VO tools and science

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Astronomical archives

- Weaknesses

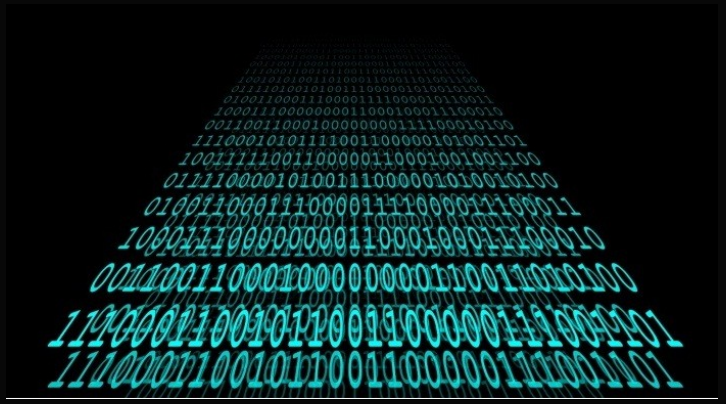
Weak point #1: Data everywhere!!

Where are the data I am interested in?

Weak point #2: Lack of standardization

Weak point #3: Data volume

Today: 1 Petabyte in archives.



✓ Rate: 0.5 PB/yr

✓ LSST, ALMA, SKA

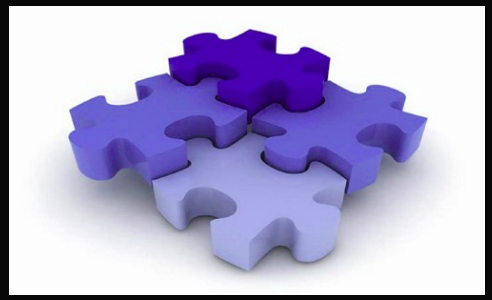
→ 60 PB in 15-20 years.

Astronomy with archives

What do I expect from VO tools?

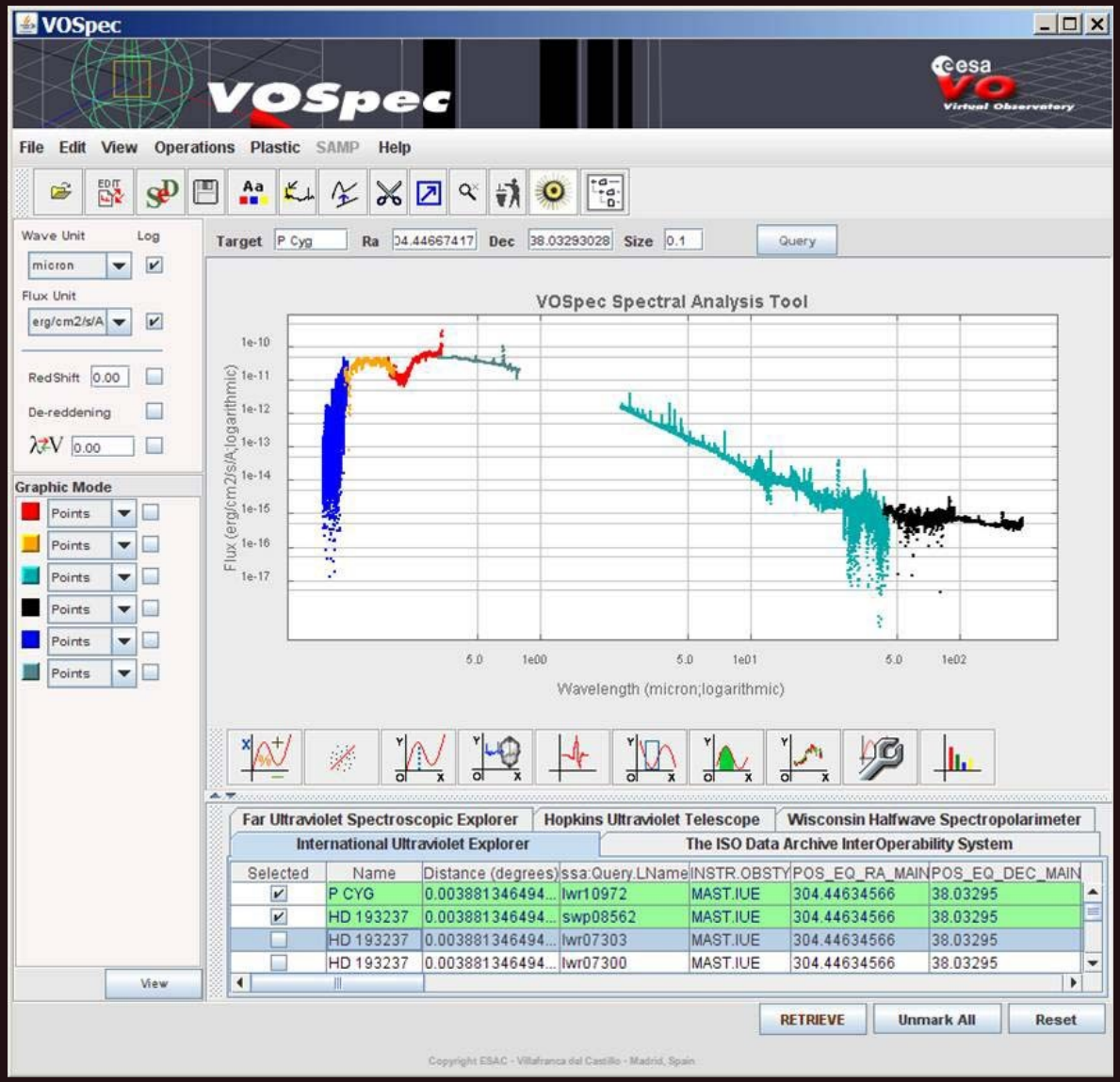
- ✓ Data discovery

- ✓ Data retrieval

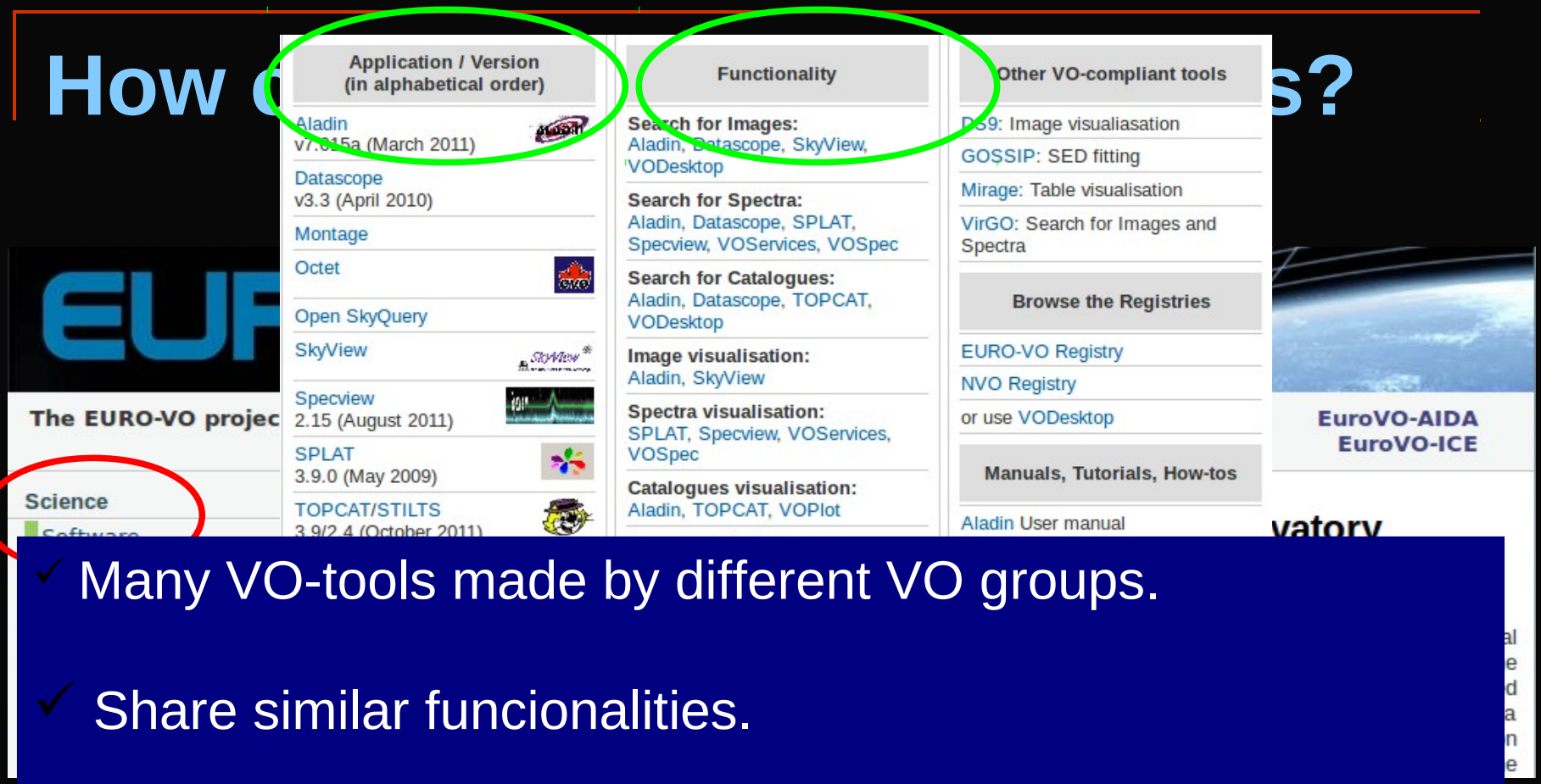


- ✓ Data analysis

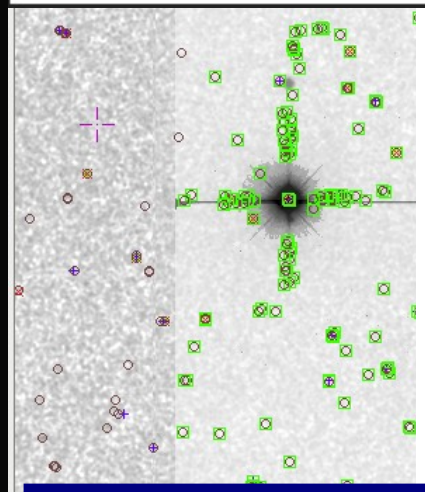
VO-tools: An example



How c s?



- ✓ Many VO-tools made by different VO groups.
- ✓ Share similar funcionalities.
- ✓ Most are Java-based but other languajes are also present (PHP).
- ✓ Some are client-side (Aladin, TOPCAT,...). Some others are server-side (VOSA).



Portal | Simbad | VizieR | Aladin | X-Match | Other | Help

CDS Portal

Portal My data Help

Target: HD141569 GO

J2000 position for HD141569: 15 49 57.748 -03 55 16.34

Object identifiers, measurements and bibliography for HD141569

- Object type: Pre-main sequence Star
- Spectral type: A0Ve
- More SIMBAD data for HD141569
- 302 bibliographic references
- 3 objects within 2'
- Display map around HD141569
- Display SimPlay interactive map around HD141569

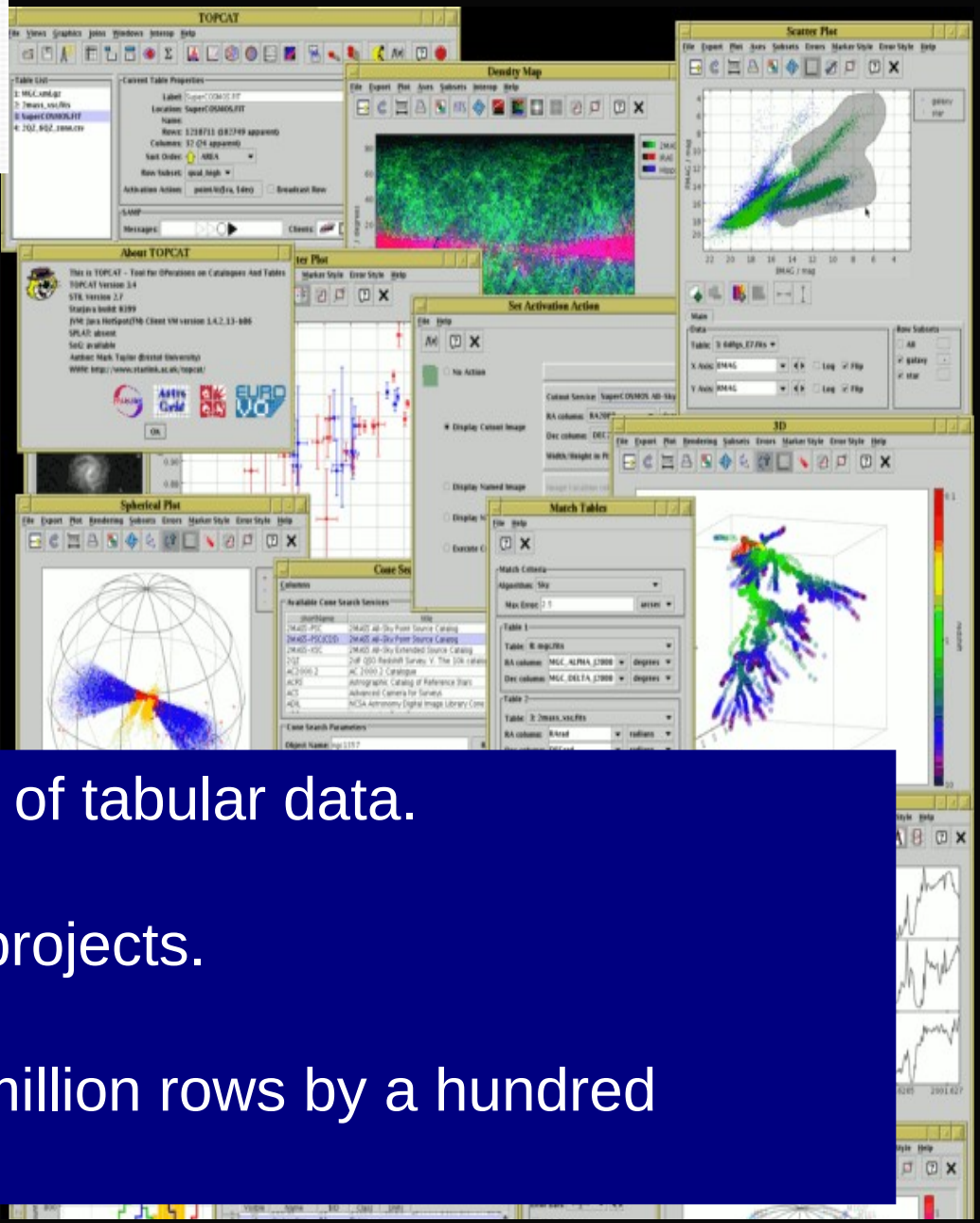
- ✓ Sky atlas
- ✓ First version on 1999 (a pre-VO tool). CDS
- ✓ Large number of functionalities to handle images and catalogues.

09221194...	All	140.549789	+50.9				
09220265...	All	140.511063	+50.9				
09215467...	All	140.477829	+51.0				
09215774...	All	140.490585	+51.0				
				DENIS	J	1.23	12.6' x 12.7'	1996-04-26	0.9" / pixel	FITS

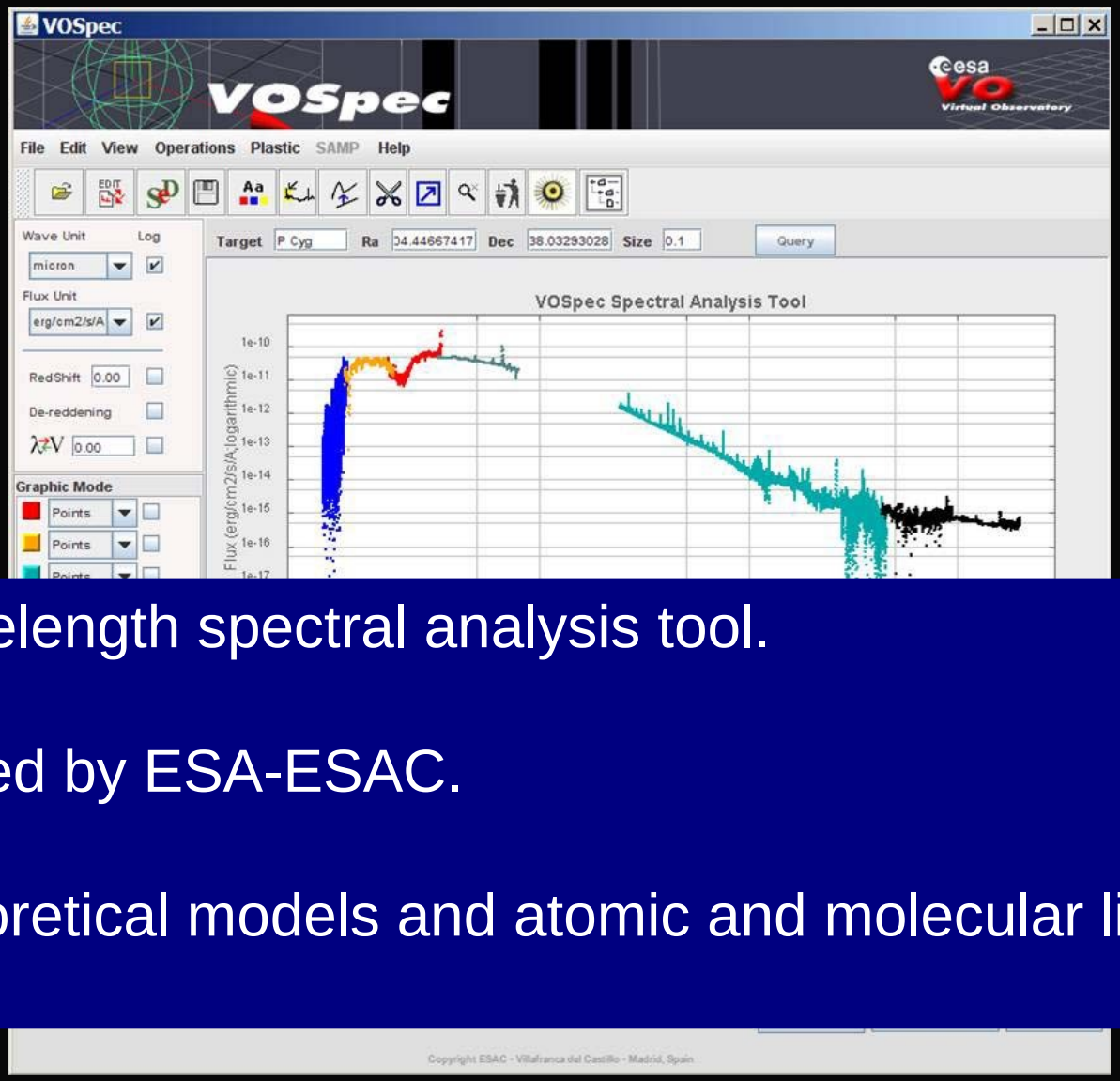
484 sel / 2697 src 88Mb

TOPCAT

Tool for OPerations on Catalogues And Tables

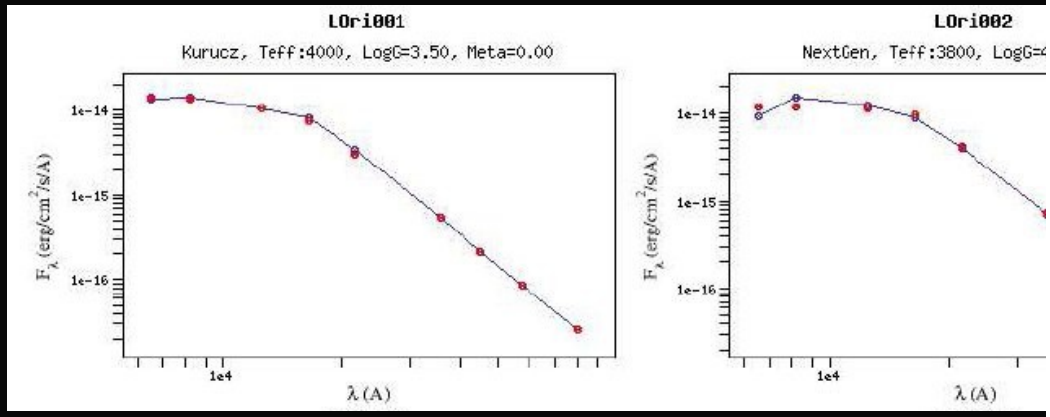


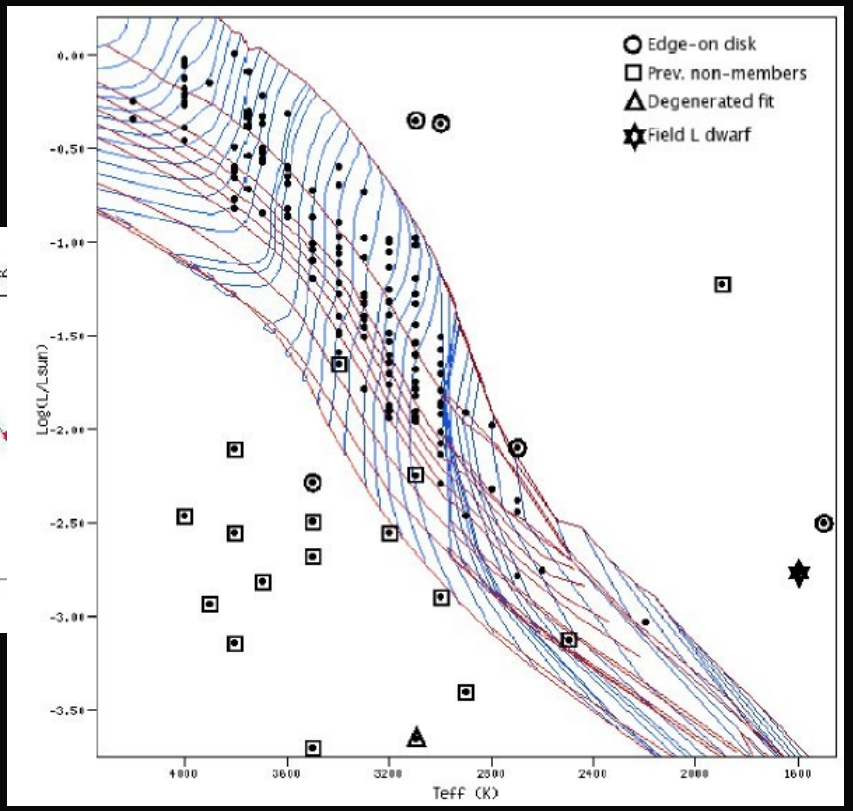
- ✓ Graphical viewer and editor of tabular data.
- ✓ Developed by various UK projects.
- ✓ Capable of handling <= a million rows by a hundred columns.



- ✓ Multi-wavelength spectral analysis tool.
- ✓ Developed by ESA-ESAC.
- ✓ Also theoretical models and atomic and molecular line databases.

VOSA VO SED Analyzer





- ✓ Developed by the Spanish VO.
- ✓ Builds an SED with photometry gathered from different VO services and compare them with different grids of models to obtain physical parameters (Teff, masses, ages, ...)

VO-Science

- ✓ *Science that cannot be done without the VO*
  - Management of large archives for the discovery of rare objects:
    "The needle in the haystack"

- ✓ Final goal of Virtual Observatories (in particular, Euro-VO) .

Where can I find VO papers?

http://www.euro-vo.org

EURO VO FACILITY CENTRE

The EURO-VO projects: EuroVO-ICE Past projects: VOTECH EuroVO-DCA EuroVO-AIDA

Science
- Software
- Scientific Tutorials
- **Scientific Papers**
- Science Advisory Committee
- Acknowledging
- EURO-VO Mailing List
- Helpdesk

Technical
- Software
- Registries
- IVOA Standards ⇒

Data Centres
- Overview
- Tutorials

VO-enabled Scientific Papers

Selected scientific publications mainly enabled by VO tools or about VO tools and methods.

For conference proceedings and other non-refereed publications, see here

REFEREED PUBLICATIONS

A universal ultraviolet-optical colour-colour-magnitude relation of galaxies
Chilingarian, I., Zolotukhin, I., 2012, MNRAS, 419, 1727

Astroinformatics of galaxies and quasars: a new general method for photometric redshifts estimation
Laurino, O., D'Abrusco, R., Longo, G., Riccio, G., 2011, MNRAS, 418, 2165

WISE/2MASS-SDSS brown dwarfs candidates using Virtual Observatory tools
Aberasturi, M., Solano, E., Martin, E. L., A&A, 2011, 534, L7

VO-Science (I)

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

Mon. Not. R. Astron. Soc. **406**, 1595–1608 (2010)

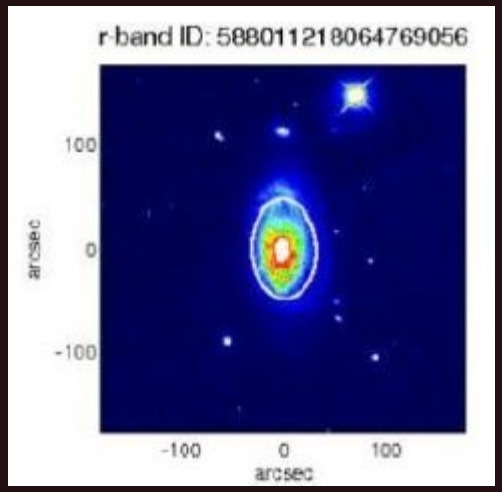
Second Euro-VO AIDA Research Initiative

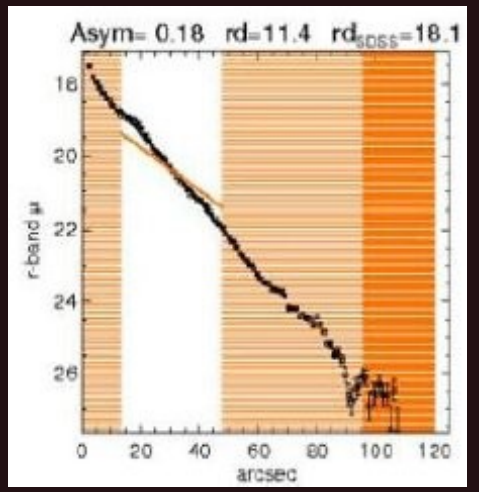
Scalelength of disc galaxies

Kambiz Fathi,[1,2⋆] Mark Allen,[3] Thomas Boch,[3] Evanthia Hatziminaoglou[4] and Reynier F. Peletier[5]

- Scalelengths for 30374 galaxies in all SDSS bands
  - Unprecedent sample (at most few hundreds in previous studies).

• Scale length:
Fundamental parameter for the morphology and dynamic of galaxies.





- Why 5 bands? → Differences in scale length as a function of passband can be used to derive information about the stellar structure and contents of galactic disks.

VO-Science (I)

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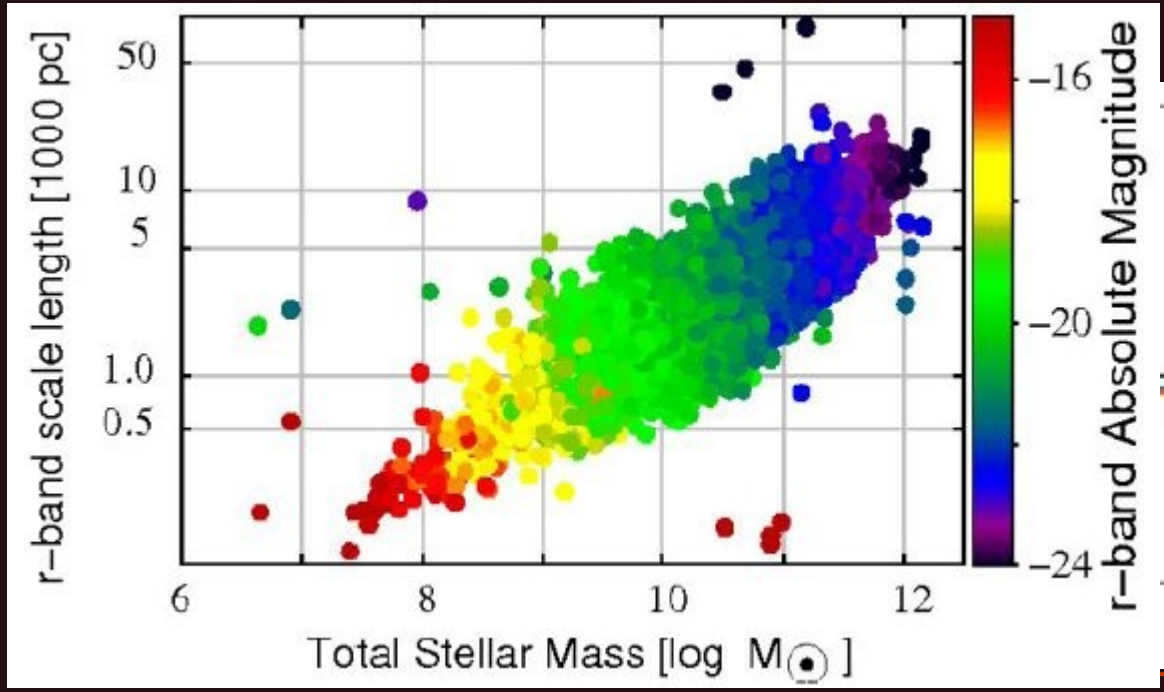
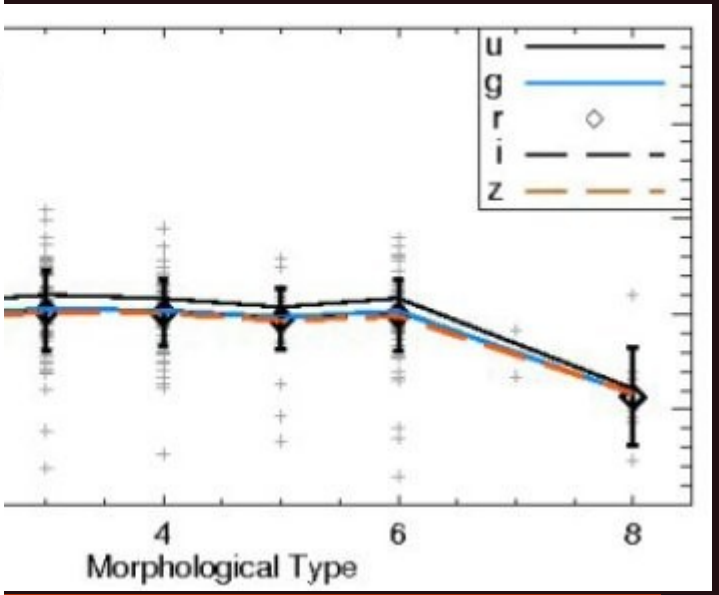
- Filtering (SDSS catalogue): 95735 galaxies
- Galaxy, low extinction (Ar < 1.0), z available , i<70º (for higher i scale lengths are not reliable)
- 24” < diam < 80”
- X-match (LEDA) to get Hubble classification
- 56096 classified as spirals
- Estimation of scale length and asymmetry parameters 30374 reliable determinations





A&A 525, A29 (2011)
DOI: 10.1051/0004-6361/201015223

Astronomy & Astrophysics

Identification of blue high proper motion objects in the Tycho-2 and 2MASS catalogues using Virtual Observatory tools

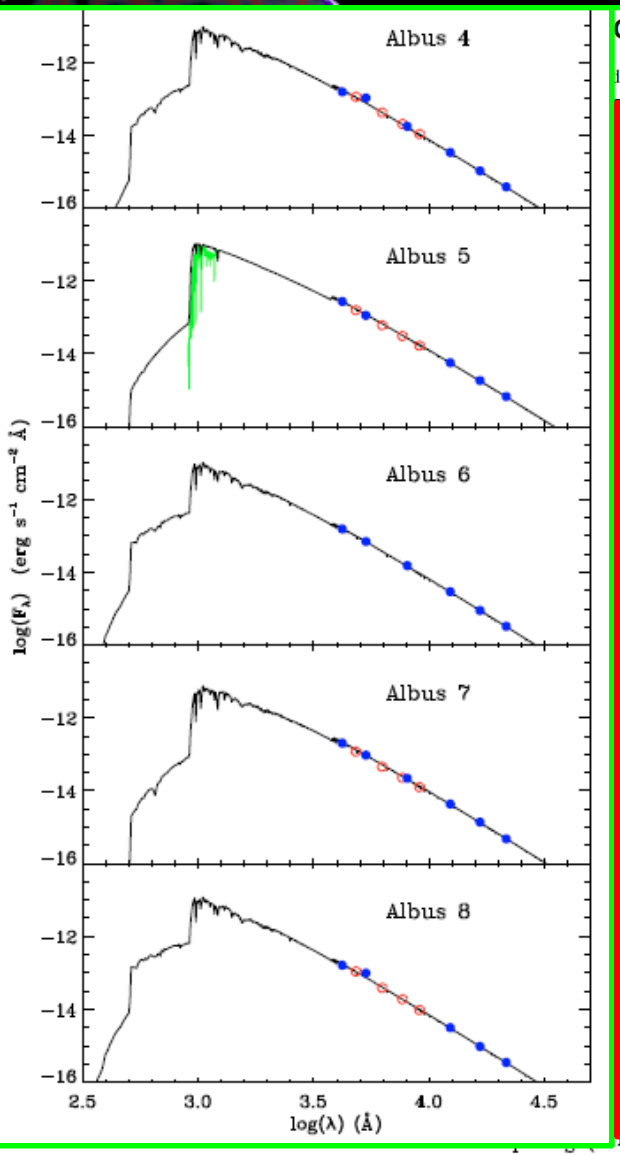
F. M. Jiménez-Esteban[1,2,3], J. A. Caballero[4], and E. Solano[1,2]

- Bright objects with blue colours and high proper motions are rare in the sky.

- Nearby white dwarfs, hot subdwarfs, runaway stars, or early-type stars in nearby young moving groups.

- Important in many fields
  - WDs are used as spectrophotometric standards
  - Early-type stars in young moving groups are fundamental for understanding the evolution of star-forming regions.

VOSA
VO SED Analyzer



ects in
Observato

l E. Solano[1,2]

VOSED
SED Building Tool
Funded by

SED Building Tool: Search Form

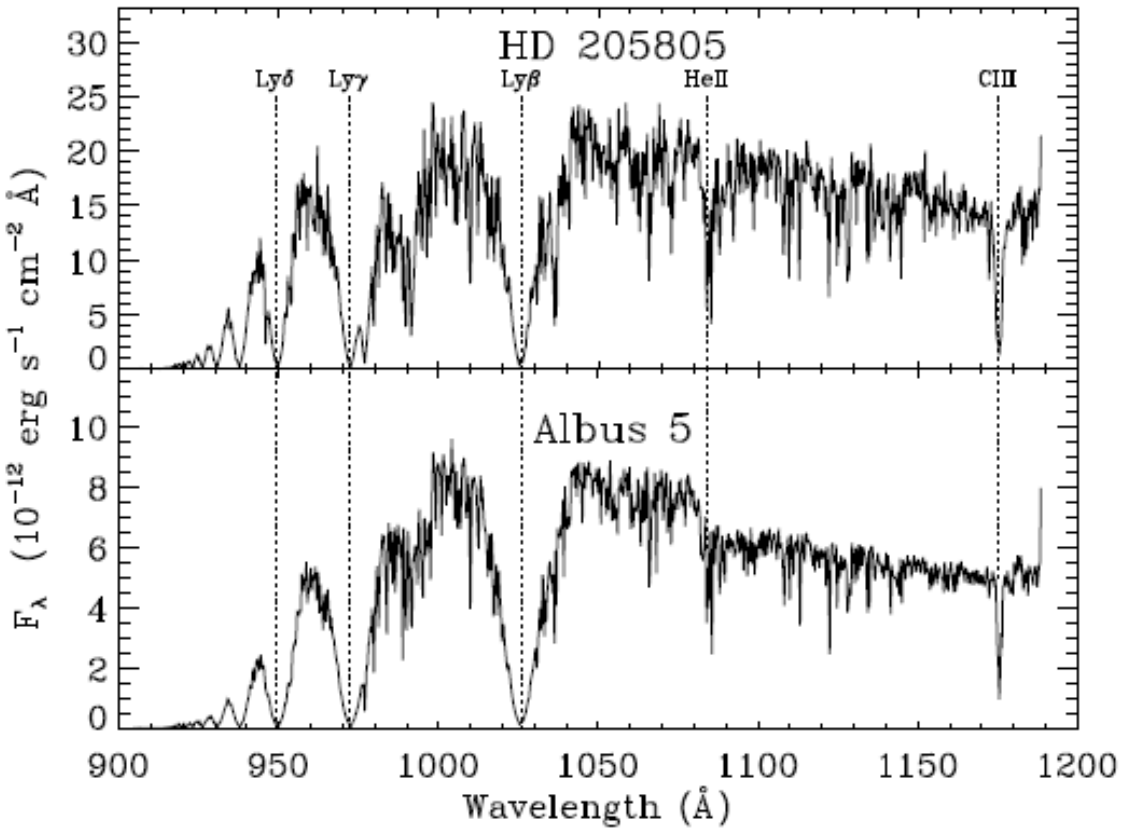


Fig. 5. *FUSE* spectra of the sdB star HD 205805 (*upper panel*) and Albus 5 (*lower panel*). The strongest observed lines (e.g. of the Lyman series) and multiplets (e.g. C III) have been labelled.

Summary

- ✓ VO-tools
  - – Not a “does-it-all” software
  - – Different tools for different problems.

- ✓ VO-science:
  - ✓ VO is an astronomical infrastructure that is producing science already.

  - ✓ The number of VO papers is growing: 91 refereed papers with “Virtual Observatory” in the abstract since Jan 2009.