The Virtual Observatory. A new framework for new science

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Spanish Virtual Observatory

Astronomy ESFRI & Research Infrastructure Cluster
ASTERICS - 653477

CENTRO DE ASTROBIOLOGÍA
ASOCIADO AL NASA ASTROBIOLOGY INSTITUTE

GOBIERNO DE ESPAÑA

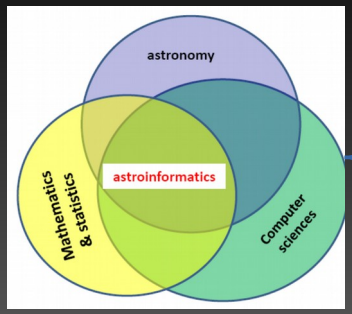
Instituto Nacional de Técnica Aeroespacial

Workflow

Education Outreach

Science

New data



Advances in Astronomy

Data Avalanche

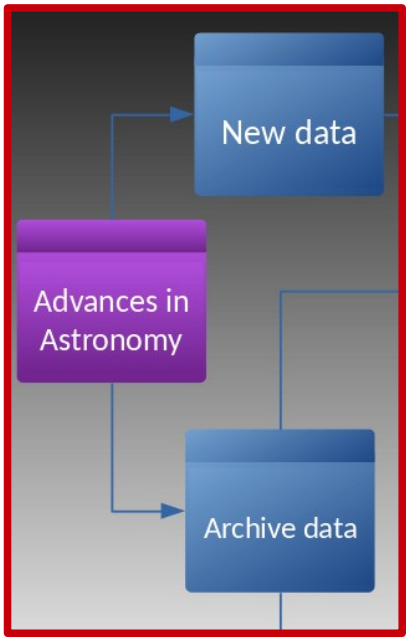
Tools

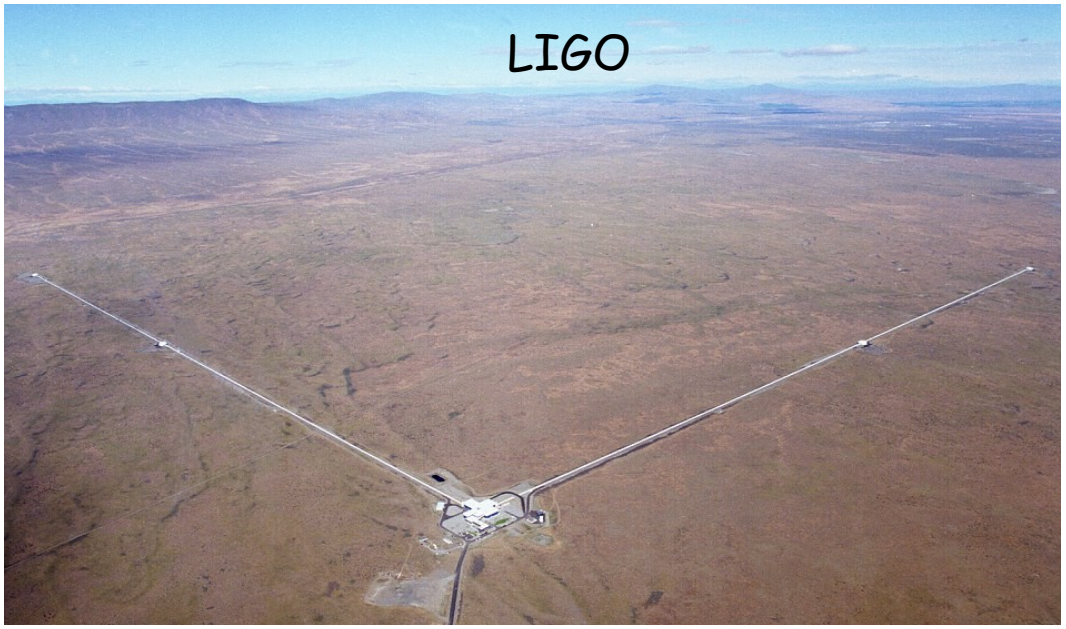
Standards

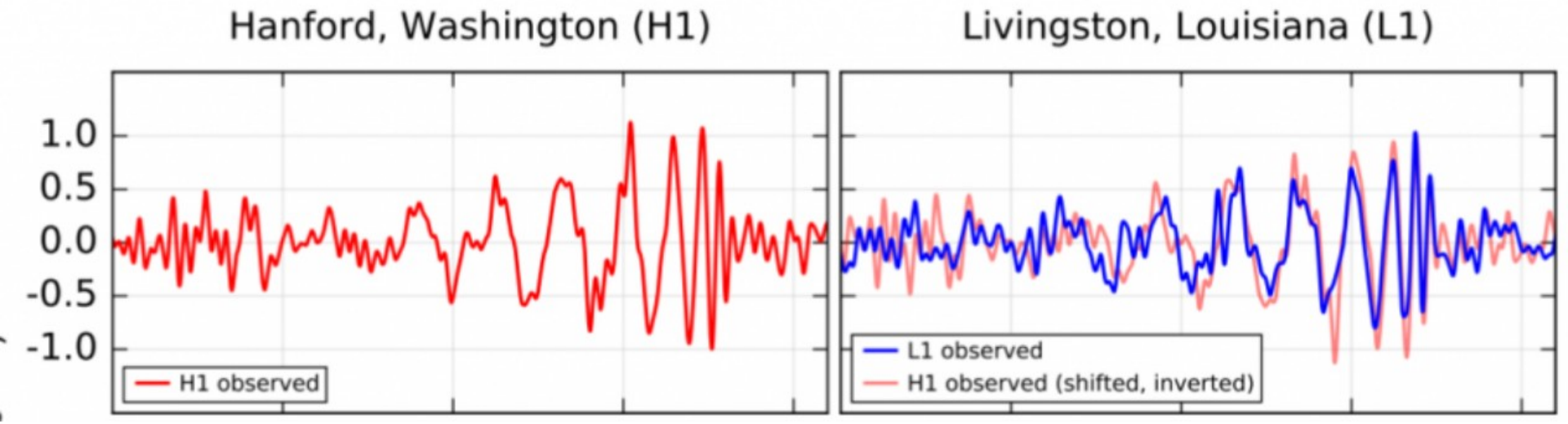
Archive data

Lack of interoperablity

Advances in Astrophysics







Not only new instrumentation

theguardian

Thursday 25 June 2015 12.09 BST

Big universe, big data, astronomical opportunity

The future of astronomy is not in acquiring new data, but in mining the old

Star cluster Messier 39 in the constellation Cygnus. New breakthroughs in astronomy may come about by looking at old data. Photograph: Alan Dyer/Alan Dyer/Stocktrek Images/Corbis

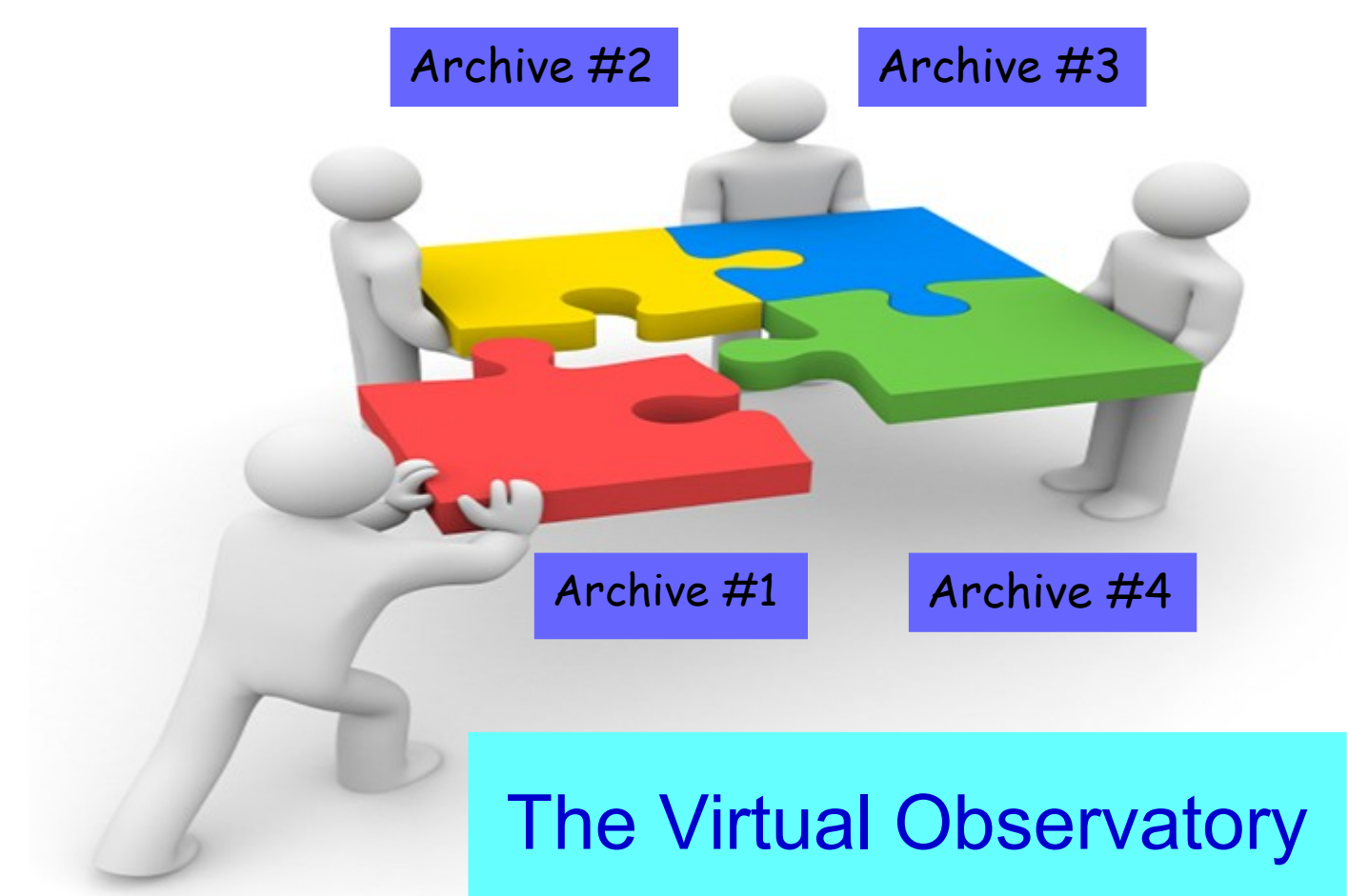
Data sharing

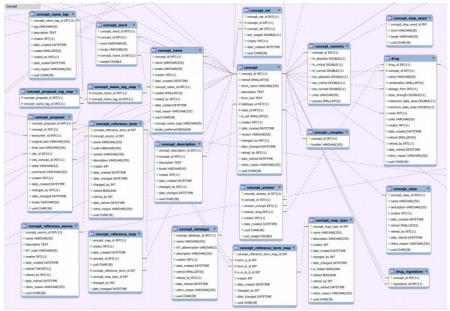
- Astronomy has been a pioneer in scientific data sharing:
  - A common data format since the 70s (FITS).
  - Open data (in general after a proprietary period).
  - Services driven by community needs (on-line archives).

NETWORKING

Networking is not enough

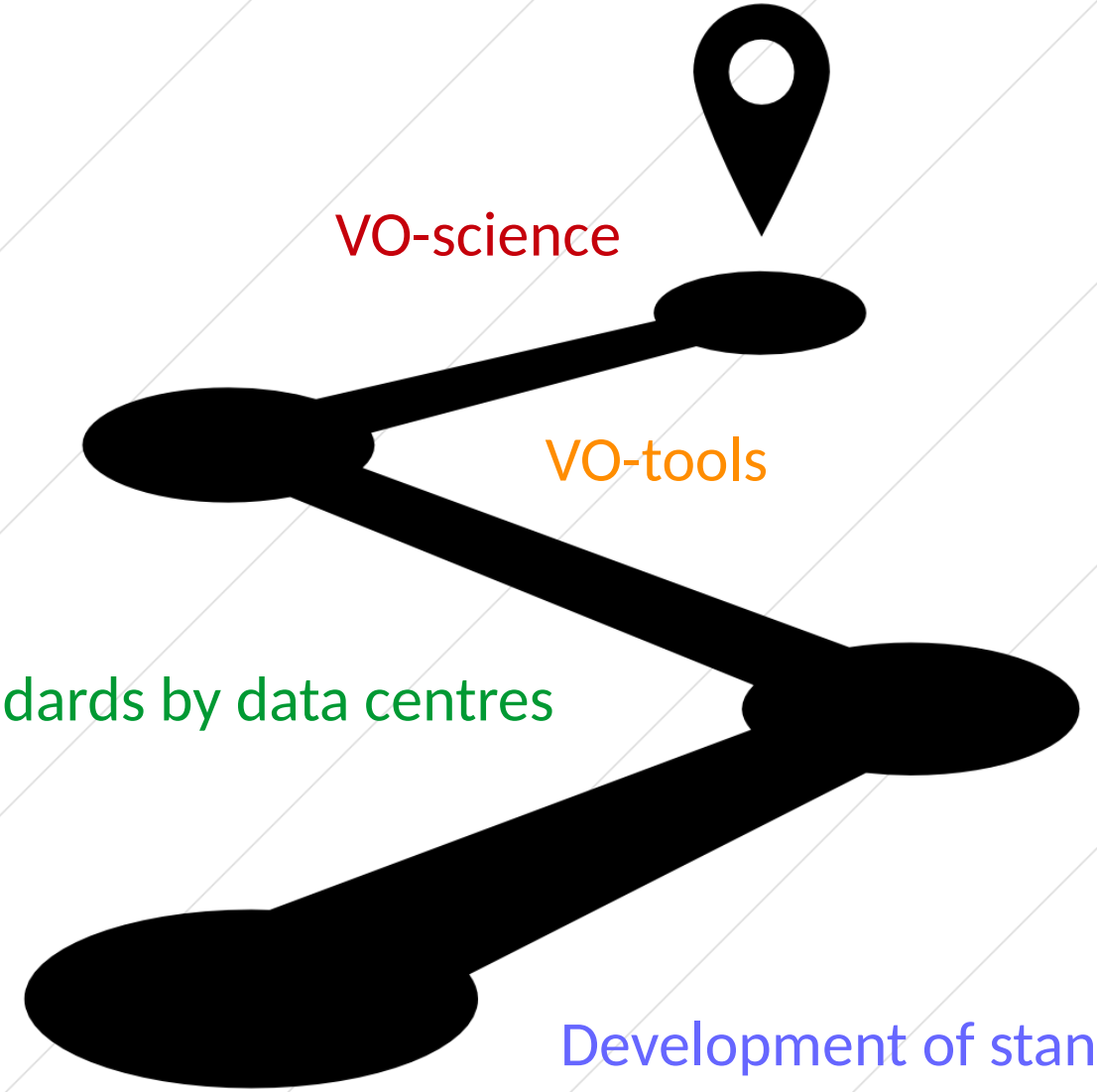
INTEROPERABILITY



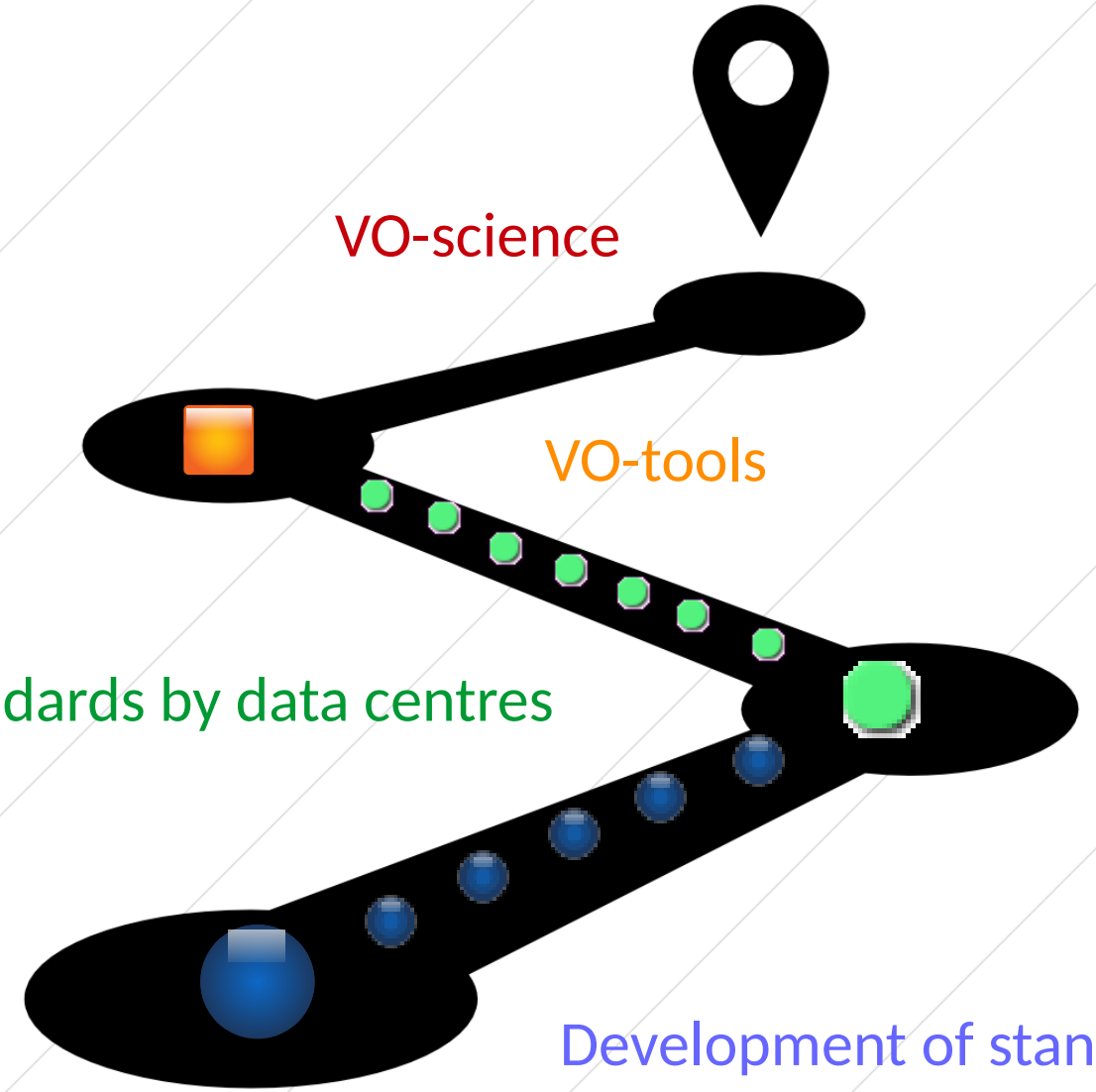


The Virtual Observatory

The VO roadmap

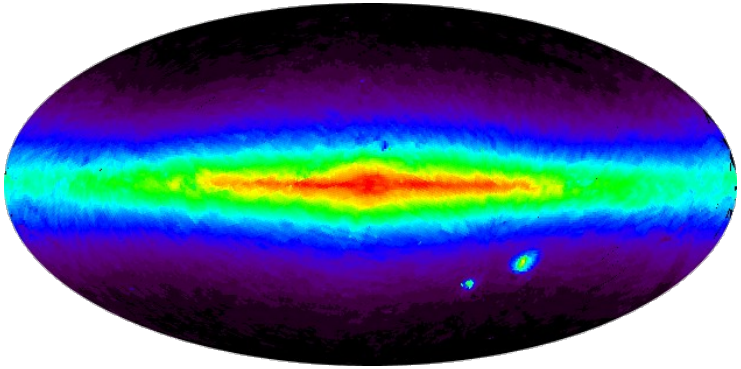


VO-tools


VO-science
VO-tools
Uptake of standards by data centres
Development of standards

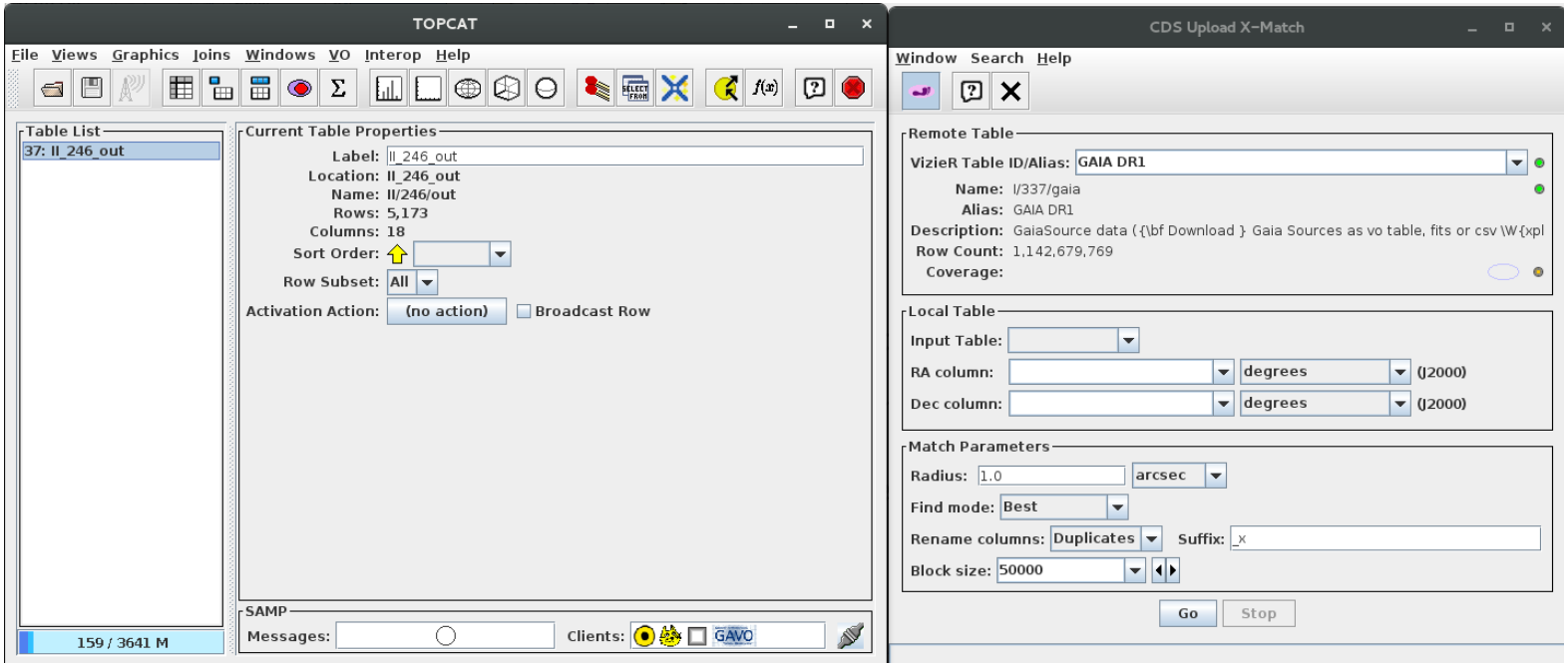
VO-tools (I)

- *"I have a list of objects, I want to get the (G-Ks) colour ."*



Gaia DR1
(1142679769 sources)

VO-tools (I)


TOPCAT
File Views Graphics Joins Windows VO Interop Help
Table List
37: II_246_out
159 / 3641 M
Current Table Properties
Label: II_246_out
Location: II_246_out
Name: II/246/out
Rows: 5,173
Columns: 18
Sort Order:
Row Subset: All
Activation Action: (no action)
Broadcast Row
SAMP
Messages:
Clients:
CDS Upload X-Match
Window Search Help
Remote Table
VizieR Table ID/Alias: GAIA DR1
Name: I/337/gaia
Alias: GAIA DR1
Description: GaiaSource data ({\bf Download } Gaia Sources as vo table, fits or csv \W{xpl
Row Count: 1,142,679,769
Coverage:
Local Table
Input Table:
RA column:
degrees
(J2000)
Dec column:
degrees
(J2000)
Match Parameters
Radius: 1.0
arcsec
Find mode: Best
Rename columns: Duplicates
Suffix: _x
Block size: 50000
Go
Stop


CDS X-Match Service
X-match
Tables management
Documentation
Choose tables to cross-match
e.g. VII/260/dr7qso, or select in list
VizieR
SIMBAD
My store
e.g. VII/233/xsc, or select in list
VizieR
SIMBAD
My store
Show options
Begin the X-Match

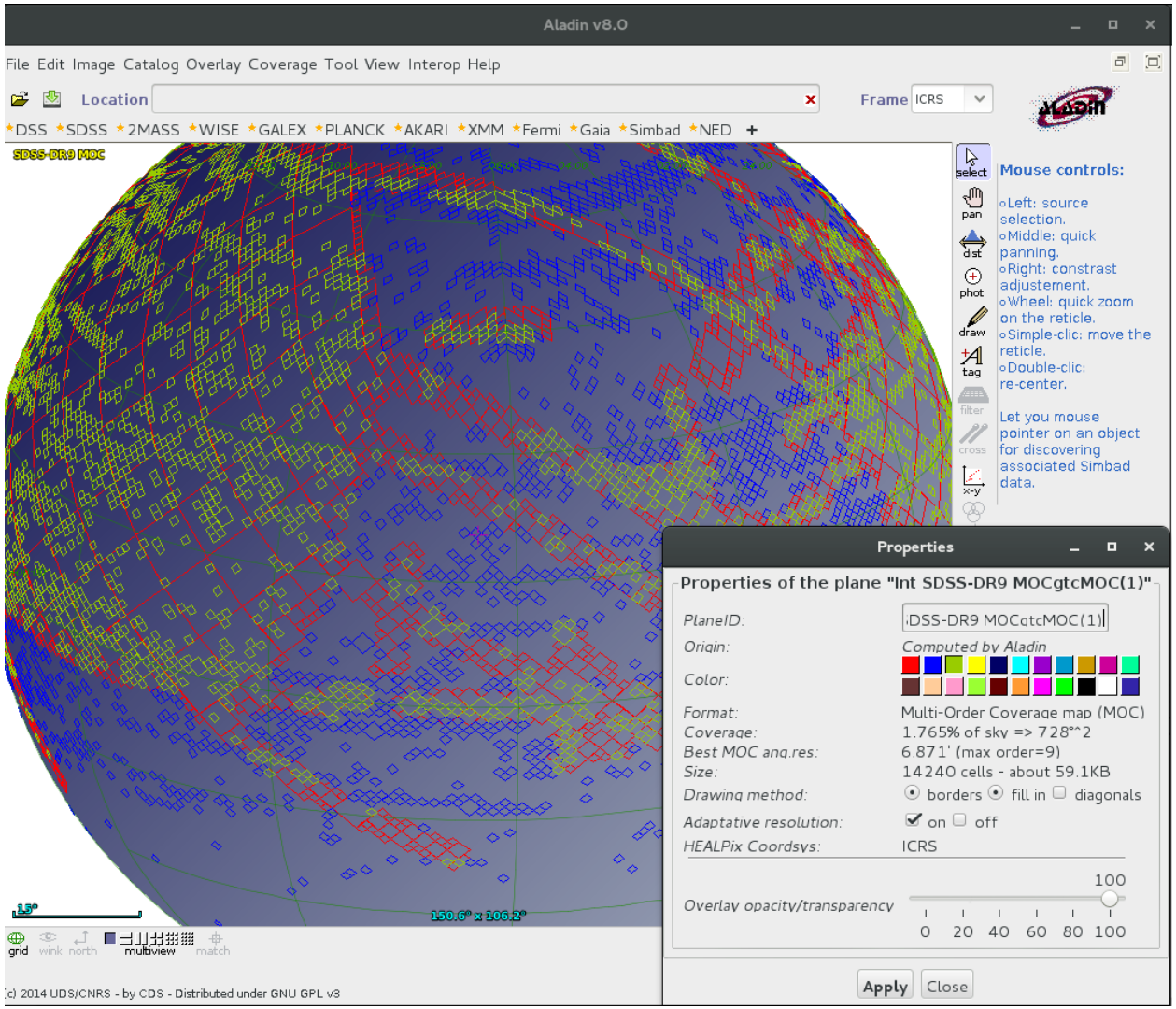
VO-tools (II)

International Virtual Observatory Alliance

HiPS – Hierarchical Progressive Survey

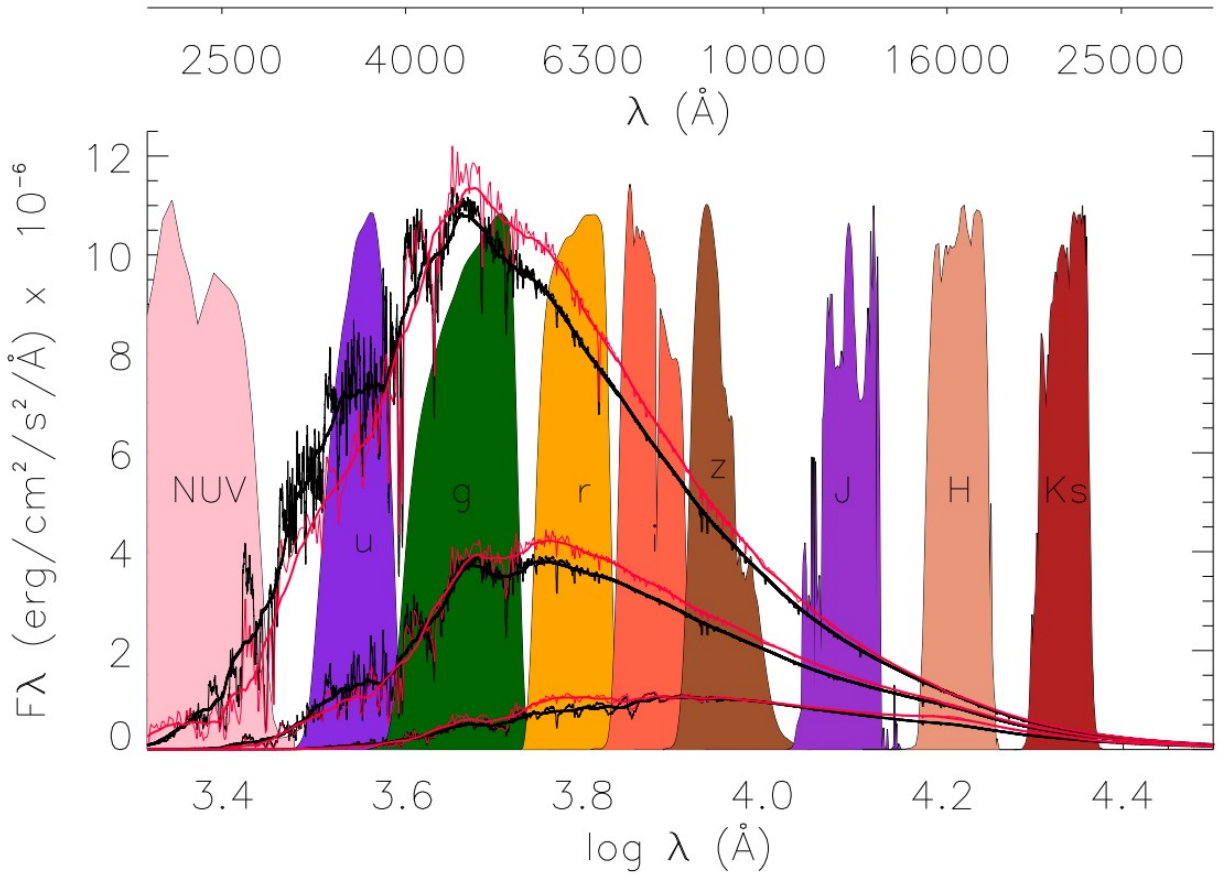
Version 1.0

IVOA Recommendation
19th May 2017



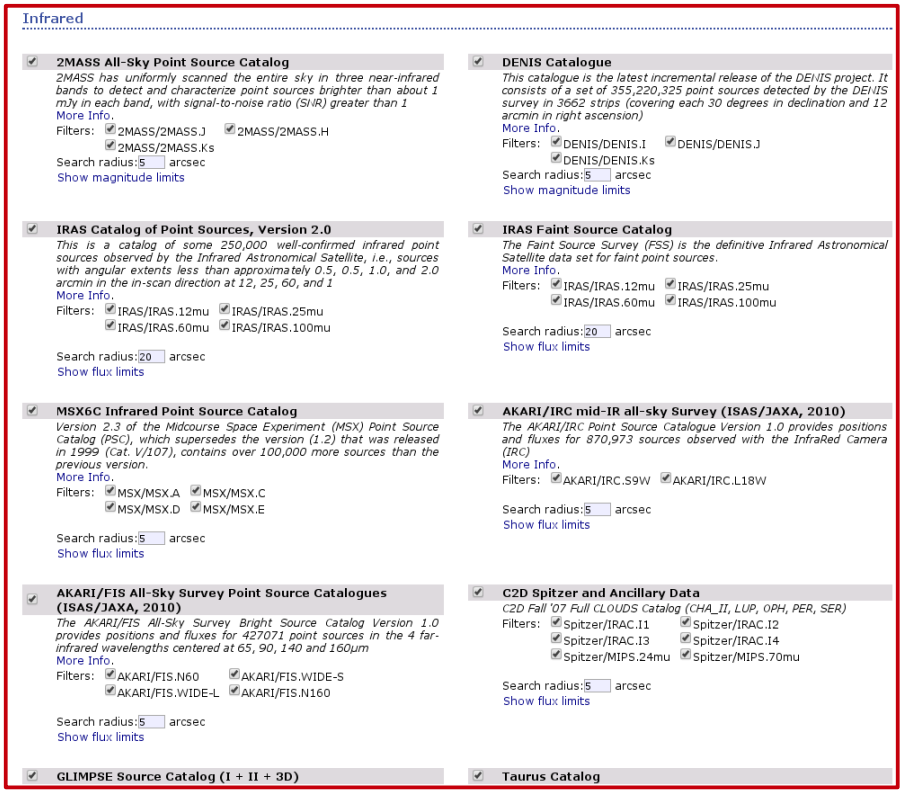
VO-tools (III)

- *"I want to estimate the effective temperatures of thousands of objects from SED fitting."*



VO-tools (III)

- **Discovery of information: Observational photometry and theoretical models.**



Infrared

2MASS All-Sky Point Source Catalog
2MASS has uniformly scanned the entire sky in three near-infrared bands to detect and characterize point sources brighter than about 1 mJy in each band, with signal-to-noise ratio (SNR) greater than 1
More Info.
Filters: 2MASS/2MASS.J 2MASS/2MASS.H 2MASS/2MASS.Ks
Search radius: 5 arcsec
Show magnitude limits

DENIS Catalogue
This catalogue is the latest incremental release of the DENIS project. It consists of a set of 355,220,325 point sources detected by the DENIS survey in 3662 strips (covering each 30 degrees in declination and 12 arcmin in right ascension)
More Info.
Filters: DENIS/DENIS.I DENIS/DENIS.J DENIS/DENIS.Ks
Search radius: 5 arcsec
Show magnitude limits

IRAS Catalog of Point Sources, Version 2.0
This is a catalog of some 250,000 well-confirmed infrared point sources observed by the Infrared Astronomical Satellite, i.e., sources with angular extents less than approximately 0.5, 0.5, 1.0, and 2.0 arcmin in the in-scan direction at 12, 25, 60, and 1
More Info.
Filters: IRAS/IRAS.12mu IRAS/IRAS.25mu IRAS/IRAS.60mu IRAS/IRAS.100mu
Search radius: 20 arcsec
Show flux limits

IRAS Faint Source Catalog
The Faint Source Survey (FSS) is the definitive Infrared Astronomical Satellite data set for faint point sources.
More Info.
Filters: IRAS/IRAS.12mu IRAS/IRAS.25mu IRAS/IRAS.60mu IRAS/IRAS.100mu
Search radius: 20 arcsec
Show flux limits

MSX6C Infrared Point Source Catalog
Version 2.3 of the Midcourse Space Experiment (MSX) Point Source Catalog (PSC), which supersedes the version (1.2) that was released in 1999 (Cat. V/107), contains over 100,000 more sources than the previous version.
More Info.
Filters: MSX/MSX.A MSX/MSX.C MSX/MSX.D MSX/MSX.E
Search radius: 5 arcsec
Show flux limits

AKARI/IRC mid-IR all-sky Survey (ISAS/JAXA, 2010)
The AKARI/IRC Point Source Catalogue Version 1.0 provides positions and fluxes for 870,973 sources observed with the InfraRed Camera (IRC)
More Info.
Filters: AKARI/IRC.S9W AKARI/IRC.L18W
Search radius: 5 arcsec
Show flux limits

AKARI/FIS All-Sky Survey Point Source Catalogues (ISAS/JAXA, 2010)
The AKARI/FIS All-Sky Survey Bright Source Catalog Version 1.0 provides positions and fluxes for 427071 point sources in the 4 far-infrared wavelengths centered at 65, 90, 140 and 160μm
More Info.
Filters: AKARI/FIS.N60 AKARI/FIS.WIDE-S AKARI/FIS.WIDE-L AKARI/FIS.N160
Search radius: 5 arcsec
Show flux limits

C2D Spitzer and Ancillary Data
C2D Fall '07 Full CLOUDS Catalog (CHA_II, LUP, OPH, PER, SER)
Filters: Spitzer/IRAC.I1 Spitzer/IRAC.I2 Spitzer/IRAC.I3 Spitzer/IRAC.I4 Spitzer/MIPS.24mu Spitzer/MIPS.70mu
Search radius: 5 arcsec
Show flux limits

GLIMPSE Source Catalog (I + II + 3D)

Taurus Catalog

AMES-Dusty 2000
The AMES-Dusty Model grid of theoretical spectra. Brown dwarfs/extrasolar planets atmosphere models without irradiation but including dust opacity (fully efficient dust settling). Wavelengths have been converted to air wavelengths.

AMES-Cond 2000
The AMES-Cond Model grid of theoretical spectra. Brown dwarfs/extrasolar planets atmosphere models without irradiation and no dust opacity (no dust settling). Wavelengths have been converted to air wavelengths.

Kurucz ODFNEW /NOVER models
ATLAS9 Kurucz ODFNEW /NOVER models. Newly computed ODFs with better opacities and better abundances have been used.

Husfeld et al models for non-LTE Helium-rich stars
Husfeld et al models for non-LTE Helium-rich stars

BT-Settl-CIFIST
The BT-Settl Model grid of theoretical spectra. With a cloud model, valid across the entire parameter range and using the Caffau et al. (2011) solar abundances. Wavelengths have been converted to air wavelengths.

BT-Settl
The BT-Settl Model grid of theoretical spectra; With a cloud model, valid across the entire parameter range. Wavelengths have been converted to air wavelengths.

BT-COND
The BT-COND Model grid of theoretical spectra. Brown dwarfs/extrasolar planets atmosphere models without irradiation and no dust opacity (no dust settling) but updated abundances. Wavelengths have been converted to air wavelengths.

BT-DUSTY
The BT-DUSTY Model grid of theoretical spectra. Brown dwarfs/extrasolar planets atmosphere models without irradiation but including dust opacity (fully efficient dust settling) and updated abundances. Wavelengths have been converted to air wavelengths.

BT-NextGen (AGSS2009)
The NextGen Model grid of theoretical spectra; Gas phase only, valid for Teff > 2700 K. Updated opacities. Wavelengths have been converted to air wavelengths.

BT-NextGen (GNS93)
The NextGen Model grid of theoretical spectra; Gas phase only, valid for Teff > 2700 K. Updated opacities. Wavelengths have been converted to air wavelengths.

Black Body
Black Body flux. Teff from 10 to 200000 K

Koester
The NextGen Model grid of theoretical spectra. Only for solar metallicity.

NextGen
The NextGen Model grid of theoretical spectra.

DRIFT-PHOENIX
Drift-Phoenix is a computer code that simulates the structure of an atmosphere including the formation of clouds. The code is part of the Phoenix-code family. Drift describes the formation of mineral clouds and allows to predict cloud details, like the size of the cloud particles and their composition

Morley 2012
Morley et al. 2012 T/Y dwarf models

Morley 2014
Morley et al. 2014 Y dwarf and exoplanet models

Saumon 2012
Saumon et al. 2012 T dwarf models

TMAP (Grid 1)
TMAP. Hydrogen+Helium NLTE Models

TMAP
TMAP. Hydrogen+Helium NLTE Models

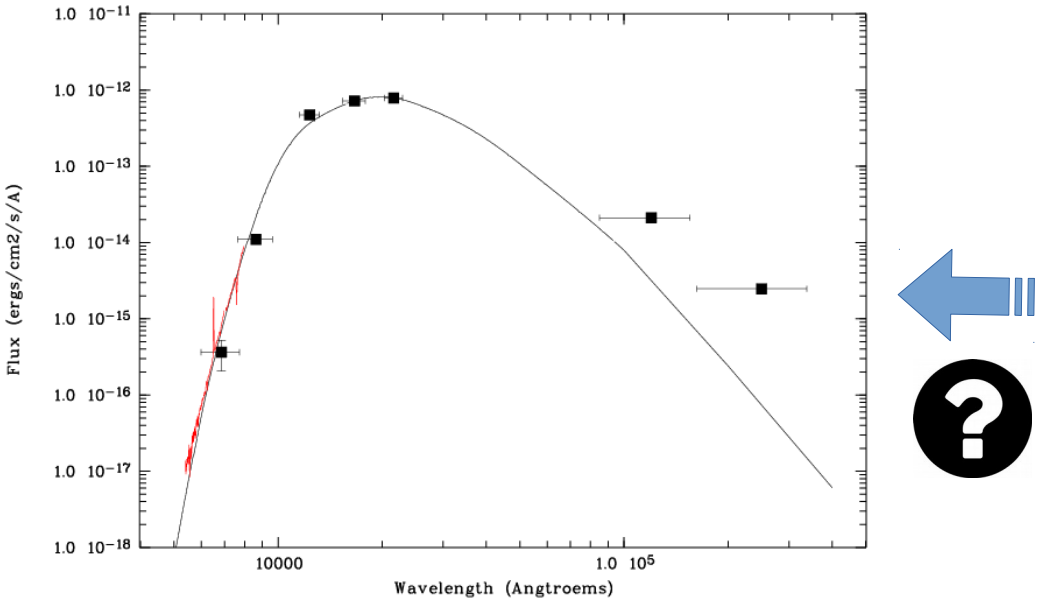
TMAP - Tubingen
Tubingen NLTE Model Atmosphere Package

GRAMS. C-rich grid

GRAMS. O-rich original grid

VO-tools (III)

- **Data Manipulation: From magnitudes to fluxes**



I/337/gaia Gaia DR1 (Gaia Collaboration, 2016
Post annotation GaiaSource data (**Download** Gaia Sc

start AladinLite

Full	RA_ICRS deg	DE_ICRS deg	<Gmag> mag
1	063.4107528711	-89.9888879972	17.965
2	037.5117084305	-89.9858176527	16.664
3	084.7593492719	-89.9781776713	18.553
4	081.5942616579	-89.9832765720	20.472
5	070.9024070024	-89.9715663343	19.829
6	060.8702751299	-89.9781334323	19.492
7	073.1733654732	-89.9817426647	20.019
8	027.3236159503	-89.9767950251	17.006
9	029.9573489468	-89.9759664621	18.649
10	020.0044580076	-89.9836077196	19.202

EUROPEAN SPACE AGENCY SCIENCE & TECHNOLOGY Search

GAIA DATA RELEASE DOCUMENTATION esa

Gaia Data Release 1 Documentation release D.0

[-] Gaia Data Release 1
Documentation release D.0
I Introduction to Gaia DR1

5 Photometry

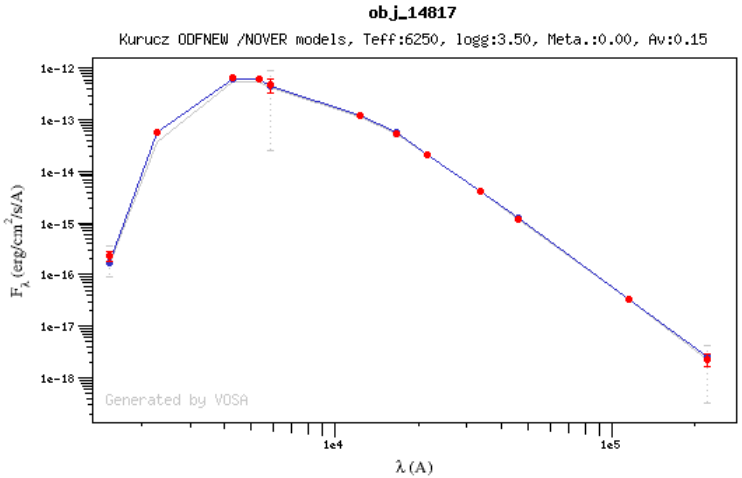
5.2 Properties of the input data 5.4 Processing steps

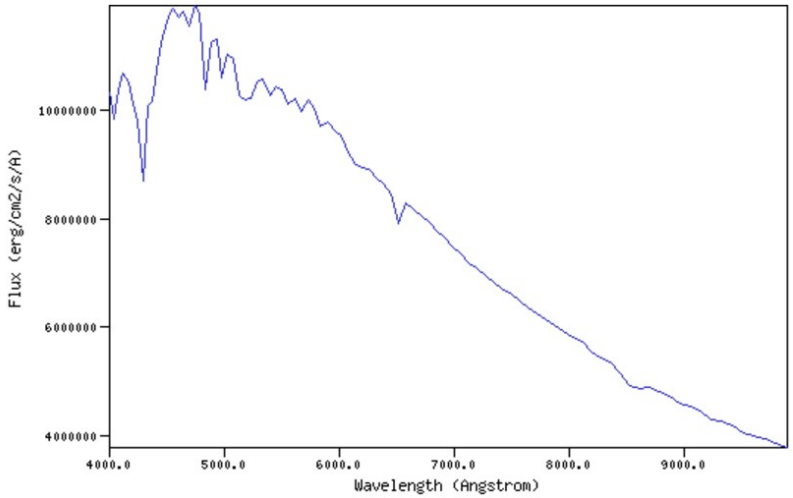
5.3 Calibration models

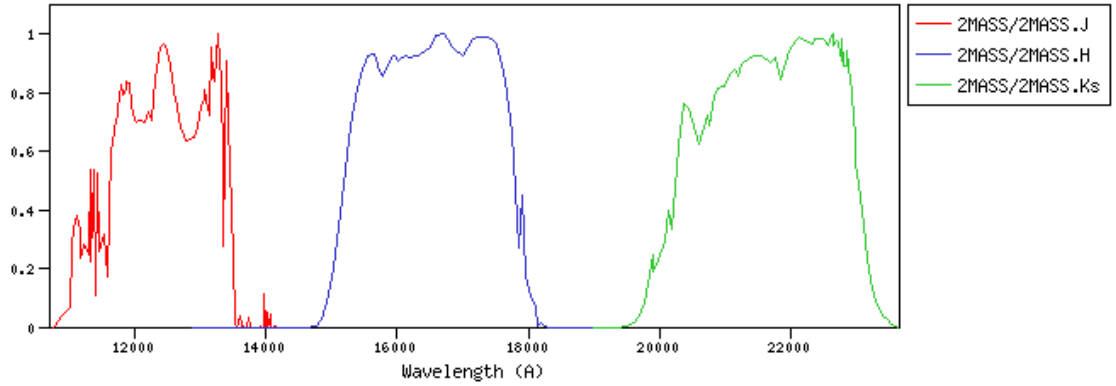
$$m_x = -2.5 \log_{10}\left(\frac{F_x}{F_{x,0}}\right)$$

VO-tools (III)

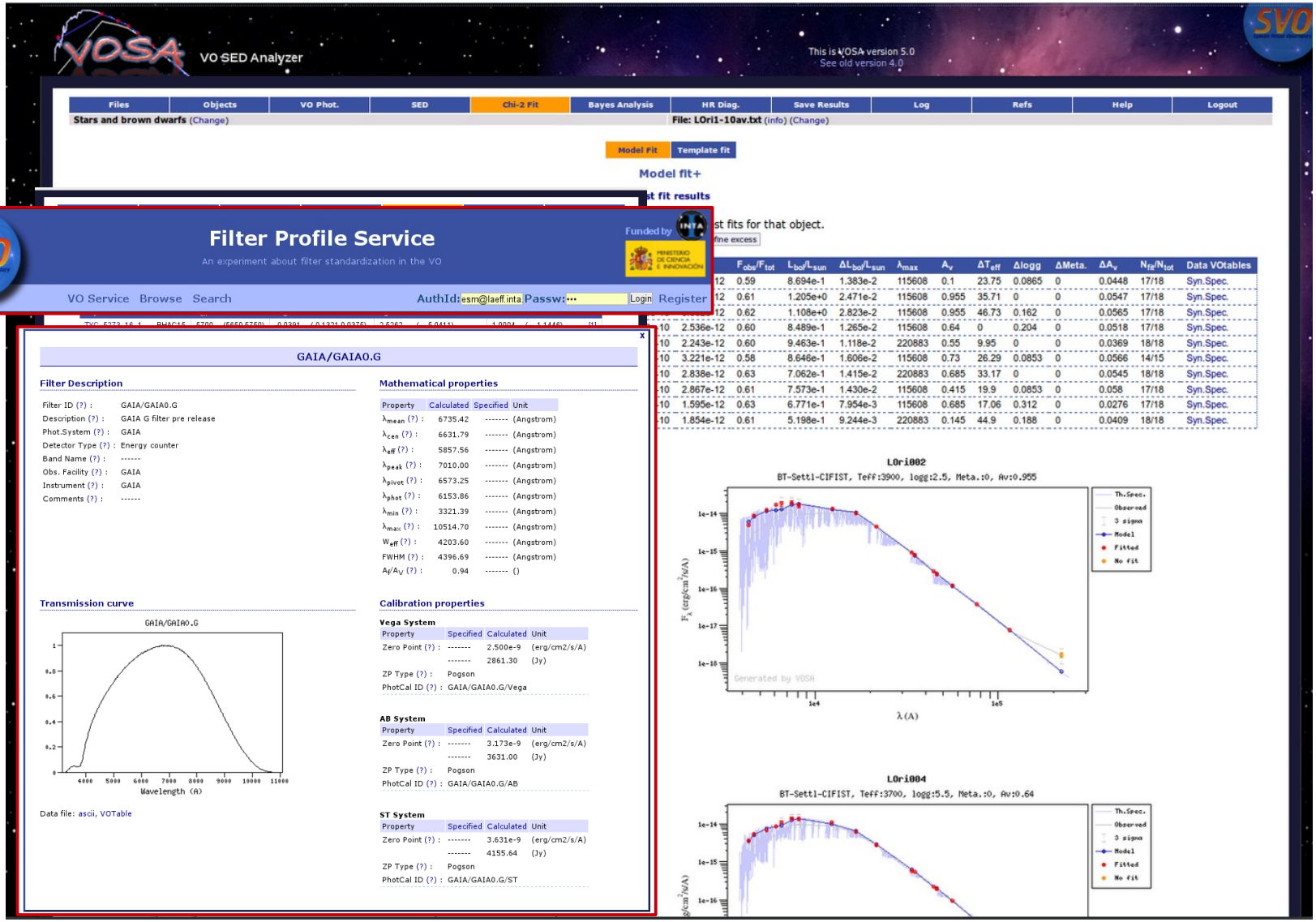
- **Data Manipulation: From theoretical spectra to synthetic photometry**



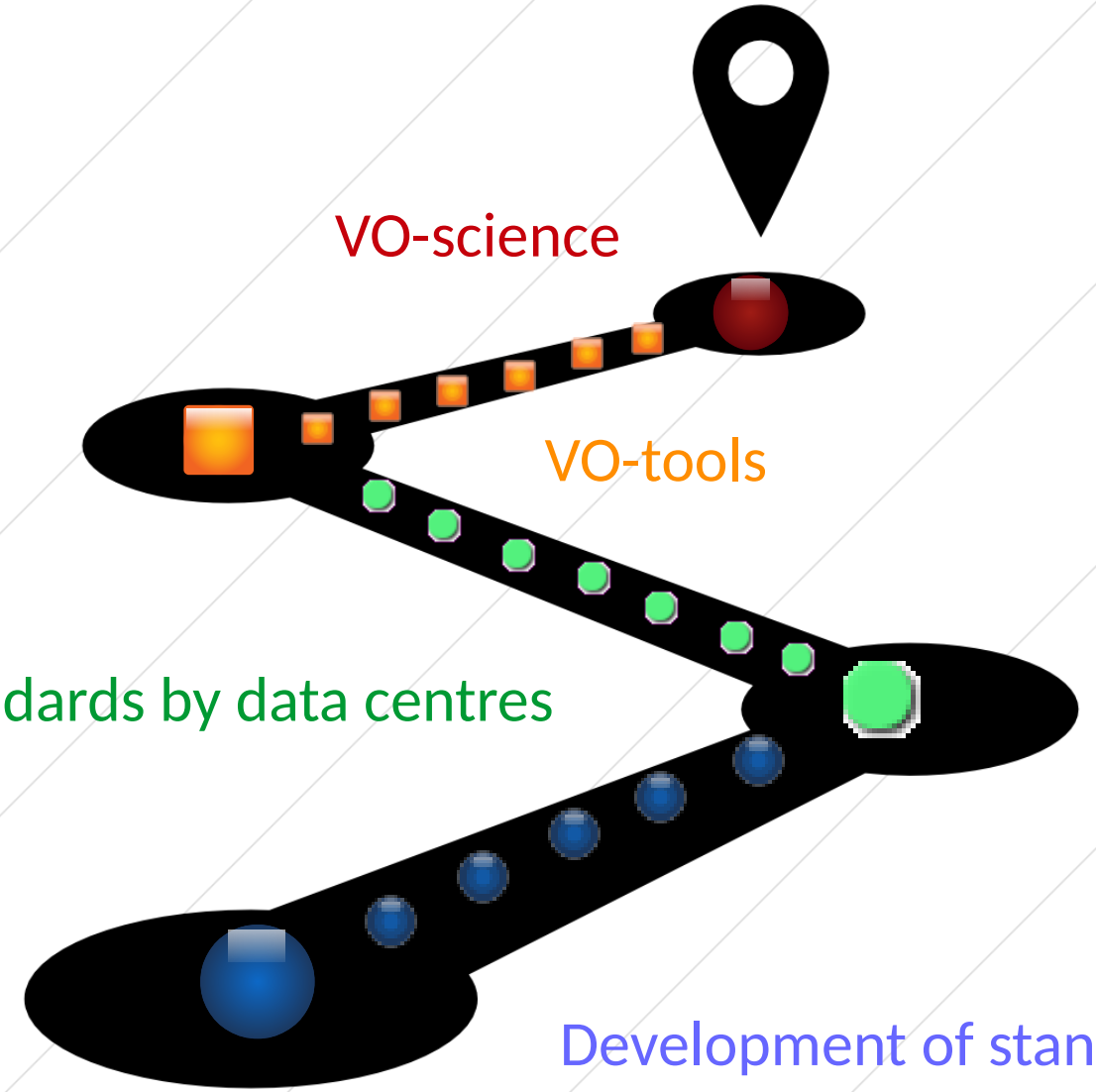




VO-tools (III)


VOSA
VO SED Analyzer
This is VOSA version 5.0
See old version 4.0
Files
Objects
VO Phot.
SED
Chi-2 Fit
Bayes Analysis
HR Diag.
Save Results
Log
Refs
Help
Logout
Stars and brown dwarfs (Change)
File: LOri1-10av.txt (info) (Change)
Model Fit
Template fit
Model fit+
Filter Profile Service
An experiment about filter standardization in the VO
Funded by
VO Service
Browse
Search
AuthId:esm@laeff.inta.
Passw:
Login
Register
GAIA/GAIA0.G
Filter Description
Filter ID (?) : GAIA/GAIA0.G
Description (?) : GAIA G filter pre release
Phot.System (?) : GAIA
Detector Type (?) : Energy counter
Band Name (?) : ------
Obs. Facility (?) : GAIA
Instrument (?) : GAIA
Comments (?) : ------
Mathematical properties
Property Calculated Specified Unit
λmean (?) : 6735.42 ------- (Angstrom)
λcen (?) : 6631.79 ------- (Angstrom)
λeff (?) : 5857.56 ------- (Angstrom)
λpeak (?) : 7010.00 ------- (Angstrom)
λpivot (?) : 6573.25 ------- (Angstrom)
λphot (?) : 6153.86 ------- (Angstrom)
λmin (?) : 3321.39 ------- (Angstrom)
λmax (?) : 10514.70 ------- (Angstrom)
Weff (?) : 4203.60 ------- (Angstrom)
FWHM (?) : 4396.69 ------- (Angstrom)
Aλ/AV (?) : 0.94 ------- ()
Transmission curve
GAIA/GAIA0.G
Wavelength (A)
Data file: ascii, VOTable
Calibration properties
Vega System
Property Specified Calculated Unit
Zero Point (?) : ------- 2.500e-9 (erg/cm2/s/A)
------- 2861.30 (Jy)
ZP Type (?) : Pogson
PhotCal ID (?) : GAIA/GAIA0.G/Vega
AB System
Property Specified Calculated Unit
Zero Point (?) : ------- 3.173e-9 (erg/cm2/s/A)
------- 3631.00 (Jy)
ZP Type (?) : Pogson
PhotCal ID (?) : GAIA/GAIA0.G/AB
ST System
Property Specified Calculated Unit
Zero Point (?) : ------- 3.631e-9 (erg/cm2/s/A)
------- 4155.64 (Jy)
ZP Type (?) : Pogson
PhotCal ID (?) : GAIA/GAIA0.G/ST
LOri002
BT-Settl-CIFIST, Teff:3900, logg:2.5, Meta.:0, Av:0.955
Th.Spec.
Observed
3 signa
Model
Fitted
No fit
Generated by VOSA
λ (A)
LOri004
BT-Settl-CIFIST, Teff:3700, logg:5.5, Meta.:0, Av:0.64

VO-science


VO-science
VO-tools
Uptake of standards by data centres
Development of standards

VO-schools

- Goal:
  - Teach participants on how to efficiently use the VO tools for their own research.
- Methodology:
  - Tutorials based on real science cases.
- Ample experience.

EURO VO

Asterics
Astronomy ESFRI & Research Infrastructure Cluster

- Madrid. Dec'15
- Strasbourg. Nov'16
- **Madrid. Nov'17**
- Strasbourg. 2018

- **Not restricted to project's partners.**
- **Open to all European institutes.**

VO-projects

Hide highlights | Show abstracts

2017MNRAS.466.2983G 2017/04

Discovery of wide low and very low-mass binary systems using Virtual Observatory tools

Gálvez-Ortiz, M. C.; Solano, E.; Lodieu, N. *and 1 more*

> *Discovery of wide low and very low-mass binary systems using Virtual Observatory tools theoretical models. Taking advantage of the virtual observatory capabilities, we looked for comoving low*

2017A&A...598A..92L 2017/02

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

Lodieu, N.; Espinoza Contreras, M.; Zapatero Osorio, M. R. *and 4 more*

> *New ultracool subdwarfs identified in large-scale surveys using Virtual Observatory tools as part of the Virtual Observatory tools. We considered different photometric and proper motion criteria*

2017A&A...597C...3L 2017/01

New ultracool subdwarfs identified in large-scale surveys using Virtual Observatory tools (Corrigendum). I. UKIDSS LAS DR5 vs. SDSS DR7

Lodieu, N.; Espinoza Contreras, M.; Zapatero Osorio, M. R. *and 3 more*

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

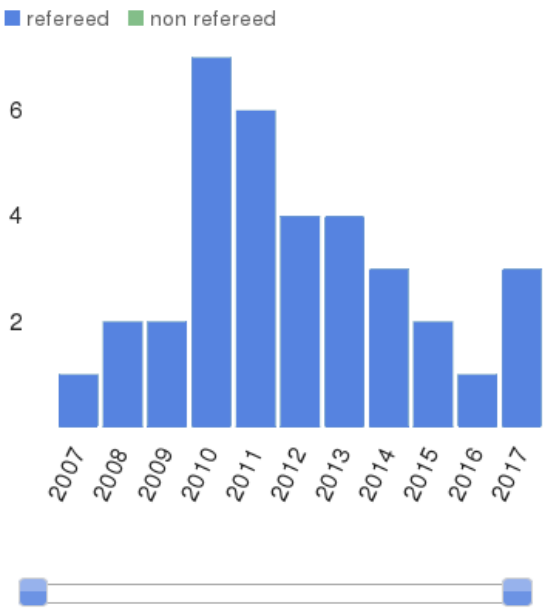
2016MNRAS.457.3396P 2016/04

A search for new hot subdwarf stars by means of virtual observatory tools II

Pérez-Fernández, E.; Ulla, A.; Solano, E. *and 2 more*

35 selected | clear all

Years | Citations | Reads



Limit results to papers from 2007 to 2017 Apply

Summary

New data

Archive data

Standards

Tools

Science

Discovery of wide low and very low-mass binary systems using Virtual Observatory tools

M. C. Gálvez-Ortiz ✉, E. Solano ✉, N. Lodieu, M. Aberasturi

Mon Not R Astron Soc (2017) 466 (3): 2983-3006.
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