

VO Archives at LAEFF

Contact Person

Raúl Gutiérrez
raul@laeff.inta.es

Web Site

http://sdc.laeff.inta.es



Description

Having an astronomical archive integrated in the VO framework constitutes an added value of enormous importance for an astronomical project.

All archives of the LAEFF astronomical data centre (the largest managed by a Spanish institution –INTA–) are VO-compliant. LAEFF has participated in the development of the European VO since its conception. INES, one of the first VO-compliant spectroscopic archives in the world, is a good example of this.

At present, LAEFF is responsible for the development of the VO Science archives of the COROT mission, the Calar Alto observatory and the GTC telescope.



SVO: The Spanish Virtual Observatory

http://svo.laeff.inta.es

The IRAM-30m VO Archive

Contact Person

José Enrique Ruíz
jer@iaa.es

Web Site

<http://www.iaa.es/AMIGA.html>
<http://www.iram.es>



Telescope

IRAM 30m radio telescope is located in Sierra Nevada near Granada. Operational since 1981 under the collaboration of IGN (Spain), CNRS (France) and Max Planck Institute (Germany), it covers three spectral bands in radio frequencies 80-115 GHz, 130-183 GHz y 200-280 GHz where mostly molecular rotational transitions can be detected. Heterodyne receivers allow observations in four frequencies at the same time, including bolometric observations in wide band (100 GHz)

Project

In late 2006 the AMIGA group (IAA-CSIC), in collaboration with IRAM, undertakes the development of IRAM 30m VO Archive, with VO services associated and a user-friendly query web interface, expected to be fully operational in late 2008.

Data

Observations associated to more than 200 scientific projects are carried out each year in this radio telescope, complemented with technical observations of calibration, pointing, flux monitoring, etc. This generates more than 1 TByte of data. The VO Archive is filled in real time thanks to a *datafiller* developed in Python scripting.

Policy

- All metadata associated to observations will be public
- Only project PI will be allowed to access their own data
- Restricted access to *Admin interface*

Technologies

- Web Server: Apache 2
- Database: MySQL 5
- Python Framework: Django
- VO Services: Conesearch, SSAP



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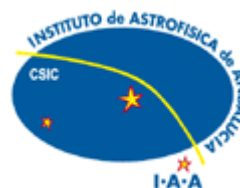
The AMIGA VO Catalogue

Contact Person

José Enrique Ruíz
jer@iaa.es

Web Site

<http://www.iaa.es/AMIGA.html>



AMIGA

We are producing and analysing a multiwavelength database for a refinement of the pioneering Catalogue of Isolated Galaxies (CIG: Karachentseva 1973) including optical, IR and radio line and continuum measurements in order to characterise all phases of the interstellar medium. The AMIGA (Analysis of the interstellar Medium of Isolated GALaxies) project involves the identification and study of a statistically significant sample of the most isolated galaxies in the local Universe, an exhaustive multiwavelength study of a complete sample of ~1000 isolated objects.

Data & VO Interface

The AMIGA Catalogue is fully accessible from a web interface and also offers Conesearch VO service. In web access interface, the data can be requested either searching by object or using any combination of parameters in order to produce your own subsample, in HTML, ASCII or VOTable format. The AMIGA Catalogue has been registered in the DCA Census of European Data Centres and has been developed under VO standards.

Technologies

- Web Server: Apache 2
- Database: MySQL 5
- PHP 5 Scripting
- VO Services: Conesearch

The screenshot displays the AMIGA web interface. At the top, the title 'AMIGA' is shown next to the subtitle 'Analysis of the Interstellar Medium of Isolated GALaxies'. Below this, there is a navigation menu on the left with items like 'Home', 'The Project', 'Science', 'Technical development', 'Team and collaborators', 'Results & Ongoing Work', 'Publications', 'Conferences', 'Public Data', 'VO Interface', 'ASCII Files', and 'Links'. A search bar is also present. The main content area is titled 'VO Interface' and offers two search methods: 'Query by name' and 'Query by parameters'. Under 'Search by name', there are 'submit' and 'reset' buttons, an 'Object Name' input field with an example '(Ex: CIG 4, UGC 00297, CIG 4%, etc..)', and an 'Or/and Input a File' section with an 'Examinar...' button and a note '(Text file with a name per line)'. The 'Output Options' section includes a 'Fields' list with checkboxes for 'Coords', 'Optical', 'Velocity', 'Morphology', 'FIR', and 'Isolation', all of which are checked. Other options include 'Equinox' set to 'J2000', 'Image preview?' with 'Yes' selected, 'Order by' set to 'Ascen.', and 'Output Format' with 'HTML' selected. 'submit' and 'reset' buttons are at the bottom.



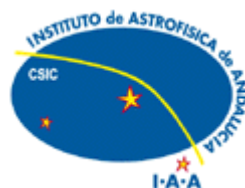
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<http://svo.laeff.inta.es>

The DSS-63 VO Archive

Contact Person

José Enrique Ruíz
Ricardo Rizzo, José Manuel Alacid
jer@iaa.es,
ricardo@laeff.inta.es, jmalacid@laeff.inta.es



Web Site:

<http://www.iaa.es/AMIGA.html>
<http://www.laeff.inta.es>

Telescope

The "Madrid Deep Space Communication Complex" (MDSCC), located in Robledo de Chavela (Madrid), is one of the three tracking stations comprising the Deep Space Network (DSN) of JPL-NASA. The station DSS-63 (70m in diameter) is the largest antenna in MDSCC. According to an international agreement, up to 5% of its operational time is routinely scheduled for radioastronomical observations in K-band (18 to 26 GHz). This band includes H₂O maser, metastable NH₃ lines, methanol, and CCS, among others.

Project

In late 2007 the AMIGA group (IAA-CSIC), in collaboration with LAEFF-INTA undertook the development of the DSS-63 VO Archive, with VO services associated and a user-friendly query web interface, expected to be fully operational in late 2008. A year before, the first VO datamodel for radio astronomy observations (RADAMS) was designed inside AMIGA based on the DSS-63 antenna, and published later as an IVOA note.

Data

Every year, raw and reduced data associated to observations made by DSS-63 are saved in *logfile*s and FITS files. The VO Archive is filled thanks to a *datafiller* developed in Python scripting which also converts DSS-63 FITS files to standard spectral FITS format readable by VO tools.

Policy

- Data will be public one year after the observation
- Restricted access to *Admin interface*

Technologies

- Python Scripting
- VO Services: Conesearch, SSAP



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<http://svo.laeff.inta.es>

The AXIS Archive

Contact Person

María Teresa Ceballos
ceballos@ifca.unican.es

Web Site:

<http://venus.ifca.unican.es/~xray/AXIS>



Description

IFCA (as part of the XMM-Newton Survey Science Centre -SSC-Consortium) is the responsible for the elaboration of an X-ray serendipitous survey named AXIS which includes 36 fields observed by the XMM Newton satellite. An optical follow-up focused on the medium flux sources has been done using different facilities. Using quality criteria, 25 fields have been selected from the AXIS sample to comprise the XMS (X-ray Medium Sensitivity Survey), a flux limited sample in several X-ray bands. It contains 319 unique X-ray sources, optically identified to a level above 90%. Among the products obtained from this work there are optical spectra and finding charts in different optical filters, as well as X-ray spectra and images. Additional information like magnitudes, fluxes, redshifts, extension, etc,... is also included.

Currently we are in the process of publishing all this information in VO using the ESAVO DALToolkit application. After this, all the XMS fields will be publicly available through our web pages.

XID sources in A1837 (currently in XMS sample)

A1837 sources in XID sample	A1837 sources in Soft sample	A1837 sources in Hard sample	A1837 sources in Ultra Hard sample	A1837 sources in Total (non excluded) sample	A1837 excluded sources
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Warning: the optical data for the counterparts of those X-ray sources with Flux below the flux limit (white background cells) must be used with caution since they have not been totally checked

#	RA (J2000)	DEC (J2000)	Par (")	XMM count XMM JAJ(armetotal) (tag)	Flux XID (10 ⁻¹⁴ W/m ²)	XMS samples	Finding Charts ug r i v z H R G H A E	Obs	EX	RA	DEC	Dist	ID [*]	z	Type/Subtype	Optical Information					Comments
																mag	err	u	g	r	
001	14:01:01.79	-11:12:23.10	0.083	2XMM J140101.8-111223 (1)	58.870	SXHL-	Ugriz-----E	A	Y	14:01:01.84	-11:12:22.71	0.7/8.6	Y	0.037	BLAGN	u:18.3 g:17.5 r:16.6 i:16.2 z:15.4 RB:1.2/1.3.5	u	Strong and broad H α , and possibly broad H β . Member of foreground cluster. [ABELL 1837;H0981432][XBSJ140102.0-111224]			
002	14:02:19.55	-11:04:58.65	0.219	2XMM J140219.6-110459 (0)	15.040	SX---	Ugriz-----E	A	N	14:02:19.58	-11:04:56.68	2.0/9.3	Y	0.000	ACKO	RB:10.5/9.9		[HD122473][XBSJ140219.6-110458]			
014	14:00:49.47	-11:07:38.55	0.328	2XMM J140049.5-110738 (0)	7.455	SX---	Ugriz-----E	A	N	14:00:49.55	-11:07:37.60	1.4/4.4	Y	0.000	Star	u:15.2 r:11.8 RB:10.8/12.0	Δ	He-e!?			
010	14:00:59.91	-11:09:41.09	0.257	2XMM J140059.9-110940 (0)	6.809	SXHL-	Ugriz-----E	A	Y	14:00:59.94	-11:09:40.72	0.6/2.2	Y	0.165	NELG	u:20.7 g:20.3 r:19.3 i:18.8 z:18.2 RB:18.8/9.2	ΔE	H α , [SII], H β , [OII], [OIII] [XBSJ140100.0-110942] BLAGN in XBS based on dilution and unabsorbed X-ray spectrum			
044	14:00:43.96	-11:00:34.81	0.444	2XMM J140044.0-110034 (1)	4.361	SXHL-	Ugriz-----E	A	Y	14:00:44.10	-11:00:34.13	2.2/5.0	Y	1.695	BLAGN	u:22.9 g:21.4 r:20.9 i:20.5 z:20.3 RB:??2.0	∇	CIII], MgII			
				2XMM J140043.99-110037.81	3.066.8		Ugriz-----E	B	Y	14:00:43.99	-11:00:37.81	3.0/6.8				u:22.8 g:24.4 r:23.3 i:21.8 z:21.2					
				2XMM J140031.56-110718																	

References

- Carrera et al. 2007 A&A, 469,27
- Barcons et al 2007, A&A, 476, 119



SVO: The Spanish Virtual Observatory
<http://svo.laeff.inta.es>

The LAEFF VO Theoretical Data Server

Contact Person

Carlos Rodrigo, Miguel Cerviño
crb@laeff.inta.es, mcs@iaa.es

Web Site:

<http://sdc.laeff.inta.es>



Context

There are many fields in Astrophysics with a strong need of direct and rigorous comparisons between theoretical models or simulations and real data. However, the different architectures, programming codes, formats, etc, make it, most of the times, extremely difficult and inefficient.

Lines of work

- VO protocols: The VO protocols defined for observational data (Conesearch, SSAP, SIAP,...) are based on absolute positions on the sky and, in most cases, cannot be applied to theoretical models.
SVO in collaboration with ESA-VO defined TSAP which has become a standard to access theoretical spectra in the VO framework. Also a new protocol (Simple Self-described Service protocol, or S3), based in the same dialog philosophy than TSAP, has been proposed as a simple solution to implement an access service for theoretical models in general.
- Implementation of theoretical data servers: Using the protocols described above, we have implemented a number of services now available in the VO.
- We have also developed an application (S3wizard) to facilitate the publication of theoretical data in the Virtual Observatory.

The screenshot displays two parts of the SVO interface. The top part shows the 'Allard, NextGen' model grid, which is a plot of flux versus wavelength. The plot includes a legend with four entries: 'NextGen Teff=17000, logg=3.5', 'NextGen Teff=17000, logg=4.0', 'NextGen Teff=17000, logg=4.5', and 'NextGen Teff=17000, logg=5.0'. The bottom part shows the 'S3 Wizard' interface for 'Kurucz ODFNEW /NOVER models'. It contains a table with columns: Model, Read File, Params, Data, Curation, Credits, and Delete. Below the table is a form with fields for Identifier, Title, Short descrip, Long descrip, Data files path, and Active, along with a 'Save Model' button.



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VO-Science:

Characterization of star-forming regions (I)

Contact Person

José Antonio Caballero, Enrique Solano
caballero@astrax.fis.ucm.es, esm@laeff.inta.es



Science case

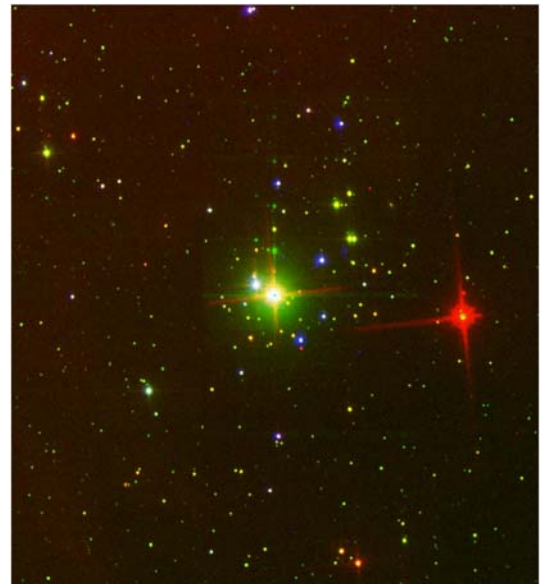
The knowledge of the frequency and characteristics of brown dwarfs is essential for the most advanced scenarios of fragmentation of molecular clouds and very low-mass star formation.

Although significant fractions of star-forming regions are being screened by deep and wide photometric surveys (e.g. Chamaeleon, Ophiuchus, σ Orionis, Pleiades, Hyades...), there are still large areas of these regions with a very incomplete knowledge of the stellar/substellar population. New locations are necessary to compare substellar mass functions, spatial distributions or disc frequencies as well as to look for new brown dwarfs and planetary-mass objects.

VO aspects

Assessing the properties of objects in star-forming regions often implies working in a multiparameter space handling information of very different nature (spectra, images, catalogues...). The Virtual Observatory has proved to be very efficient to tackle such a type of problems.

Using this methodology we have analyzed the stellar and high-mass substellar population in the Orion belt, in particular, around Anilam (ϵ Ori) and Mintaka (δ Ori) and σ Ori.



References

- Caballero 2007, A&A 466, 917
- Caballero 2008, A&A 478, 667
- Caballero & Solano 2008 A&A, 485, 931



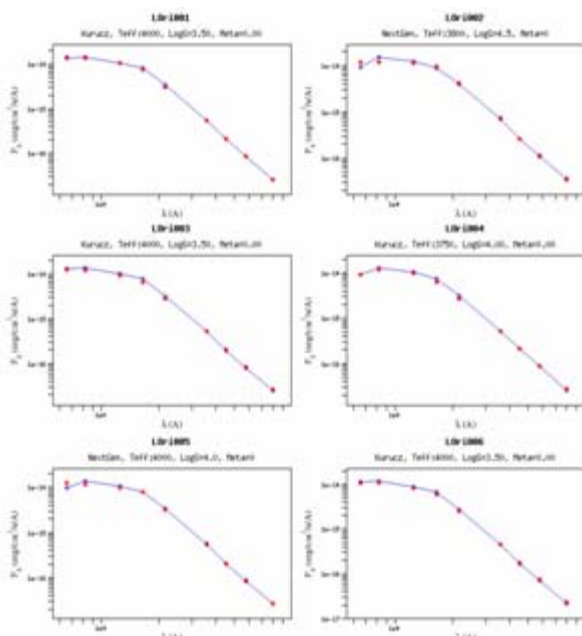
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<http://svo.laeff.inta.es>

Characterization of star-forming regions (II). The case of Collinder 69

Contact Person

David Barrado, Amelia Bayo

barrado@laeff.inta.es, abayo@laeff.inta.es



Example of SED fit for some sources

Science case

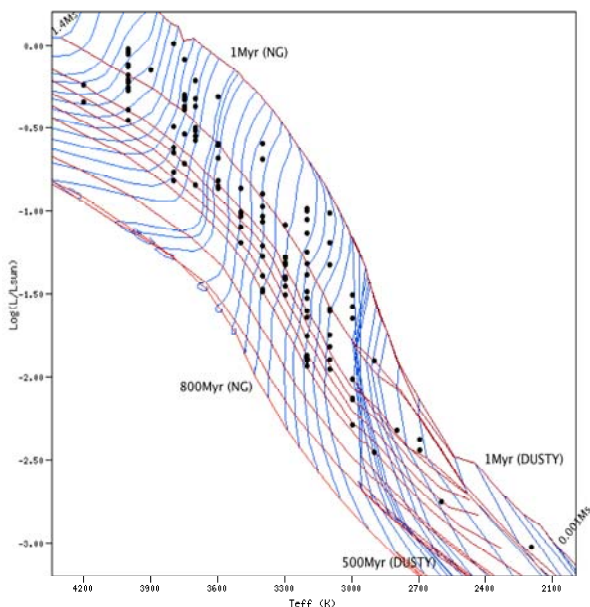
One very interesting Star Forming Regions is associated to the O8III star λ Orionis (located at about 400 pc, presenting very low extinction in its inner area and with a previously estimated age of 5-20 Myr).

Our goal is to determine physical parameters and properties of a large sample of candidate members of this cluster by comparing their SEDs with theoretical models.

Studying the physical parameters of a large population of sources belonging to the same cluster is advantageous, since we can infer properties not only of the individual sources but also of the association as a whole, for example its age, since we can assume that all objects are coeval.

Trying to compile all the information available for each object and then compare the built SED with all the available models one by one with classical methodologies can be very tedious and time consuming, Instead, we have used VOSA¹, to perform these tasks in an automatic manner.

¹<http://www.laeff.inta.es/svo/theory/vosa2>



HR diagram built by VOSA for the members of C69.

The results

- We have determined effective temperatures, gravities, bolometric luminosities, and in most of the cases, masses and ages for 167 candidate members of Collinder 69.
- We have independently confirmed the classification from Barrado y Navascués et al. (2007) of non-members for 16 of the sources of the sample, and we have added a new possible non-member to this list.
- We have derived an upper-limit for the age of the association of 12.3-16 Myr consistent with previous estimations in the literature.



References

- Bayo et al. 2008, A&A (submitted)

Discovery of accreting very low-mass objects

Contact Person

Luisa Valdivielso, Eduardo Martín
Enrique Solano
lval@iac.es, ege@iac.es
esm@laeff.inta.es



Science case

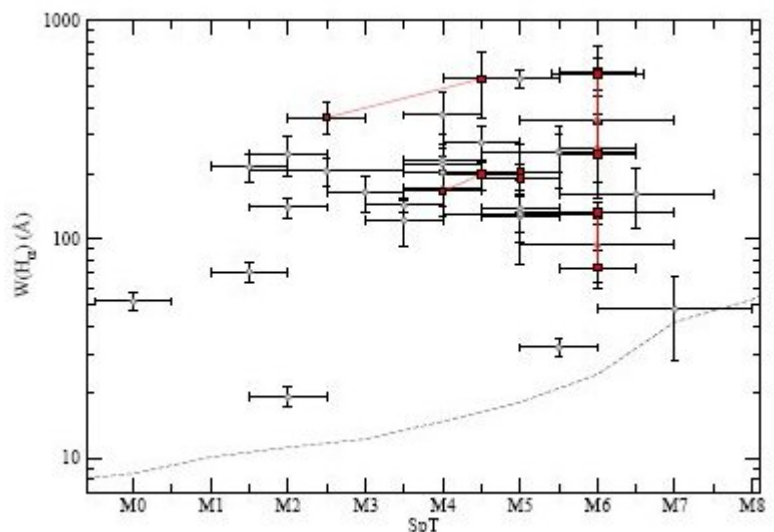
Due to mass accretion processes, many young very low-mass (VLM) stars and brown dwarfs show H α emission stronger than that expected from chromospheric activity. H α surveys have, thus, the potential to identify very young objects still accreting material from their disks.

So far the overwhelming majority of surveys for young VLM objects concentrate on nearby star-forming regions and young clusters. IPHAS is a photometric survey covering 1800 squares degrees of the northern Milky Way in the latitude range $-5^\circ < b < 5^\circ$ and providing (Sloan) r' , i' and narrowband H α photometry down to a limiting magnitude of $r'=20$ (10σ). IPHAS gives, for the first time, the opportunity of identifying young VLM candidates over a large area and far from known star-forming regions. The existence of such objects is of high interest for understanding the formation of very low-mass stars and brown dwarfs.

VO aspects

Using VO tools (Aladin¹) we have cross-correlated the IPHAS point source catalogue with 2MASS selecting the potential candidates on the basis of their near-infrared colours and H α emission. Follow-up spectroscopic observations were carried out for 113 candidates. 23 bona-fide VLM objects were identified.

¹ <http://aladin.u-strasbg.fr/aladin.gml>



References

- Valdivielso et al. 2008, A&A (accepted)

VO-Science: Search for hot subdwarfs

Contact Person

Ana Ulla, Enrique Solano
ulla@uvigo.es, esm@laeff.inta.es



Science case

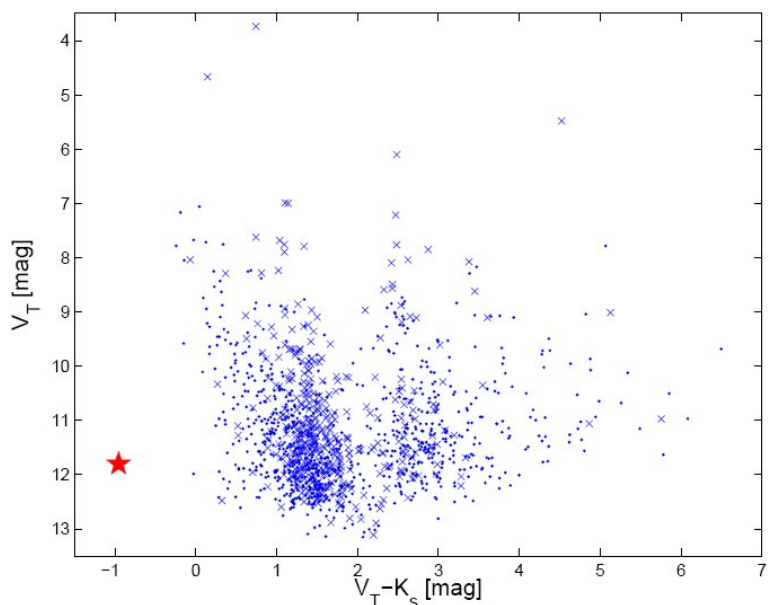
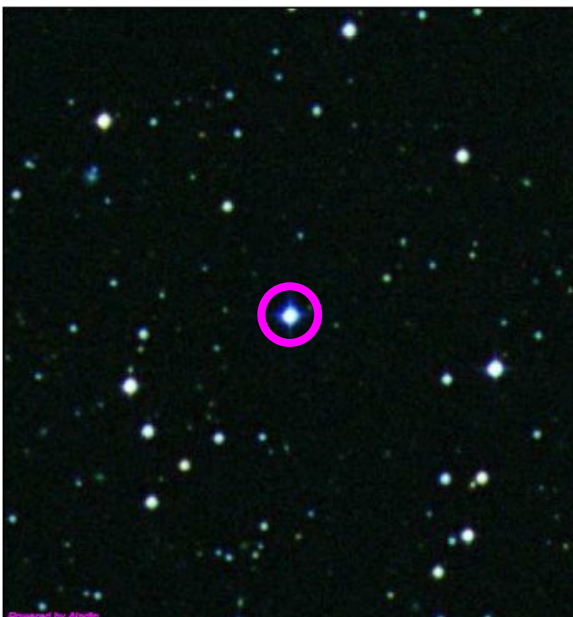
Hot subdwarf stars (hot sds) are evolved stars in a pre-white dwarf state after starting their lives in the Main Sequence as a star of less than 3 solar masses. Although discovered more than 60 years ago there are still many open questions about the nature of these objects, in particular regarding their evolutionary state.

The observational discovery of the first pulsating subdwarf (EC 14026-2647) has boosted enormously the interest of the scientific community in these objects, as asteroseismological techniques can then be used to gain insights of their interiors.

VO aspects

Albus 1, one of the brightest Hydrogen hot subdwarf stars (sdB) known to date, was serendipitously discovered in a correlation between the Tycho-2 and the 2MASS catalogues with the aid of VO tools.

We are following here a similar methodology to conduct a systematized search for new hot subdwarf candidates among the VO archives and catalogues. A combination of the tools offered by VO together with clustering techniques is expected to provide a significant increase in the number of hot subdwarf pulsating candidates, in particular of O-type (where only one oscillator is known to date). Follow-up asteroseismic observations will be carried out to all the hot subdwarf candidates eventually discovered with the VO methodology.



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References

- Caballero & Solano 2007, ApJ 665, L151

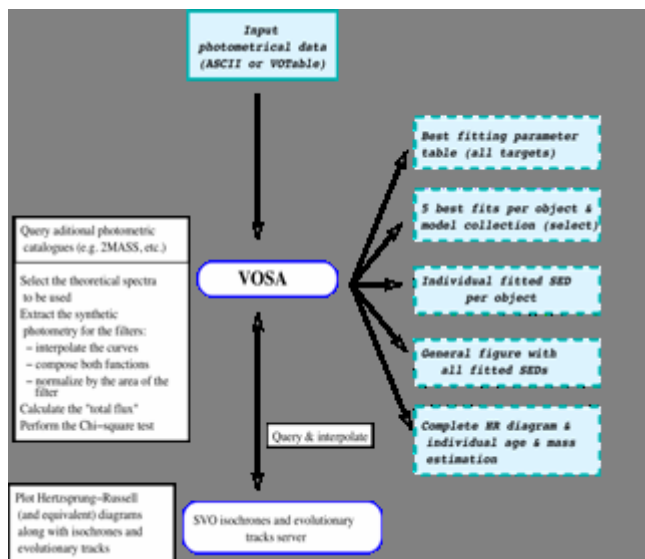
VOSA: Virtual Observatory SED Analyzer

Contact People

Carlos Rodrigo, Amelia Bayo
 crb@laeff.inta.es, abayo@laeff.inta.es

Web Site

<http://www.laeff.inta.es/svo/theory/vosa2/>



Schematic view of VOSA functionalities

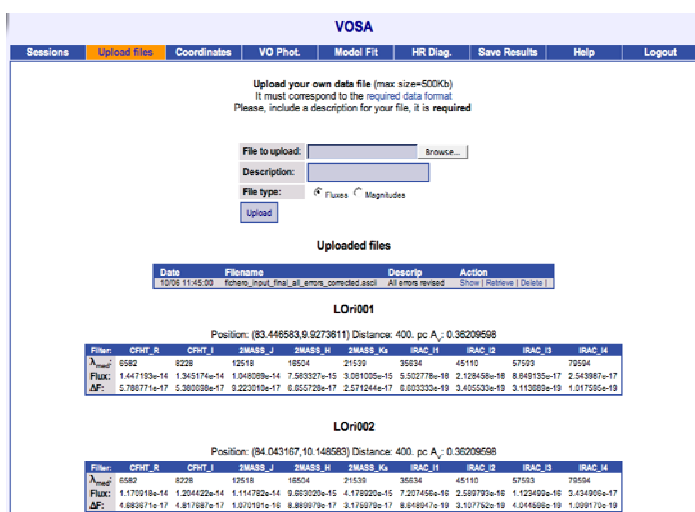
Context

The determination of physical parameters of astronomical objects from observational data is frequently linked with the use of theoretical models as templates. One of these methods relies on the comparison of the shape of the Spectral Energy Distributions constructed from observational photometric data with the corresponding synthetic ones using large grids of theoretical models. However, the use, -in the traditional way-, of these methodologies can easily become tedious and even unfeasible when applied to large amount of data.

The tool: VOSA

The SVO-LAEFF team has developed a new VO-tool that performs the following tasks in an automatic manner:

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Example of the VOSA web-interface



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References

- Bayo et al. 2008, A&A (submitted)

The DUNES VO Discovery Tool

Contact People

Raúl Gutiérrez, María Arévalo
 Carlos Eiroa
 raul@laeff.inta.es, maria.arevalo@laeff.inta.es
 carlos.eiroa@uam.es



Web Site

<http://sdc.laeff.inta.es/dunes/>

Context

DUNES is a Herschel Key Programme that aims at finding and characterizing faint exo-solar analogues to the Kuiper Belt in a sample of 300 nearby ($d < 25$ pc) A- to M-type, Main Sequence stars. This ambitious endeavour requires a careful selection of the target and an extremely detailed knowledge of their properties and of their environment.

A large volume of astrophysical data and information distributed among a number of astronomical archives, databases and papers already exist on the DUNES targets. The compilation of all this information is very important for an appropriated planning of the project. However, this is a complicated, tedious and time-consuming task is performed outside the Virtual Observatory framework.

VO aspects

Fast and efficient data discovery is one of the consequences of the VO standardization. We have developed a VO discovery tool for DUNES which allows accessing, visualizing, filtering and retrieving relevant information that is already available in astronomical archives and services following a VO methodology. Some fundamental parameters and properties of the stars can be also determined using photometric information and appropriate calibrations.

HIP	HD
34	224758

Catalog Name	Catalog Code	Vsini	Vsini error	NomCol	Units	UCD
Glebocki+, 2000	III/226	21.00	3.00	vsini	km/s	phys.veloc.rotat
Hoffleit+, 1991	V/50			RotVel	km/s	phys.veloc.rotat
Nordstrom+, 2004	V/117	21		vsini	km/s	phys.veloc.rotat

SIAP

- http://irsa.ipac.caltech.edu/cgi-bin/Atlas/nph-atlas?mission=ISSA&hdr_location=%5CICISS
- http://irsa.ipac.caltech.edu/cgi-bin/2MASS/IM/nph-im_sia?type=q&ds=asky
- http://galex.stsci.edu/gx/WS/SIAP/gxSIAP.aspx?
 - http://galex.stsci.edu/GR2/data/GR3/pipe/01-vsn/13023-AISCHV4_145_21321/d/00-vi
 - http://galex.stsci.edu/GR2/data/GR3/pipe/01-vsn/13023-AISCHV4_145_21321/d/00-vi
- http://skyview.gsfc.nasa.gov/cgi-bin/vo/sia.pl?survey=DSS&
- http://skyview.gsfc.nasa.gov/cgi-bin/vo/sia.pl?survey=DSS2&
- http://skyview.gsfc.nasa.gov/cgi-bin/vo/sia.pl?survey=NEAT&
- http://irsa.ipac.caltech.edu/cgi-bin/2MASS/IM/nph-im_sia?type=at&ds=asky
- http://aladin.u-strasbg.fr/cgi-bin/nph-HTTP.cgi?FORMAT=image/fits&mode=siap_atlas&d
- http://irsa.ipac.caltech.edu/cgi-bin/2MASS/IM/nph-im_sia?type=at&ds=asky
- http://www.cadc-ccda.hia-ihia.nrc-cnrc.gc.ca/ivoa/CADC/siapQuery?
- http://www.g-vo.org/rosat/SIAP?action=queryImage&siap=siap.service.rosat&
- http://archive.eso.org/bin/dss_sia/dss.sia?VERSION=1.0&



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Data Mining in the VO

Contact Person

Luis Manuel Sarro
Mauro López, Miguel García
lsb@dia.uned.es
mauro@laeff.inta.es, mgarciat@laeff.inta.es



Description

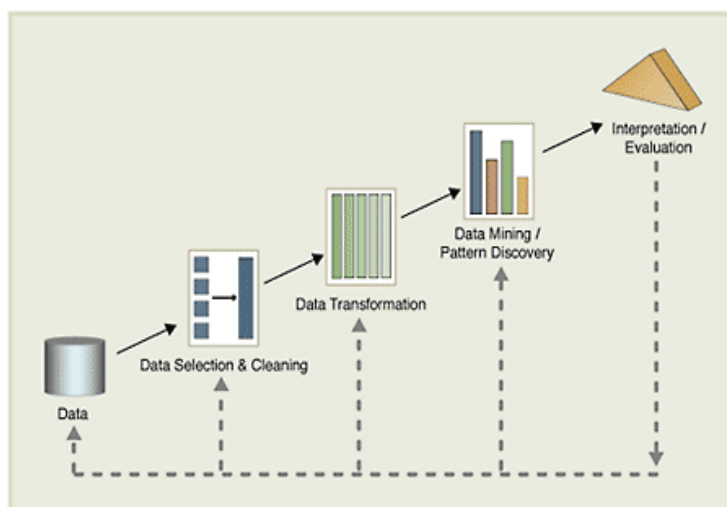
The potential for scientific discovery afforded by the mass of data available from the VO services is enormous: new and unexpected scientific results of major significance will undoubtedly emerge from the combined use of datasets and services, a type of science that would not be possible from such sets used singly.

Data mining, defined as the non-trivial extraction of previously unknown implicit information, represents the best way to perform a systematic study of VO data and the only way, from a time-consuming perspective, to extract information from the huge databases that are involved. Automated classification of astronomical objects, the search for the rare ("outlier science"), the search for rules and properties..., are some of the fields that will clearly benefit from the use of Data Mining techniques in a VO framework.

After several years of work, SVO is now in a privileged position amongst the teams in charge of the data analysis of several key missions, already operating (COROT) or in preparation (GAIA).

Lines of work

- Stellar variability studies: supervised classification. OMC, COROT and GAIA
- Knowledge discovery: clustering and outlier detection: COROT, GAIA, solar databases (SOHO, TRACE).



References

- Debosscher et al. 2007, *A&A*, 475, 1159
- Sarro et al, 2008, *A&A*, accepted

