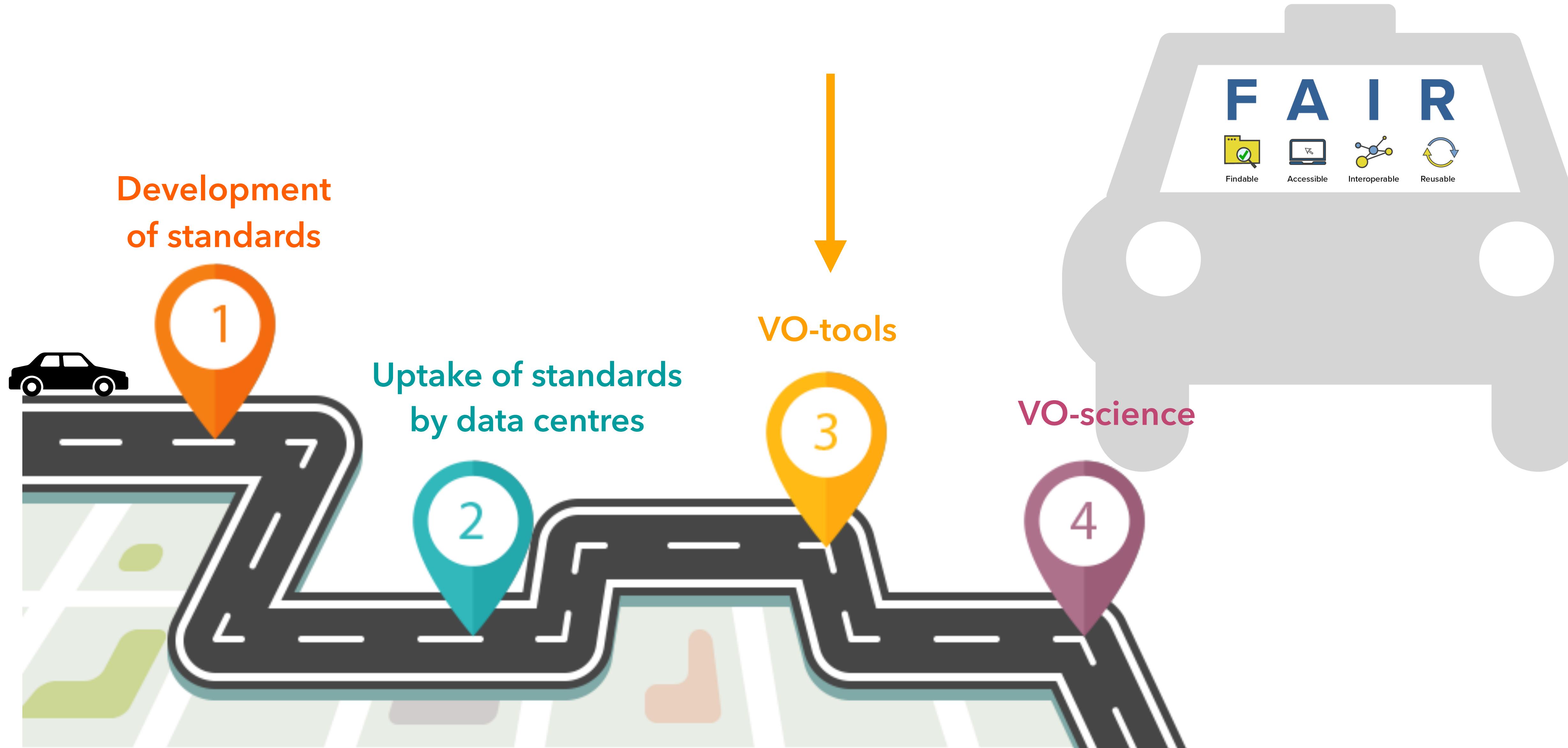
July 31 - August 4, 2000  
Garching, Germany



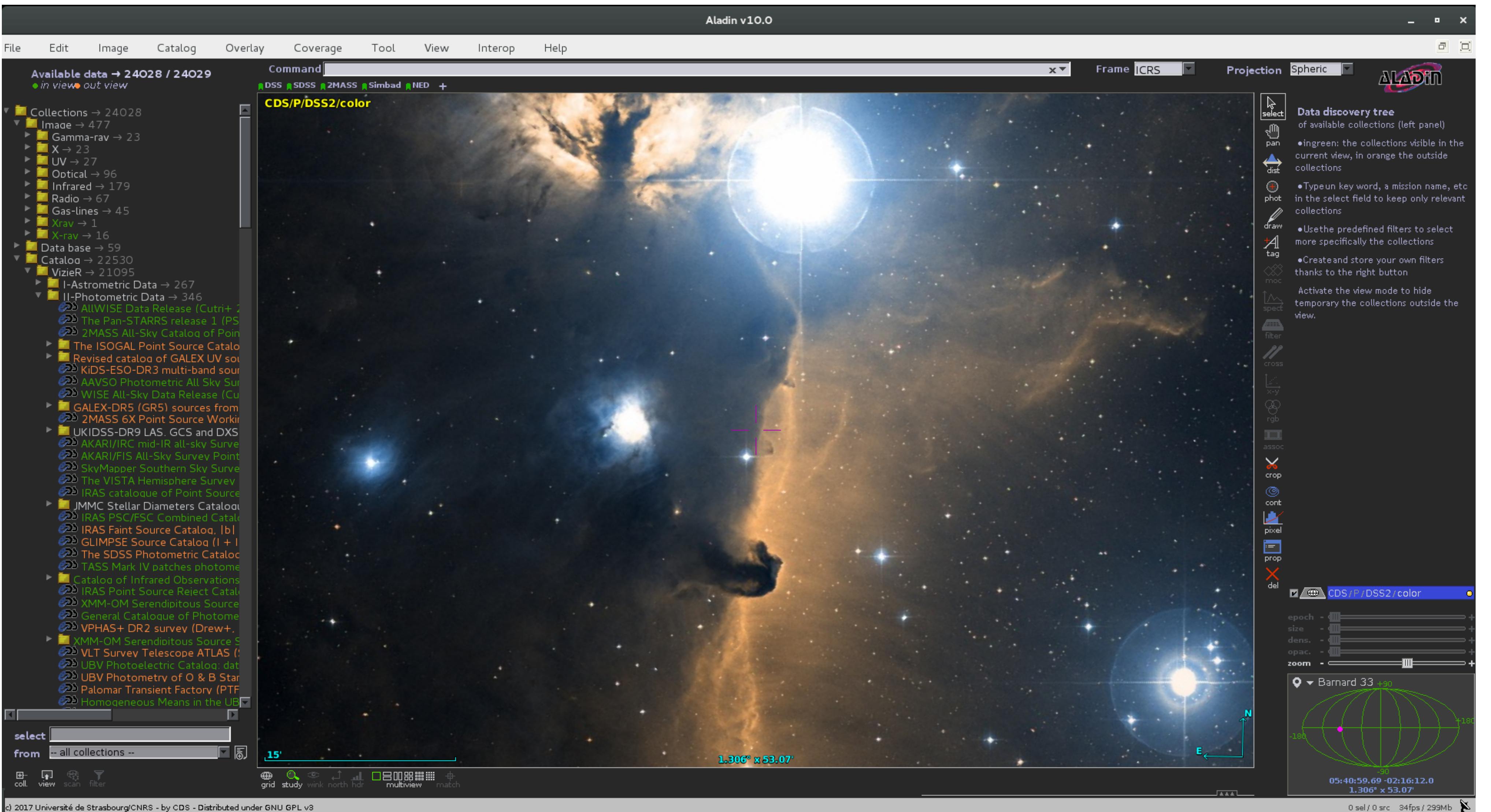
# THE VIRTUAL OBSERVATORY ROADMAP



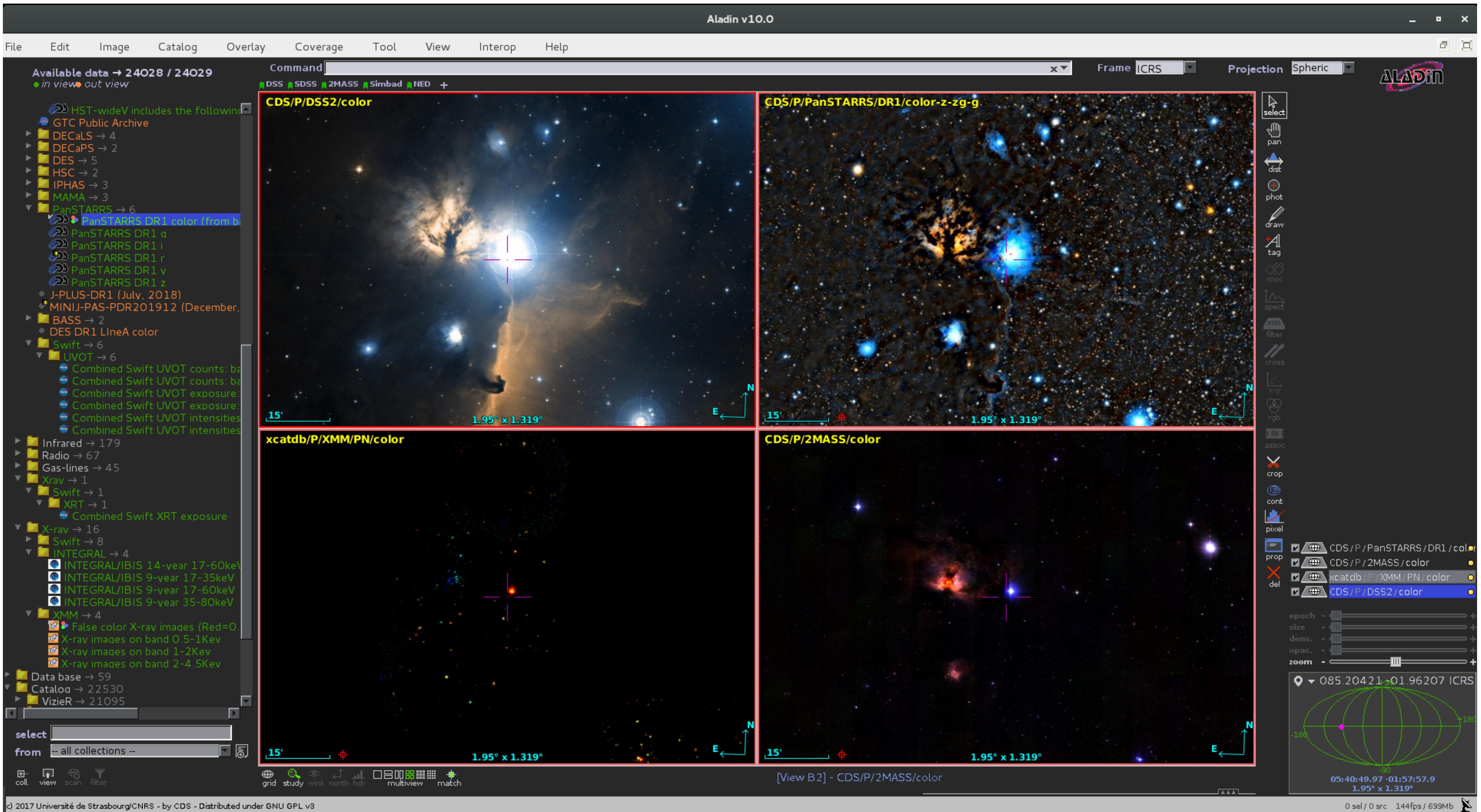
# THE VIRTUAL OBSERVATORY ROADMAP



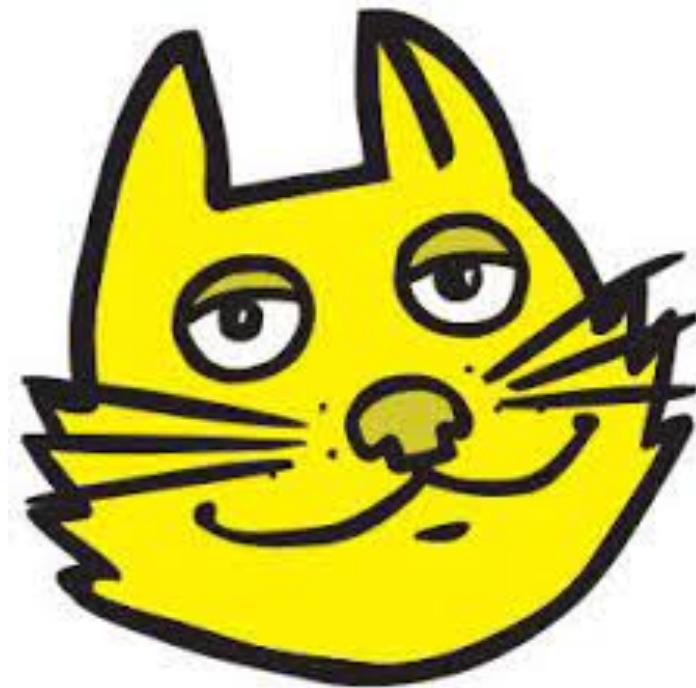
# THE POWER OF VO: ALADIN



# THE POWER OF VO: ALADIN



# THE POWER OF VO: TOPCAT



The figure displays two software interfaces side-by-side, illustrating the integration of the Table Access Protocol (TAP) for astronomical data.

**Left Interface (TOPCAT):**

- Table List:** Shows a table named "4: TAP\_4\_gaiadr1.tgas\_source".
- Current Table Properties:** Label: TAP\_4\_gaiadr1.tgas\_source,gaiadr1.tmass\_best\_nei., Location: TAP\_4\_gaiadr1.tgas\_source,gaiadr1.tmass\_best\_neighbour,gaiadr, Name: sync, Rows: 10,000, Columns: 3, Sort Order: Ascending (indicated by an upward arrow), Row Subset: All, Action: (no action), Broadcast Row.
- SAMP:** Messages: 330 / 3547 M, Clients: 1.
- Plane Plot:** A scatter plot showing the relationship between g\_mag\_abs (Y-axis, ranging from -1 to 9) and g\_min\_ks (X-axis, ranging from 0 to 3.5). The data points are red, forming a dense, elongated cluster.

**Right Interface (Table Access Protocol (TAP) Query):**

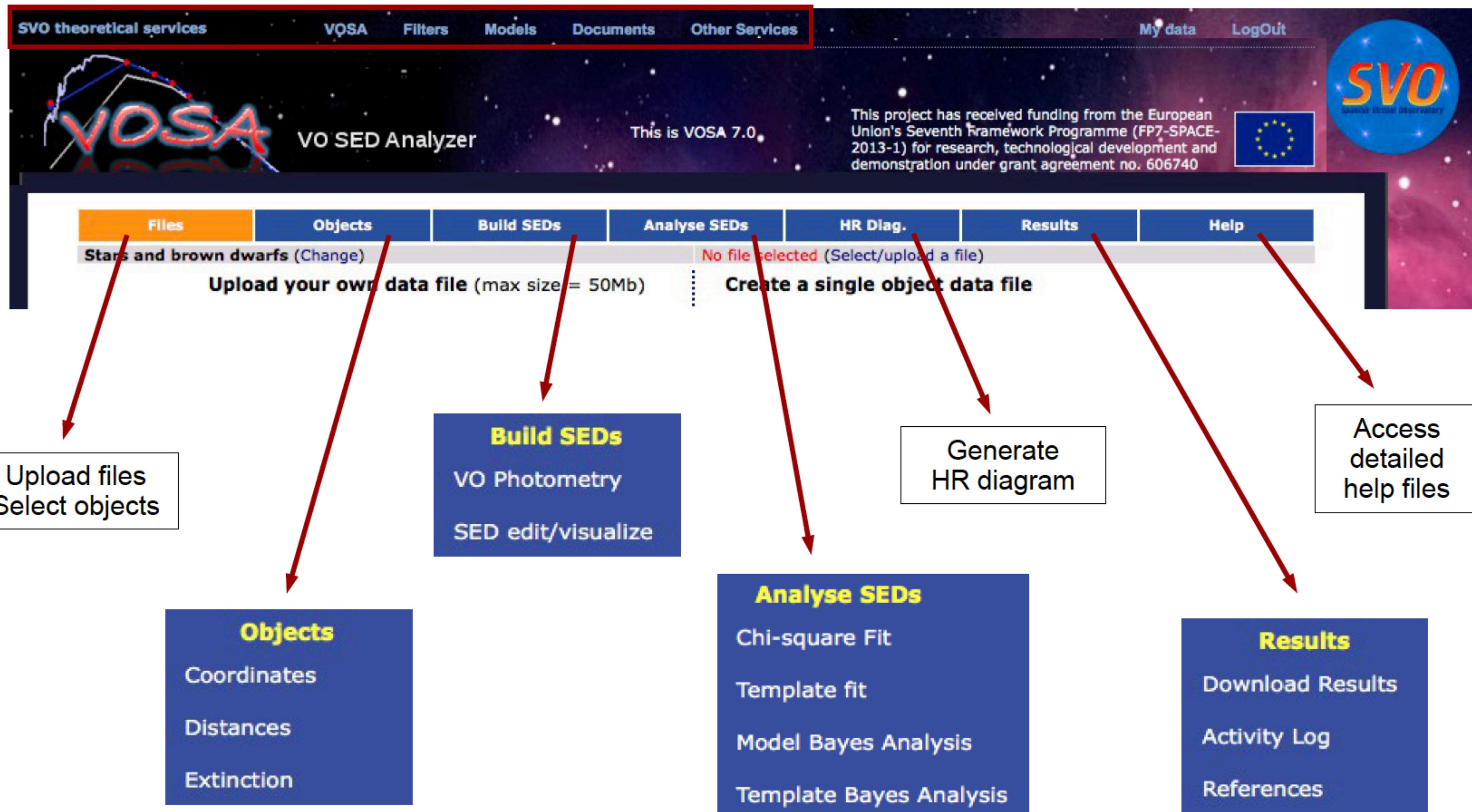
- Window Menu:** Window, TAP, Registry, Edit, Interop, Help.
- Toolbar:** Includes icons for SELECT, FROM, WHERE, JOIN, GROUP BY, HAVING, ORDER BY, LIMIT, and various query options.
- Select Service:** Tabbed interface for Select Service, Use Service, Resume Job, and Running Jobs.
- Metadata:** Shows a table of column metadata for the selected service. The table includes columns for Name, DataType, Indexed, and Unit. Some columns are highlighted in blue.

Name	DataType	Indexed	Unit
solution_id	BIGINT	✓	
designation	VARCHAR	✓	
source_id	BIGINT	✓	
random_index	BIGINT	✓	
ref_epoch	DOUBLE	✓	yr
ra	DOUBLE	✓	deg
ra_error	DOUBLE	✓	mas
dec	DOUBLE	✓	deg
dec_error	DOUBLE	✓	mas
parallax	DOUBLE	✓	mas
parallax_error	DOUBLE	✓	mas
parallax_over_error	REAL	✓	
pmra	DOUBLE	✓	mas.yr**-1
pmra_error	DOUBLE	✓	mas.yr**-1
pmdec	DOUBLE	✓	mas.yr**-1
pmdec_error	DOUBLE	✓	mas.yr**-1
ra_dec_corr	REAL	✓	
ra_parallax_corr	REAL	✓	
ra_pmra_corr	RFAI	✓	

- Service Capabilities:** Query Language: ADQL-2.0, Max Rows: 3000000 (default), Uploads: 100Mb.
- ADQL Text:** Shows the ADQL query used to generate the data:

```
SELECT TOP 10000 gaia.source_id,
       gaia.phot_g_mean_mag + 5 * log10(gaia.parallax) - 10 AS g_mag_abs ,
       gaia.phot_g_mean_mag - tmass.ks_m AS g_min_ks
  FROM gaiadr1.tgas_source AS gaia
 INNER JOIN gaiadr1.tmass_best_neighbour AS xmatch
   ON gaia.source_id = xmatch.source_id
 INNER JOIN gaiadr1.tmass_original_valid AS tmass
   ON tmass.tmass_oid = xmatch.tmass_oid
 WHERE gaia.parallax/gaia.parallax_error >= 5 AND
       ph_qual = 'AAA' AND
       sqrt(power(2.5 / log(10) * gaia.phot_g_mean_flux_error
                  / gaia.phot_g_mean_flux, 2) ) <= 0.05 AND
       sqrt(power(2.5 / log(10) * gaia.phot_g_mean_flux_error
                  / gaia.phot_g_mean_flux, 2)
          + power(tmass.ks_msigcom, 2)) <= 0.05
```
- Buttons:** Examples, Run Query, Info.

# THE POWER OF VO: VOSA



# THE POWER OF VO: VOSA

The screenshot displays the VOSA (VO SED Analyzer) software interface, which is a tool designed to perform tasks such as reading user photometry-tables, querying photometrical catalogs, calculating synthetic photometry for theoretical models, performing statistical tests, and estimating bolometric luminosity.

**Top Header:** The header includes links for "vivo theoretical services", "VOSA", "Filters", "Models", "Documents", "Other Services", "Logout", "Forgot Password", and "Register". It also features the "SVO" logo and a note about funding from the European Union's Seventh Framework Programme (FP7-GA-2013-1) for research, technological development and demonstration under grant agreement no. 606749.

**Login/Registration:** A login form with fields for "Email" and "Pass" and buttons for "Login" and "Register".

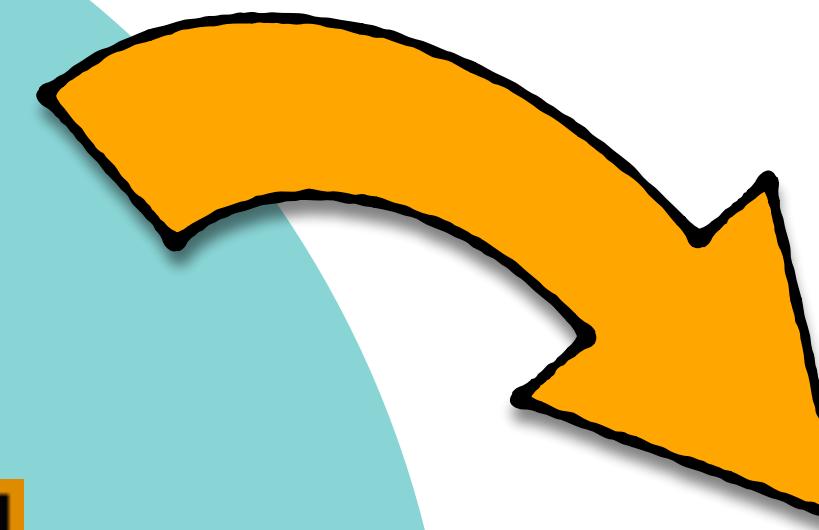
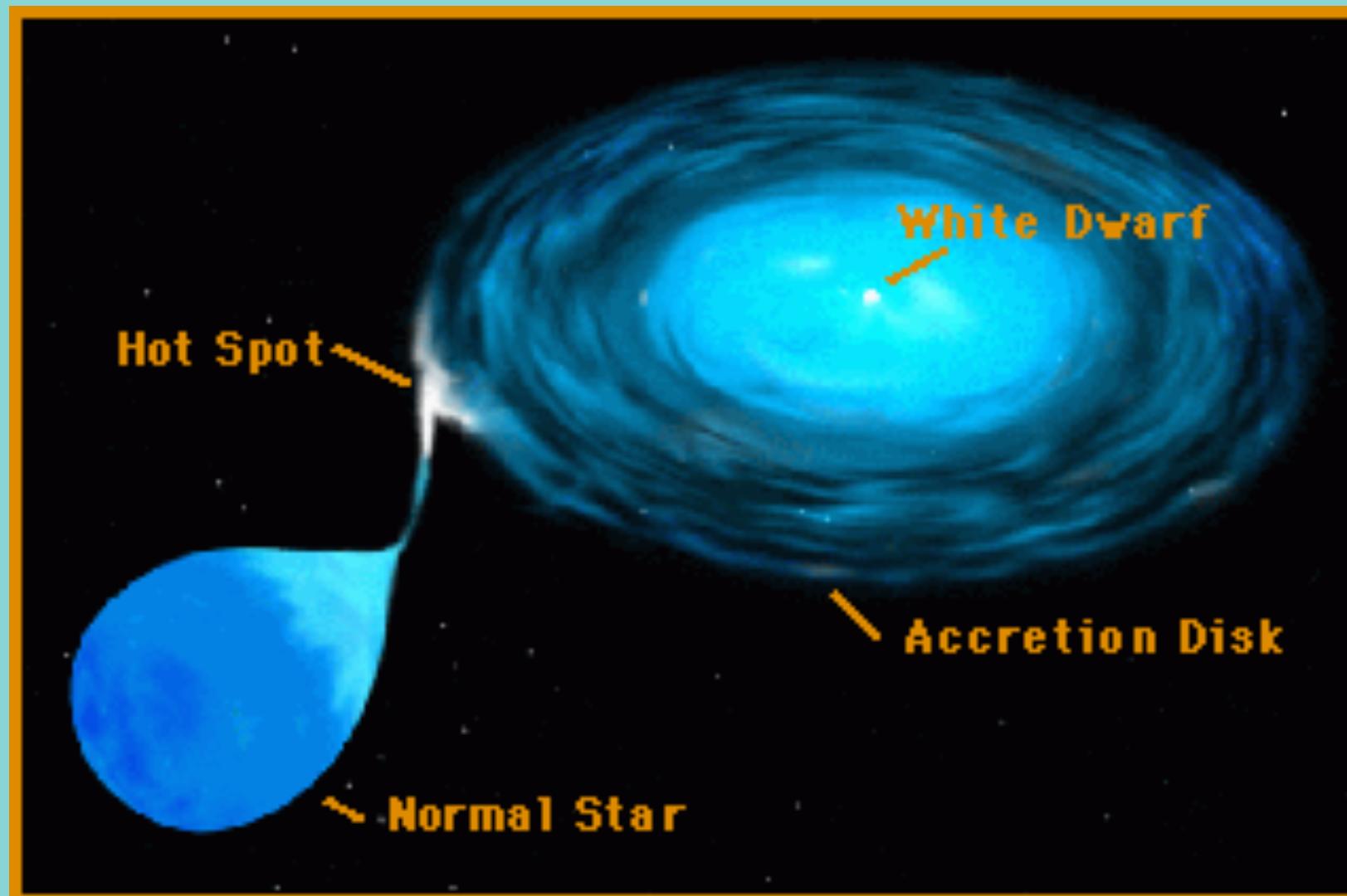
**Description:** A text block explaining VOSA's purpose and capabilities, including reading user photometry-tables, querying photometrical catalogs, calculating synthetic photometry for theoretical models, performing statistical tests, and estimating bolometric luminosity.

**Plots and Data:** The interface contains several plots:

- A small plot labeled "stars1" showing flux density vs wavelength.
- A large plot labeled "stars3" showing flux density vs wavelength, with a legend for "Fit Edd", "SedMod", "Observed", "Sed", "Model", "Point", "Error", and "Near Limit".
- A large plot on the right showing a grid of model spectra (blue lines) and observed data points (red points).
- A text box with instructions for using the application and a registration note.

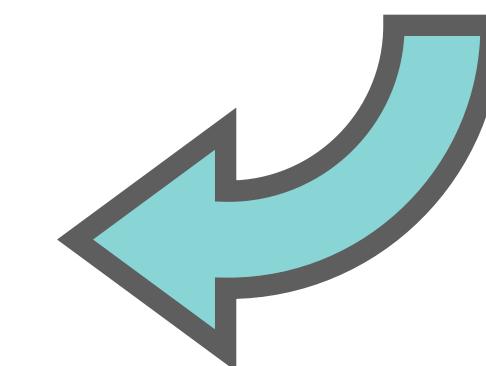
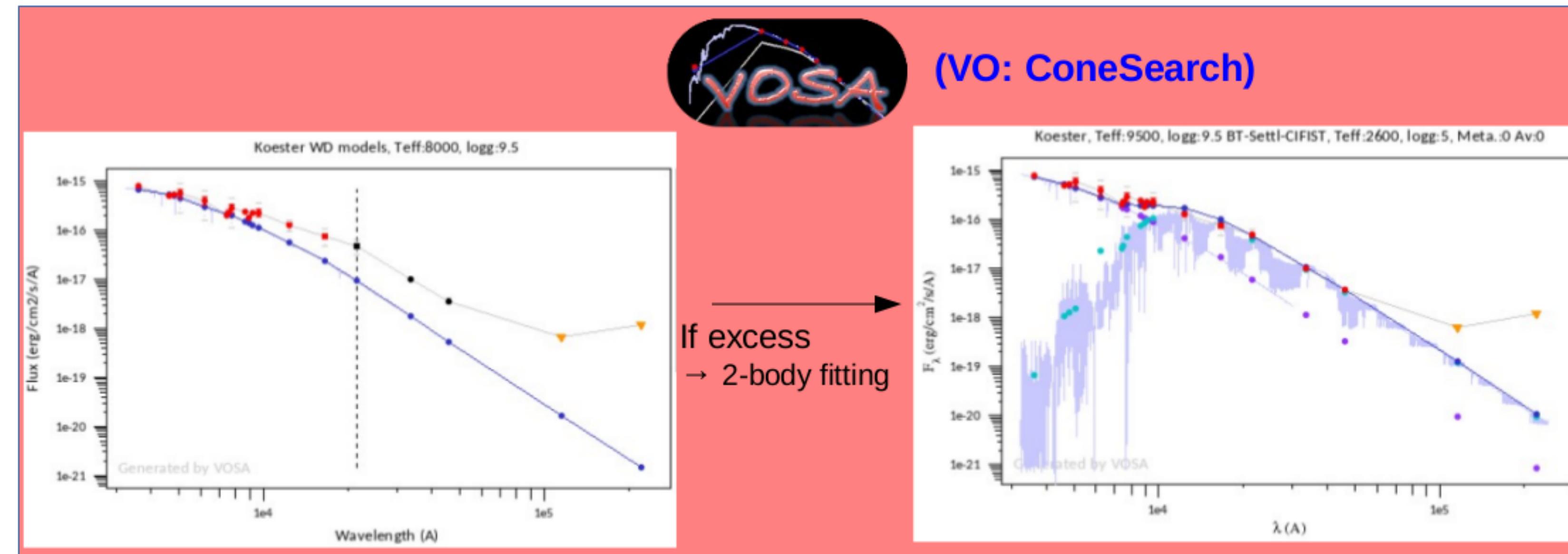
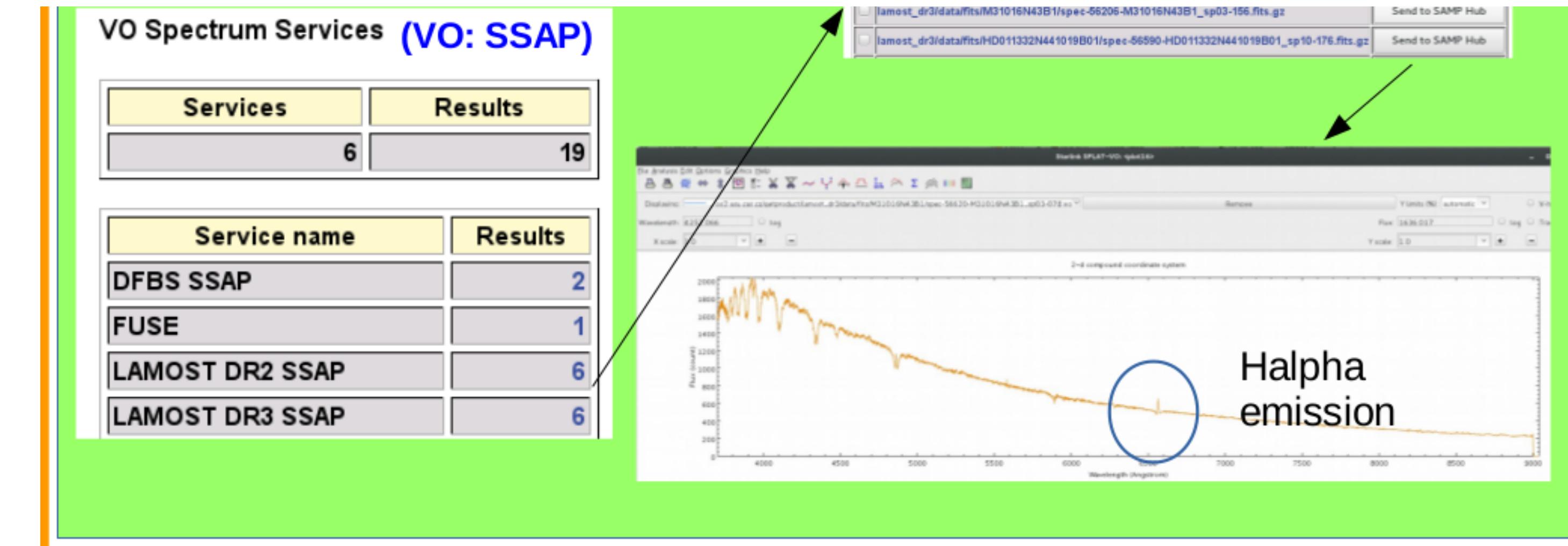
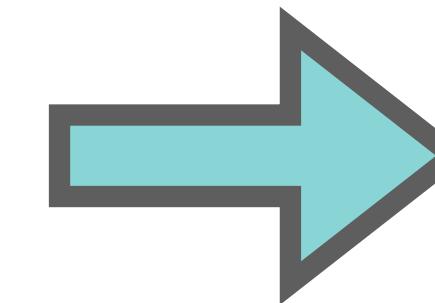
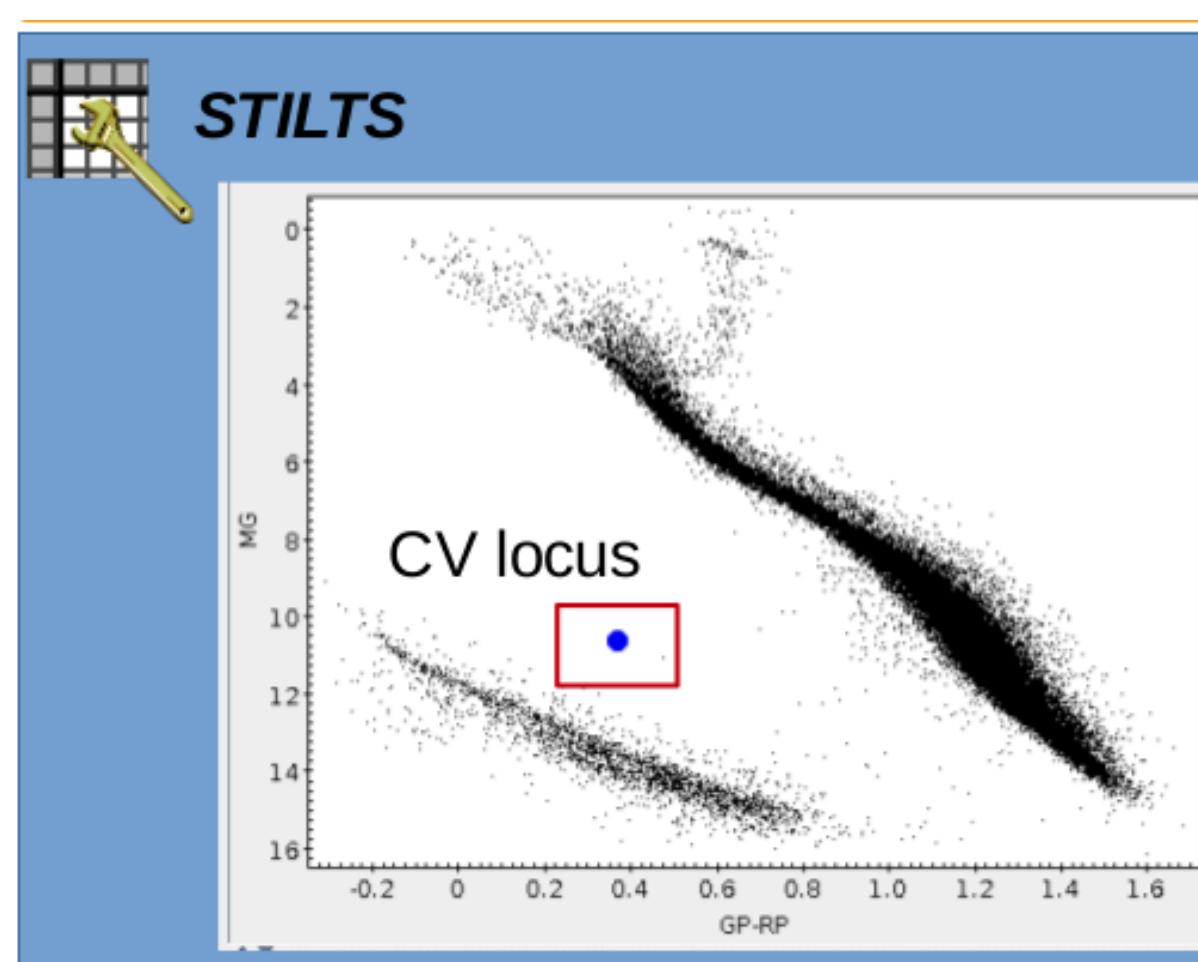
# THE POWER OF VO: TRANSIENTS

**WORKFLOW:** Discovering  
new **Cataclysmic Variables**  
with VO tools

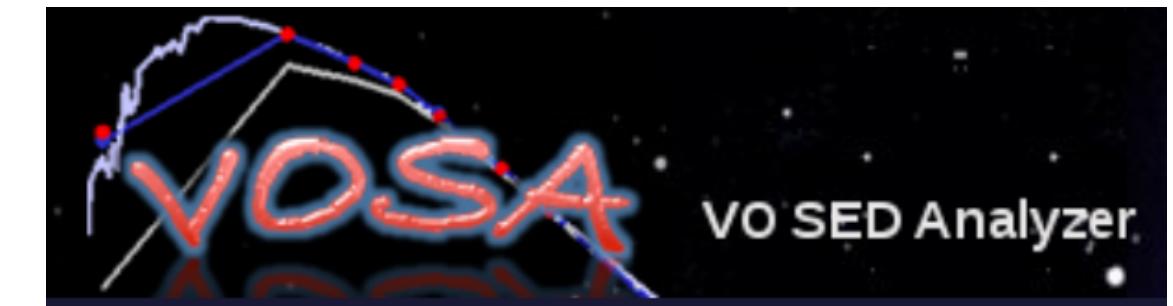
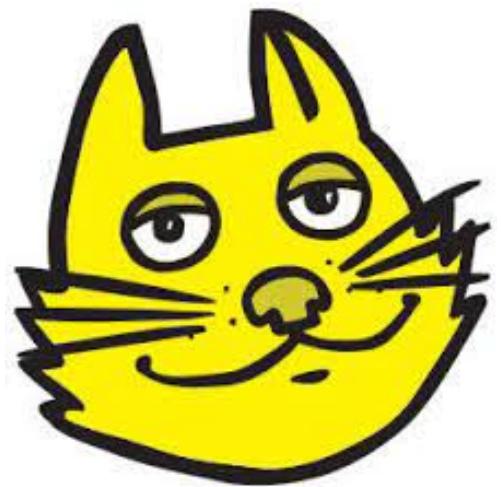
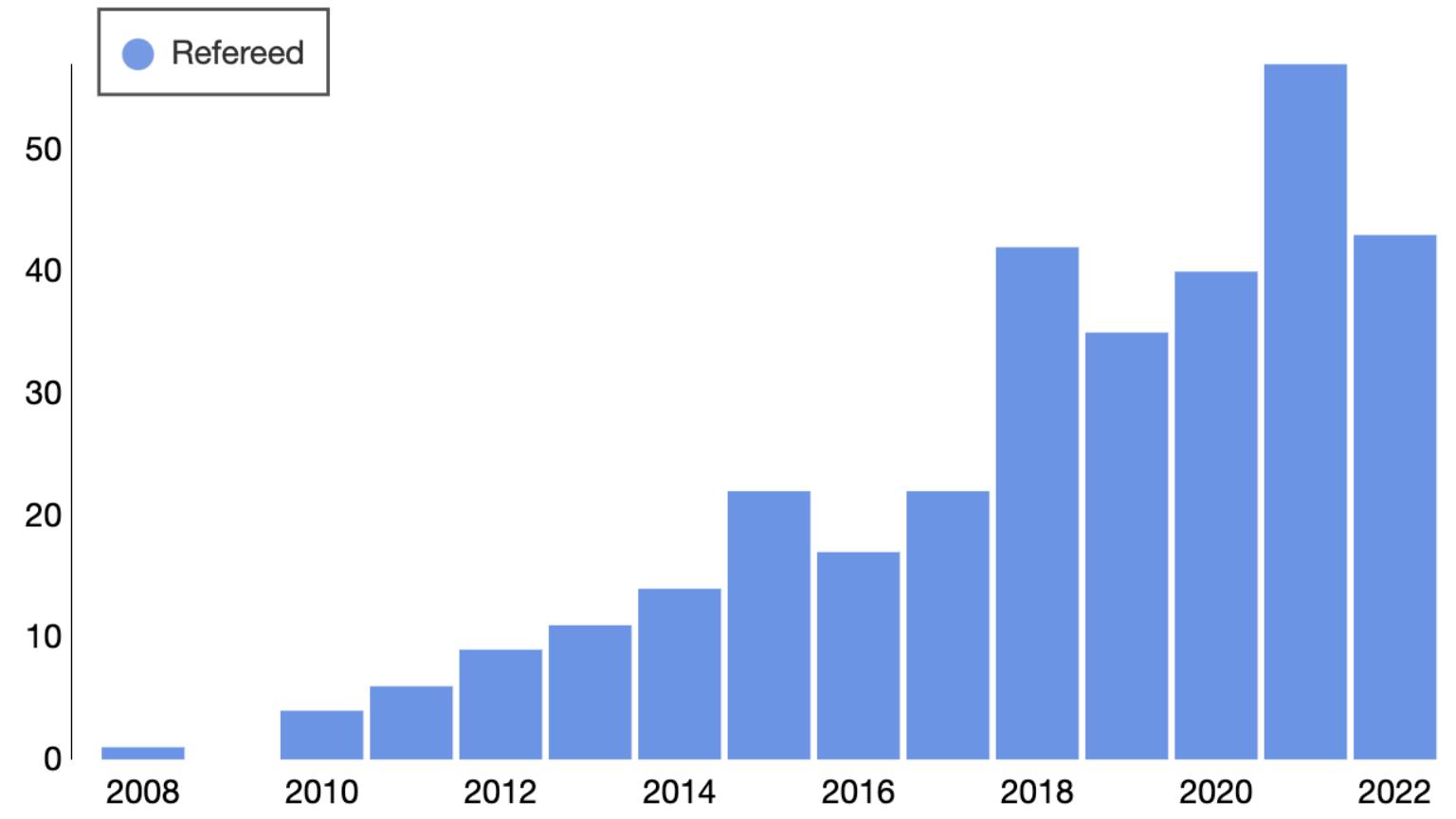
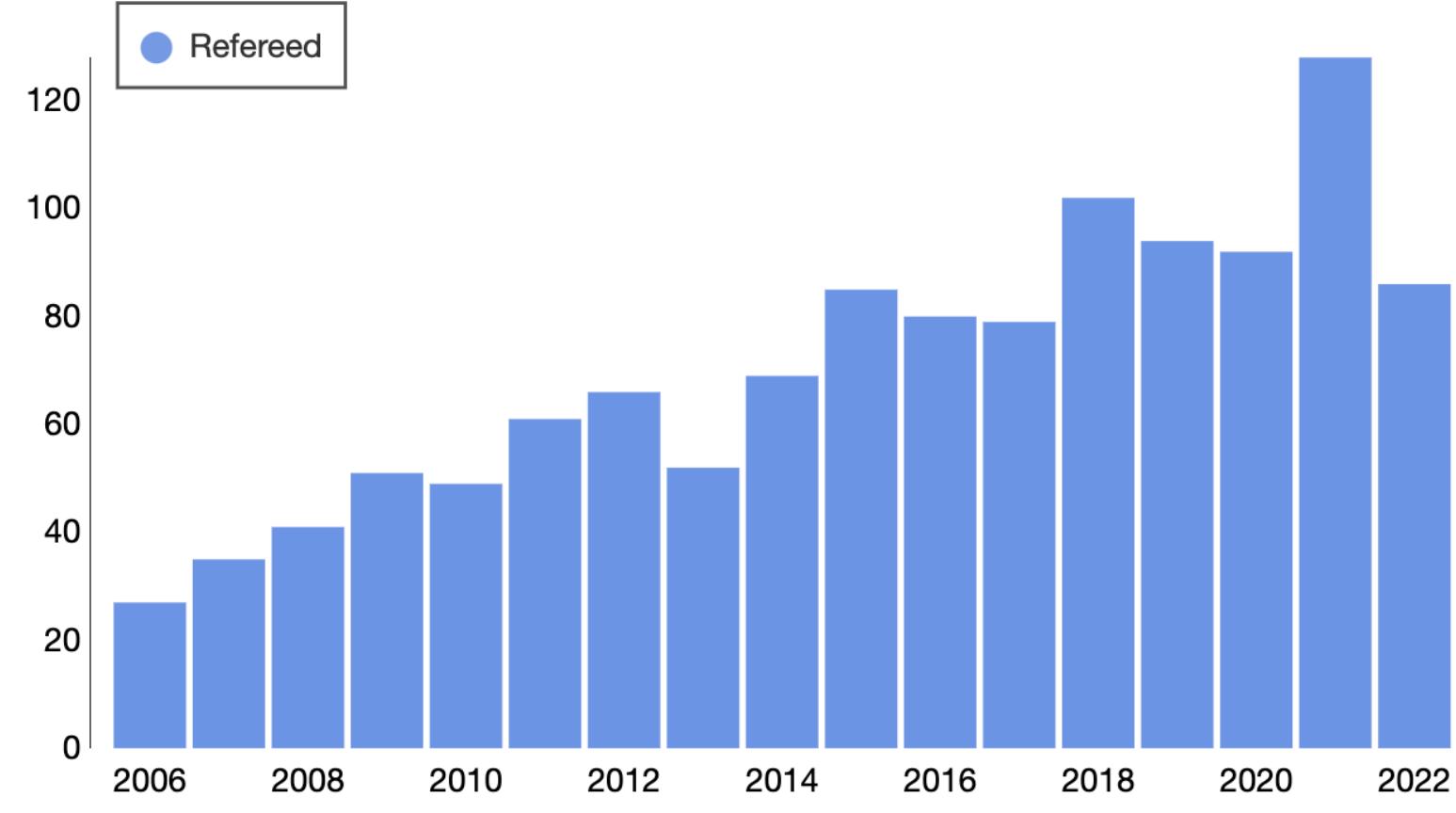
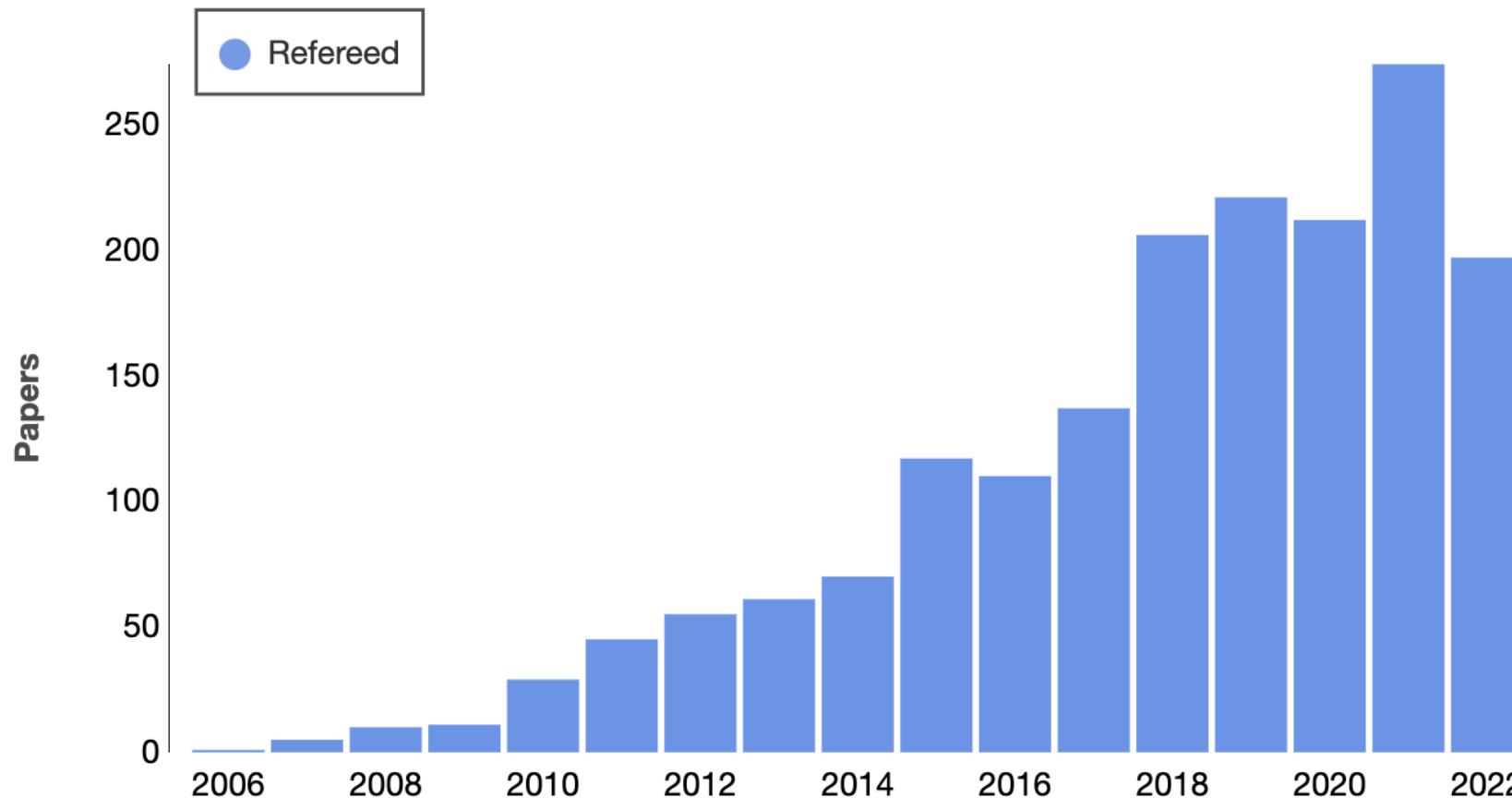


- Halpha emission due to accretion
- Close binaries (WD+Main seq.) -> composite SEDs
- Well defined locus in the HR diagram

# THE POWER OF VO: TRANSIENTS



# HOW USED ARE VO-TOOLS?



# F.A.I.R. PRINCIPLES BEYOND ASTROPHYSICS



**MANIFESTO FOR  
EU COVID-19 RESEARCH**

July 2020

**MAXIMISING THE ACCESSIBILITY OF  
RESEARCH RESULTS IN THE FIGHT  
AGAINST COVID-19**

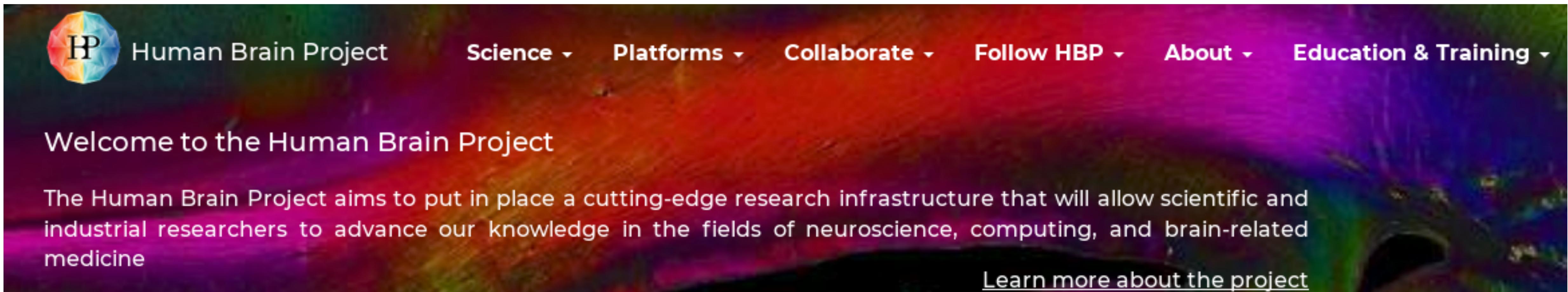
We agree and endorse the principles below when dealing with research results stemming from EU funded research grants related to COVID-19 on prevention (including vaccines), testing and treatment:

- 1 Make the generated results, whether tangible or intangible, **public and accessible** without delay, for instance on the Horizon Results Platform, on an existing IP sharing platform, or through an existing patent pool.
- 2 Make scientific papers and research data available in **open access** without delay and following the **FAIR principles** via preprint servers or public repositories, with rights for others to build upon the publications and data and with access to the tools needed for their validation. In particular, make COVID-19 research data available through the European COVID-19 Data Platform.
- 3 Where possible, grant for a limited time<sup>3</sup>, **non-exclusive royalty free licences** on the intellectual property resulting from EU-funded research. These non-exclusive royalty free licenses shall be given in exchange for the licensees' commitment to rapidly and broadly distribute the resulting products and services under fair and reasonable conditions to prevent, diagnose, treat and contain COVID-19.



# The FAIR principles are fulfilled in Astronomy thanks to the Virtual Observatory making reality what in other disciplines is just a dream

HILL: I felt a little bit like I stepped into the future when I went to a meeting of the [virtual observatories](#) in astronomy. They've already done a lot of the things that we're aiming to do in the sense that they've got observatories from all around the world that are sharing, through a common infrastructure, the data that they're measuring. And they're integrating it into a unified picture of the sky and our universe. These same data contribute to building large-scale simulations of the universe. I think that's extremely inspiring. If we can have a common infrastructure that allows us to have a globally integrated view of the data being produced, and the tools to run large-scale simulations from the data, we will really have made progress in neuroscience.



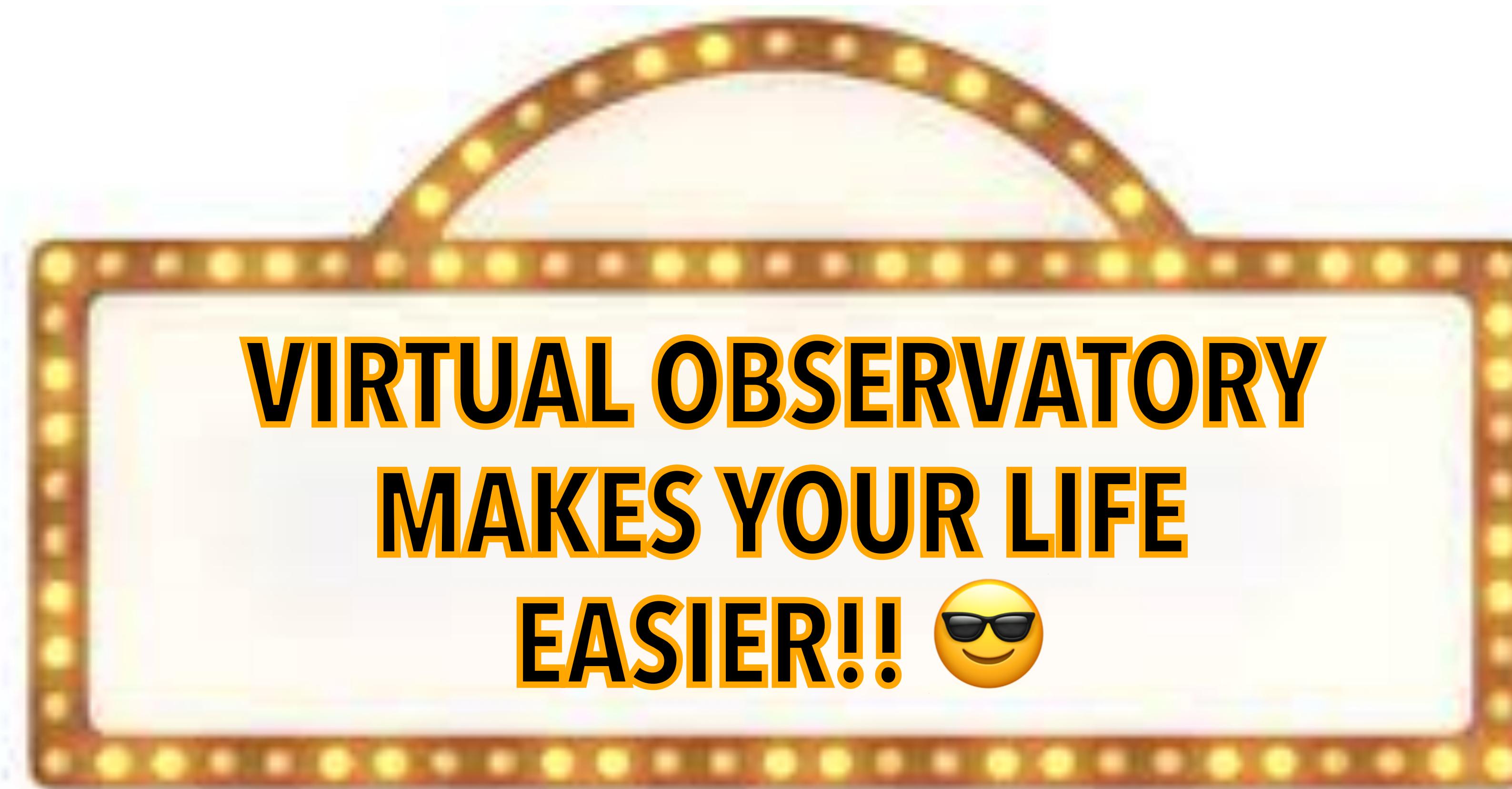
 Human Brain Project     [Science](#) • [Platforms](#) • [Collaborate](#) • [Follow HBP](#) • [About](#) • [Education & Training](#) •

Welcome to the Human Brain Project

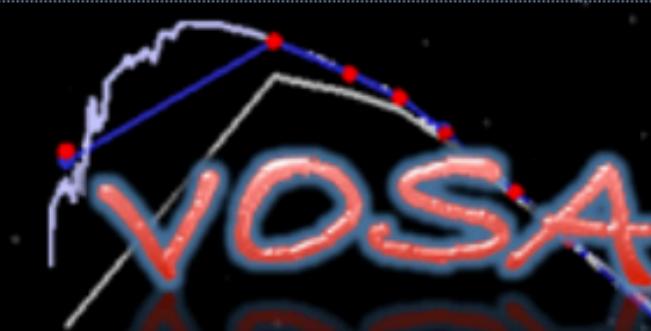
The Human Brain Project aims to put in place a cutting-edge research infrastructure that will allow scientific and industrial researchers to advance our knowledge in the fields of neuroscience, computing, and brain-related medicine

[Learn more about the project](#)

# **FINAL REMARKS**



If you have any question please, let us know: [svo-support@cab.inta-CSIC.es](mailto:svo-support@cab.inta-CSIC.es)



VO SED Analyzer

This is VOSA 7.5

This project has received funding from the European Union's Seventh Framework Programme (FP7-SPACE-2013-1) for research, technological development and demonstration under grant agreement no. 606740



Email:

Pass:



If you are a new user, please, [register](#).  
If you don't remember your password, [click here](#).

VOSA (VO Sed Analyzer) is a tool designed to perform the following tasks in an automatic manner:

- Read user photometry-tables.
- Query several photometrical catalogs accessible through VO services (increases the wavelength coverage of the data to be analyzed).
- Query VO-compliant theoretical models (spectra) and calculate their synthetic photometry.
- Perform a statistical test to determine which model reproduces best the observed data.
- Use the best-fit model as the source of a bolometric correction.
- Provide the estimated bolometric luminosity for each source.
- Generate a Hertzsprung-Russel diagram with the estimated parameters.
- Provide an estimation of the mass and age of each source

[\(Take a look to the VOSA Help\)](#)

You need a username and password to use the application because it keeps a number of files and database entries with your results and we need to be able to identify which results belong to each user so that you can recover them in future sessions. If you don't have a username and password yet, please feel free to register.

<http://svo2.cab.inta-csic.es/theory/vosa/>