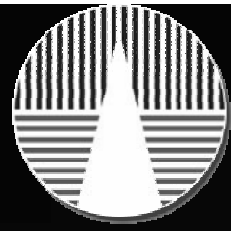


The Spanish-VO and the VO-Science

Francisco Jiménez Esteban

CAB / SVO (INTA-CSIC)

Suffolk University

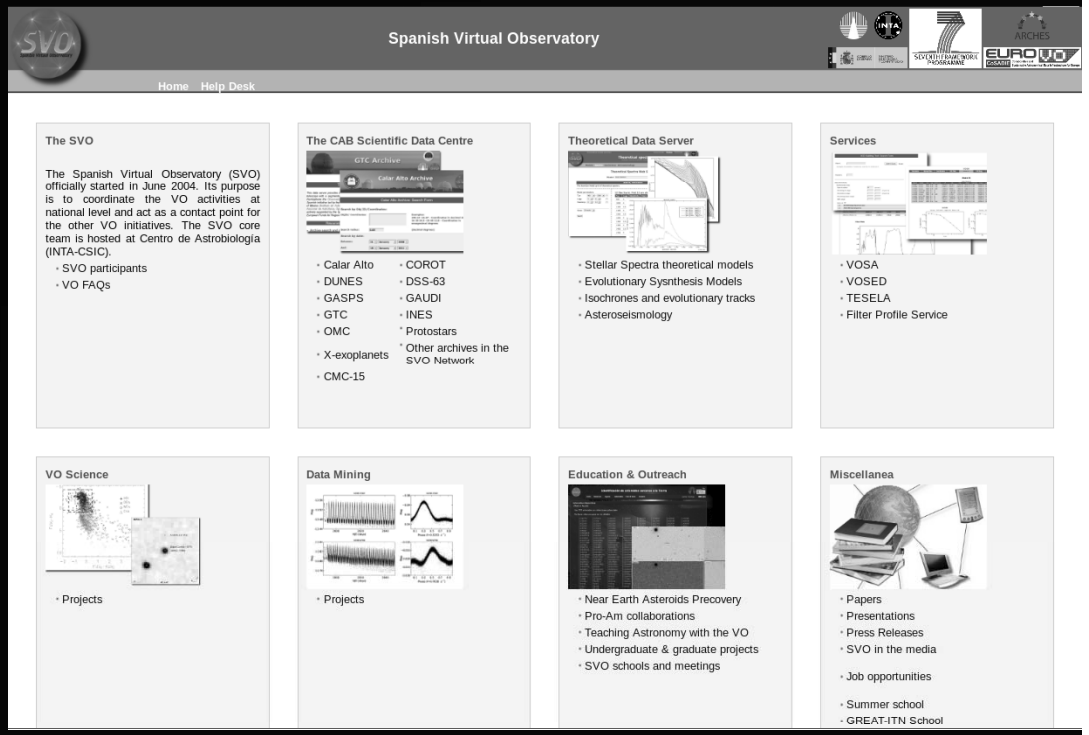
The Spanish-VO (SVO)

- **IVOA** was created in June 2002 with the mission to facilitate the international coordination and collaboration.

- Organized in working groups, IVOA is the forum where the standards, tools, roadmap,… are defined.

The Spanish-VO
SVO - http://svo.cab.inta-csic.es

- Officially started in June 2004.
- Development of a VO infrastructure in Spain.
- Coordination of the activities of the Spanish institutes in the VO framework.
- Contact-point for the international VO-projects.



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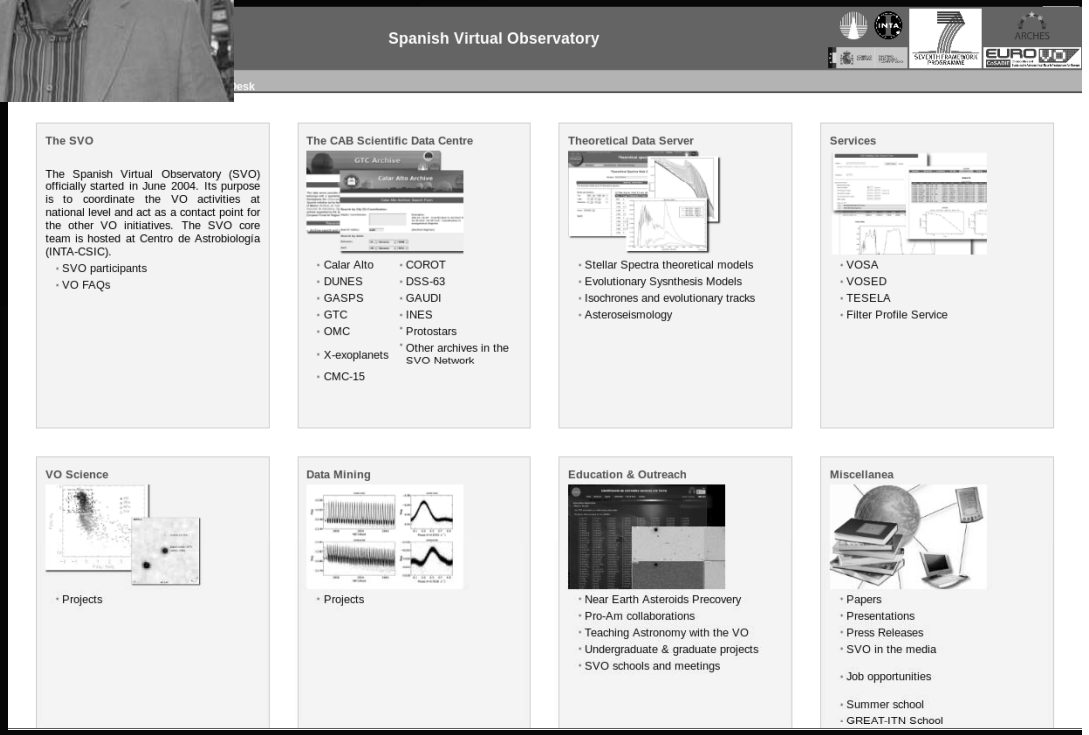
Buenos Aires, November 2013

The Spanish-VO
SVO - http://svo.cab.inta-csic.es

- Led by E. Solano (CAB / INTA-CSIC)

- Network of almost 200 researchers from 33 institutes

- Funded by the INTA, the Spanish Government and the EU.



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The Spanish-VO
The CAB Scientific Data Center

The CAB Scientific Data Centre

- Calar Alto
- DUNES
- GASPS
- GTC
- OMC
- X-exoplanets
- CMC-15
- COROT
- DSS-63
- GAUDI
- INES
- Protostars
- Other archives in the SVO Network

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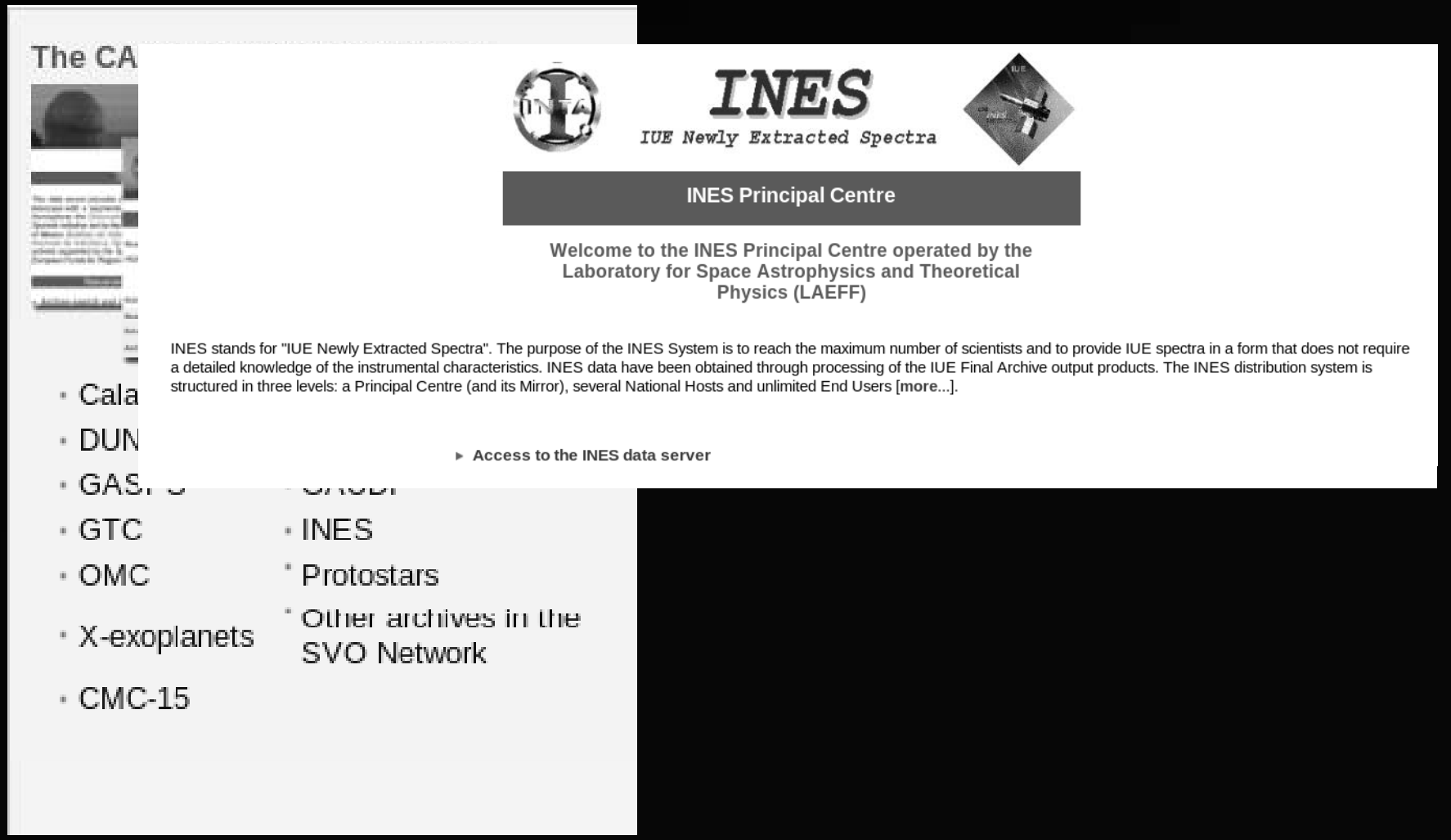
The Spanish-VO
The CAB Scientific Data Center



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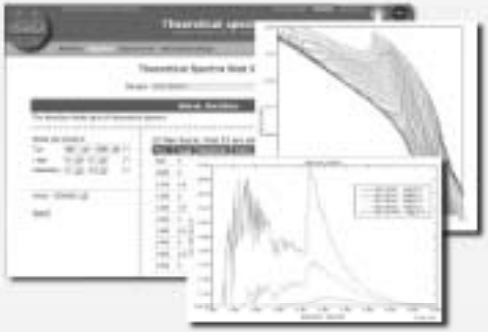
The Spanish-VO Theoretical Data Server

Theoretical Data Server



- Stellar Spectra theoretical models
- Evolutionary Sysnthesis Models
- Isochrones and evolutionary tracks
- Asteroseismology

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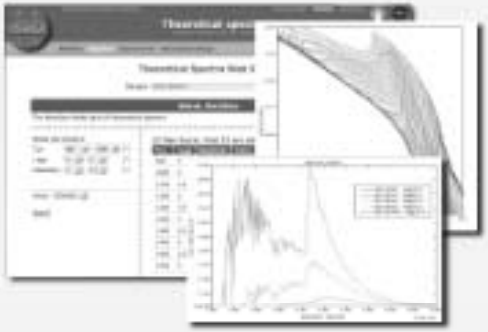
The Spanish-VO Theoretical Data Server

Theoretical Data Server



- Stellar Spectra theoretical m
- Evolutionary Sysnthesis Mod
- Isochrones and evolutionary
- Asteroseismology

Theoretical Models Web Server

Stellar Spectra Models

- **Dalessio disk models:**
  Models of irradiated accretion disks around pre-main sequence stars by D'Alessio et al. (1998,1999,2001).
- **Coelho Synthetic stellar library:**
  Synthetic stellar library by P. Coelho, fully described in Coelho et al. (2005) (*Astron.and.Astroph., in press*)
- **Allard, NextGen:**
  The NextGen Model grid of theoretical spectra; Hauschildt, P.H., Allard, F., Baron, E., Schweitzer, A., ApJ 312, 377, 1999
- **Allard, COND 2000:**
  The COND00 Model grid of theoretical spectra. (*Chabrier et al. 2000, ApJ, 542,464*)
- **Allard, DUSTY 2000:**
  The DUSTY00 Model grid of theoretical spectra (*Allard et al. 2001, ApJ, 556, 357*)
- **Kurucz ODFNEW /NOVER models:**
  ODFNEW /NOVER models. Newly computed ODFs with better opacities and better abundances have been used. (*The convective treatment is described in Castelli et al. 1997, AA 318, 841*)
- **Husfeld et al models for non-LTE Helium-rich stars:**
  Husfeld et al models for non-LTE Helium-rich stars (*Husfeld et al. 1989 A%26A, 222, 150*)
- **TLUSTY BSTAR2006:**
  TLUSTY BSTAR2006 Grid: Early B-type stars, Teff = 15000K - 30000 K (*Lanz, T., Hubeny, I. 2007, ApJS, 169, 83*)
- **TLUSTY OSTAR2002:**
  TLUSTY OSTAR2002 Grid: O-type stars, Teff = 27500K - 55000 K (*Lanz, T., & Hubeny, I. 2003, ApJS, 146, 417*)
- **TLUSTY OSTAR2002+BSTAR2006:**
  TLUSTY OSTAR2002+BSTAR2006 Grid, The merged files use the BSTAR2006 models for effective temperatures up to 30,000 K and the OSTAR2002 models for higher temperatures. (*TLusty web page*)

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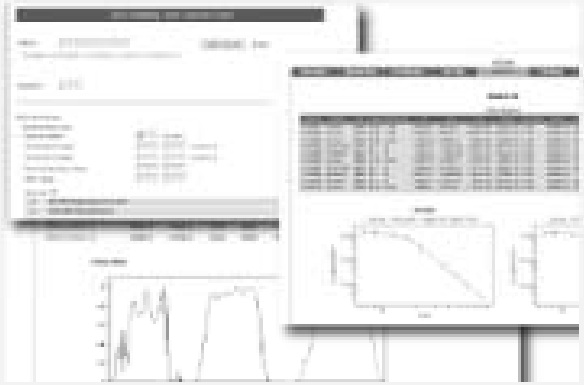
The Spanish-VO Services

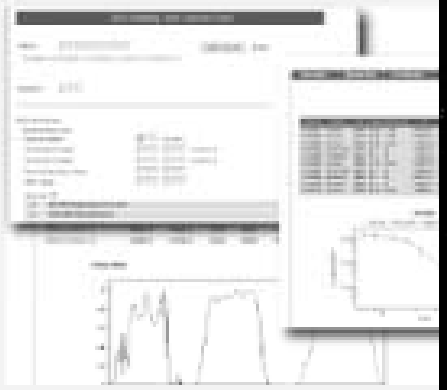
Services



- VOSA
- VOSED
- TESELA
- Filter Profile Service

The Spanish-VO Services

Services



- VOSA
- VOSED
- TESELA
- Filter Profile Service

SVO theoretical services | Documents | Models | Services | Email: | Pass: | Login | (?) Register

VOSA — VO SED Analyzer

Email:
Pass:
Login
Register

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

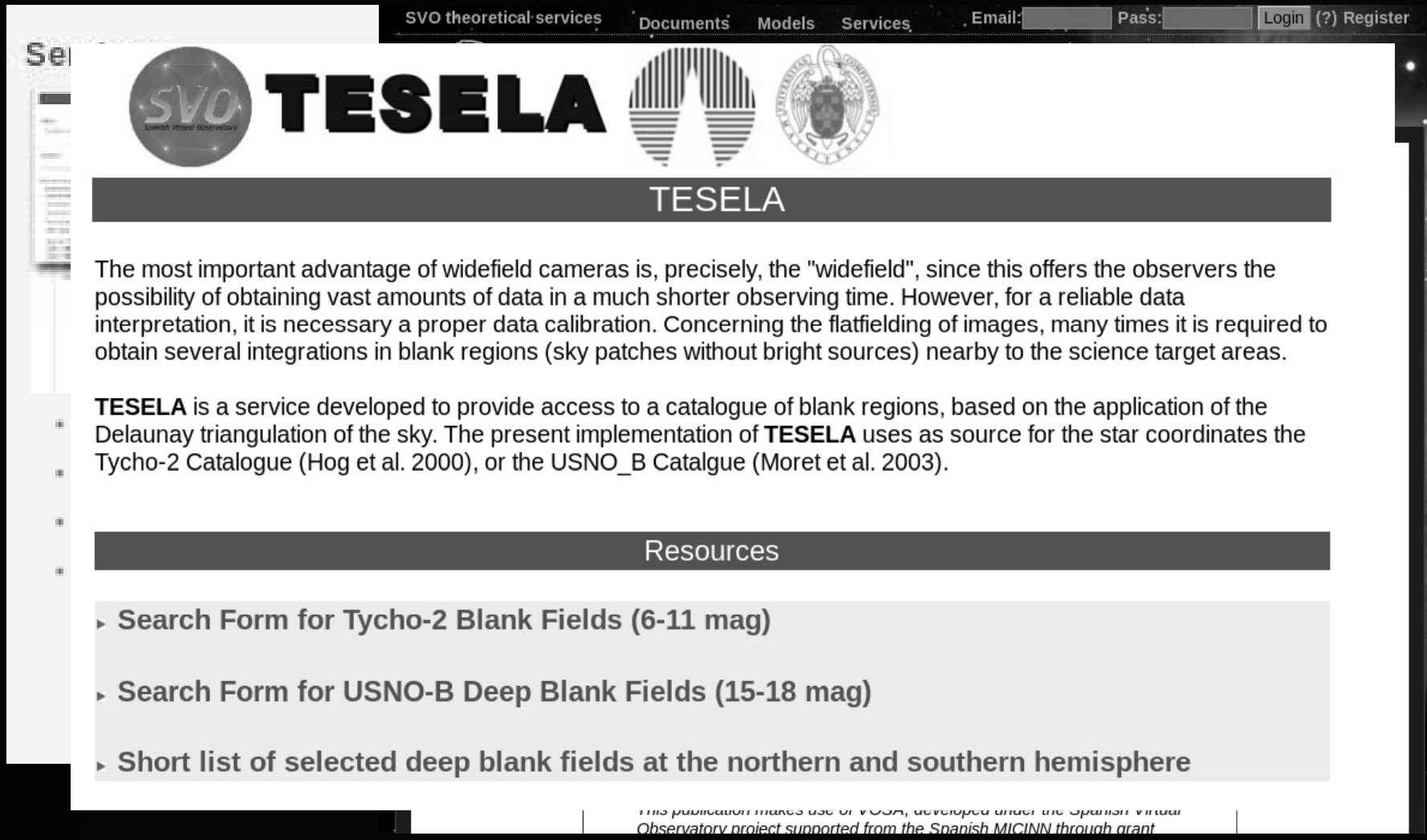
(Take a look to the VOSA Help)

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.

Acknowledging VOSA in publications:
Please include the following in any published material that makes use of VOSA:

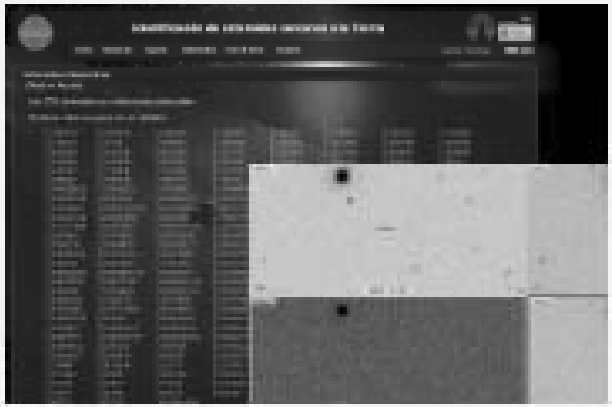
This publication makes use of VOSA, developed under the Spanish Virtual Observatory project supported from the Spanish MICINN through grant

The Spanish-VO Services



The Spanish-VO
Education & Outreach

Education & Outreach



- Near Earth Asteroids Precovery
- Pro-Am collaborations
- Teaching Astronomy with the VO
- Undergraduate & graduate projects
- SVO schools and meetings

The Spanish-VO Education & Outreach

F. Jiménez Esteban – fran@cab.inta-csic.es

Buenos Aires, November 2013

The Spanish-VO Education & Outreach

Dedicated VO-school around Spain

SVO Meetings

Talleres

- Máster MTAF. Universidad de Granada. Granada. Abril 2012
- RoPACS VO School. Madrid. 28 noviembre, 2011
- Cuarto Curso de la Red Temática SVO. Barcelona. 18-19 noviembre, 2010
- Tercer Curso de la Red Temática SVO. Madrid. 8-9 junio, 2010
- Segundo Curso de la Red Temática SVO. La Laguna, Marzo, 2010
- Primer Curso de la Red Temática SVO. Granada, Octubre, 2009

- Segunda Escuela de la Red Temática SVO. Madrid, Febrero 12-13, 2007
- Primera Escuela de la Red Temática SVO. Madrid, Noviembre 27-28, 2006

Reuniones de la Red

- Primera Reunión de la Red Temática SVO. Madrid, Abril 6-7, 2006

Otras reuniones y cursos

- Escuela VO. Universidad Católica del Norte. Antofagasta, Chile. Abril 2012
- First International Meeting on Astrostatistics. Valparaíso. Chile. Mayo 2013

The Spanish-VO Education & Outreach

Dedicated VO-school around Europe

- 3/2009 Garching, EuroVO-AIDA Hands-on workshop http://cds.u-strasbg.fr/twikiAIDA/bin/view/EuroVOAIDA/VOSchool09/WebHome
- 6/2009 Madrid, EuroVO-AIDA Workshop on How to Publish Data in the VO http://cds.u-strasbg.fr/twikiAIDA/bin/view/EuroVOAIDA/AidaVOWS2009/WebHome
- 1/2010 Strasburg, EuroVO-AIDA School http://cds.u-strasbg.fr/twikiAIDA/bin/view/EuroVOAIDA/VOSchool10/WebHome
- 3/2011 Strasburg, EuroVO-ICE School 2011 Strasburg http://cdsweb.u-strasbg.fr/voschool2011/index.html
- 2/2013 Madrid, EuroVO-COSADIE VO School http://www.laeff.cab.inta-csic.es/projects/cosadie/main/index.php

The Spanish-VO Education & Outreach

Dedicated VO school around Europe

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- 3/2 l1/index.html
- 2/2
  csi

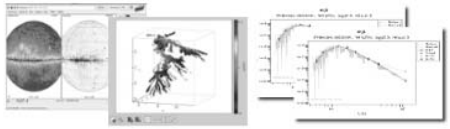
EURO VO CoSADIE — Collaborative and Sustainable Astronomical Data Infrastructure for Europe

Home | Program | Registered Applicants | Accepted Applicants | Waiting List | Venue | Accomodation | Feedback | Participant Use Cases

Email: Pass: Login

CoSADIE VO School

Madrid,
2013 February 5-7



Presentation

Important dates

- First announcement : 30 November 2012
- Deadline for workshop registration: 21 December 2012
- Workshop: 5,6,7 February 2013.

Purpose & Goals

The CoSADIE project is organising an international Virtual Observatory school at the Centro de Astrobiología, Madrid, Spain.

The Virtual Observatory (VO) is opening up new ways of exploiting the huge amount of data provided by the ever-growing number of ground-based and space facilities, as well as by computer simulations. The goal of the school is to expose European astronomers to the variety of VO tools and services available today so that they can use them efficiently for their own research.

Workshop format

To achieve these goals, VO experts will lecture and tutor the participants on the usage of such tools. Real life examples of scientific applications will be given, some of them selected from the science cases that participants will be asked to submit at the time of registration. A large fraction of the time will be dedicated to hands-on exercises, which will allow participants to become fully familiar with the VO capabilities on their own laptops.

The Spanish-VO Education & Outreach

Dedicated VO school around Europe

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  csi

EURO VO
CoSADIE Collaborative and Sustainable Astronomical Data Infrastructure for Europe

Home Program Registered Applicants Accepted Applica
Venue Accomodation Feedback Participant Use Cases

CoSAD
2013

Presentation

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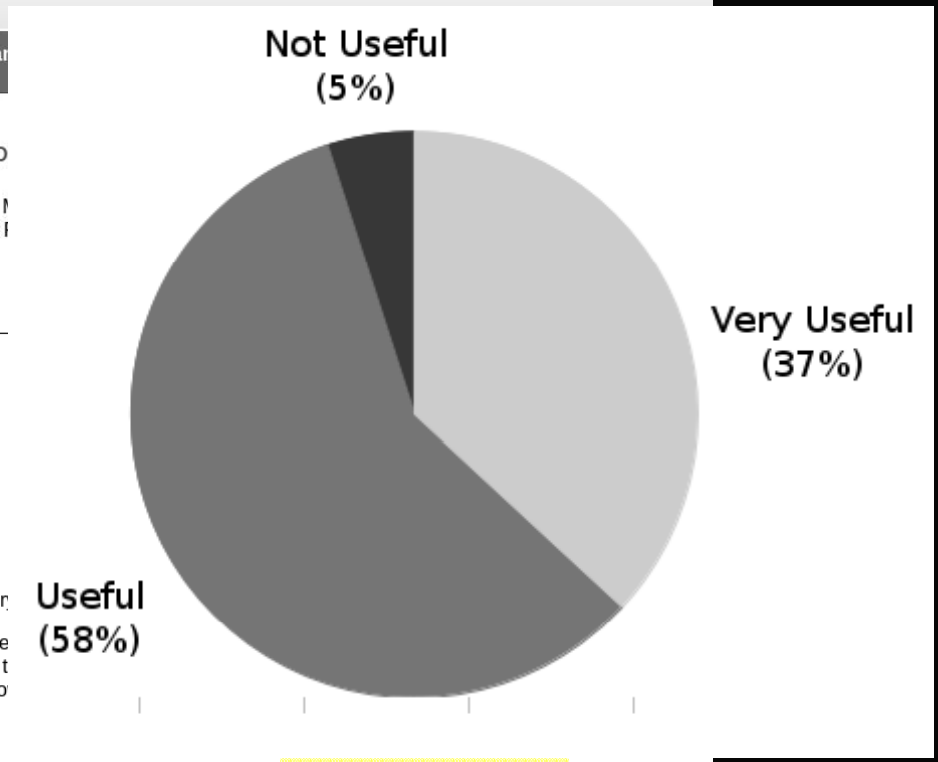
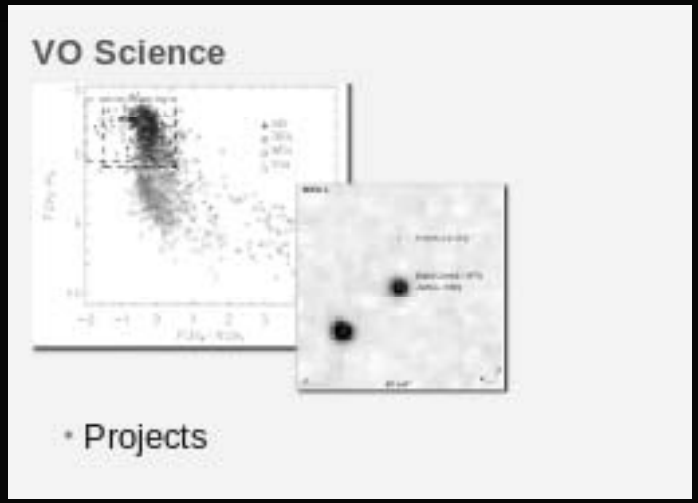


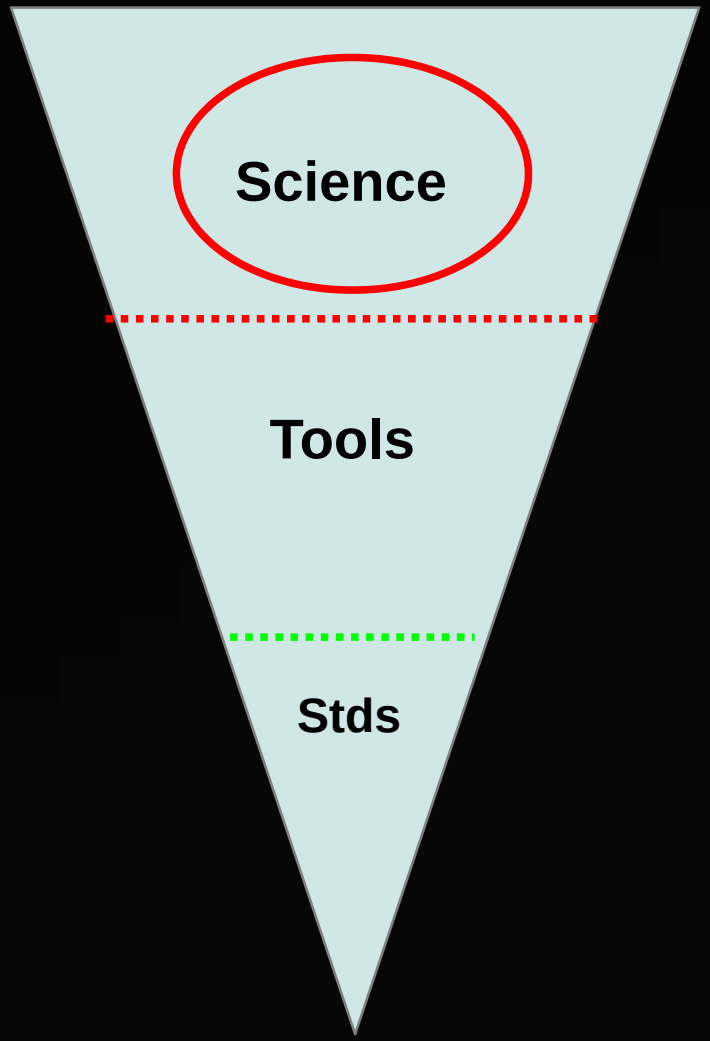
The Spanish-VO
VO Science

- Foster the VO-Science among the Spanish astronomers
- SVO is one of the most active groups around the world in VO-science.
- Since Jan 2012, around 50 VO papers
  - ✓ 20% with participation of the SVO.



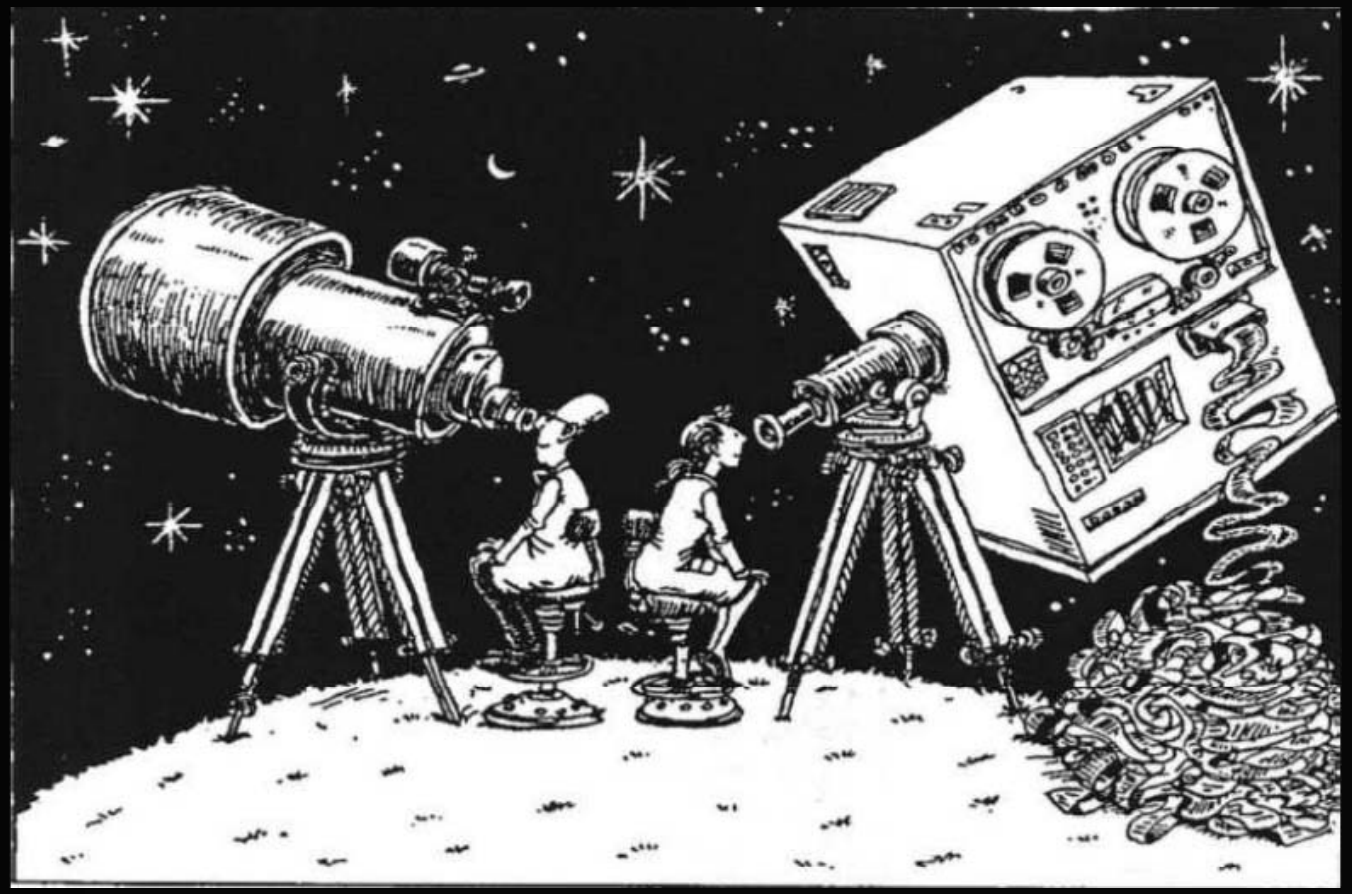
F. Jiménez Esteban – fran@cab.inta-csic.es

VO Science



VO Science

Archives: Fundamental tools for modern astrophysics.



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Buenos Aires, November 2013

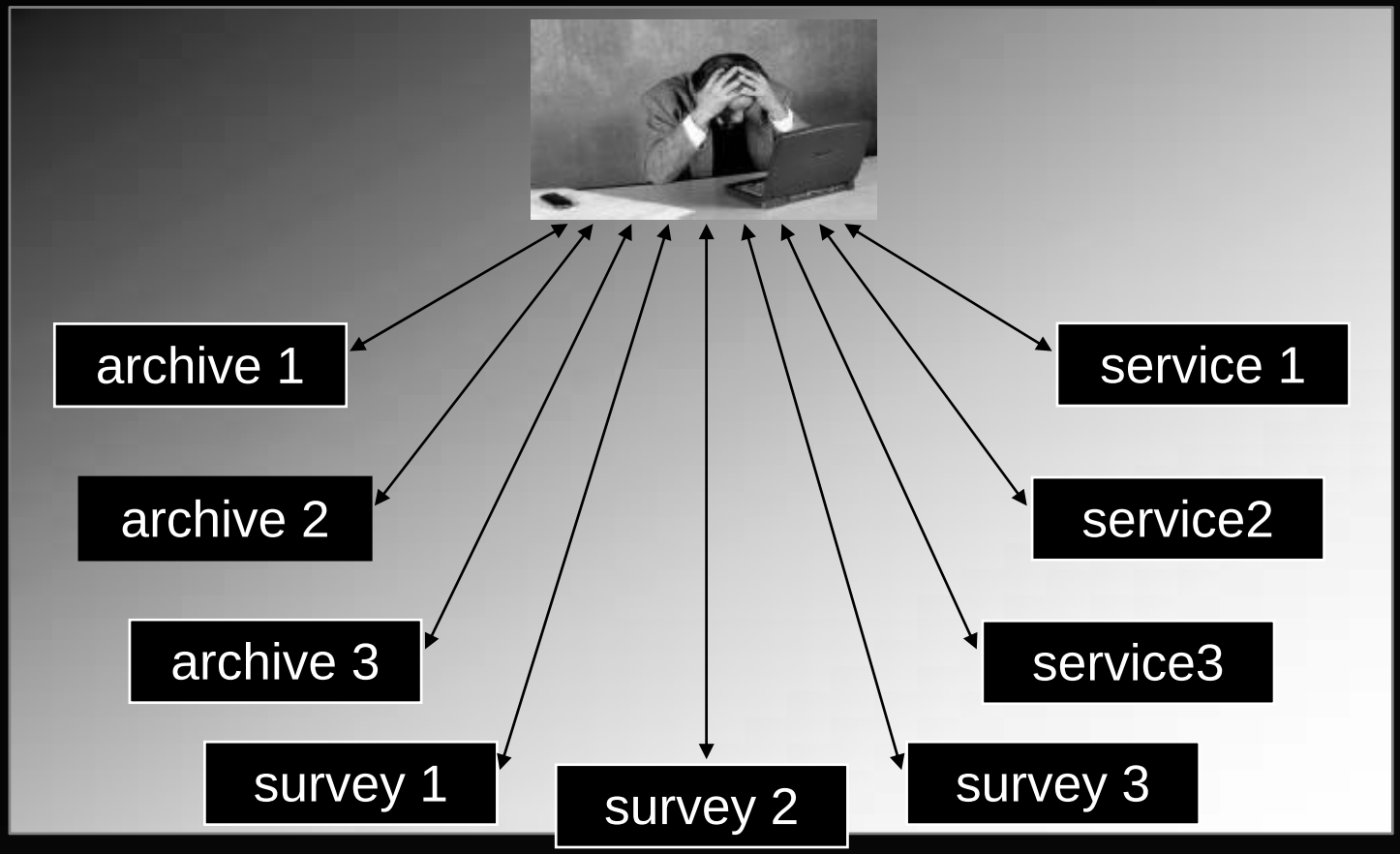
VO Science

Weak point #1: Data everywhere!!

Where are the data I am interested in?

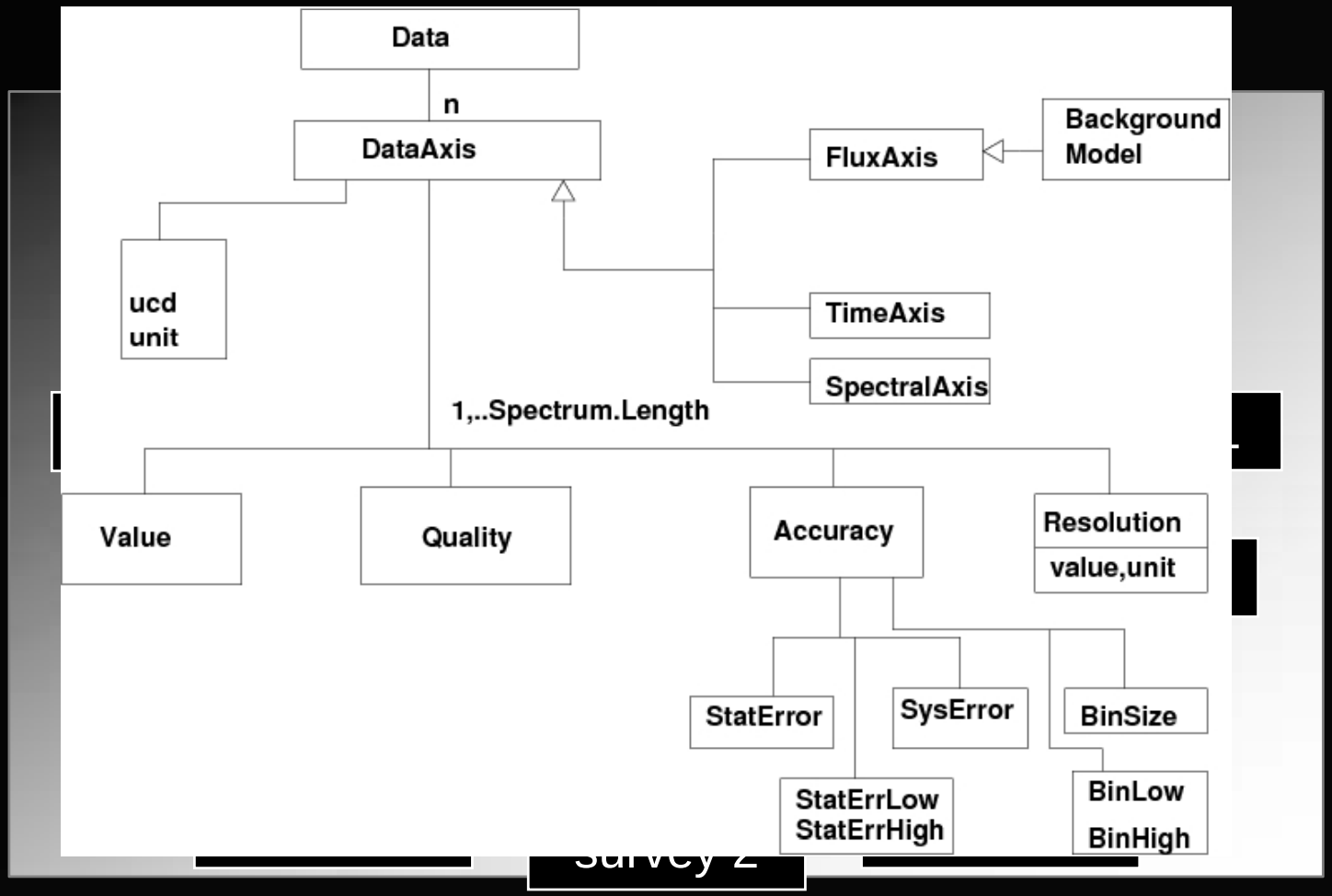
VO Science

Weak point #2: Lack of standardization



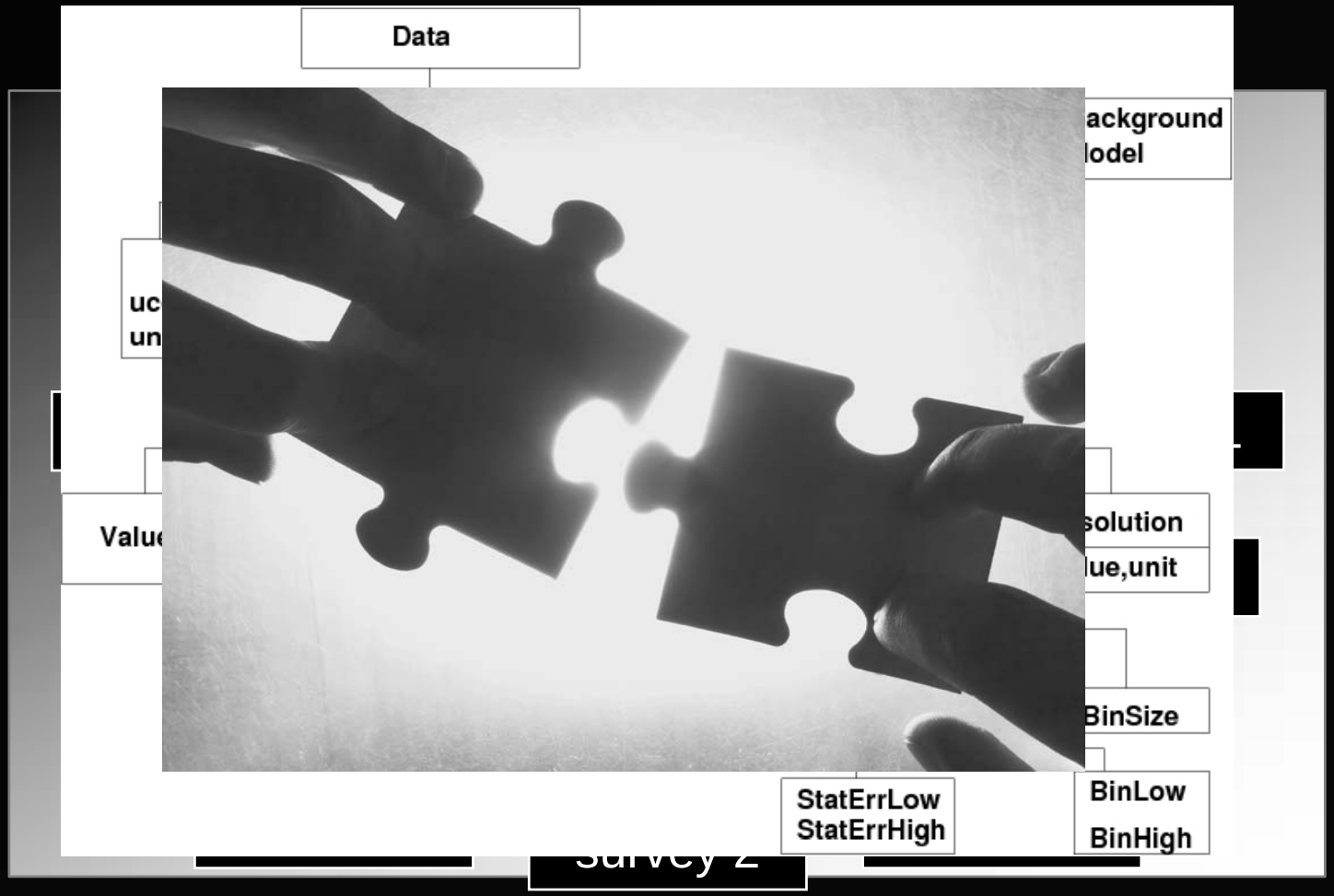
VO Science

Weak point #2: Lack of standardization



VO Science

Weak point #2: Lack of standardization

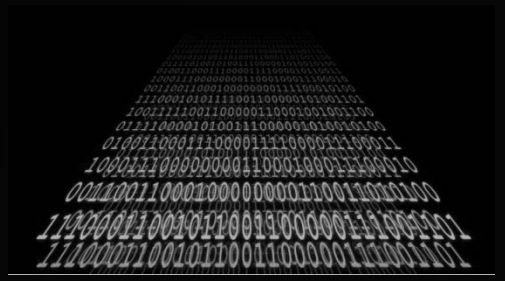


VO Science

Weak point #3: Data volume

Today: 1 Petabyte in archives.

- ✓ Rate: 0.5 PB/yr



VO Science

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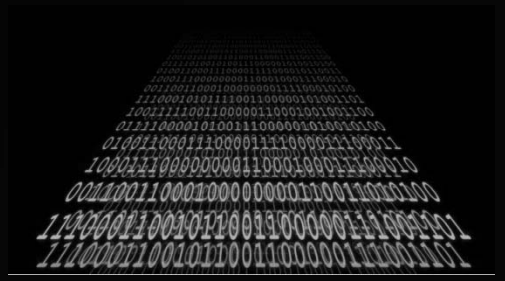

✓ Rate: 0.5 PB/yr

LSST, ALMA, SKA

→ 60 PB in 15-20 years.

VO Science

Astronomy with archives

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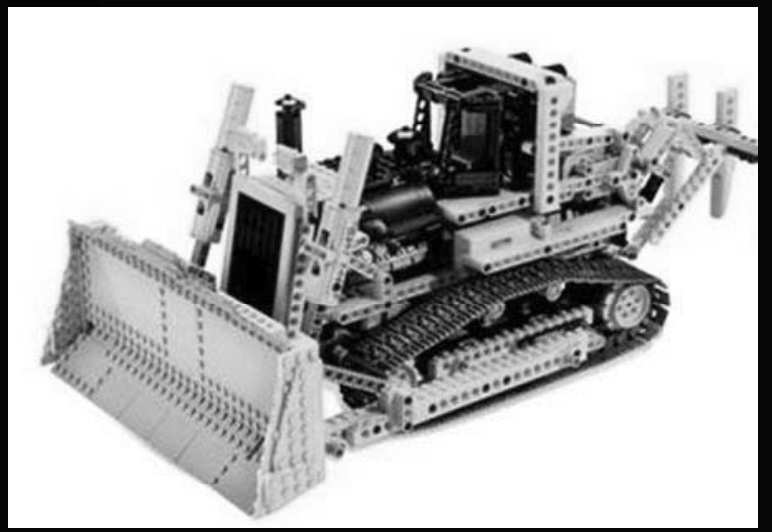
Buenos Aires, November 2013

VO Science

Astronomy with archives



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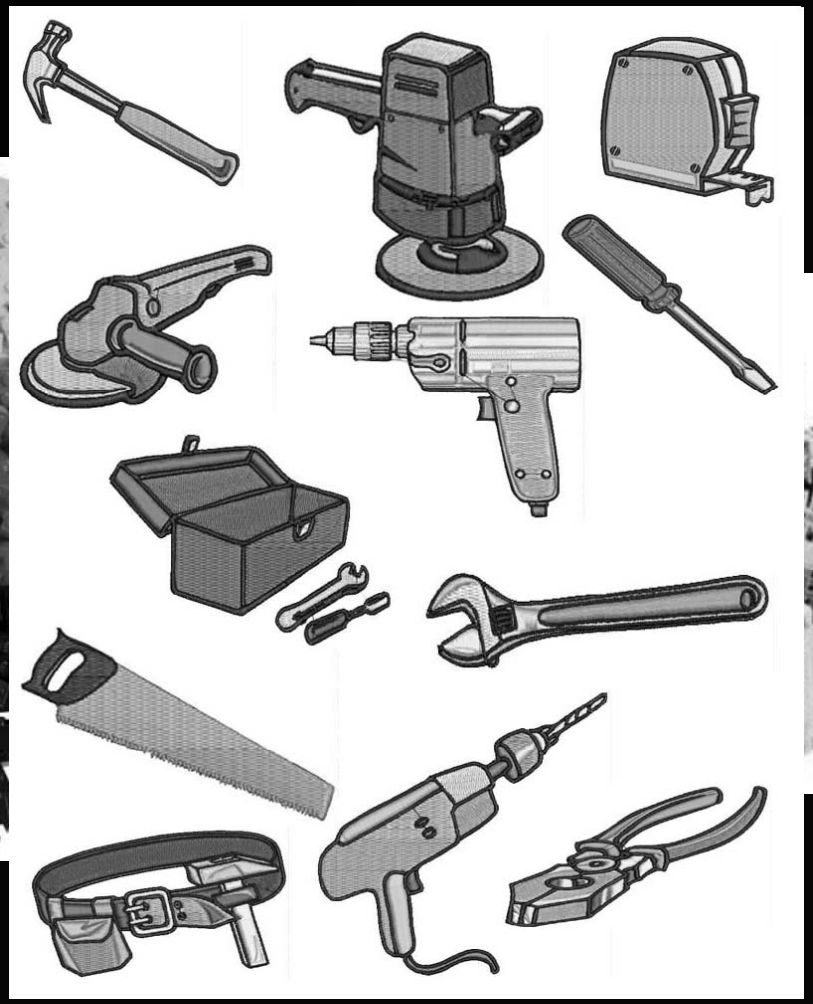
VO Science

Astronomy with archives



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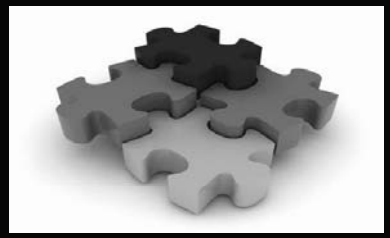
VO Science

What do I expect from VO tools?

- ✓ Data discovery

- ✓ Data retrieval



- ✓ Data analysis

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VO Science. Case I

Preparation of observations

DUNES: DUst around NEarby Stars

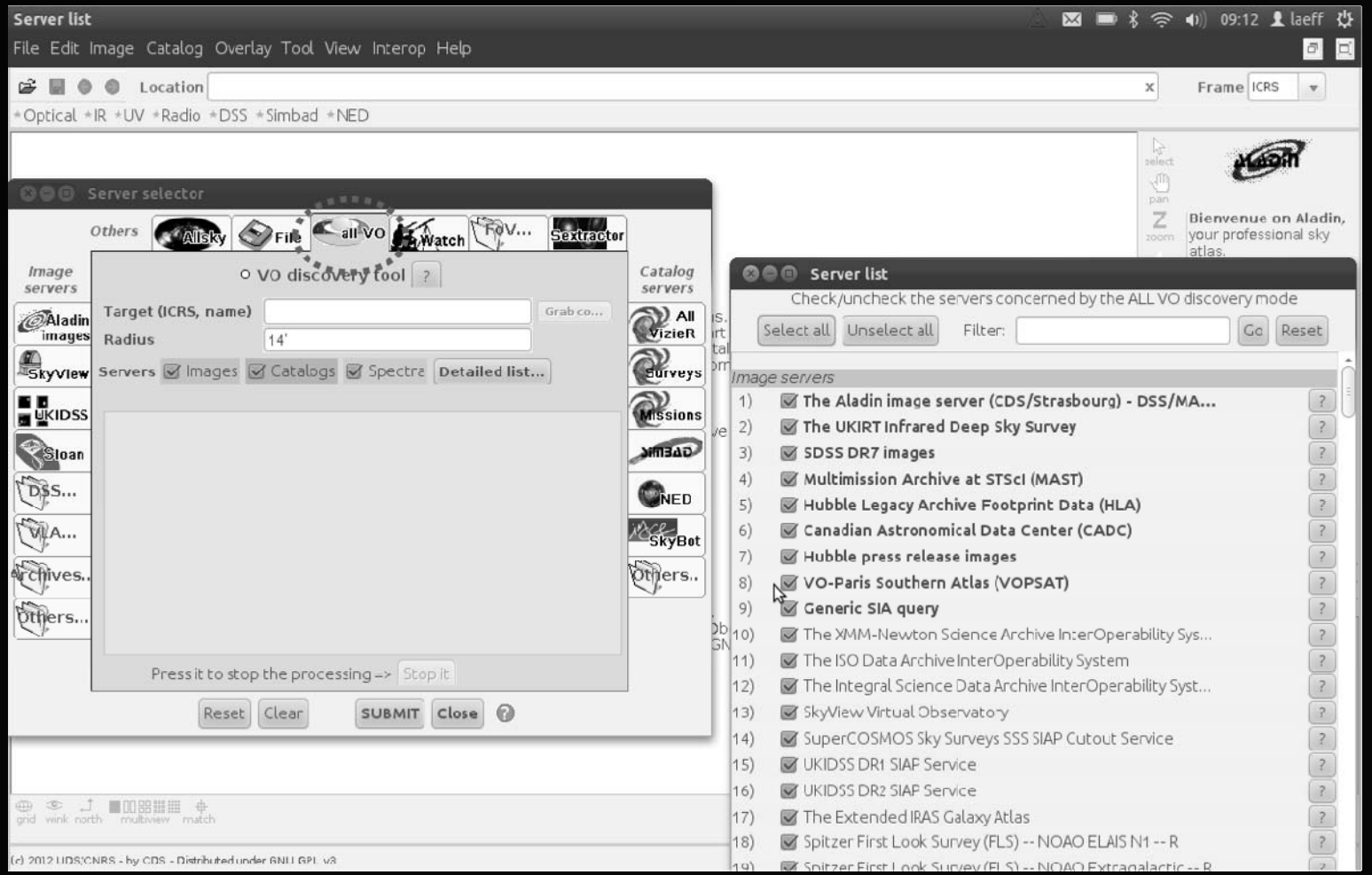
A Herschel Key Programme

- ✓ Systematic survey for faint, cold debris disks (similar to Kuiper belt) around nearby stars.
  - ✓ 239 IV-V stars. Sample is volume-limited (d < 25 pc; Hipparcos)

- ➢ The detailed analysis of faint cold disks require a good knowledge of the stellar properties, like e.g. T_{eff}, luminosity, age, metallicity or activity.

VO Science. Case I

Preparation of observations



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VO Science. Case II

Discovering new objects of a given class

New ultracool subdwarfs identified in large-scale surveys using Virtual Observatory tools ⋆ ⋆⋆

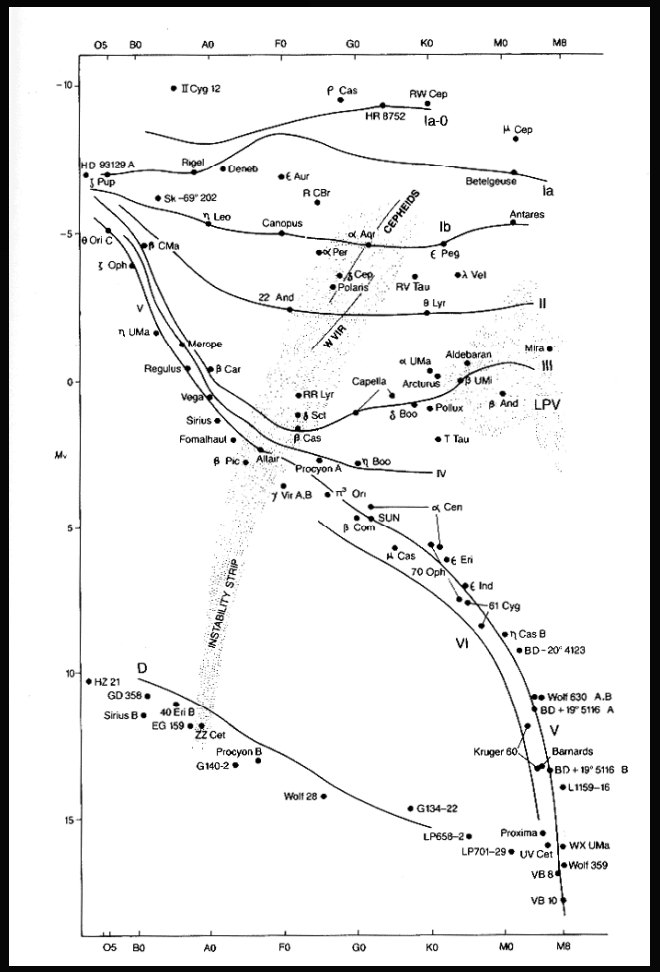
Part I: UKIDSS LAS DR5 vs SDSS DR7

N. Lodieu[1,2], M. Espinoza Contreras[1], M. R. Zapatero Osorio[3], E. Solano[4,5], M. Aberasturi[4,5], and E. L. Martín[3]

VO Science. Case II

Discovering new objects of a given class

- ✓ Metal-poor dwarfs with spectral type later than M7.
- ✓ Hotter than their solar metallicity counterparts.
- ✓ Population II. Useful tracers of the Galactic chemical history.
- ✓ Known around fifty in 2011.



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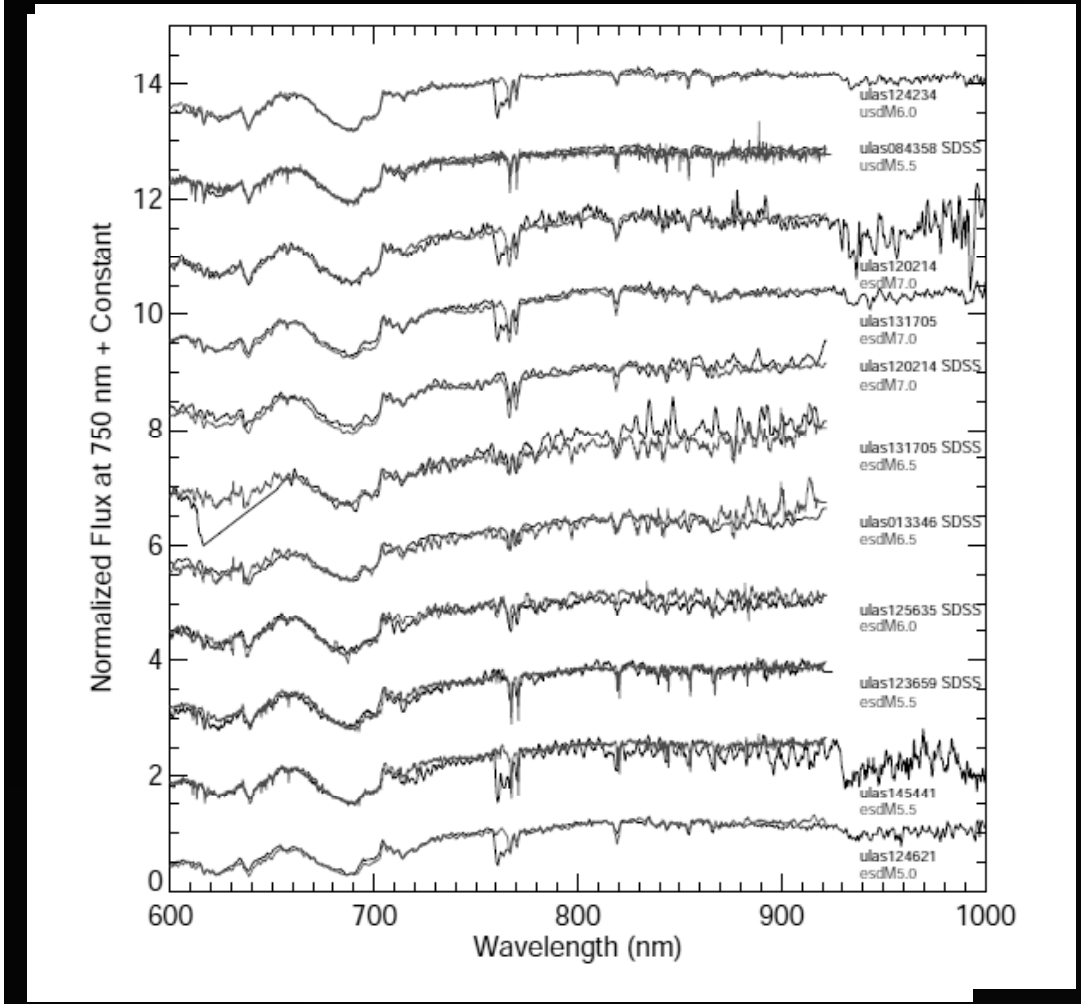
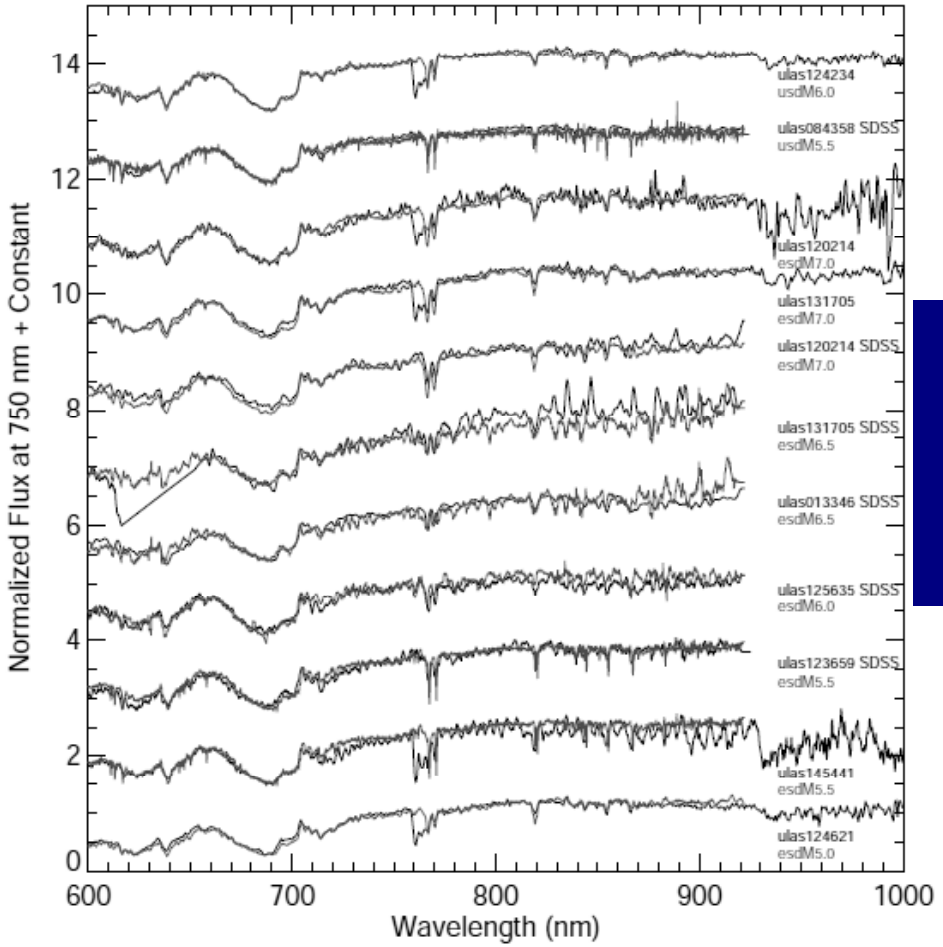
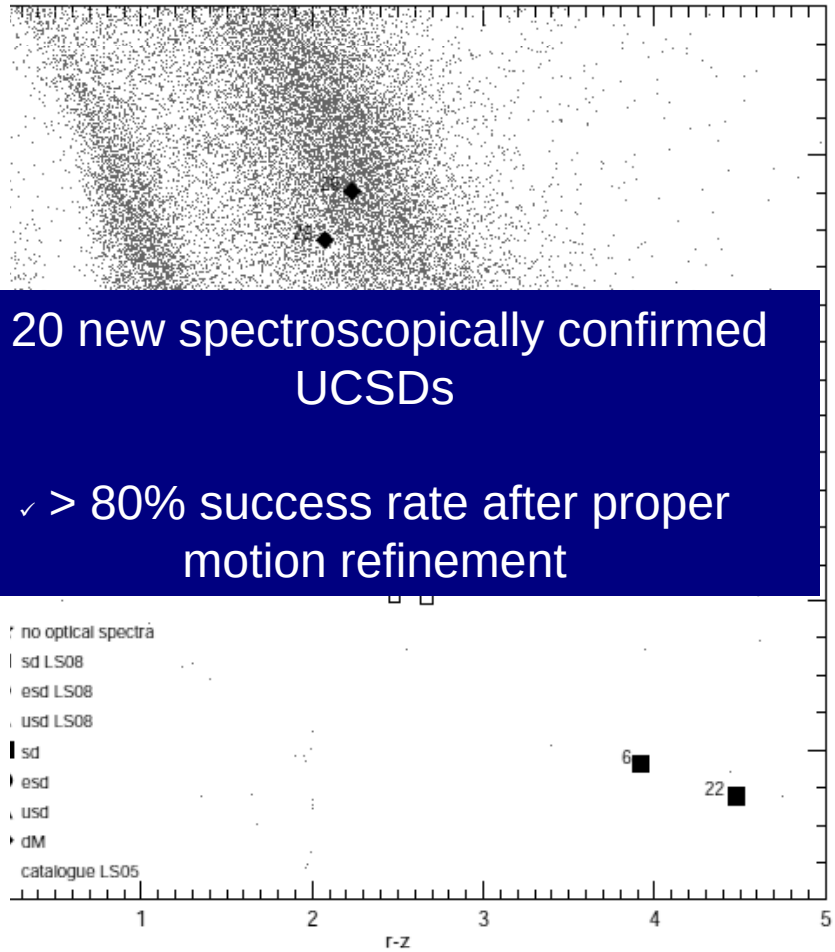
VO Science. Case II



VO Science. Case II





- ✓ 20 new spectroscopically confirmed UCSDs
- ✓ > 80% success rate after proper motion refinement

VO Science. Case III

Discovery of peculiar objects

✓ Bright objects with peculiar colours and high proper motions are rare in the sky.

✓ The closer/brighter the easier to investigate their physical properties

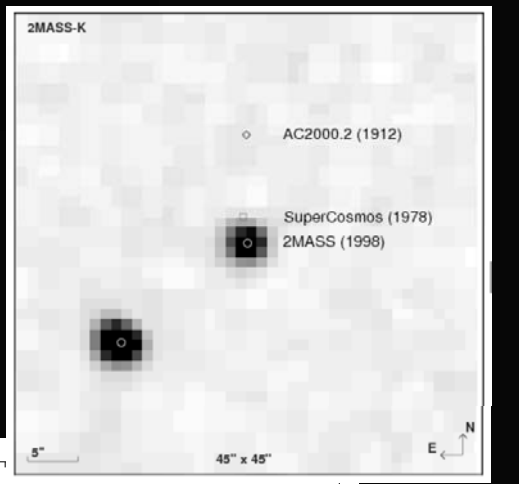
- Blue: Nearby WD, subO, runaway stars, or OB stars in nearby young moving groups.

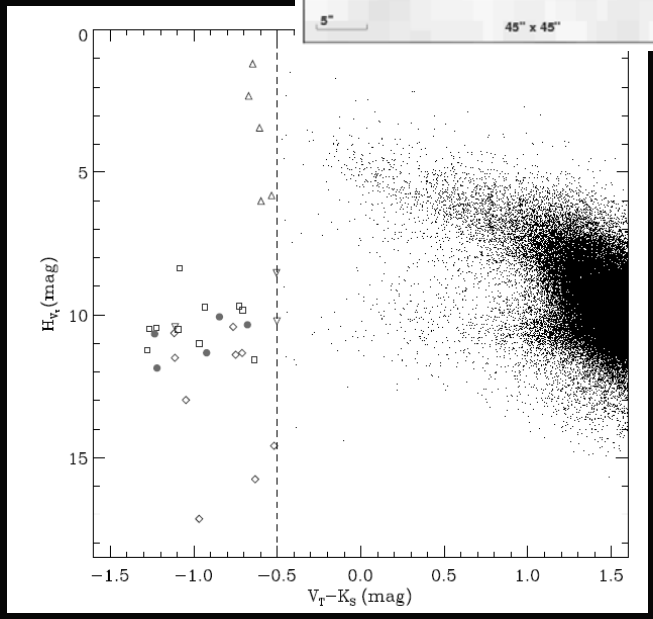
- Red: nearby M dwarfs or RG with high tangential velocity

VO Science. Case III

Discovery of peculiar objects

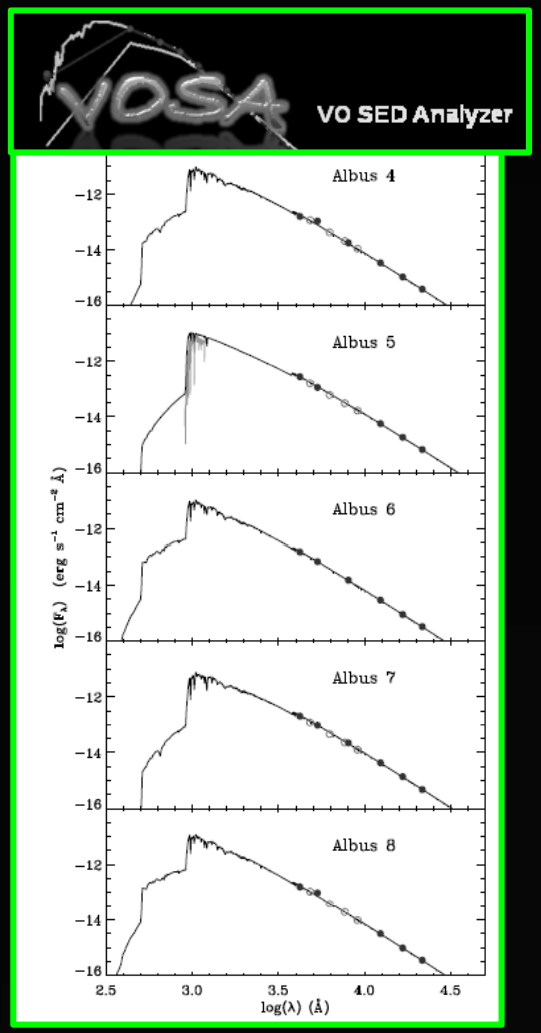
- Cross-matched Tycho-2 and 2MASS
- 155,000 high proper motion candidates ($\mu > 50$ mas/yr)
- Reduced proper motion diagram H_{VT} vs. $V_T - K_s$
- Blue sources $V_T - K_s < -0.5$
  - 32 blue (OB, sdO, WD)
  - 5 unknown WD or sdO





VO Science. Case III

Discovery of peculiar objects



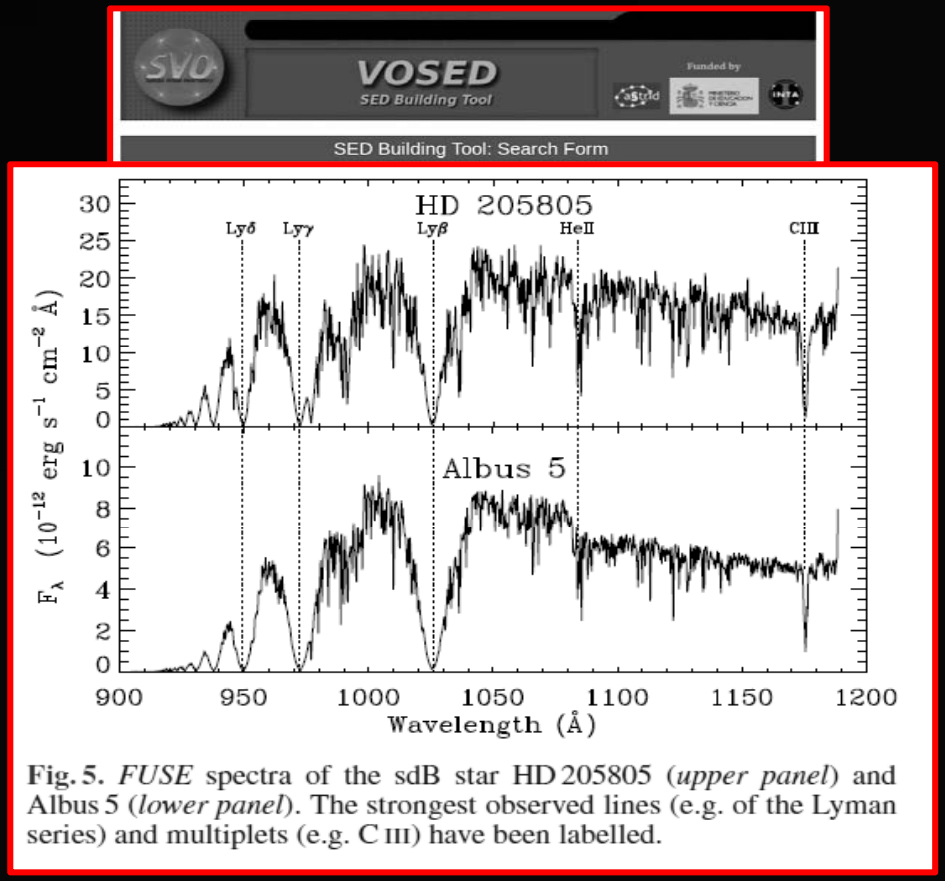


Fig. 5. *FUSE* spectra of the sdB star HD 205805 (*upper panel*) and Albus 5 (*lower panel*). The strongest observed lines (e.g. of the Lyman series) and multiplets (e.g. C III) have been labelled.

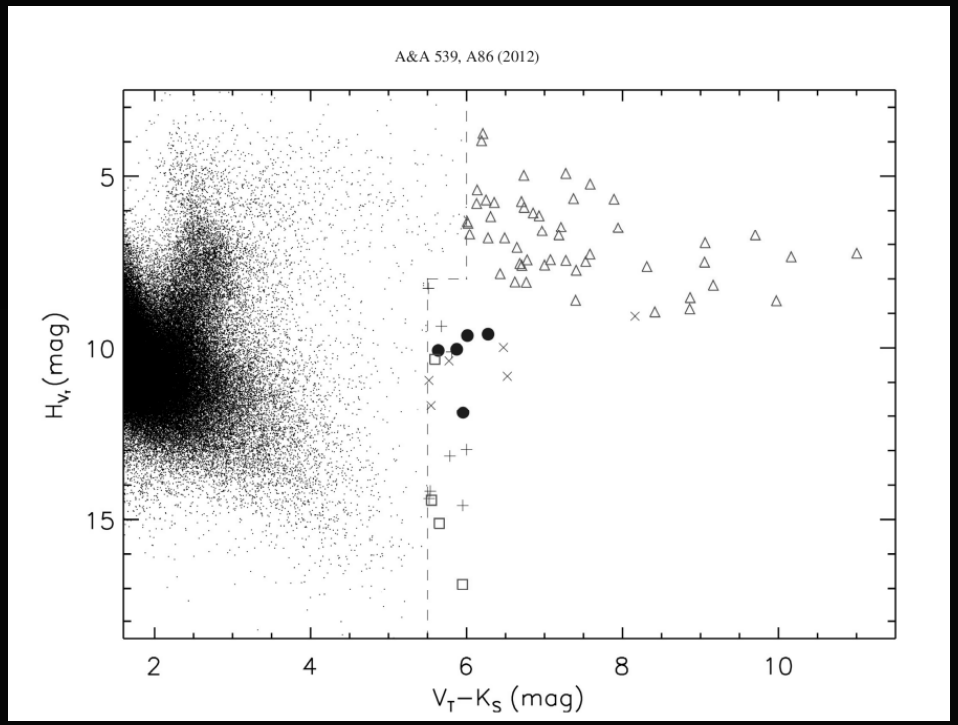
We confirmed the nature of one sdO (*FUSE* spectra)

VO Science. Case III

Discovery of peculiar objects

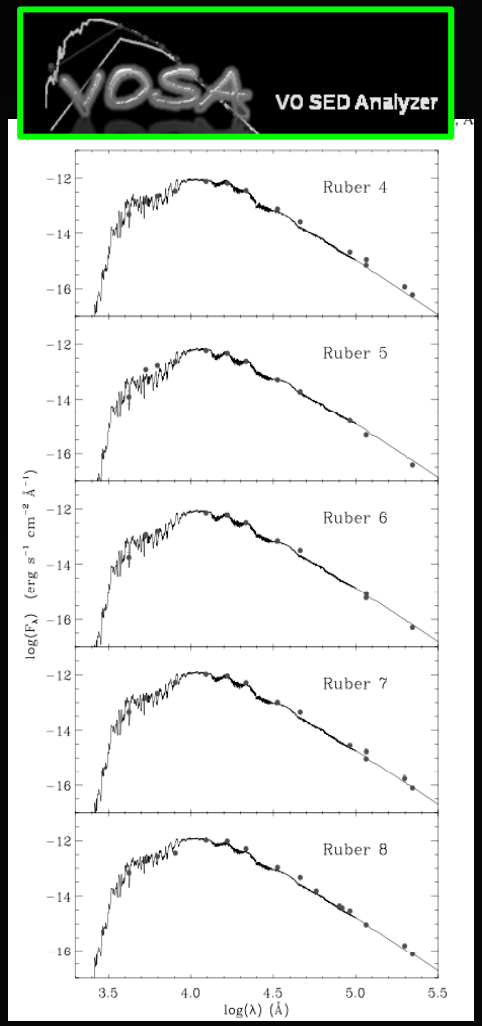
Red sources $V_T - K_s > 5.5$

- 59 red (M dwarfs and giants)
- 5 unknown, probably thick-disc and halo giants



VO Science. Case III

Discovery of peculiar objects



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Discovery of peculiar objects

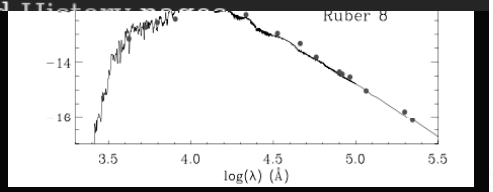
The All Sky Automated Survey

- **Goals**

The All Sky Automated Survey (**ASAS**) is a low cost project dedicated to constant photometric monitoring of the whole available sky, which is approximately 10^7 stars brighter than 14 magnitude. The project's ultimate goal is detection and investigation of of any kind of the photometric variability. One of the main obectives of **ASAS** is to find and catalog variable stars.

- **Equipment**

Presently, **ASAS** consists of two observing stations, one in LCO, Chile (since 1997) and the other on Haleakala, Maui (since 2006). Both are equipped with two wide-field 200/2.8 instruments, observing simultaneously in ***V*** and ***I*** band. For technical and



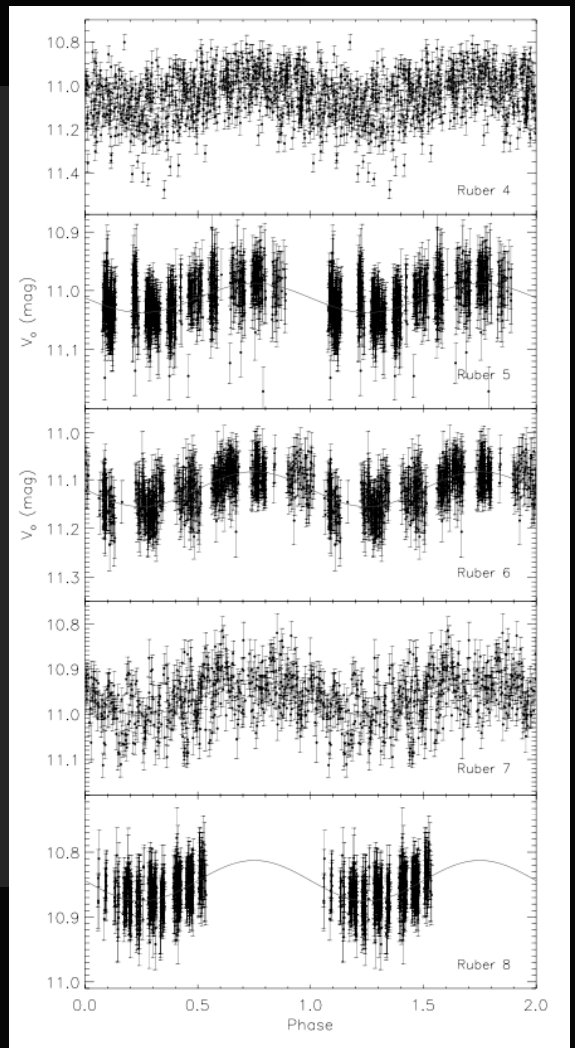


Fig. 6. ASAS *V*-band light curves as a function of phase of Ruber 4

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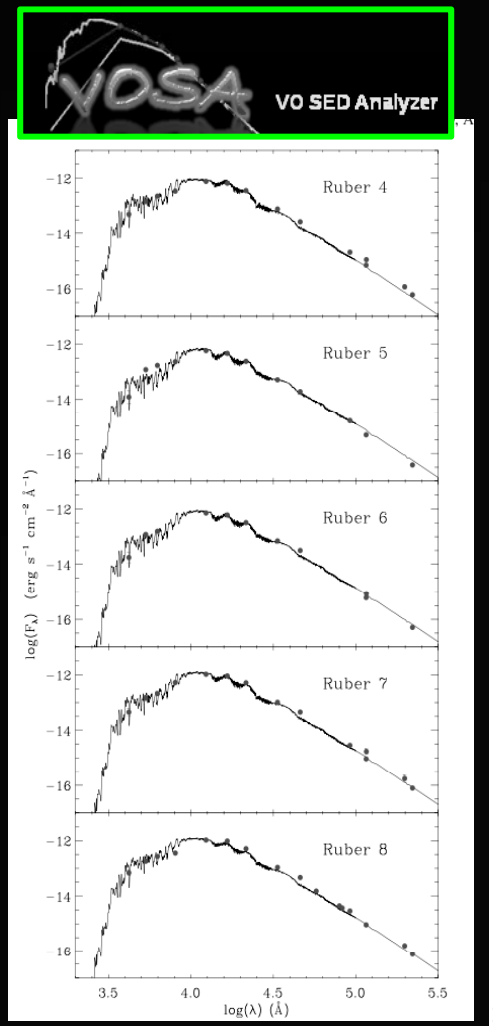
Discovery of peculiar objects

We found from ASAS analysis:

- 1 long secondary period
- 1 extremely long period

We confirmed with follow-up observations:

- 1 RG
- 1 metal-poor RG



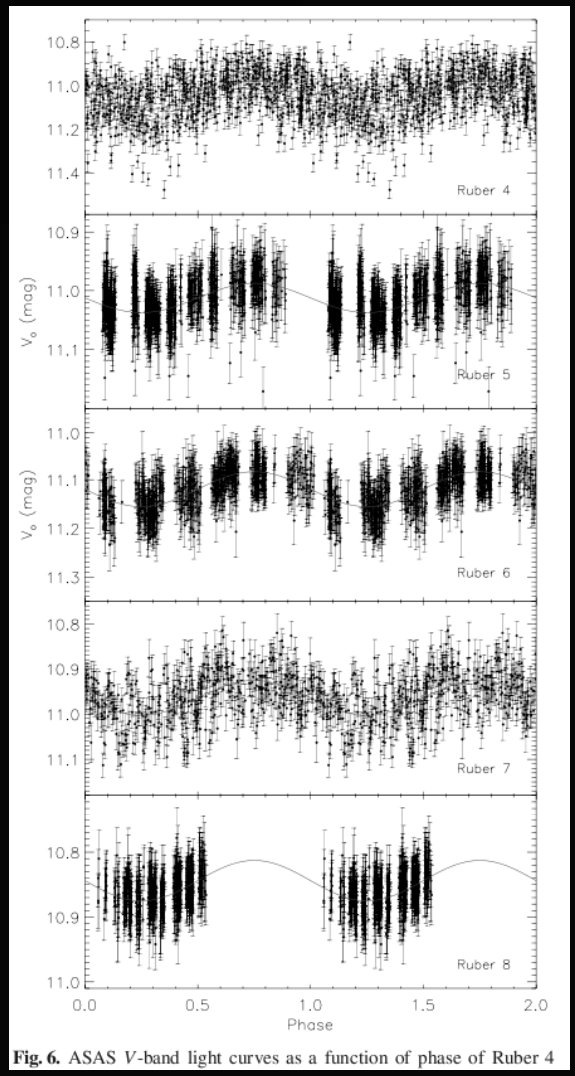


Fig. 6. ASAS *V*-band light curves as a function of phase of Ruber 4

VO Science. Case III

Discovery of peculiar objects

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Astronomy & Astrophysics

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

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ABSTRACT

Aims. With available Virtual Observatory tools, we looked for new bright blue high proper motion objects in the entire sky: white dwarfs, hot subdwarfs, runaway OB stars, and early-type stars in nearby young moving groups.
Methods. We performed an all-sky cross-match between the optical Tycho-2 and near-infrared 2MASS catalogues with Aladin, and selected objects with proper motions $\mu > 50$ mas yr^{-1} and colours $V_T - K_s < -0.5$ mag with TOPCAT. We also collected multi-wavelength photometry, constructed the spectral energy distributions and estimated effective temperatures from fits to atmospheric models with VOSA for the most interesting targets.
Results. We assembled a sample of 32 bright blue high proper motion objects, including ten sdO/B subdwarfs, nine DA white dwarfs, five young early-type stars (two of which are runaway stars), two blue horizontal branch stars, one star with poor information, and five objects reported for the first time in this work. These last five objects have magnitudes $B_T \approx 11.0$–11.6 mag, effective temperatures $T_{\rm eff} \approx 24\,000$–$30\,000$ K, and are located in the region of known white dwarfs and hot subdwarfs in a reduced proper motion-colour diagram. We confirmed the hot subdwarf nature of one of the new objects, Albus 5, with public far-ultraviolet spectroscopic data obtained with *FUSE*.

Key words. astronomical databases: miscellaneous – virtual observatory tools – stars: early-type – stars: peculiar – subdwarfs – white dwarfs

A&A 539, A86 (2012)
DOI: 10.1051/0004-6361/201118375

Astronomy & Astrophysics

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

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ABSTRACT

Aims. With available Virtual Observatory tools, we looked for new M dwarfs in the solar neighbourhood and M giants with high tangential velocities.
Methods. From an all-sky cross-match between the optical Tycho-2 and the near-infrared 2MASS catalogues, we selected objects with proper motions $\mu > 50$ mas yr^{-1} and very red $V_T - K_s$ colours. For the most interesting targets, we collected multi-wavelength photometry, constructed spectral energy distributions, estimated effective temperatures and surface gravities from fits to atmospheric models, performed time-series analysis of ASAS V-band light curves, and assigned spectral types from low-resolution spectroscopy obtained with CAFOS at the 2.2 m Calar Alto telescope.
Results. We got a sample of 59 bright red high proper-motion objects, including fifty red giants, four red dwarfs, and five objects reported in this work for the first time. The five new stars have magnitudes $V_T \approx 10.8$–11.3 mag, reduced proper motions midway between known dwarfs and giants, near-infrared colours typical of giants, and effective temperatures $T_{\rm eff} \approx 2900$–3400 K. From our time series analysis, we discovered a long secondary period in Ruber 4 and an extremely long primary period in Ruber 6. With the CAFOS spectra, we confirmed the red giant nature of Ruber 7 and 8, the last of which seems to be one of the brightest metal-poor M giants ever identified.

Key words. stars: oscillations – stars: late-type – stars: chemically peculiar – virtual observatory tools – stars: peculiar – astronomical databases: miscellaneous

Summary

- ✓ Archives: Fundamental tool for modern astrophysics.
- ✓ Strengths:
  - Efficiency
  - Legacy
- ✓ Weaknesses:
  - Inefficient scientific exploitation
    - Distributed resources / lack of interoperability
    - Huge volumes of data

Summary

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Virtual Observatory

Summary

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Virtual Observatory

- ✓ VO is already an astronomical infrastructure that is producing science.
- ✓ The number of VO-papers is growing. Currently, there are more than 200 papers with “Virtual Observatory” in the abstract
  - ✓ > 3000 citations.

Thanks!

F. Jiménez Esteban – fran@cab.inta-csic.es

Buenos Aires, November 2013