



# Using Astronomical Data Archives for Stellar Spectroscopy

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# Outline

- **Where to start searching for online data related to stellar spectroscopy?**
  - 1. Retrieve online observed stellar spectra in any wavelength domain
  - 2. Retrieve online theoretical spectra (pre-calculated) for analysis and comparison with observed stellar spectra
  - 3. Retrieve online atomic and molecular transition data for theoretical stellar spectrum calculations
- **Can I develop my own local database or online archive/portal ?**
  - 1. Local database GUI packages and query tools for SQL, MySQL, PostgreSQL, and many other db formats
  - 2. Online db maintenance and development (client-server, online db maintenance and administration, db query interface development)

# Main astronomical spectroscopic archives

- **Ground-based stellar spectra** mostly incorporated in **Telescope Data Archives** offering data from various instruments (institutional involvement/funding)
- **Space-based stellar spectra** mostly incorporated in **National Data Archives** offering data from various space missions (governmental involvement/funding)



"Guide us, Oh Database Manager!"

# Where to search first?

- **Ground-based spectra:**

- CDS <https://cdsweb.u-strasbg.fr/index-fr.gml>  
offering useful online analysis tools as Simbad, VizieR, Aladin
- ESO Science Archive Facility <http://archive.eso.org/cms.html>
  - ESO VO <https://archive.eso.org/cms/virtual-observatory-tools.html>
  - UVES POP Archive <https://www.eso.org/sci/observing/tools/uvespop.html>
- ING Data Archives <http://casu.ast.cam.ac.uk/casuadc/ingarch/query>
- AAT data archive <https://aat.anu.edu.au/science/aat-data-archive>
- LAMOST <http://www.lamost.org/dr8/v1.1/search>
  - GAVO LAMOST [https://dc.zah.uni-heidelberg.de/lamost6/q/mrs\\_web/form](https://dc.zah.uni-heidelberg.de/lamost6/q/mrs_web/form)
- Keck Obs. Archive <https://koa.ipac.caltech.edu/cgi-bin/KOA/nph-KOALogin>
- OHP Elodie Archive <http://atlas.obs-hp.fr/elodie/>
- OHP Sophie Archive <http://atlas.obs-hp.fr/sophie/>
- CFHT Polarbase <http://polarbase.irap.omp.eu/>
  - General search form: <https://www.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/en/search/>
- NSF Astro Data Archive <https://astroarchive.noirlab.edu/>
- HERMES Melchior [https://www.royer.se/melchior/melchior\\_table.html](https://www.royer.se/melchior/melchior_table.html)

# Where to search first?

- **Space-based spectra:**

- ESA Data Archives at ESAC <https://www.cosmos.esa.int/web/esdc>
  - Gaia Data Archive <https://gea.esac.esa.int/archive/>
  - ISO Data Archive <https://nida.esac.esa.int/nida-cl-web/>
  - Herschel Data Archive <http://archives.esac.esa.int/hsa/whsa/>
  - XMM-Newton, HST Data Archives are also accessible from ESAC
- MAST Data Archive <https://archive.stsci.edu/>
  - HST Search for spectra <https://mast.stsci.edu/search/ui/#/hst>
  - General Search form (also including IUE, FUSE spectra)  
<https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>
- IRSA Caltech Science Archive Spitzer Spectra (also LRS IRAS, 2MASS spectra)  
<https://irsa.ipac.caltech.edu/data/SPITZER/SASS/overview.html>  
<https://cassis.sirtf.com/atlas/query.shtml>

# Literature search of published stellar spectra

- CDS VizieR <https://cdsarc.cds.unistra.fr/assocdata/> offers access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications:

Rho Cas

Search associated data among the VizieR catalogues

This web page is an access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications. This tool is the result of the documentation assigned by the authors of the catalogues and supervised by the CDS documentalist team (see the [VizieR ingestion tool](#)).

**VO compatibility**  
The meta-data and the search engine are built according to the VO framework (SIA, SSA, ObsTAP) and can so be queried by VO softwares. The data are gathered with the Saada engines, and the VO data model ObsCore has been chosen for the documentation.

Simple search ObsTAP Query

Q Search by position : 59596887605 57.49938 radius 1.5 min

Q Search by spectral band : min max  $\mu\text{m}$  -

Q Search by time data : start stop (MJD)

Q Search by catalog: Identifier:

Spectrum / Time series  Image

500 entries max Search OTar

Show 50 entries Filter

4 entries

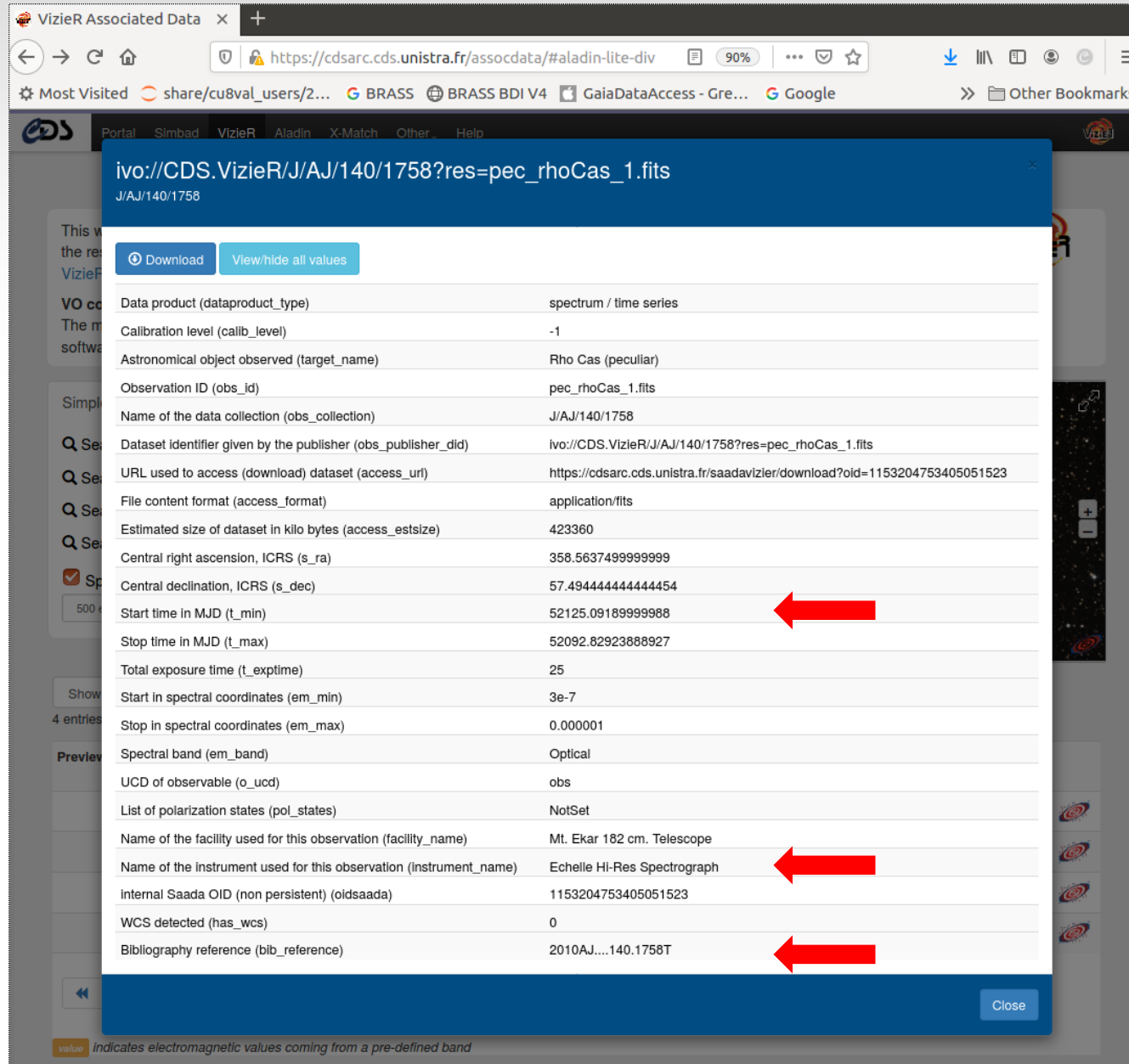
Preview	Target	Data collection	Ra	Dec	Band min (nm)	Band max (nm)	Begin time (MJD)	End time (MJD)	Facility
	Rho Cas (peculiar)	J/AJ/140/1758	358.564	57.494	300.0000	1,000.0000	52,125.092	52,092.829	Mt. Ekar 182 cm. Telescope
	Rho Cas (peculiar)	J/AJ/140/1758	358.561	57.493	300.0000	1,000.0000	52,125.095	52,092.829	Mt. Ekar 182 cm. Telescope
	Rho Cas (peculiar)	J/AJ/140/1758	358.561	57.493	300.0000	1,000.0000	52,125.095	52,092.829	Mt. Ekar 182 cm. Telescope
	Rho Cas (peculiar)	J/AJ/140/1758	358.564	57.494	300.0000	1,000.0000	52,125.092	52,092.829	Mt. Ekar 182 cm. Telescope

Prev p.1/1 Next

value indicates electromagnetic values coming from a pre-defined band

# Literature search of published stellar spectra

- CDS VizieR <https://cdsarc.cds.unistra.fr/assocdata/> offers access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications:



The screenshot shows a web browser window displaying the CDS VizieR Associated Data interface. The URL in the address bar is <https://cdsarc.cds.unistra.fr/assocdata/#aladin-lite-div>. The page title is "VizieR Associated Data". The main content area shows a table of metadata for a specific observation. The table has two columns: "Data product (dataprodukt\_type)" and "Value". The table is titled "ivo://CDS.VizieR/J/AJ/140/1758?res=pec\_rhoCas\_1.fits" and "J/AJ/140/1758". There are buttons for "Download" and "View/hide all values". The table contains the following rows:

Data product (dataprodukt_type)	Value
Calibration level (calib_level)	-1
Astronomical object observed (target_name)	Rho Cas (peculiar)
Observation ID (obs_id)	pec_rhoCas_1.fits
Name of the data collection (obs_collection)	J/AJ/140/1758
Dataset identifier given by the publisher (obs_publisher_did)	ivo://CDS.VizieR/J/AJ/140/1758?res=pec_rhoCas_1.fits
URL used to access (download) dataset (access_url)	<a href="https://cdsarc.cds.unistra.fr/saadavizier/download?oid=1153204753405051523">https://cdsarc.cds.unistra.fr/saadavizier/download?oid=1153204753405051523</a>
File content format (access_format)	application/fits
Estimated size of dataset in kilo bytes (access_estsize)	423360
Central right ascension, ICRS (s_ra)	358.5637499999999
Central declination, ICRS (s_dec)	57.4944444444444454
Start time in MJD (t_min)	52125.09189999988
Stop time in MJD (t_max)	52092.82923888927
Total exposure time (t_exptime)	25
Start in spectral coordinates (em_min)	3e-7
Stop in spectral coordinates (em_max)	0.000001
Spectral band (em_band)	Optical
UCD of observable (o_ucd)	obs
List of polarization states (pol_states)	NotSet
Name of the facility used for this observation (facility_name)	Mt. Ekar 182 cm. Telescope
Name of the instrument used for this observation (instrument_name)	Echelle HI-Res Spectrograph
Internal Saada OID (non persistent) (oidsaada)	1153204753405051523
WCS detected (has_wcs)	0
Bibliography reference (bib_reference)	2010AJ....140.1758T

Red arrows point to the "Start time in MJD (t\_min)", "Name of the instrument used for this observation (instrument\_name)", and "Bibliography reference (bib\_reference)" rows.

value indicates electromagnetic values coming from a pre-defined band

# Literature search of published stellar spectra

- CDS VizieR <https://cdsarc.cds.unistra.fr/assocdata/> offers access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications:

6 Cas

Search associated data among the VizieR catalogues

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**VO compatibility**  
The meta-data and the search engine are built according to the VO framework (SIA, SSA, ObsTAP) and can so be queried by VO softwares. The data are gathered with the Saada engines, and the VO data model ObsCore has been chosen for the documentation.

Simple search  ObsTAP Query

Q Search by position : 357.209043816 62.2145 radius 2 sec

Q Search by spectral band : min max  $\mu\text{m}$

Q Search by time data : start stop (MJD)

Q Search by catalog: Identifier:

Spectrum / Time series  Image

500 entries max Search Tar

Show 10 entries Filter

3 entries

Preview	Target	Data collection	Ra	Dec	Band min (nm)	Band max (nm)	Begin time (MJD)	End time (MJD)	Facility			
	HD223385	J/MNRAS/371/703	357.209	62.214	352.500	750.000			Isaac Newton Telescope	Download	Search	Header
	HD223385	III/251	357.208	62.214	390.000	680.000	52,240.745	50,832.769	OHP	Download	Search	Header
	HD223385	III/251	357.208	62.214	390.000	680.000	52,240.745	50,832.769	OHP	Download	Search	Header

Prev p.1/1 Next

value indicates electromagnetic values coming from a pre-defined band



# Literature search of published stellar spectra

- CDS VizieR <https://cdsarc.cds.unistra.fr/assocdata/> offers access to the VizieR Associated data (images, spectra, timeseries, SED) which comes from publications:

6 Cas

The screenshot displays a computer interface with two main windows. The left window is titled "POW (Build 1.514)" and shows a spectral plot for "01940-1.fits\_0". The plot has a y-axis labeled "norm to cont" ranging from 0 to 2 and an x-axis labeled "WAVE-WA" ranging from 4000 to 5000. The plot shows a spectrum with several absorption lines. A smaller inset plot in the top right of the POW window shows a zoomed-in view of the spectrum. The right window is a web browser showing the VizieR interface. It displays a star field with a red crosshair and a table of associated data. The table has columns for Index, Extension, Type, Dimension, and View. The table content is as follows:

Index	Extension	Type	Dimension	View
0	Primary	Image	58001	Header Plot Table
1	FCANOR	Binary	1 cols X 149 rows	Header Hist Plot All Select
2	NOISE	Image	58001	Header Plot Table
3	FCAPHY	Binary	1 cols X 421 rows	Header Hist Plot All Select

# Literature search of published stellar spectra

- CDS Simbad <https://vizier.cds.unistra.fr/viz-bin/VizieR-2>

Catalog search:

Betelgeuse

The screenshot shows the VizieR web interface. At the top, there is a navigation bar with 'CDS' logo and links for 'Portal', 'Simbad', 'VizieR', 'Aladin', 'X-Match', 'Other', and 'Help'. Below this, the page title is 'VizieR' and there are several utility links: 'VizieR home', 'Photometry viewer', 'Query VizieR using TAP', 'X-match tables', and 'Query images/spectra'. A message states: 'The VizieR service is now hosted by CDS domain (cds.unistra.fr). Please, modify your configuration for the new domain.'

The main search area is titled 'Find catalogs among 24035 available'. It features a search input field containing 'Betelgeuse' and a 'Find...' button. Below the input field, there is an 'Expand search' checkbox. To the right of the search area, there are three columns of filters: 'Wavelength' (Radio, Millimeter, IR, optical, UV, EUV, X-ray), 'Mission' (AKARI, ANS, ASCA, BeppoSAX, Cassini-Huygens, CGRO, Chandra), and 'Astronomy' (Abundances, Ages, AGN, Associations, Asteroseismology, Atomic\_Data, Binaries:cataclysmic).

On the left side, there is a 'Search Criteria' panel with 'Keywords' (HD224014), 'Preferences' (max: 50, HTML Table), 'All columns' (checkbox), 'Compute' (button), 'Mirrors' (CDS, France), and 'More about VizieR' (link).

Below the search area, there is a section for 'Search by Position across 26883 tables'. It includes a 'Target Name (resolved by Sesame) or Position:' field with a 'Clear' button and a 'J2000' dropdown. To the right, there is a 'Target dimension:' section with a '2' input field, an 'arcmin' dropdown, and a 'Go!' button. Below this, there is a note: 'NB: The epoch used for the query is the original epoch of the table(s)' and radio buttons for 'Radius' (selected) and 'Box size'. A small image of a star is visible on the right side of this section.

At the bottom right, there is a 'Find Catalogs' button with a red arrow pointing to it. The text 'Empty result' is displayed in red next to the button.

# Literature search of published stellar spectra

- CDS Simbad <https://vizier.cds.unistra.fr/viz-bin/VizieR-2>

Catalog search:

Betelgeuse

The screenshot shows the VizieR search interface. The search criteria are set to "Keywords" with the value "HD224014". The search term "Betelgeuse" is entered in the search box. The interface includes a "Find catalogs among 24035 available" section with a search button. There are also options for "Search by Position across 26883 tables" and "Search for catalogs by column descriptions (UCD)". A "Find Catalogs" button is highlighted with a red arrow. The interface also displays a table of available catalogs with columns for "Wavelength", "Mission", and "Astronomy".

The screenshot shows the VizieR search results page. The search criteria are set to "Keywords" with the value "Betelgeuse". The search results are displayed in a table with columns for "Keywords", "Tables", "Description", and "Actions". The table lists several catalogs, including "J/ApJ/905/34", "J/A+A/650/L17", "J/A+A/545/A99", "J/other/Nat/594.365", and "J/ApJ/902/63". The "J/A+A/650/L17/data-obs" entry is selected. The interface includes a "Reset All" button and "Query selected Tables" and "Join selected Tables" buttons. A red arrow points to the "J/A+A/650/L17/data-obs" entry.

Keywords	Tables	Description	Actions
J/ApJ/905/34	J/ApJ/905/34	2017-2020 photometry of Betelgeuse (Harper+, 2020)	ReadMe+ftp
J/ApJ/905/34/fig1a	..fig1a	Five years of photometry: Teff and C magnitudes, averaged into 7 day bins (C-band and Teff plots) (118 rows)	timeSerie
J/ApJ/905/34/fig1b	..fig1b	Five years of V-band photometry (timeSerie) (Interactive plot) (209 rows)	timeSerie
J/A+A/650/L17	J/A+A/650/L17	HERMES spectra of Betelgeuse (Kravchenko+, 2021)	ReadMe+ftp
J/A+A/650/L17/data-obs	..data-obs	Information on HERMES spectra (spectrum) (37 rows)	spectrum
J/A+A/545/A99	J/A+A/545/A99	2 supergiants and 2 hypergiants radio spectra (Teyssier+, 2012)	image/fits
J/A+A/545/A99/list	J/A+A/545/A99	(c)List of spectra (image/fits) (56 rows)	spectrum
J/other/Nat/594.365	J/other/Nat/594.365	Betelgeuse during its Great Dimming (Montargès+, 2021)	image/fits
J/other/Nat/594.365/list	J/other/Nat/594.365	(c)List of fits images (44 rows)	spectrum
J/ApJ/902/63	J/ApJ/902/63	SMEI photometry of Betelgeuse (Joyce+, 2020)	ReadMe+ftp
J/ApJ/902/63/table1	J/ApJ/902/63	Processed SMEI photometry of $\alpha$ Ori (timeSerie) (Interactive plot) (2038 rows)	timeSerie

# Literature search of published stellar spectra

- CDS Simbad <https://vizier.cds.unistra.fr/viz-bin/VizieR-2>

Catalog search:

Betelgeuse

The screenshot shows the VizieR web interface. The main search area displays the query 'HERMES spectra of Betelgeuse (Kravchenko+, 2021)' and the identifier 'J/A+A/650/L17'. The search results are shown as a table with 37 rows, and the first row is highlighted. The table columns are: 'recno', 'Obs.date', 'Name', 'sp', 'FileName', and 'Com'. The 'sp' column is selected, and the 'Submit' button is highlighted with a red arrow. The 'Constraints' section is visible, showing the query 'Query by Constraints applied on Columns' and the 'Show Sort Column' and 'Constraint' columns. The 'sp' column is selected, and the 'Submit' button is highlighted with a red arrow.

**VizieR**

HERMES spectra of Betelgeuse (Kravchenko+, 2021) [ReadMe+ftp](#)

J/A+A/650/L17 [Post annotation](#) [spectrum](#) [Objects](#) [Similar Catalogs](#) [2021A&A...650L..17K](#)

1. J/A+A/650/L17/data-obs Information on HERMES spectra **[spectrum]** (37 rows)

**Simple Constraint** [List Of Constraints](#)

Query by [Constraints](#) applied on Columns (Output Order:  +  -)

Show	Sort	Column	Constraint	Explain (UCD)
<input type="checkbox"/>	<input type="radio"/>	recno		Record number assigned by the VizieR team. Should Not be used for identification. ( <a href="#">meta.record</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	Obs.date	d	Julian date of the observations ( <a href="#">time.epoch;obs</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	Name		Unique HERMES spectrum number ( <a href="#">meta.id;meta.main</a> )
<input checked="" type="checkbox"/>	<input type="radio"/>	sp	sp	Spectrum ( <a href="#">meta.ref.url</a> ) <a href="#">spectrum</a>
<input checked="" type="checkbox"/>	<input type="radio"/>	FileName	(char)	Name of spectrum file in subdirectory sp ( <a href="#">meta.id;meta.file</a> ) <a href="#">spectrum</a>
<input checked="" type="checkbox"/>	<input type="radio"/>	Com	(char)	Comments ( <a href="#">meta.note</a> )

ALL cols    indexed column

# Literature search of published stellar spectra

- CDS Simbad <https://vizier.cds.unistra.fr/viz-bin/VizieR-2>

Catalog search:

Betelgeuse

The screenshot shows the VizieR search interface. The search criteria are set to 'J/A+A/650/L17'. The constraints are applied to the columns 'recno', 'Obs.date', 'Name', 'sp', 'FileName', and 'Com'. The 'sp' column is highlighted in red, and a red arrow points to it. The 'Submit' button is also highlighted with a red arrow.

The screenshot shows the VizieR search results page. The table displays the following data:

Full	Obs.date	Name	sp	FileName	Com
1	2457336.6827627	681031	sp	00681031_c.dat	
2	2457369.3972946	690665	sp	00690665_c.dat	Saturated in the red and should be used with caution for temperature determination; radial velocities are ok
3	2457401.4761909	696015	sp	00696015_c.dat	
4	2457449.5083571	701271	sp	00701271_c.dat	
5	2457473.4220102	705891	sp	00705891_c.dat	
6	2457492.3610758	708218	sp	00708218_c.dat	
7	2457659.7752031	751206	sp	00751206_c.dat	
8	2457662.7791152	751442	sp	00751442_c.dat	
9	2457673.7649583	753003	sp	00753003_c.dat	Saturated in the red and should be used with caution for temperature determination; radial velocities are ok
10	2457712.6235630	759580	sp	00759580_c.dat	
11	2457729.5764611	761335	sp	00761335_c.dat	
12	2457766.4316477	763947	sp	00763947_c.dat	
13	2457793.4469861	767842	sp	00767842_c.dat	
14	2457851.3666384	774393	sp	00774393_c.dat	Saturated in the red and should be used with caution for temperature determination; radial velocities are ok
15	2457867.3682187	777563	sp	00777563_c.dat	Saturated in the red and should be used with caution for temperature determination; radial velocities are ok
16	2458010.7600657	843041	sp	00843041_c.dat	

# Literature search of published stellar spectra

- CDS Simbad <https://vizier.cds.unistra.fr/viz-bin/VizieR-2>

Catalog search:

Betelgeuse

VizieR

HERMES spectra of Betelgeuse (Kravchenko+, 2021)

J/A+A/650/L17

1. J/A+A/650/L17/data-obs Information on HERMES spectra [spectrum] (37 rows)

Simple Constraint List Of Constraints

Query by Constraints applied on Columns (Output Order: + -)

Show Sort Column	Constraint	Explain (UCD)
<input type="checkbox"/>	recno	Record number assigned by the VizieR team. Should Not be used for identification. (meta.record)
<input checked="" type="checkbox"/>	Obs.date	Julian date of the observations (time.epoch;obs)
<input checked="" type="checkbox"/>	Name	Unique HERMES spectrum number (meta.id;meta.main)
<input checked="" type="checkbox"/>	sp	Spectrum (meta.ref.url)
<input checked="" type="checkbox"/>	FileName	Name of spectrum file in subdirectory sp (meta.id;meta.file)
<input checked="" type="checkbox"/>	Com	Comments (meta.note)

Submit

VizieR

The 1 column in color are computed by VizieR, and are not part of the

J/A+A/650/L17/data-obs HERMES spectra of Betelgeuse (Kravchenko+, 2021)

Full	Obs.date	Name	sp	FileName
1	2457336.6827627	681031	sp	00681031_c.dat
2	2457369.3972946	690665	sp	00690665_c.dat
3	2457401.4761909	696015	sp	00696015_c.dat
4	2457449.5083571	701271	sp	00701271_c.dat
5	2457473.4220102	705891	sp	00705891_c.dat
6	2457492.3610758	708218	sp	00708218_c.dat
7	2457659.7752031	751206	sp	00751206_c.dat
8	2457662.7791152	751442	sp	00751442_c.dat
9	2457673.7649583	753003	sp	00753003_c.dat
10	2457712.6235630	759580	sp	00759580_c.dat
11	2457729.5764611	761335	sp	00761335_c.dat
12	2457766.4316477	763947	sp	00763947_c.dat
13	2457793.4469861	767842	sp	00767842_c.dat
14	2457851.3666384	774393	sp	00774393_c.dat
15	2457867.3682187	777563	sp	00777563_c.dat
16	2458010.7600657	843041	sp	00843041_c.dat

Complement to J/A+A/650/L17

Betelgeuse spectrum No. 00751206

00751206\_c.dat

Flux

$\lambda$  [Å]

Adapt Plot

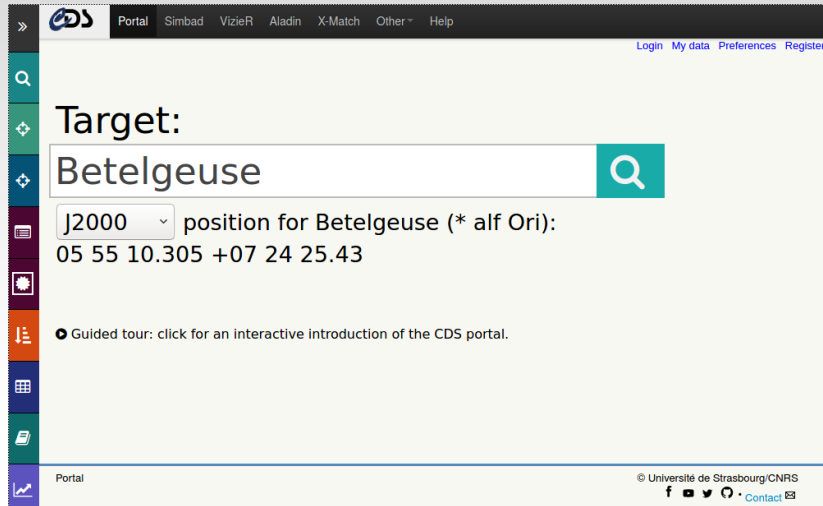
x cuts:   xlog  Bitmap size: 600x400

y cuts:   ylog  Adapt the plot

# Literature search of published stellar spectra

- **CDS Portal** <http://cdsportal.u-strasbg.fr/>

Portal search:

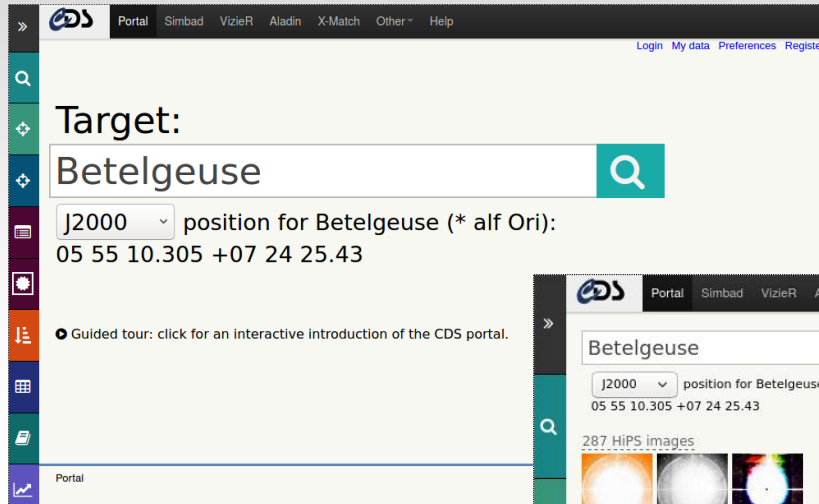


The screenshot shows the CDS Portal search interface. The top navigation bar includes links for Portal, Simbad, VizieR, Aladin, X-Match, Other, and Help. The main search area features a search bar with the text "Target: Betelgeuse" and a search button. Below the search bar, there is a dropdown menu set to "J2000" and a text input field containing "position for Betelgeuse (\* alf Ori): 05 55 10.305 +07 24 25.43". A "Guided tour" link is also visible. The footer contains the text "© Université de Strasbourg/CNRS" and social media icons for Facebook, YouTube, Twitter, and LinkedIn, along with a "Contact" link.

# Literature search of published stellar spectra

- CDS Portal <http://cdsportal.u-strasbg.fr/>

Portal search:



The screenshot shows the CDS Portal object page for Betelgeuse. The page is divided into several sections:

- Object (Simbad):** Main ID: \*alf Ori; Object type: Red Supergiant; Spectral type: M1-M2Ia-Iab; z: 0.00007308656408078207.
- Magnitudes:** U: 4.38, B: 2.27, V: 0.42, R: -1.17, I: -2.45, J: -3.0, H: -3.73, K: -4.05.
- Object (NED):** Main ID: alpha Ori; Object type: Infrared source.
- Images:** 287 HiPS images available 0.20° around 05 55 10.305 +07 24 25.43. Filtered to 12 entries.
- Aladin Lite:** DSS colored image of the star.

title	wavelength	sky fraction
★ DSS2 Blue (Xj+S)	Optical	99.72 %
★ DSS colored	Optical	100 %
★ DSS2 Red (F+R)	Optical	100 %
★ Finkbeiner Halpha composite survey	Optical	100 %
★ Mellinger color optical survey	Optical	100 %
★ PanSTARRS DR1 color (from bands z and g)	Optical	78.12 %
★ PanSTARRS DR1 g	Optical	75.82 %
★ PanSTARRS DR1 z	Optical	76.15 %
★ 2MASS color J (1.23um), H (1.66um), K (2.16um)	Infrared	100 %
★ AKARI FIS Color WideL (140um), WideS (90um), N60 (65um)	Infrared	100 %

Catalogues



Tabular data



Photometric SED

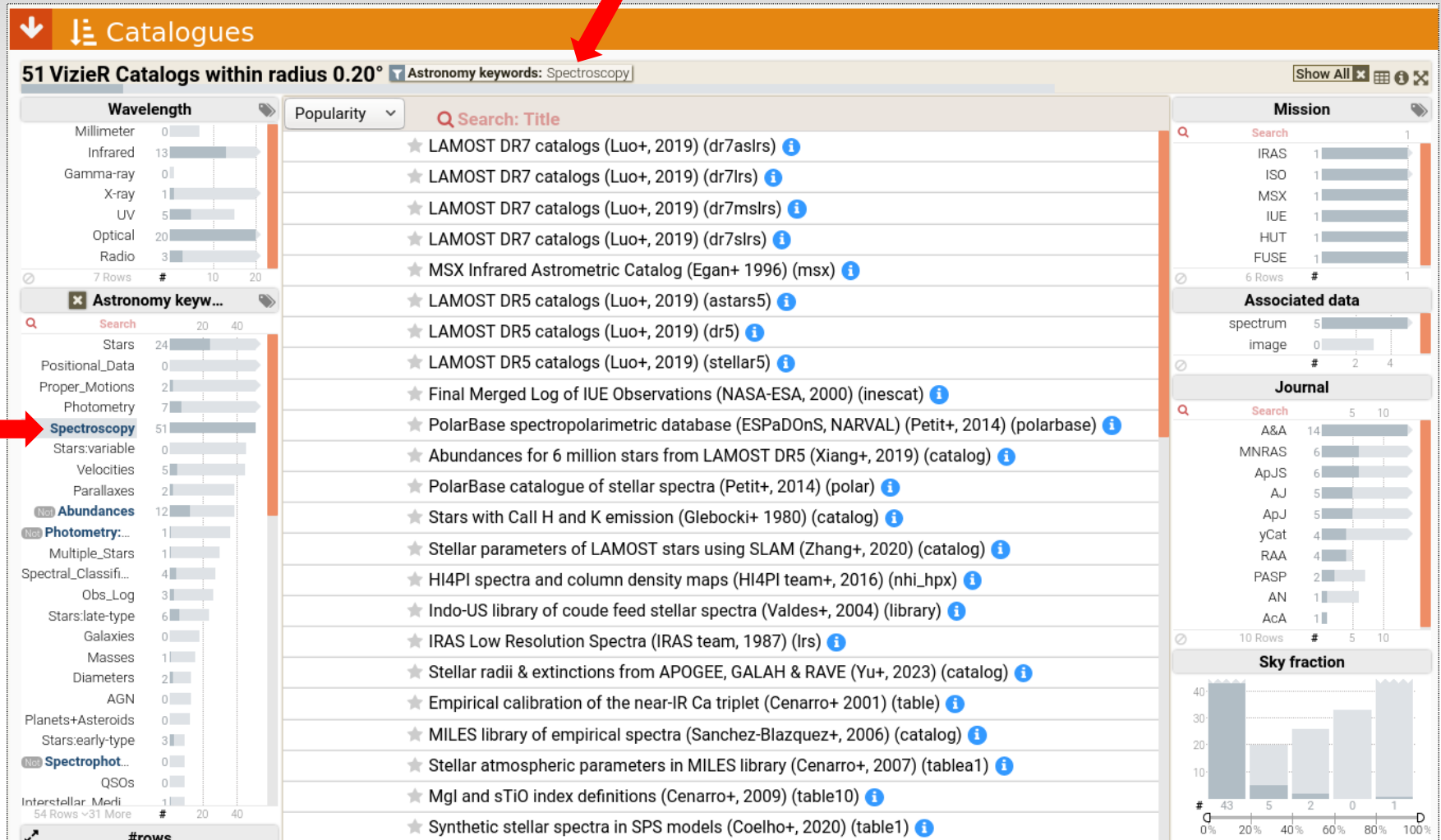




# Literature search of published stellar spectra

- CDS Portal <http://cdsportal.u-strasbg.fr/>

Portal search:



# Literature search of published stellar spectra





















- CDS Portal <http://cdsportal.u-strasbg.fr/>

Portal search for spectra:

Tabular data

SIMBAD 2MASS Gaia DR3 SDSS DR12 VizieR images **VizieR spectra**

Filter: 16 entries within radius 0.20°

access_url	access_estsize (kbyte)	access_format	bib_reference	calib_level	dataprodct_type	em_band (spect)	em_max	em_min	extension (meta.code)	facility_name
<a href="#">Preview</a>  	17280	application/fits	2012A&A...545A..99T	-1	spectrum		0.00016286423313093405	0.00016263800231268563		HIF-04-WH-7B
<a href="#">Preview</a>  	17280	application/fits	2012A&A...545A..99T	-1	spectrum		0.00016350782694679673	0.00016327980584575935		HIF-04-WH-7B
<a href="#">Preview</a>  	23040	application/fits	2020AN....341..908B	-1	spectrum		6.821723423242597e-7	6.619000000000003e-7		University Observatory Jena
<a href="#">Preview</a>  	23040	application/fits	2012A&A...545A..99T	-1	spectrum		0.0004342244959147404	0.0004316368343152669		HIF-04-WV-2A
<a href="#">Preview</a>  	23040	application/fits	2006MNRAS.371..703S	-1	spectrum		7.5e-7	3.525e-7		Isaac Newton Telescope
<a href="#">Preview</a>  	34560	application/fits	2003A&A...402..433L	-1	spectrum		9.89669023929647e-7	3.198796e-7		Jacobus Kaptein Telescope, RMO, La
<a href="#">Preview</a>  	34560	application/fits	2003A&A...402..433L	-1	spectrum		9.899e-7	3.2e-7		Jacobus Kaptein Telescope, RMO, La
<a href="#">Preview</a>  	218880	application/fits	2020A&A...634A.133G	-1	spectrum	UV	3e-7	1e-7		ESO-VLT-U2
<a href="#">Preview</a>  	403200	application/fits	2020A&A...634A.133G	-1	spectrum	Optical	0.000001	3e-7		ESO-VLT-U2
<a href="#">Preview</a>  	717120	application/fits	2022A&A...660A..34V	-1	spectrum		0.0000024769591039170984	3.5000000000000004e-7		ESO-VLT-U2

16 entries within radius 0.20°

# Literature search of published stellar spectra

- CDS Portal <http://cdsportal.u-strasbg.fr/>

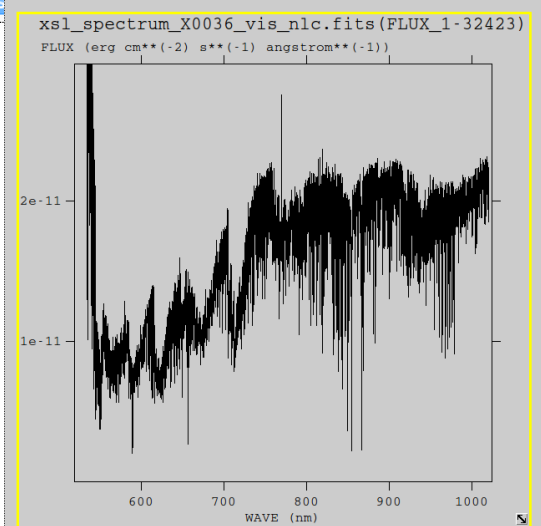
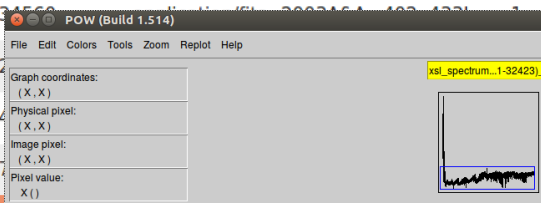
Portal search for spectra:

Tabular data

SIMBAD 2MASS Gaia DR3 SDSS DR12 VizieR images **VizieR spectra**

Filter: 16 entries within radius 0.20°

access_url	access_estsize (kbyte)	access_format	bib_reference	calib_level	datapoint_type	em_band (spect)	em_max	em_min	extension (meta.code)	facility_name
<a href="#">Preview</a>	17280	application/fits	2012A&A...545A..99T	-1	spectrum		0.00016286423313093405	0.00016263800231268563		HIF-04-WH-7B
<a href="#">Preview</a>	17280	application/fits	2012A&A...545A..99T	-1	spectrum		0.00016350782694679673	0.00016327980584575935		HIF-04-WH-7B
<a href="#">Preview</a>	23040	application/fits	2020AN....341..908B	-1	spectrum		6.821723423242597e-7	6.619000000000003e-7		University Observatory Jena
<a href="#">Preview</a>	23040	application/fits	2012A&A...545A..99T	-1	spectrum		0.0004342244959147404	0.0004316368343152669		HIF-04-WV-2A
<a href="#">Preview</a>	23040	application/fits	2006MNRAS.371..703S	-1	spectrum		7.5e-7	3.525e-7		Isaac Newton Telescope
<a href="#">Preview</a>	34560	application/fits	2003A&A...402..433L	-1	spectrum		9.89669023929647e-7	3.198796e-7		Jacobus Kaptein Telescope, RMO, La
<a href="#">Preview</a>					spectrum		9.899e-7	3.2e-7		Jacobus Kaptein Telescope, RMO, La
<a href="#">Preview</a>					spectrum	UV	3e-7	1e-7		ESO-VLT-U2
<a href="#">Preview</a>					spectrum	Optical	0.000001	3e-7		ESO-VLT-U2
<a href="#">Preview</a>					spectrum		0.0000024769591039170984	3.5000000000000004e-7		ESO-VLT-U2



# Searching ground-based public domain spectra

- ESO Archive <http://archive.eso.org/scienceportal/home>  
Science Portal – Processed Data

The screenshot displays the ESO Archive Science Portal interface. At the top, the search bar shows 'J2000' coordinates, the star name 'HR5171', a magnitude of '30', and the action 'intersects'. Two red arrows point to the 'HR5171' and '30' fields. On the left sidebar, the 'Data Type' filter is set to 'SPECTRUM', highlighted by a red arrow. Below it, the 'Spectral Range' filter is set to 'opt'. At the bottom left, the 'Spectral Resolution' filter is set to '10k-100k'. The main area shows a star field visualization with a blue circle around the star HR5171. The coordinates '13 47 22.804 -62 32 11.74' and 'FoV: 12.96'' are displayed above the visualization. At the bottom, a table lists the datasets found.

Actions	Dist.	Data Type	Spec. Range	Spec. Res.	SNR	Obs. Date	Collection	Instrum.	T. Exp. T.	#OBs	PI.	Program Id	Object	Data Prov.	Pub. Date
<input type="checkbox"/>	0.738"	SPECTRUM	377.2-790 nm	190000	260.6	2019-03-02 06:53:35	ESPRESSO	ESPRESSO	300 s	single	WITTKOWSKI, MARKUS	0102.D-0102	V766Cen	ESO, PHASE3	2021-04-29
<input type="checkbox"/>	0.738"	SPECTRUM	377.2-790 nm	190000	46.7	2019-03-02 06:50:33	ESPRESSO	ESPRESSO	10 s	single	WITTKOWSKI, MARKUS	0102.D-0102	V766Cen	ESO, PHASE3	2021-04-29
<input type="checkbox"/>	0.934"	SPECTRUM	377.2-790 nm	190000	151.9	2019-01-14 08:11:13	ESPRESSO	ESPRESSO	300 s	single	WITTKOWSKI, MARKUS	0102.D-0102	V766Cen	ESO, PHASE3	2021-04-29
<input type="checkbox"/>	13.85'	SPECTRUM	352.8-921.7 nm	48000	297.1	2015-05-30 03:45:09	FEROS	FEROS	120 s	single	NEGUERUELA, IGNACIO	095.A-9020	HR5171	ESO, PHASE3	2016-11-07
<input type="checkbox"/>	17.72'	SPECTRUM	352.7-921.6 nm	48000	244.1	2016-07-29 23:55:26	FEROS	FEROS	60 s	single	PALOUS, JAN	097.A-9039	V766_Cen	ESO, PHASE3	2016-11-07
<input type="checkbox"/>	18.16'	SPECTRUM	352.7-921.6 nm	48000	235.4	2016-07-29 23:53:34	FEROS	FEROS	60 s	single	PALOUS, JAN	097.A-9039	V766_Cen	ESO, PHASE3	2016-11-07

# Searching ground-based public domain spectra

- ESO Archive <http://archive.eso.org/scienceportal/home>  
Science Portal – Processed Data

The screenshot displays the ESO Archive Science Portal interface. At the top, the search bar contains 'J2000', 'HR5171', and '30°', with red arrows pointing to these fields. The main view shows a star field with coordinates '13 47 22.804 -62 32 11.74' and 'FoV: 12.96''. On the left, the 'Data Type' filter is set to 'SPECTRUM' (6 items), and the 'Spectral Range' filter is set to '6'. Below the star field, a table lists datasets with columns for 'Actions', 'Dist.', and 'Data Type'. The second dataset is highlighted with a red arrow. On the right, a spectral plot shows 'Wavelength: 6701.605 Flux: 2.111e-11 SNR: 602.987' and a zoomed-in view of the spectrum with a red arrow pointing to a specific feature.

Search filters and results:

- Observatory: La Silla Paranal APEX (6)
- Data Type: SPECTRUM (6)
- Spectral Range: 6
- Filter/Band: No data to display
- Spectral Resolution: 3

Actions	Dist.	Data Type
<input type="checkbox"/>	0.738°	SPECTRUM
<input type="checkbox"/>	0.738°	SPECTRUM
<input type="checkbox"/>	0.934°	SPECTRUM
<input type="checkbox"/>	13.85°	SPECTRUM
<input type="checkbox"/>	17.72°	SPECTRUM
<input type="checkbox"/>	18.16°	SPECTRUM

Dataset details:

- Object: V766Cen
- RA (J2000): 13:47:10.82
- Dec (J2000): -62:35:22.3
- Galactic longitude: 309.2976
- Galactic latitude: -0.4088
- Data Type: SPECTRUM
- Signal-to-Noise Ratio: 250.6
- Data Level: 2
- Spectral Range: 377.2-790 nm
- Spectral Resolution (R): 190000
- Start of Observation: 2019-03-02 06:53:35
- End of Observation: 2019-03-02 06:58:35
- MJD Range: 58544.28722-58544.29069
- Effective Exposure Time: 300 s
- Total Exposure Time: 300 s
- Number of Observations: single

# Searching ground-based public domain spectra

- ESO Archive [http://archive.eso.org/wdb/wdb/adp/phase3\\_spectral/form](http://archive.eso.org/wdb/wdb/adp/phase3_spectral/form)  
Spectral Data Products

**Spectral Data Products Query Form**

This form provides access to **reduced spectra** and **data cubes** that were contributed by PIs of ESO programmes or produced by ESO (using ESO calibration pipelines with the best available calibration data). These data were then integrated into the ESO [Science Archive Facility](#) through the [Phase 3 process](#). Each available data set is fully described; please see the [list of contributed data releases](#) and [pipeline-processed data](#) Read more...

**Search**  Output preferences:   Return max  rows.

**Target/Position Information**

**Star ALS 15229 in Trumpler 14 cluster**

**Target name**  **SIMBAD name**  [Query by Target List:](#)  No file selected.

**Input Coord. Sys.**

**Position** **RA**  **DEC**  RA: *sexagesimal hours, decimal degrees*

**Search Box**   **Output Display:**  RA  DEC  Gal long  Gal lat

**Spectra & Cubes Characteristics**

**Wavelength coverage**  [nm] Examples: [656, 393 AND 656, 393..656](#).

**R ( $\lambda/\Delta\lambda$ )**  e.g. [> 10000](#) or [≤ 3000](#) or [3000..10000](#)

**Flux Calibration**

**Product category**  Any  cube  spectrum

**Parameters specific to 1d spectra** **Parameters specific to data cubes**

**SNR (spectra)**

**Aperture**  [arcsec]

**Spectral bin**  [nm]

**Dispersive element**

**Extended object**

**Normalised**

**Total flux**

**ABMAGLIM (cubes)**

**Spatial Resolution**  [arcsec]

**Strehl Ratio**  *a constraint on a number between 0 and 1*

**Observation/Temporal Parameters**

**Telescope**   
APEX-12m  
ESO-3.6  
ESO-NTT  
ESO-VLT-U1

**Instrument**   
APEXHET  
EFOSC  
ESPRESSO  
FEROS

**OBSTECH**   
ECHELLE  
ECHELLE,ABSORPTION-CELL  
ECHELLE,ABSORPTION-CELL,SLIC#1  
ECHELLE,ABSORPTION-CELL,SLIC#3

**Date Obs**  **UT time** (Place the mouse here to see examples)



# Searching ground-based public domain spectra

- ESO Catalogue Facility <https://www.eso.org/qi/>  
Public Surveys: 58 catalogues including GES DR5, FEROS, HARPS, X-SHOOTER, ...

The screenshot shows the ESO Catalogue Facility website. At the top, there is the ESO logo and the text "European Southern Observatory" and "ESO — Reaching New Heights in Astronomy". Below this is a navigation bar with links for "Public", "Science", "User Portal", "Intranet", "Contact", "Site Map", and a search box. The main content area is titled "Science Users Information > ESO Science Archive Facility > ESO Data > ESO Catalogue Facility". On the left, there is a sidebar menu with various options, and a red arrow points to "ESO Catalogue Facility". The main content area contains a search form with fields for "Title" and "Content", a "Find" button, and a checkbox for "include obsolete versions". Below the search form, it says "58 catalogues found (out of 58)". A table titled "ESO public survey" lists various surveys with columns for PROGRAMME, TITLE, INSTRUMENT, FILTER SET, VERSION, PUBLICATION DATE, INFO, and REQUEST. A red arrow points to the "GAIAESO" row in the table.

European Southern Observatory

ESO — Reaching New Heights in Astronomy

Public Science User Portal Intranet Contact Site Map Search Go!

Science Users Information > ESO Science Archive Facility > ESO Data > ESO Catalogue Facility Alex Label Logout

ESO Data  
Raw Data Query Form  
Reduced Data Query Form  
Instrument Specific Query Forms  
PI Packages  
Observation Schedule  
Ambient Conditions Database  
User Publications  
Data Direct Retrieval  
Data Products  
Data Packages  
ESO Catalogue Facility  
User Help

The catalogue facility provides access to the collection of catalogue data that were produced by PIs of ESO programmes and then integrated into the ESO science archive through the **Phase 3** process.

Find catalogues by

Title  Content    include obsolete versions

58 catalogues found (out of 58)

**ESO public survey**

PROGRAMME	TITLE (click on title for querying)	INSTRUMENT	FILTER SET	VERSION	PUBLICATION DATE	INFO	REQUEST
UltraVISTA	<a href="#">COSMOS2020 CLASSIC catalogue: multi-wavelength traditional aperture photometry and photometric redshifts in the COSMOS field</a>	VIRCAM	Y,J,H,Ks,NB118	2	2022-06-30	(i)	(r)
UltraVISTA	<a href="#">COSMOS2020 FARMER catalogue: multi-wavelength profile fitting photometry and photometric redshift in the COSMOS field</a>	VIRCAM	Y,J,H,Ks,NB118	2	2023-03-09	(i)	(r)
UltraVISTA	<a href="#">Deep/Ultra-Deep Near-IR Survey of the COSMOS Field (Ultra-VISTA)</a>	VIRCAM	Y,J,H,Ks,NB118	4	2023-05-03	(i)	(r)
GCAV	<a href="#">GCAV catalogue for RXCJ1514.9-1523 cluster</a>	VIRCAM	Y,J,Ks	1	2018-12-20	(i)	(r)
GCAV	<a href="#">GCAV catalogue for RXCJ2129.6+0005 cluster</a>	VIRCAM	Y,J,Ks	1	2018-12-20	(i)	(r)
GAIAESO	<a href="#">Gaia-ESO spectroscopic survey</a>	MULTI		4	2023-07-02	(i)	(r)
LEGA-C	<a href="#">Large Early Galaxy Census Spectroscopic Survey</a>	VIMOS		3	2021-07-29	(i)	(r)
PESSTO	<a href="#">PESSTO Multi-epoch Photometry</a>	MULTI		3	2021-07-23	(i)	(r)
PESSTO	<a href="#">PESSTO Public ESO Spectroscopic Survey of Transient Objects</a>	EFOSC		3	2021-03-23	(i)	(r)



# Searching ground-based public domain spectra

- ESO Catalogue Facility <https://www.eso.org/qi/>  
Public Surveys: 58 catalogues including GES DR5, FEROS, HARPS, X-SHOOTER, ...

Public Science User Portal Intranet Contact Site Map Search Go!

Science Users Information > ESO Science Archive Facility > ESO Data > ESO Catalogue Facility Alex Label Logout

ESO Data  
Raw Data Query Form  
Reduced Data Query Form  
Instrument Specific Query Forms  
PI Packages  
Observation Schedule  
Ambient Conditions Database  
User Publications  
Data Direct Retrieval  
Data Products  
Data Packages  
ESO Catalogue Facility  
User Help

### Gaia-ESO spectroscopic survey, Version 4 (Details)

#### Search by position

Single Target List of Targets

Target:

Size:    Cone  Box

in  format

#### Constraints per column

Sort	Column	Constraint	Unit	Description	UCD
	OBJECT	<input type="text"/>		GES object name from coordinates	meta.id;meta.main
	GES_FLD	<input type="text"/>		GES field name from CASU	meta.id
	GES_TYPE	<input type="text"/>		GES Classification System of Target Programmes	meta.code.member

# Searching ground-based public domain spectra

- ESO Catalogue Facility <https://www.eso.org/qi/>  
Public Surveys: 58 catalogues including GES DR5, FEROS, HARPS, X-SHOOTER, ...

Science Users Information > ESO Science Archive Facility > ESO Data > ESO Catalogue Facility Alex Label Logout

**ESO Data**  
Raw Data Query Form  
Reduced Data Query Form  
Instrument Specific Query Forms  
PI Packages  
Observation Schedule  
Ambient Conditions Database  
User Publications  
Data Direct Retrieval  
Data Products  
Data Packages  
ESO Catalogue Facility  
User Help

**Gaia-ESO spectroscopic survey, Release 4 (Details)**

**Query constraints**  
RA (J2000) 160.9 (10 43 56.6)  
Dec (J2000) -59.6 (-59 33 11)  
Cone size 1 arcmin  
[New Query](#) [Modify Query](#)

**Query Results**  
37 records found (out of 114916) [Download](#) in  Format  Only selected columns  
Elapsed time: 0.722 s  
Results 1-37 of 37 Show 50 results per page

Text boxes under columns select matching rows [Apply Filter](#) [Clear Filter](#)

OBJECT	GES_FLD	GES_TYPE	REC_SETUP	RAVAIL_SETUP	SETUP	REC_WG	RA	DECLINATION	SNR	TEFF
String	String	String	String	String	String	String	Number	Number	Number	Number
10435440-5932574	HD93128	GE_SD_BW	HR14A HR3 HR5A HR6 HR9B U580	HR14A HR3 HR5A HR6 HR9B U580	HR14A:HR3:HR5A:HR6:HR9B:U580	WG13	160.97667	-59.54928	234.740	43440.
10435366-5933006	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.97358	-59.55017	133.290	29432.
10435522-5933147	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.98008	-59.55408	103.200	30834.
10435756-5933385	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.98983	-59.56069	122.120	29684.
10435952-5932316	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.99800	-59.54211	95.3200	25550.
10435090-5933506	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.96208	-59.56406	113.320	25547.
10435388-5932451	Trumpler14	GE_CL			HR14A:HR3:HR4:HR5A:HR6		160.97450	-59.54586	129.290	
10435650-5932498	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.98542	-59.54717	136.400	28754.
10435796-5933537	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.99150	-59.56492	118.610	26104.
10435847-5933016	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.99362	-59.55044	126.200	16630.
10435230-5932361	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.96792	-59.54336	65.8000	16984.
10435622-5932277	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.98425	-59.54103	65.6100	7680.00
10435953-5932227	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.99804	-59.53964	81.5200	22565.
10435580-5932520	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.98250	-59.54778	78.6700	20716.
10435208-5932401	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.96700	-59.54447	46.2100	20500.
10435902-5933197	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR3:HR4:HR5A:HR6	WG13	160.99592	-59.55547	84.9200	26108.
10435724-5932412	Trumpler14	GE_CL	HR14A HR3 HR4 HR5A HR6	HR14A HR3 HR4 HR5A HR6	HR14A:HR15N:HR3:HR4:HR5A:HR6	WG13	160.98850	-59.54478	69.5000	16720.
10435920-5933215	Trumpler14	GE_CL			HR15N		160.99670	-59.55597	100.420	

# Searching ground-based public domain spectra

- ESO Catalogue Facility <https://www.eso.org/qi/>  
Public Surveys: 58 catalogues including GES DR5, FEROS, HARPS, X-SHOOTER, ...

The screenshot displays the ESO Catalogue Facility search interface. At the top, the search criteria are set to "Trumpler 14" with a radius of "1'". The main view shows a star field with a circular selection region. A table below lists search results for "Sky selection (2)".

Actions	Dist.	Data Type	Spec. Range	Spec. Res.	SNR	Obs. Date	Collection	Instrum.	T. Exp. T.	#Obs	PI.	Program Id	Object	Data Prov.	Pub. Date
<input checked="" type="checkbox"/>	11.48"	SPECTRUM	418.3-439.5 nm	23000	105.6	2016-02-28 03:47:37	GIRAFFE	GIRAFFE	780 s	single	GILMORE, GERARD	193.B-0936	ALS_15_229	ESO, PHASE3	2019-01-21
<input checked="" type="checkbox"/>	11.48"	SPECTRUM	418.3-439.5 nm	23000	83.2	2016-02-28 03:31:59	GIRAFFE	GIRAFFE	780 s	single	GILMORE, GERARD	193.B-0936	ALS_15_229	ESO, PHASE3	2019-01-21
<input checked="" type="checkbox"/>	11.48"	SPECTRUM	629.9-669.1 nm	17000	189.5		GIRAFFE	GIRAFFE	1008 s	single	GILMORE, GERARD	193.B-0936	ALS_15_229	ESO, PHASE3	2018-12-19
<input checked="" type="checkbox"/>	22.5"	SPECTRUM	644.4-681.6 nm	19200	9.4		GAIAESO	GIRAFFE	3000 s	single	GILMORE, GERARD	193.B-0936	10435855-5933280	GILMORE, GERARD	2020-12-09
<input checked="" type="checkbox"/>	22.5"	SPECTRUM	644.2-682.2 nm	17000	17.5		GIRAFFE	GIRAFFE	3000 s	single	GILMORE, GERARD	193.B-0936	2MASS10435855-5933280	ESO, PHASE3	2019-01-23
<input type="checkbox"/>	5.38"	SPECTRUM	643.7-718.2 nm	8100	35.7		GIRAFFE	GIRAFFE	2760 s	single	BECCARI, GIACOMO	095.C-0557	301833	ESO, PHASE3	2019-04-26
<input type="checkbox"/>	5.38"	SPECTRUM	611.4-640.4 nm	24000	6.7		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09
<input type="checkbox"/>	5.38"	SPECTRUM	611.4-640.4 nm	24000	14.2		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09
<input type="checkbox"/>	5.38"	SPECTRUM	611.4-640.4 nm	24000	7.4		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09
<input type="checkbox"/>	5.38"	SPECTRUM	611.4-640.4 nm	24000	17.6		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09
<input type="checkbox"/>	5.38"	SPECTRUM	644.2-682.2 nm	17000	10.9		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09
<input type="checkbox"/>	5.38"	SPECTRUM	644.2-682.2 nm	17000	24		GIRAFFE	GIRAFFE	2415 s	single	BECCARI, GIACOMO	092.C-0820	301833	ESO, PHASE3	2019-09-09

# Searching space-based public domain spectra

- MAST Archive <https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>  
Portal of multiple space missions

Eta Car

Select a collection... MAST Observations by Object Name or RA/Dec and enter target: Eta Car

anonymous  
Login...  
Account Info...

Upload Target List My Download Basket: 0 files Portal User Guide | Leave Feedback | About This Site

Home Page MAST: Eta Car

Displaying 1359 of 12209 Total Rows \* eta Car (RA: 10:45:03.538, Dec: -59:41:04.05), radius: 0.20000"

Filters

Waveband

- Optical (444 of 7,977)
- UV (899 of 1,231)
- Infrared (16 of 1,172)
- OPTICAL (0 of 1,049)
- INFRARED (0 of 79)

Target Classification

- STAR (686 of 2,327)
- ETA CARINAE STAR (479 of 1,123)
- UNIDENTIFIED (21 of 653)
- PARALLEL FIELD (14 of 646)
- MAIN SEQUENCE O (73 of 594)

Product Type

- image (0 of 6,578)
- timeseries (0 of 4,105)
- spectrum (1,359 of 1,359)
- IMAGE (0 of 167)

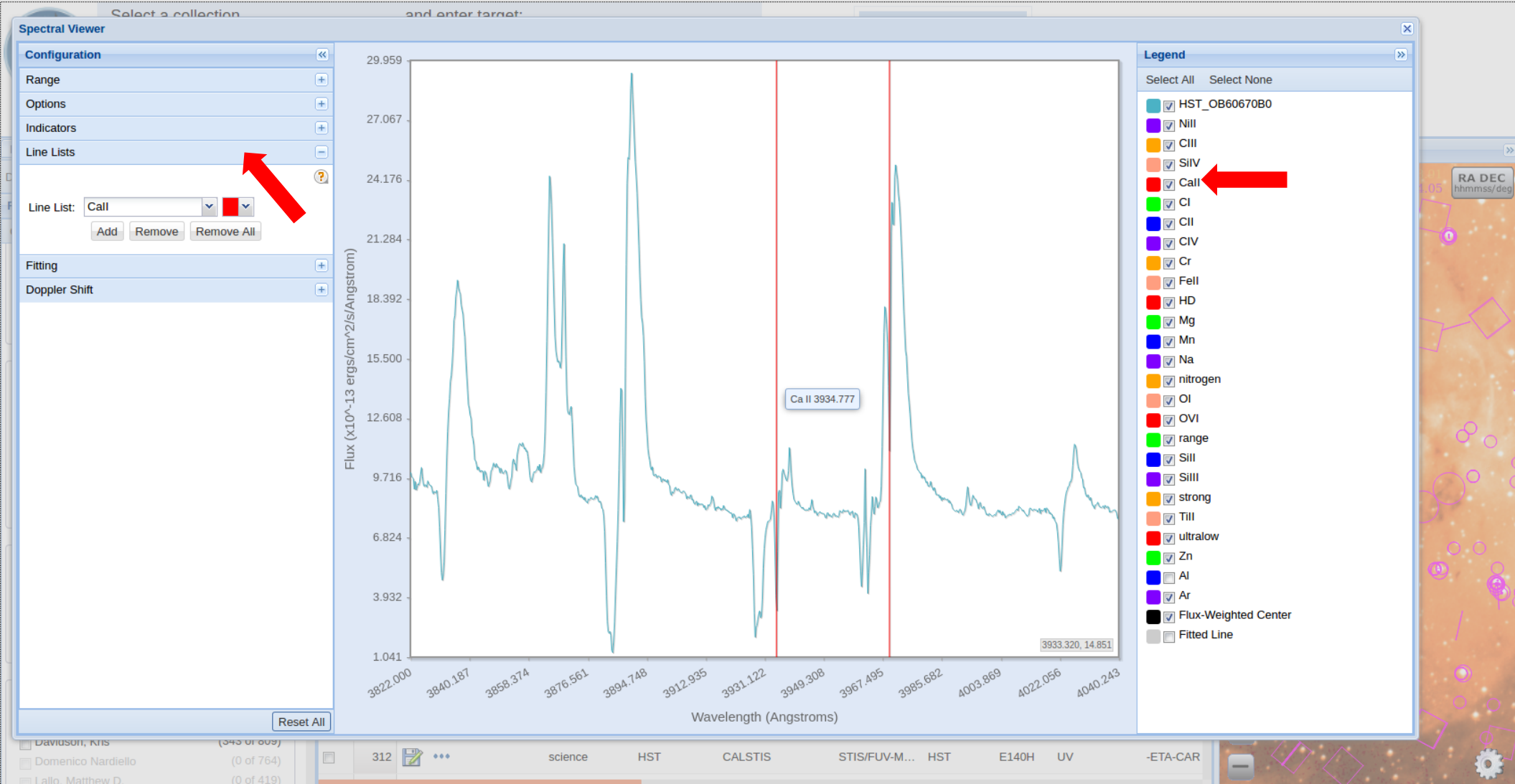
Actions	Observation T...	Mission	Provenance Name	Instrument	Project	Filters	Waveband	Target Name
298	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
299	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
300	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
301	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-NNE
302	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-NNE
303	science	HST	CALSTIS	STIS/CCD	HST	G430M	Optical	ETA-CAR-NNE
<input checked="" type="checkbox"/> 304	science	HST	CALSTIS	STIS/CCD	HST	G430M	Optical	ETA-CAR-NNE
305	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
306	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR
307	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
308	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR-A
309	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	ETA-CAR
310	science	HST	CALSTIS	STIS/CCD	HST	G750M	Optical	-ETA-CAR
311	science	HST	CALSTIS	STIS/FUV-M...	HST	E140H	UV	-ETA-CAR
312	science	HST	CALSTIS	STIS/FUV-M...	HST	E140H	UV	-ETA-CAR

AstroView

10:45:44.051 -59:34:29.12 RA DEC  
10:45:03.538 -59:41:04.05 hhmms/deg

# Searching space-based public domain spectra

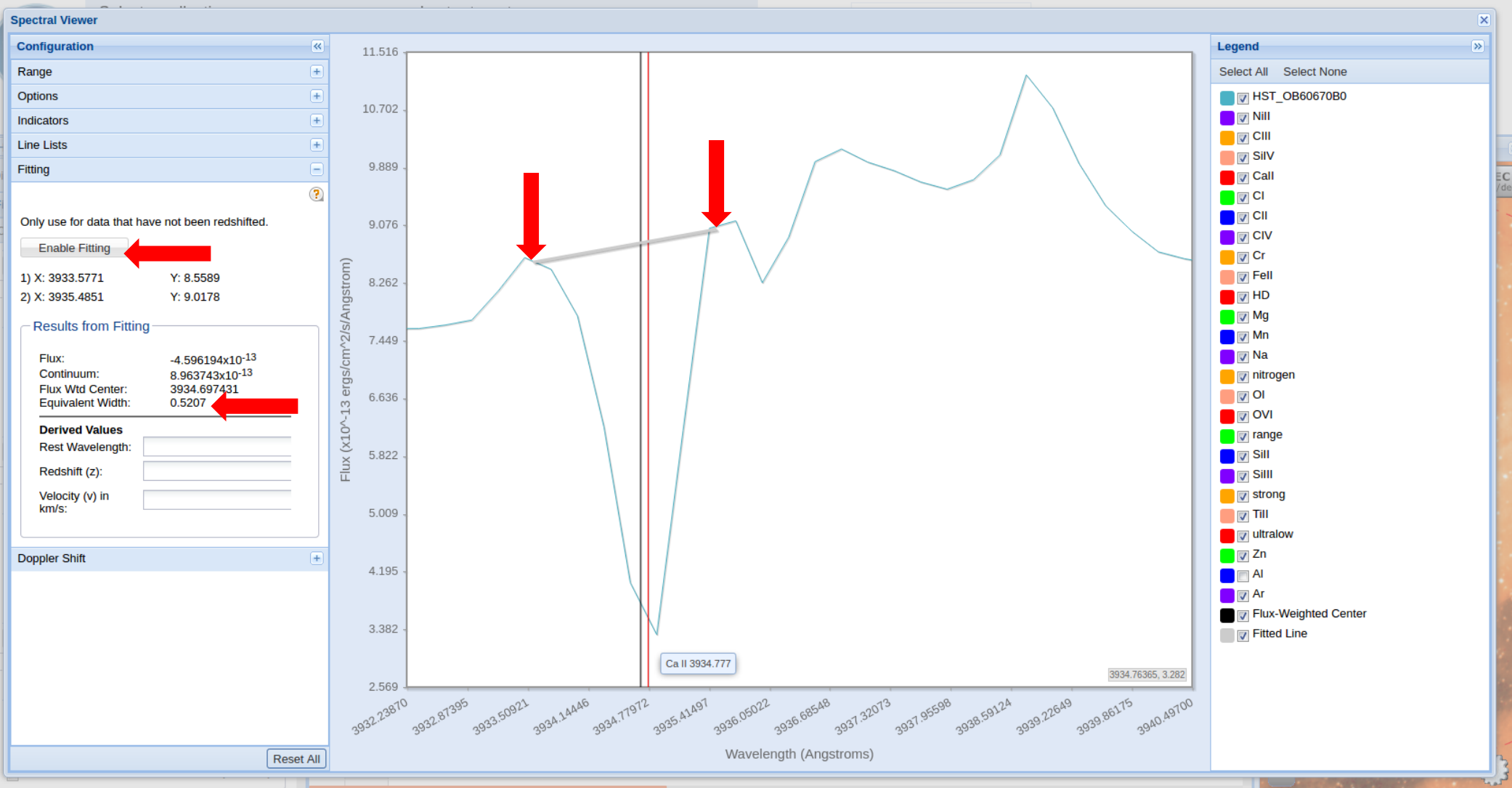
- MAST Archive <https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>  
Portal of multiple space missions



Near-UV Ca II doublet lines in Eta Car (Ca II H line inside of P Cyg profile of H I epsilon)

# Searching space-based public domain spectra

- MAST Archive <https://mast.stsci.edu/portal/Mashup/Clients/Mast/Portal.html>  
Portal of multiple space missions




Eta Car: measure online equivalent line width of Ca II K absorption line of  $W_{\text{eq}} = 0.5207 \text{ \AA}$

# Some useful archive & catalog data crawlers

- Search through large number of catalogs at once from very diverse sources (including spectrum models). Queries on star names may take long to complete.
- VO <https://heasarc.gsfc.nasa.gov/cgi-bin/vo/datascope/init.pl>

VAO Logo  
Virtual  
Astronomical  
Observatory



VAO Data Discovery: DataScope

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VAO Home Help Contact Us

## Search a position for all known information

Use DataScope to find everything that's known about a given target or region of the sky. DataScope will query hundreds of VO-enabled data resources and organize the results for your viewing. *New in version 4:* Additional resources now being searched, which can (among other things) significantly increase the number of VizieR catalogs found.

**Position:**

Use a target name (e.g., 3c273) or position (e.g., 10 10 10.1, 20 20 20.2)

**Size:**  (in degrees, max is 2)

**Run query:**

**Skip cache?**  Do not add to list of recent queries?

**Positions** may be entered in decimal (dd.f, sdd.f) or sexagesimal (hh mm ss.f, dd mm ss.f) notation or as targets recognized by NED or SIMBAD.

The **Size** should be entered in decimal degrees.

Use the **Skip cache** flag to ensure that you get the latest results from all services.

By default the last few queries anyone has made are shown at the bottom of the page but there is a checkbox to keep your query from being recorded on this list.

Some recent queries:

- null (3.33E-4)
- null (10.0)
- m57 (0.25)
- null (0.2)
- Rho Cas (0.01)

(version 4.5, last updated June 25 2013)

---

Developed with the support of the [National Science Foundation](#) under Cooperative Agreement AST0122449 with the Johns Hopkins University

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IVOA

MEET THE DEVELOPERS  
Meet the Developers

This NVO Application is hosted by [NASA/HEASARC](#)

---

Hosted by the [Astrophysics Science Division](#) and the High Energy Astrophysics Science Archive Research Center (HEASARC) at [NASA/ GSFC](#)

HEASARC Director: [Dr. Alan P. Smale](#),  
Responsible NASA Official: [Phil Newman](#)

[Privacy Security Notices](#)

# Some useful archive & catalog data crawlers

- Search through large number of catalogs at once from very diverse sources (including spectrum models). Queries on star names may take long to complete.
- VO <https://heasarc.gsfc.nasa.gov/cgi-bin/vo/datascope/init.pl>

**VAO Data Discovery: DataScope**

VAO Logo Virtual Astronomical Observatory | NASA logo Hosted by: HEASARC NASA/GSFC

**Search a position for all known information**

Use DataScope to find everything that's known about a given target or region of the sky. DataScope will query hundreds of VO-enabled data resources and organize the results for your viewing. *New in version 4:* Additional resources now being searched, which can (among other things) significantly increase the number of VizieR catalogs found.

**Position:**  (Use a target name (e.g., 3c273) or position (e.g., 10 10 10.1, 20 20 20.2))

**Size:**  (in degrees, max is 2)

**Run query:**

**Skip cache?** Do not allow cache

**Positions** may be entered in decimal (dd.f, sdd.f) or sexagesimal targets recognized by NED or SIMBAD.  
The **Size** should be entered in decimal degrees.  
Use the **Skip cache** flag to ensure that you get the latest results from the cache.  
By default the last few queries anyone has made are shown at the bottom of the page. Use the checkbox to keep your query from being recorded on this list.

Some recent queries:

- null (3.33E-4)
- null (10.0)
- m57 (0.25)
- null (0.2)
- Rho Cas (0.01)

(version 4.5, last updated June 25 2013)

---

Developed with the support of the [National Science Foundation](#) AST0122449 with the Johns Hopkins University  
The NVO is a member of the [International Virtual Observatory Alliance](#)  
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NSF HOME | NASA HOME

Hosted by the [Astrophysics Science Division](#) and the [High Energy Astrophysics Science Archive Research Center](#)  
HEASARC Director: [Dr. Alan P. Smale](#),  
Responsible NASA Official: [Phil Newman](#)  
[Privacy](#) [Security](#) [Notices](#)

**NVO Portal: DataScope Response**

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Home | New Query | Help | Contact Us

Data found(238) | No data (8218) | Errors(9993) | Waiting(0) | 100% complete

Position: Rho Cas | Resources/hits: 18449/201691 | Cache age: 0.582 hours

**Summary** | Resources | Data Table | No Data | Still Processing | Errors | Help

**Summary of Request and Selections**

Request parameters	
Target:	Rho Cas
23 54 23.3	57 29 57.8
358.595969	57.499382
Size:	0.01

No resources currently selected.  
When you check tables and individual data files, you can download them in a single tar file or send them to Aladin from here.  
A know bug will sometime cause this page to not properly reflect selected values. If this happens you should reload the page and try again.

**Analysis Options**


SkyView Image  
DSS1 Optical Image of Requested Region (from [SkyView](#))



# Some useful archive & catalog data crawlers

- Search through large number of catalogs at once from very diverse sources (including spectrum models). Queries on star names may take long to complete.
- VO <https://heasarc.gsfc.nasa.gov/cgi-bin/vo/datascope/init.pl>

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Virtual  
Astronomical  
Observatory



VAO Data Discovery: DataScope

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## Search a position for all known information

Use DataScope to find everything that's known about a given target or region of the sky. DataScope will query hundreds of VO-enabled data resources and organize the results for your viewing. *New in version 4: Additional resources now being searched, which can (among other things) significantly increase the*

Scroll down results page to Spectra

<input type="checkbox"/> J/MNRAS/363/1111 (1) ?	<input type="checkbox"/> J/MNRAS/389/869 (1) ?	<input type="checkbox"/> J/MNRAS/427/343 (1) ?	<input type="checkbox"/> V/15 (1) ?	<input type="checkbox"/> V/17A (1) ?
<input type="checkbox"/> V/50 (1) ?	<input type="checkbox"/> V/51 (3) ?	<input type="checkbox"/> V/53A (1) ?	<input type="checkbox"/> V/68A (1) ?	<input type="checkbox"/> V/69 (1) ?
<input type="checkbox"/> V/95 (1) ?				
<input type="checkbox"/> Other tables				
<input type="checkbox"/> ASCC-2.5_Search (2) ?	<input type="checkbox"/> FONAC_Version2.0 (1) ?			
<input type="checkbox"/> Spectra				
<input type="checkbox"/> ELODIE (14) ?	<input type="checkbox"/> Polarbase SSAP (1076) ?	<input type="checkbox"/> ATMO-CEQ (231) ?	<input type="checkbox"/> ATMO-NEQs (140) ?	<input type="checkbox"/> ATMO-NEQw (139) ?
<input type="checkbox"/> BT-COND (13648) ?	<input type="checkbox"/> BT-DUSTY (13674) ?	<input type="checkbox"/> Black Body (588) ?	<input type="checkbox"/> BT-NextGen-AGSS (13627) ?	<input type="checkbox"/> BT-NextGen-GNS93 (3903) ?
<input type="checkbox"/> BT-Settl-AGSS (14195) ?	<input type="checkbox"/> BT-Settl-CIFIST (446) ?	<input type="checkbox"/> BT-Settl-GNS93 (3850) ?	<input type="checkbox"/> BT-Settl (13722) ?	<input type="checkbox"/> COND00 (317) ?
<input type="checkbox"/> Coelho (SEDs) (3727) ?	<input type="checkbox"/> Coelho (highres) (3727) ?	<input type="checkbox"/> DRIFT-PHOENIX (520) ?	<input type="checkbox"/> DUSTY00 (199) ?	<input type="checkbox"/> Goyal_local (28160) ?
<input type="checkbox"/> GRAMS-Crich (12243) ?	<input type="checkbox"/> GRAMS-Orich (1225) ?	<input type="checkbox"/> Goyal_rainout (28160) ?	<input type="checkbox"/> HRES (1650) ?	<input type="checkbox"/> Husfeld (448) ?
<input type="checkbox"/> Kurucz (3808) ?	<input type="checkbox"/> Kurucz2003 (3808) ?	<input type="checkbox"/> Kurucz2003a04 (4284) ?	<input type="checkbox"/> Kurucz2003all (8092) ?	<input type="checkbox"/> Levenhagen (2183) ?
<input type="checkbox"/> Morley 2012 (182) ?	<input type="checkbox"/> Morley 2014 (76) ?	<input type="checkbox"/> Morley15Cfree_em (29) ?	<input type="checkbox"/> Morley15Cfree_tr (29) ?	<input type="checkbox"/> Morley15Cloud_em (72) ?
<input type="checkbox"/> Morley15Cloud_tr (72) ?	<input type="checkbox"/> Morley15Soot_em (120) ?	<input type="checkbox"/> Morley15Soot_tr (120) ?	<input type="checkbox"/> Morley15Thol_em (100) ?	<input type="checkbox"/> Morley15Thol_tr (100) ?
<input type="checkbox"/> NextGen (272) ?	<input type="checkbox"/> NextGen (2712) ?	<input type="checkbox"/> POPSTAR+Chabrier (1908) ?	<input type="checkbox"/> POPSTAR+Ferrini (1908) ?	<input type="checkbox"/> POPSTAR+Kroupa (1908) ?
<input type="checkbox"/> POPSTAR+Salpeter (1908) ?	<input type="checkbox"/> POPSTAR+Salpeter (1869) ?	<input type="checkbox"/> Pacheco2021 (96) ?	<input type="checkbox"/> Saumon2012 (149) ?	<input type="checkbox"/> TLUSTY BSTAR2006 (981) ?
<input type="checkbox"/> TLUSTY Merged (1299) ?	<input type="checkbox"/> TLUSTY OSTAR2002 (690) ?	<input type="checkbox"/> TMAP (1287) ?	<input type="checkbox"/> TMAP (Grid 1) (59) ?	

response

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Query Help Contact Us

Waiting(0) 100% complete  
Cache age:0.582 hours

data Still Processing Errors Help

an  
bin  
SkyView Image  
DSS1 Optical Image of Requested Region (from SkyView)

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HEASARC Director: Dr. Alan P. Smale,

Responsible NASA Official: Phil Newman

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### Analysis Options

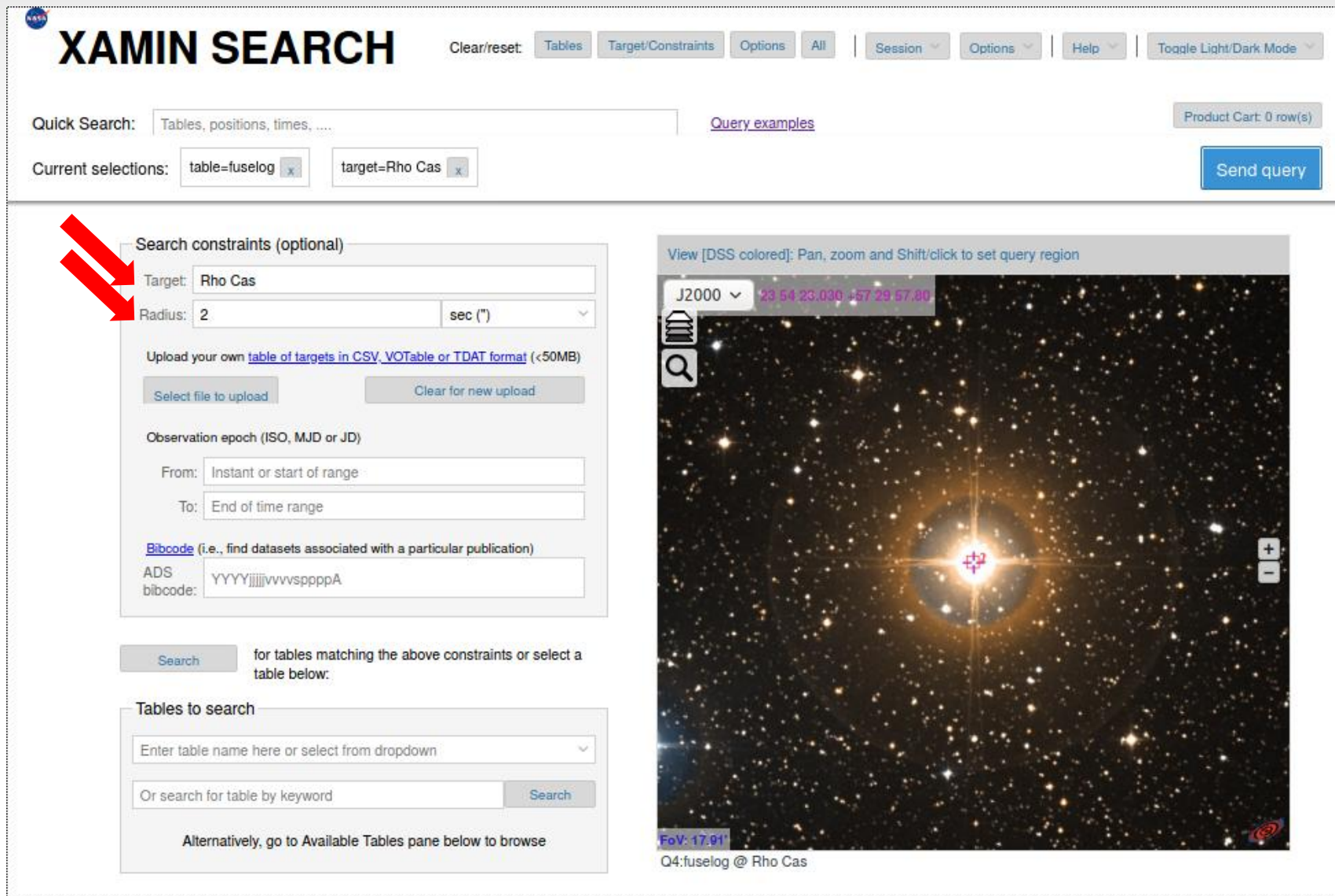
Aladin Applet

Aladin script

Save as tar

# Some useful archive & catalog data crawlers

- Search through large number of online catalogs at once from very diverse missions (rather used for high-energy astrophysics, Chandra, XMM, FUSE, ...)
- XAMIN Search [https://heasarc.gsfc.nasa.gov/xamin\\_beta/](https://heasarc.gsfc.nasa.gov/xamin_beta/)



**XAMIN SEARCH** Clear/reset: Tables Target/Constraints Options All Session Options Help Toggle Light/Dark Mode

Quick Search: Tables, positions, times, .... Query examples Product Cart: 0 row(s)

Current selections: table=fuselog target=Rho Cas Send query

**Search constraints (optional)**

Target: Rho Cas

Radius: 2 sec (")

Upload your own [table of targets in CSV, VOTable or TDAT format](#) (<50MB)

Select file to upload Clear for new upload

Observation epoch (ISO, MJD or JD)

From: Instant or start of range

To: End of time range

[Bibcode](#) (i.e., find datasets associated with a particular publication)

ADS bibcode: YYYYYjjjjjvvvsvppppA

Search for tables matching the above constraints or select a table below:

**Tables to search**

Enter table name here or select from dropdown

Or search for table by keyword Search

Alternatively, go to Available Tables pane below to browse

View [DSS colored]: Pan, zoom and Shift/click to set query region

J2000 23 54 23.030 +57 29 57.80

FoV: 17.91

Q4:fuselog @ Rho Cas

# Some useful archive & catalog data crawlers

- Search through large number of online catalogs at once from very diverse missions (rather used for high-energy astrophysics, Chandra, XMM, FUSE, ...)
- XAMIN Search [https://heasarc.gsfc.nasa.gov/xamin\\_beta/](https://heasarc.gsfc.nasa.gov/xamin_beta/)

The screenshot displays the XAMIN Search interface. At the top, the title "XAMIN SEARCH" is prominent, followed by navigation buttons like "Clear/reset", "Tables", "Target/Constraints", "Options", "All", "Session", "Options", "Help", and "Toggle Light/Dark Mode". A "Quick Search" input field contains "Tables, positions, times, ...." and a "Send query" button is visible. Below this, "Current selections" shows "table=fuselog" and "target=Rho Cas".

The main content area is divided into several sections:

- Matches in HEASARC Catalogs**: A section for search results.
- Available Tables**: A list of tables with a search icon.
- Available Tables (click on plus to add, i to view documentation)**: A list of categories including "Master Observation Tables", "Popular Missions (521)", "All Missions (684)", "Alphabetic (1015)", "Regime (1000)", and "Type (262)".
- Selected table(s): 1 selected (click on minus to remove)**: Shows "fuselog" is selected.
- Table Parameters & Constrains: For fuselog**: A section for table-specific settings.
- Results**: A table of search results.

The results table is titled "Q3:fuselog @ Rho Cas" and includes columns for "obsid", "name", "ra", "dec", "start\_time", "exposure\_time", "public\_flag", and "\_offset". Two rows are visible:

	obsid	name	ra	dec	start_time	exposure_time	public_flag	_offset
1	U1047...	HD224...	23 54 23.0	57 29 58	2006-11-01T16:18:46	22550	null	0.0118
2	E0680...	HD224...	23 54 23.0	57 29 58	2004-07-27T12:34:33	28005	null	0.0118

Below the table, there is a section for "FUSE resources at MAST (compound)" with links to "FUSE Data Preview (MAST)", "FUSE Data Search (MAST)", and "FUSE Proposal Info (MAST)". A red arrow points to the "FUSE Data Preview" link.

On the right side, there is a large image of a star field with a central bright star. A text box above the image says "zoom and Shift/click to set query region". Below the image, there is a "FoV: 17.91" label and "Q4:fuselog @ Rho Cas".

# Some useful archive & catalog data crawlers

- Search through large number of online catalogs at once from very diverse missions (rather used for high-energy astrophysics, Chandra, XMM, FUSE, ...)
- XAMIN Search [https://heasarc.gsfc.nasa.gov/xamin\\_beta/](https://heasarc.gsfc.nasa.gov/xamin_beta/)

**XAMIN SEARCH** Clear/reset: Tables Target/Constraints Options All Session Options Help Toggle Light/Dark Mode

Quick Search: Tables, positions, times, .... Query examples Product Cart: 0 row(s)

Current selections: table=fuselog target=Rho Cas Send query

Matches in HEASARC Catalogs

Available Tables

Available Tables (click on plus to add, i to view documentation)

- Master Observation Tables
- Popular Missions (521)
- All Missions (684)
- Alphabetic (1015)
- Regime (1000)
- Type (262)

Table Parameters & Constraints: For fuselog

Results

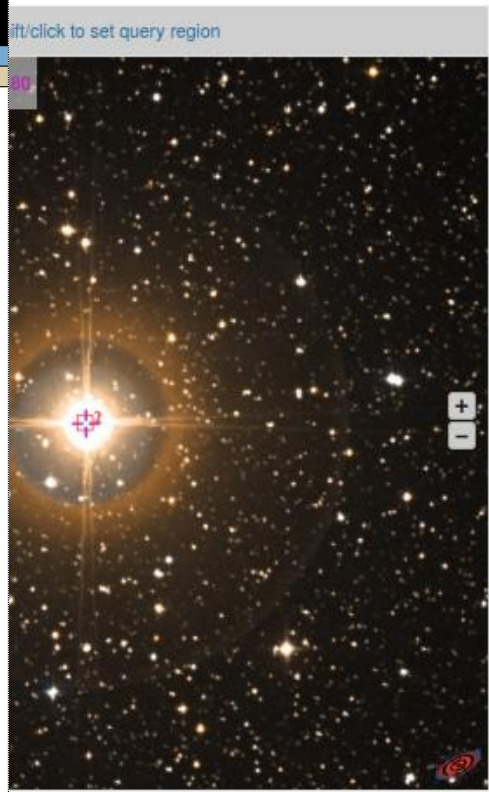
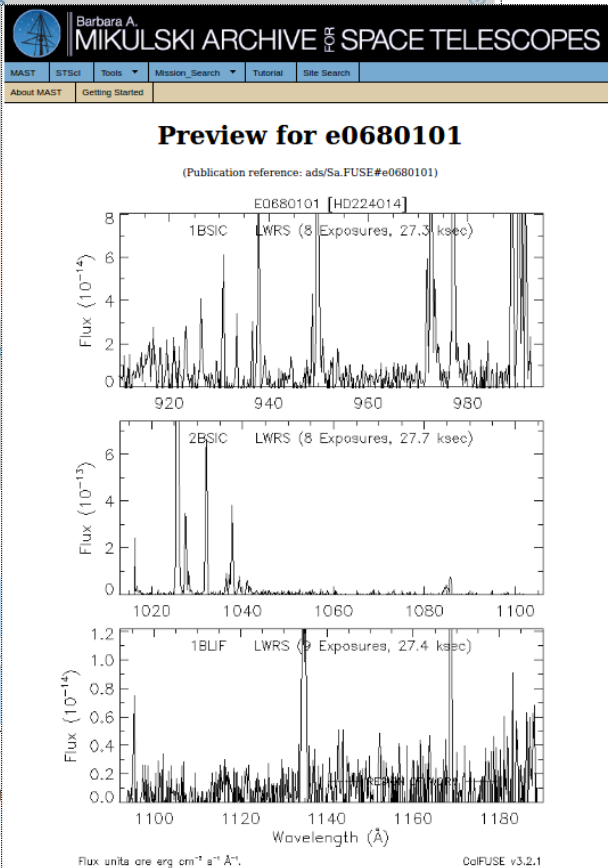
Q3:fuselog @ Rho Cas

Click to filter by product type

	obsid	name	ra	dec	start_time	exposure_time
1	U1047...	HD224...	23 54 23.0	57 29 58	2006-11-01T16:18:46	22550
2	E0680...	HD224...	23 54 23.0	57 29 58	2004-07-27T12:34:33	28005

FUSE resources at MAST (compound)

- FUSE Data Preview (MAST), (html) <http://archive.stsci.edu/cgi-bin/mastrpreview?mission=fuse&da>
- FUSE Data Search (MAST), (html)
- FUSE Proposal Info (MAST), (html)



# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

The screenshot displays the ESA-Gaia Data Archive interface for the star Gaia DR3 411183456779557376, identified as Cepheid BF Oph. The page is organized into several sections:

- Search and Navigation:** The top navigation bar includes 'HOME', 'SEARCH', 'SINGLE OBJECT', 'VISUALISATION', and 'HELP'. A search bar contains the ID 'Gaia DR3 411183456779557376' with a 'Download' button and a close icon. A red arrow points to the search bar.
- Astrometry Table:** A table with columns 'Description', 'Value', and 'Unit' provides key parameters:

Description	Value	Unit
Equatorial ICRS (RA,DEC) at epoch 2016	256.5229102004, -26.5805651308	deg
Galactic (l, b) at epoch 2016	357.0803450631, 8.5731964881	deg
Parallax	1.1538 ± 0.0241	mas
RA proper motion	0.3896 ± 0.0256	mas yr <sup>-1</sup>
DEC proper motion	-0.2893 ± 0.0165	mas yr <sup>-1</sup>
Renormalised unit weight error	0.837	
- Epoch Photometry:** A scatter plot showing magnitude (6.5 to 8) versus time in TCB (Jan 2015 to Jan 2017). Data points are color-coded by filter: G Mag (green), BP Mag (blue), and RP Mag (red).
- BP/RP (XP) Spectrum:** A plot of flux (W m<sup>-2</sup> nm<sup>-1</sup>) versus wavelength (300-1000 nm), showing the broad-band photometric response.
- RVS Spectrum:** A plot of normalized flux versus wavelength (845-870 nm), showing the high-resolution spectrum. A red arrow points to a specific absorption feature at approximately 850 nm.
- ESASky Visualization:** A large image showing the star's position in a field of stars, with a crosshair marking the target. The interface includes search and navigation tools.

# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

The screenshot shows the ESA Gaia Archive search interface. At the top, there are navigation links for "EUROPEAN SPACE AGENCY" and "ABOUT ESAC", along with a "SIGN IN" button. The main header features the "gaia archive" logo and the ESA logo. Below the header, there are navigation tabs: "HOME", "SEARCH", "SINGLE OBJECT", "VISUALISATION", and "HELP". The "SEARCH" tab is active, and the "Advanced (ADQL)" sub-tab is selected. A search bar contains the text "gaia". To the left of the search bar, there are icons for various data types: "Other", "Gaia Data Release 1", "Gaia Data Release 2", "Gaia Data Release 3", "Astrophysical parameters", "Auxiliary", "Cross match", "Extra-galactic", "Non-single stars", "Performance verification", "Reference frame", "Science alerts", "Simulation", "Solar system", "Spectroscopy", and "Variability". The "Gaia Data Release 3" category is expanded, showing sub-categories like "gaiadr3.gaia\_source", "gaiadr3.gaia\_source\_lite", and "gaiadr3.xp\_summary".

The main search area contains a "Job name:" field and a "Query examples" link. The query entered is: `1 SELECT * FROM gaiadr3.vari_epoch_radial_velocity WHERE source_id=411183456779557376`. Below the query field, there is a "Ctrl+Space for query autocompletion"提示 and two buttons: "Reset Form" and "Submit Query".

The results table shows a single job with the following details:

Status	Job	Creation date	Num. rows	Size	Actions
✓	16941070026270	07-Sep-2023, 19:16:42	31	2 KB	[Info] [Download] [Export] [Print] [Share]

Red arrows point to the "31" in the "Num. rows" column and the "Export" icon in the "Actions" column. Below the table, there is a text label "31 epoch RV values". At the bottom of the page, there are navigation controls (1-1 of 1), a "Download format" dropdown set to "CSV", and buttons for "Apply jobs filter", "Filter this session", "Select all jobs", and "Delete selected jobs". A "(Cookie policy) (v3.3.2)" link is visible in the bottom right corner.

# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

EUROPEAN SPACE AGENCY ABOUT ESAC SIGN IN

## gaia archive

HOME SEARCH SINGLE OBJECT VISUALISATION HELP

Basic Advanced (ADQL) **Query Results**

16941091707940

source_id	transit_id	rv_obs_time d	radial_velocity km.s <sup>-1</sup>	radial_velocity_error km.s <sup>-1</sup>	rejected_by_variability	solution_id
4111834567779557376	17443071633056607	1712.2937251997012	-14.084229649176656	0.3071819685748134	false	375316653866487564
4111834567779557376	29506380911141698	1930.4558703658586	-26.74419896551725	0.22384114524415394	false	375316653866487564
4111834567779557376	39096989405439781	2103.8912319752476	-46.69977226118124	0.1769115743727786	false	375316653866487564
4111834567779557376	39968131156440891	2119.6440603493024	-44.25474893763902	0.19695150651679305	false	375316653866487564
4111834567779557376	39972223407940574	2119.7180600603956	-46.058494202080496	0.18463377143885398	false	375316653866487564
4111834567779557376	49525670254794059	2292.4942508326494	-26.231450129785443	0.22956990853814763	false	375316653866487564
4111834567779557376	50116308134151796	2303.1764734683206	-46.85290991533672	0.18127101750801816	false	375316653866487564
4111834567779557376	50120400440451700	2303.2504870072516	-46.13243988210951	0.1799828927735967	false	375316653866487564
4111834567779557376	55345055387505932	2397.735797920915	-33.769309198941	0.21506608574264585	false	375316653866487564
4111834567779557376	55349147696943721	2397.809800030841	-32.49167826971084	0.21446689465946525	false	375316653866487564
4111834567779557376	55842998104380641	2406.7401615340423	-21.541846028762507	0.2276354291142216	false	375316653866487564
4111834567779557376	55847090435191049	2406.81416336761	-20.734087153926477	0.2450000566210672	false	375316653866487564
4111834567779557376	60281801259795240	2487.006267912707	-37.02472080275497	0.20359162062915737	false	375316653866487564
4111834567779557376	60291542079522176	2487.182413212812	-34.59888001379213	0.21453455730607762	false	375316653866487564
4111834567779557376	60305375111304143	2487.432559091624	-30.748071681613837	0.21987343102546142	false	375316653866487564
4111834567779557376	60309467361638107	2487.506560186235	-30.008427938636423	0.22323064674012844	false	375316653866487564
4111834567779557376	60319208065623076	2487.6827024284103	-27.150185419511384	0.228018684714549	false	375316653866487564
4111834567779557376	60333040963974781	2487.9328455666027	-23.58866227129888	0.23308974376231614	false	375316653866487564
4111834567779557376	60346873822081774	2488.1829880743335	-20.550845289170876	0.23824742913105945	false	375316653866487564
4111834567779557376	60360706657513811	2488.4331294287426	-17.382397462468045	0.24814962231330387	false	375316653866487564

1-20 of 31

Gaia DR3 Data Model

Show query in ADQL form

VOTable

Download

31 epoch RV values

(Cookie policy) (v3.3.2)

# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

The screenshot shows the ESA Gaia Job DataLink interface. The main header includes the ESA logo and navigation tabs: HOME, SEARCH, SINGLE OBJECT, VISUALISATION, and HELP. The search results are displayed in a table with columns for 'Num. rows' and 'Size'. The table shows 31 rows and 2 KB of data. A red arrow points to a link icon in the table's action column. A modal window titled 'Gaia Job DataLink' is open, displaying information about the DataLink protocol and ancillary products. The modal includes a 'Show Data' button, a 'Data release' dropdown set to 'Gaia DR3', and a 'Data structure' dropdown set to 'INDIVIDUAL'. A list of data products is shown, with red arrows pointing to 'Epoch photometry (1)' and 'RVS mean spectra (1)'. The modal also includes a 'Download format' dropdown set to 'CSV' and a 'Save All Data' button. The footer of the page includes a 'Cookie policy (v3.3.2)' link.

gaia archive

HOME SEARCH SINGLE OBJECT VISUALISATION HELP

Basic Advanced (ADQL) Query Results

gaia

Job name:

```
1 SELECT * FROM ga
```

Ctrl+Space for query autocom

Status

✓

Download format: CSV

Save All Data

Depending on the amount and type of data retrieved, Archive response times range from seconds to minutes.

Close

Download format: CSV

Apply jobs filter Filter this session  Select all jobs  Delete selected jobs

Query examples

34567779557376

Reset Form Submit Query

Num. rows Size

31 2 KB

G, BP, RP time-series  
Mean RVS spectrum

(Cookie policy) (v3.3.2)



# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

The screenshot shows the ESA Gaia Data Archive website interface. A 'Text Import' dialog box is open, displaying the following settings and data:

**Import**

- Character set: Western Europe (DOS/OS2-860/Portuguese)
- Language: Default - English (USA)
- From row: 1

**Separator Options**

- Fixed width
- Tab
- Comma
- Semicolon
- Space
- Other
- Text delimiter: [dropdown]

**Other Options**

- Quoted field as text
- Detect special numbers

**Fields**

Column type: [dropdown]

	Standard	Standard	Standard	Standard	Standard	Standard
	source_id	transit_id	rv_obs_time	radial_velocity	radial_velocity_error	rejected_by_variab
1	4111834567779557376	17443071633056607	1712.2937251997012	-14.084229649176656	0.3071819685748134	false
2	4111834567779557376	29506380911141698	1930.4558703658586	-26.74419896551725	0.22384114524415394	false
3	4111834567779557376	39096989405439781	2103.8912319752476	-46.69977226118124	0.1769115743727786	false
4	4111834567779557376	39968131156440891	2119.6440603493024	-44.25474893763902	0.19695150651679305	false
5	4111834567779557376	39972223407940574	2119.71800600603956	-46.058494202080496	0.18463377143885398	false
6	4111834567779557376	49525670254794059	2292.4942508326494	-26.231450129785443	0.22956990853814763	false
7	4111834567779557376	50116308134151796	2303.1764734683206	-46.85290991533672	0.18127101750801816	false
8	4111834567779557376	50120400440451700	2303.2504870072516	-46.13243988210951	0.1799828927735967	false
9	4111834567779557376	55345055387505932	2397.735797920915	-33.769309198941	0.21506608574264585	false
10	4111834567779557376	55349147696943721	2397.809800030841	-32.49167826971084	0.21446689465946525	false
11	4111834567779557376	55842998104380641	2406.7401615340423	-21.541846028762507	0.2276354291142216	false
12	4111834567779557376	55847090435191049	2406.81416336761	-20.734087153926477	0.2450000566210672	false
13	4111834567779557376	60281801259795240	2487.006267912707	-37.02472080275497	0.20359162062915737	false
14	4111834567779557376	60291542079522176	2487.182413212812	-34.59888001379213	0.21453455730607762	false
15	4111834567779557376	60305375111304143	2487.432559091624	-30.748071681613837	0.21987343102546142	false
16	4111834567779557376	60309467361638107	2487.506560186235	-30.008427938636423	0.22323064674012844	false
17	4111834567779557376					

The dialog box includes 'Help', 'OK', and 'Cancel' buttons. A red arrow points to the 'Import to local CSV' button in the dialog box.

# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

The screenshot shows the ESA Gaia Data Archive interface. At the top, there are navigation links for 'EUROPEAN SPACE AGENCY' and 'ABOUT ESAC', along with a 'SIGN IN' button. The main header features the 'gaia archive' logo and the ESA logo. Below the header is a navigation menu with 'HOME', 'SEARCH', 'SINGLE OBJECT', 'VISUALISATION', and 'HELP'. The interface is divided into 'Basic', 'Advanced (ADQL)', and 'Query Results' tabs. The 'Advanced (ADQL)' tab is active, showing a query editor with the following SQL query: `1 SELECT source_id,teff_gspphot,has_epoch_rv,has_epoch_photometry,phot_g_n_obs FROM gaiadr3.gaia_source WHERE has_rvs='True'`. Below the query editor are 'Reset Form' and 'Submit Query' buttons. A red arrow points to the 'Submit Query' button. Below the query editor is a table with the following columns: 'Status', 'Job', 'Creation date', 'Num. rows', and 'Size'. The table contains one row with the following data: '✓', '16941085998000', '07-Sep-2023, 19:43:19', '999645', and '12 MB'. A red arrow points to the '999645' value in the 'Num. rows' column. At the bottom of the interface, there are options for 'Download format: CSV', 'Apply jobs filter', 'Filter this session', 'Select all jobs', and 'Delete selected jobs'. A '(Cookie policy) (v3.3.2)' link is visible in the bottom right corner.

Search for all stars having a mean RVS spectrum, list their Teff, and if epoch RVs/G are available

# ESA-Gaia Data Archive

- Data Release 3 of Jun 2022 covering 34 months of observations since 2013.
- Search public Gaia Archive at <https://gea.esac.esa.int/archive/>

EUROPEAN SPACE AGENCY ABOUT ESAC SIGN IN

## gaia archive

HOME SEARCH SINGLE OBJECT VISUALISATION HELP

Basic Advanced (ADQL) Query Results

16941085998000 ✕

source_id	teff_gspphot K	has_epoch_rv	has_epoch_photometry	phot_g_n_obs
2263114441170949504	4865.2344	false	false	372
2263123752659225216		false	false	368
2263127158571260160	5982.2725	false	false	335
5912880003244296448		false	false	754
2270836070814554752		false	false	359
5912389792852926336	4324.677	false	false	495
5912880243762495360		false	false	721
2263149247585066752	4633.369	false	false	336
2263152962734596352		false	false	257
2263155982093821312	5735.404	false	false	299
2263159624226073216	5060.1353	false	false	309
2263161930626313600		false	false	310
2263162205504246016		false	false	266
5912391545199459840		false	false	470
.....	.....	...	...	...

1-20 of 2,000 Gaia DR3 Data Model Show query in ADQL form VOTable Download results

(Cookie policy) (v3.3.2)

Search for all stars having a mean RVS spectrum, list their Teff, and if epoch RVs/G are available

# Some theoretical spectrum archive links

- Hard to fully cover this topic since very much depending on user needs.
- Users should beware that spectral models are only 'state-of-the-art' and are mostly developed for specific needs (e.g. quickly becoming obsolete).
  - many old and recent publications provide own dedicated model grids.
- Spanish Virtual Obs. <http://svo2.cab.inta-csic.es/theory/newov2/>
- Pollux Explore by Stellar Params: <https://pollux.oreme.org/explore/CMFGEN/>
- APOGEE Spectral Libs: <https://www.sdss4.org/dr17/irspec/apogee-libraries/>
- PoWR <https://www.astro.physik.uni-potsdam.de/~wrh/PoWR/powrgrid1.php>

## OB model grids

Grids of models for O- and B-type stars are provided for solar metallicity, for a metallicity of 1/2 solar as appropriate for the Large Magellanic Cloud (LMC), and for a metallicity of 1/7 solar as appropriate for the Small Magellanic Cloud (SMC), respectively.

Each grid has a two-dimensional parameter space, namely the stellar temperature  $T_*$  and the surface gravity  $g_{\text{grav}}$ . The grid resolution is 1 kK for the stellar temperature and 0.2dex for the surface gravity,  $\log g$ . Regarding the stellar wind, the different grids of OB-type stars which are provided have either a fixed mass-loss rate, a fixed  $\log Q$  value (see "OB model parameter details" below for the definition of  $Q$ ), or each model has a specific mass-loss rate as predicted from theoretical mass-loss recipes (see Table below). For more information about the individual grids click on "Details".

	$T_*$ [kK]	$\log g$ [cgs]	$\log \dot{M}$ [ $M_{\text{sun}}/\text{yr}$ ]	$\log Q$	$D_{\text{max}}$	$v_{\text{turb}}$ km/s	$X_{\text{H}}$	$X_{\text{He}}$	$X_{\text{C}}$	$X_{\text{N}}$	$X_{\text{O}}$	$X_{\text{Mg}}$	$X_{\text{Si}}$	$X_{\text{P}}$	$X_{\text{S}}$	$X_{\text{Fe}}$	
mass fractions																	
Galactic Metallicity																	
OB-I	<a href="#">Details</a>	15...56	2.0...4.4	-7	10	7	0.738	0.258	2.4E-3	6.9E-4	5.7E-3	6.9E-4	6.7E-4	5.8E-6	3.1E-4	1.2E-3	
LMC Metallicity																	
LMC-OB-I	<a href="#">Details</a>	15...50	2.0...4.4	-7	10	7	0.738	0.258	4.7E-4	7.8E-5	2.6E-3	2.1E-4	3.2E-4	2.9E-6	1.5E-4	7.0E-4	
SMC Metallicity																	
SMC-OB-Vd3	<a href="#">Details</a>	15...50	2.0...4.4	Vink et al. (2001) / 3	10	7	0.738	0.261	2.1E-4	3.3E-5	1.1E-3	9.9E-5	1.3E-4	8.3E-7	4.4E-5	3.5E-4	
SMC-OB-I	<a href="#">Details</a>	15...50	2.0...4.4	moderate	-13.0	10	10	0.738	0.261	2.1E-4	3.3E-5	1.1E-3	9.9E-5	1.3E-4	8.3E-7	4.4E-5	3.5E-4
SMC-OB-II	<a href="#">Details</a>	15...50	2.0...4.4	high	-12.0	10	10	0.738	0.261	2.1E-4	3.3E-5	1.1E-3	9.9E-5	1.3E-4	8.3E-7	4.4E-5	3.5E-4
SMC-OB-III	<a href="#">Details</a>	15...50	2.0...4.4	low	-14.0	10	10	0.738	0.261	2.1E-4	3.3E-5	1.1E-3	9.9E-5	1.3E-4	8.3E-7	4.4E-5	3.5E-4

You can choose the OB model grid:

OB-I

Next

OB model parameter details

click to expand

# Some theoretical spectrum archive links

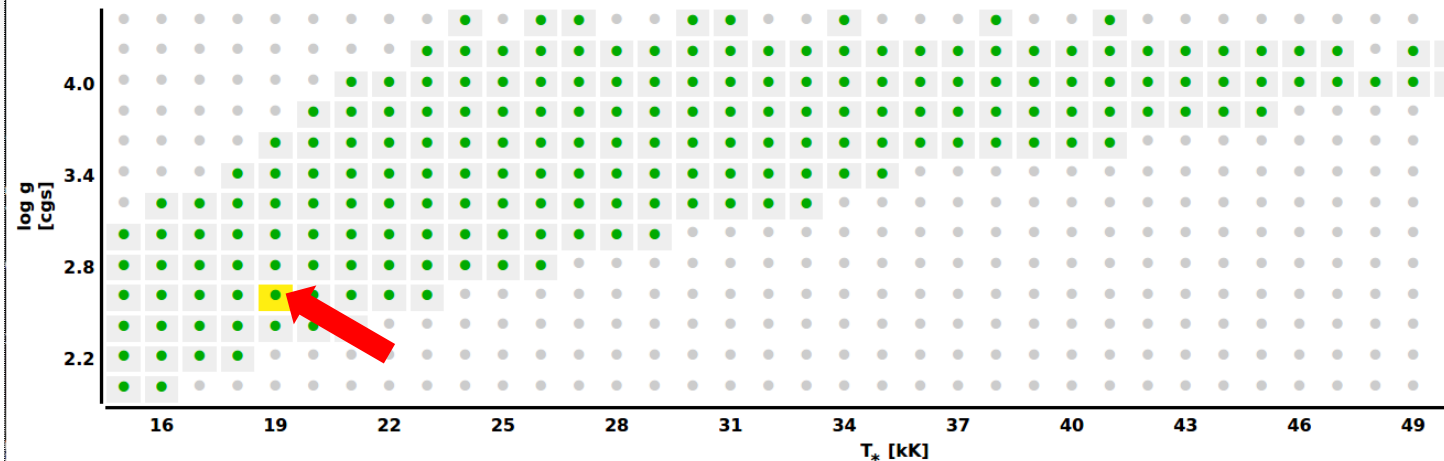
- PoWR <https://www.astro.physik.uni-potsdam.de/~wrh/PoWR/powrgrid1.php>

## PoWR - OB-I grid model selection

[Back to grid overview](#)

**Selected grid:** OB-I, Galactic Metallicity,  $\dot{M} = -7$  ([more information](#))

**Grid downloads:** If you are interested in obtaining data for all models from this grid, just select a random model and proceed to the next page. There will be a grid download option allowing you to retrieve the data for all models from the grid using the selected download settings.



Link to this grid:

<http://www.astro.physik.uni-potsdam.de/~wrh/PoWR/OB-I/>

Model information:

[click to expand](#) ▼

Current selection:

←

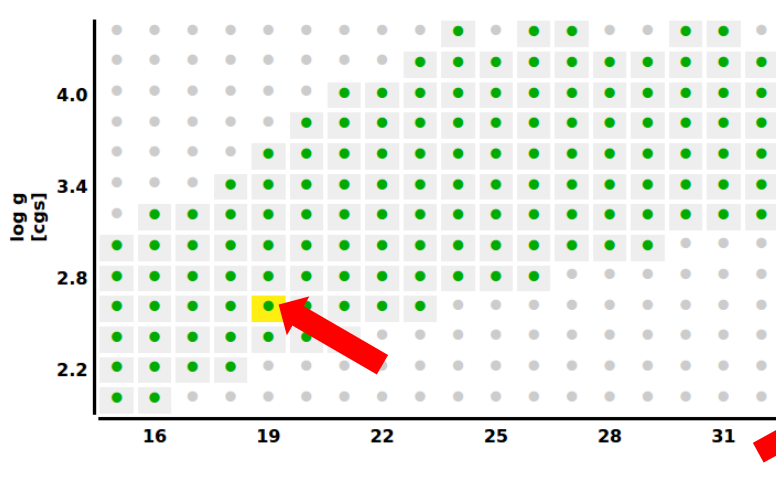
# Some theoretical spectrum archive links

- PoWR <https://www.astro.physik.uni-potsdam.de/~wrh/PoWR/powrgrid1.php>

## PoWR - OB-I grid model selection

Back to grid overview Selected grid: OB-I, Galactic Metallicity,  $\dot{M} = -7$  (more info)

**Grid downloads:** If you are interested in obtaining data for all models from this grid, just select a model and proceed to the next page. There will be a grid download option allowing you to retrieve all models from the grid using the selected download settings.



Link to this grid:  
<http://www.astro.physik.uni-potsdam.de/~wrh/PoWR/OB-I/>

Model information:

Current selection: 19-26

## PoWR - OB-I model 19-26: data selection

Colors & ionizing photons

Stratification

### Spectral data

Spectral Energy Distribution  
Provides the flux over the whole spectrum, including the lines, but degraded to a coarse wavelength grid.

Line Spectrum (normalized)  
The detailed line spectrum in high resolution, normalized to the continuum.

**Please select a wavelength band:**

UV ( $\lambda_{vac} = 920 - 3100 \text{ \AA}$ )

Visual ( $\lambda_{air} = 3099 - 9997 \text{ \AA}$ )

J-Band ( $\lambda_{vac} = 1.00 - 1.40 \text{ \mu m}$ )

H-Band ( $\lambda_{vac} = 1.40 - 1.90 \text{ \mu m}$ )

K-Band ( $\lambda_{vac} = 1.90 - 2.40 \text{ \mu m}$ )

mid-IR ( $\lambda_{vac} = 10.00 - 20.00 \text{ \mu m}$ )

Limit range:   $\text{\AA}$  to   $\text{\AA}$

Display line identifications

**Preview options:**

.png (in browser popup)

.ps (PostScript download)

.pdf (PDF download)

**Download options:**

.tgz (tar+gzip)

.zip (zip)

.txt (uncompressed ASCII)

Line Spectrum (calibrated)  
The detailed line spectrum in high resolution, given as  $\log F_{\lambda}$  at 10pc distance in units of  $\text{erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$

### Parameters of selected model:

Grid	<b>OB-I</b>
Model	<b>19-26</b>
$T_*$ [kK]	19
$\log g$ [cgs]	2.6
$\log L [L_{\odot}]$	5.29
$\log \dot{M} [M_{\odot}/\text{yr}]$	-7.00
$v_{\infty}$ [km/s]	585
$R_*$ [ $R_{\odot}$ ]	40.9

[\[ show more details \]](#)

Link to this model:  
<http://www.astro.physik.uni-potsdam.de/~wrh/PoWR/OB-I/19-26>

Change to WR model grid:

Change to other OB model grid:

[Back to PoWR grid overview](#)

Download spectral data for **all** models from the current grid using the settings specified on the left side:

Grid downloads are only possible as .tgz or .zip files.  
**Warning:** Extracting data from the whole grid may take considerable time and might create a big amount of data.

# Some theoretical spectrum archive links

- PoWR <https://www.astro.physik.uni-potsdam.de/~wrh/PoWR/powrgrid1.php>

## PoWR - OB-I grid model selection

[Back to grid overview](#)

**Selected grid:** OB-I, Galactic Metallicity,  $\dot{M} = -7$  ([more info](#))

**Grid downloads:** If you are interested in obtaining data for all models from this grid, just select a model and proceed to the next page. There will be a grid download option allowing you to retrieve all models from the grid using the selected download settings.

Link to this grid: <http://www.astro.physik.uni-potsdam.de/~wrh/PoWR/ob-i-grid1.php>

Model information:

Current selection:

### PoWR - OB-I model 19-26: data selection

Colors & ionizing photons click to expand ▼

Stratification click to expand ▼

**Spectral data**

Spectral Energy Distribution  
Provides the flux over the whole spectrum, including the lines, but degraded to a coarse wavelength grid.

Line Spectrum (normalized)

**Parameters of selected model:**

Grid	<b>OB-I</b>
Model	<b>19-26</b>
$T_*$ [kK]	19
log g [cgs]	2.6
log L [ $L_\odot$ ]	5.29
log $\dot{M}$ [ $M_\odot$ /yr]	-7.00
$v_\infty$ [km/s]	585
$R_*$ [ $R_\odot$ ]	40.9

[\[ show more details \]](#)

OB-I Model 19-26

Download

Line Spectrum (calibrated)  
The detailed line spectrum in high resolution, given as  $\log F_\lambda$  at 10pc distance in units of  $\text{erg cm}^{-2} \text{s}^{-1} \text{\AA}^{-1}$

Link to this model:  
<http://www.astro.physik.uni-potsdam.de/~wrh/PoWR/OB-I/19-26>

Change to WR model grid:

Change to other OB model grid:

[▶ Back to PoWR grid overview](#)

Download spectral data for **all** models from the current grid using the settings specified on the left side:

Grid downloads are only possible as .tgz or .zip files.  
**Warning:** Extracting data from the whole grid may take considerable time and might create a big amount of data.

# Atomic data archives for stellar spectroscopy

- Atomic and molecular data needs are fundamentally important for astronomy.
- 'Laboratory Astrophysics' is a research field combining physics and astronomy.

## NIST Atomic Spectra Database Lines/Levels Form

<https://www.nist.gov/pml/atomic-spectra-database>

The screenshot shows the NIST Atomic Spectra Database Lines Form. At the top left is the ASD logo. Below it are two main sections: 'DATA' with sub-links 'LINES' and 'LEVELS', and 'INFORMATION' with sub-links 'List of SPECTRA', 'GROUND STATES & IONIZATION ENERGIES', 'Bibliography', and 'Help'. The NIST logo and 'National Institute of Standards and Technology Physical Meas. Laboratory' are in the top right. A note says 'Best viewed with the latest versions of Web browsers and JavaScript enabled'. The form has a teal background. Under 'Main Parameters', the 'Spectrum' field contains 'Fe I'. Below it, 'Limits for Wavelengths' are set to 'Lower: 5500' and 'Upper: 5550'. 'Wavelength Units' is set to 'Å'. At the bottom, there are four buttons: 'Reset input', 'Retrieve Data', 'Show Graphical Options', and 'Show Advanced Settings'. Red arrows point to the 'Spectrum', 'Lower', 'Upper', and 'Retrieve Data' fields.

ASD DATA INFORMATION  
LINES LEVELS List of SPECTRA GROUND STATES & IONIZATION ENERGIES Bibliography Help

NIST  
National Institute of  
Standards and Technology  
Physical Meas. Laboratory

NIST Atomic Spectra Database Lines Form Best viewed with the latest versions of Web browsers and JavaScript enabled

Main Parameters Spectrum Fe I e.g., Fe I or Na;Mg; Al or mg i-iii or 198Hg I

Limits for Wavelengths Lower: 5500 Upper: 5550

Wavelength Units: Å

Reset input Retrieve Data Show Graphical Options Show Advanced Settings




# Atomic data archives for stellar spectroscopy

- Atomic and molecular data needs are fundamentally important for astronomy.
- ‘Laboratory Astrophysics’ is a research field combining physics and astronomy.

## NIST Atomic Spectra Database Lines/Levels Form

<https://www.nist.gov/pml/atomic-spectra-database>



**ASD**

DATA

**LINES** LEVELS


INFORMATION

List of SPECTRA

GROUND STATES & IONIZATION ENERGIES

Bibliography

Help



NIST  
National Institute of Standards and Technology  
Physical Meas. Laboratory

**NIST Atomic Spectra Database Lines Data**

Fe I: 28 Lines of Data Found  
Z = 26, Fe isoelectronic sequence

Wavelength range: 5500 - 5550 Å  
Wavelength in: vacuum below 2000 Å, air between 2000 and 20000 Å, vacuum above 20000 Å  
Highest relative intensity: 22400

Some data for neutral and singly-charged ions are available in the [Handbook of Basic Atomic Spectroscopic Data](#)

**Example of how to reference these results:**  
Kramida, A., Raichenko, Yu., Reader, J., and NIST ASD Team (2022). *NIST Atomic Spectra Database* (ver. 5.10), [Online]. Available: <https://physics.nist.gov/asd> [2023, September 6]. National Institute of Standards and Technology, Gaithersburg, MD. DOI: <https://doi.org/10.18434/T4W30F>  
[BibTex Citation](#) (new window)

**Main Parameters**      Spectrum Fe I

Limits for Wavelengths Lower: 5500 Upper: 5550

Wavelength Units: Å

Reset input      Retrieve

Primary data sources		Query NIST Bibliographic Databases for Fe I (new window)
Energy Levels: <a href="#">Nave et al. 1994</a>	The wavenumber measurements in Nave et al 1994 were calibrated with respect to Ar II lines measured by <a href="#">Norién 1973</a> , which were re-measured later by <a href="#">Whaling et al. 1995</a> and found to be systematically too small. To account for this calibration error, the original measured wavenumbers and energy level values from Nave et al. 1994 have been increased here by 6.7 parts in 10 <sup>8</sup> . The ionization energy is from <a href="#">Schoenfeld et al. 1995</a> , adjusted by the same scaling factor.	<a href="#">Fe I Energy Levels</a>
Lines: <a href="#">Nave et al. 1994</a>	Observed wavenumbers have been increased by 6.7 parts in 10 <sup>8</sup> , similar to the energy levels.	<a href="#">Fe I Line Wavelengths and Classification</a>
Transition Probabilities: <a href="#">Fuhr and Wiese 2006</a>		<a href="#">Fe I Transition Probabilities</a>

Observed Wavelength Air (Å)	Unc. (Å)	Ritz Wavelength Air (Å)	Unc. (Å)	Rel. Int. (?)	A <sub>ki</sub> (s <sup>-1</sup> )	log(g <sub>f</sub> k)	Acc.	E <sub>i</sub> (eV)	E <sub>k</sub> (eV)	Lower Level Conf., Term, J	Upper Level Conf., Term, J	Type	TP Ref.	Line Ref.	
5 501.4649	0.0009	5 501.4647	0.0004	14500	2.20e+04	-3.047	B	0.95815732	3.21118938	3d <sup>6</sup> ( <sup>4</sup> F)4s	a <sup>3</sup> F 3	3d <sup>6</sup> ( <sup>3</sup> D)4s4p( <sup>3</sup> P <sup>o</sup> )	z <sup>3</sup> D <sup>o</sup> 4	T5720	L11631
5 504.362	0.005	5 504.3614	0.0007	20				3.57321890	5.82506529	3d <sup>7</sup> ( <sup>3</sup> H)4s	a <sup>3</sup> H 5	3d <sup>6</sup> ( <sup>3</sup> H)4s4p( <sup>3</sup> P <sup>o</sup> )	z <sup>3</sup> H <sup>o</sup> 6		L11631
5 505.8813	0.0024	5 505.8808	0.0004	234				4.41527878	6.66650376	3d <sup>7</sup> ( <sup>4</sup> F)4p	z <sup>3</sup> G <sup>o</sup> 3	3d <sup>7</sup> ( <sup>4</sup> F)4d	f <sup>3</sup> G 4		L11631
5 506.7788	0.0009	5 506.7785	0.0004	22400	5.01e+04	-2.797	A	0.99011115	3.24096914	3d <sup>7</sup> ( <sup>4</sup> F)4s	a <sup>3</sup> F 2	3d <sup>6</sup> ( <sup>3</sup> D)4s4p( <sup>3</sup> P <sup>o</sup> )	z <sup>3</sup> D <sup>o</sup> 3	T3548	L11631
5 508.408	0.005	5 508.4085	0.0010	50				4.95563019	7.2058221	3d <sup>6</sup> ( <sup>3</sup> D)4s4p( <sup>1</sup> P <sup>o</sup> )	x <sup>3</sup> D <sup>o</sup> 3	3d <sup>6</sup> ( <sup>3</sup> D)4d	<sup>3</sup> F 4		L11631
5 512.2563	0.0024	5 512.2576	0.0004	229	9.9e+05	-1.39	E	4.37135106	6.61997175	3d <sup>7</sup> ( <sup>4</sup> F)4p	z <sup>3</sup> G <sup>o</sup> 4	3d <sup>7</sup> ( <sup>4</sup> F)4d	g <sup>3</sup> F 4	T2578n	L11631
5 512.402	0.005	5 512.4017	0.0004	126				4.41527878	6.66384071	3d <sup>7</sup> ( <sup>4</sup> F)4p	z <sup>3</sup> G <sup>o</sup> 3	3d <sup>7</sup> ( <sup>4</sup> F)4d	f <sup>3</sup> D 3		L11631
5 517.065	0.005	5 517.0680	0.0004	60	2.0e+05	-2.34	E	4.20888328	6.45554341	3d <sup>6</sup> ( <sup>3</sup> D)4s4p( <sup>3</sup> P <sup>o</sup> )	z <sup>3</sup> P <sup>o</sup> 2	3d <sup>6</sup> ( <sup>3</sup> D)4s ( <sup>4</sup> D)4d	e <sup>3</sup> P 2	T2578n	L11631
5 522.4461	0.0009	5 522.4459	0.0004	347	1.3e+06	-1.52	D	4.20888328	6.45335558	3d <sup>6</sup> ( <sup>3</sup> D)4s4p( <sup>3</sup> P <sup>o</sup> )	z <sup>3</sup> P <sup>o</sup> 2	3d <sup>6</sup> ( <sup>3</sup> D)4s ( <sup>4</sup> D)5s	g <sup>3</sup> D 2	T2578n	L11631
5 523.993	0.005	5 523.9908	0.0010	79				5.10547240	7.34931170	3d <sup>8</sup>	<sup>3</sup> P 1	3d <sup>7</sup> ( <sup>4</sup> F <sub>7/2</sub> )4f	<sup>2</sup> [ <sup>3</sup> / <sub>2</sub> ] <sup>o</sup> 2		L11631

# Atomic data archives for stellar spectroscopy

- Atomic and molecular data needs are fundamentally important for astronomy.
- 'Laboratory Astrophysics' is a research field combining physics and astronomy.

## NIST Atomic Spectra Database Lines/Levels Form

<https://www.nist.gov/pml/atomic-spectra-database>

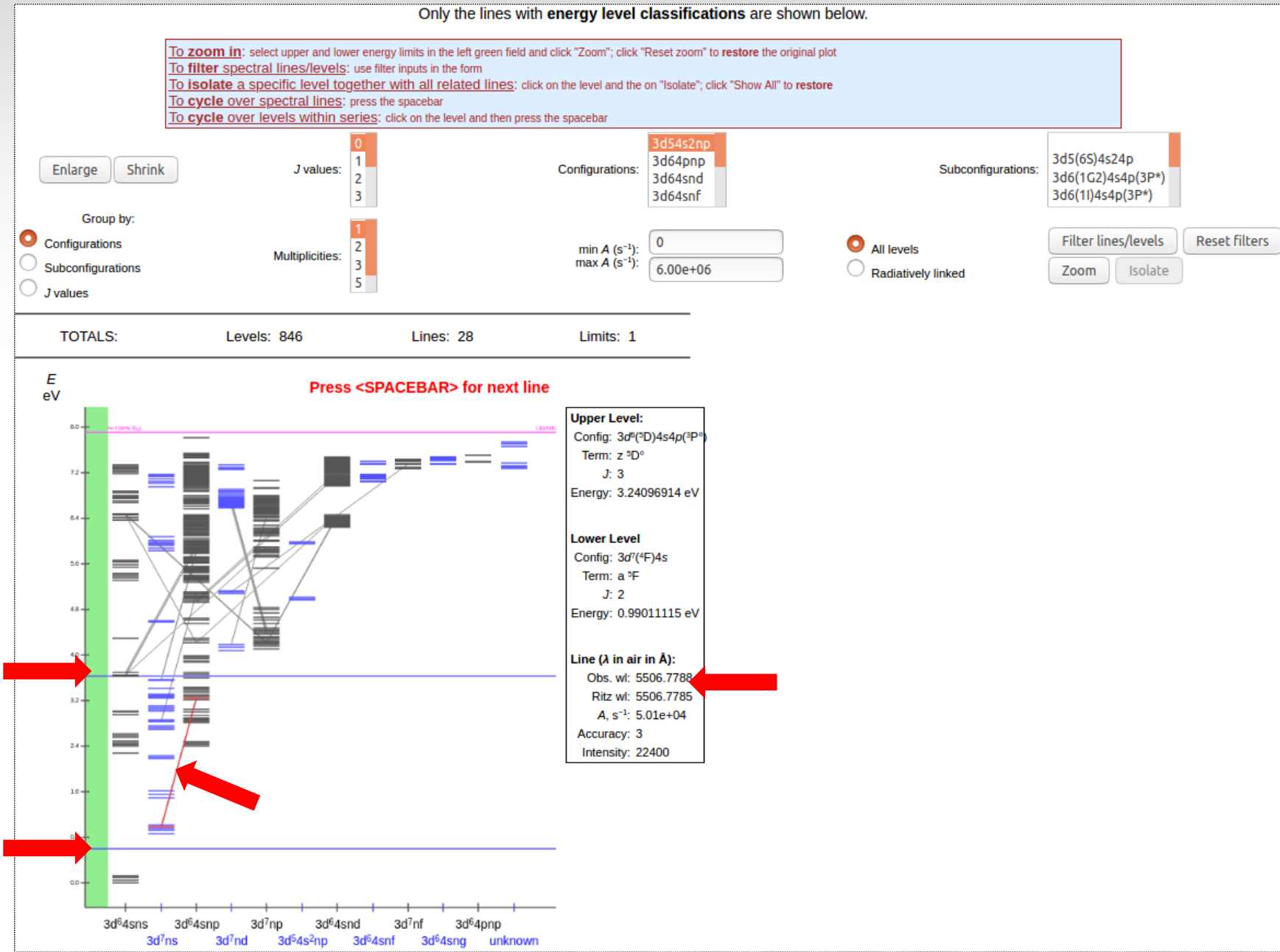
The screenshot shows the NIST Atomic Spectra Database Lines Form. At the top left is the ASD logo. Below it are tabs for 'DATA' (with sub-tabs 'LINES' and 'LEVELS') and 'INFORMATION' (with sub-tabs 'List of SPECTRA', 'GROUND STATES & IONIZATION ENERGIES', 'Bibliography', and 'Help'). The NIST logo and 'National Institute of Standards and Technology Physical Meas. Laboratory' are in the top right. The main title is 'NIST Atomic Spectra Database Lines Form' with a note: 'Best viewed with the latest versions of Web browsers and JavaScript enabled'. The 'Main Parameters' section includes a 'Spectrum' dropdown set to 'Fe I' (with examples: 'e.g., Fe I or Na;Mg; Al or mg i-iii or 198Hg I'), 'Limits for' a 'Wavelengths' dropdown, 'Lower:' (5500) and 'Upper:' (5550) input fields, and 'Wavelength Units:' (Å) dropdown. At the bottom are buttons for 'Reset input', 'Retrieve Data', 'Show Graphical Options' (indicated by a red arrow), and 'Show Advanced Settings'.

The 'Graphical Output Options' panel is shown. It has a 'Dynamic Plots' section with 'Line Identification Plot:' (radio button), 'Saha-LTE Spectrum:' (radio button), and 'Intensity scale:' (radio buttons for 'Energy flux' and 'Photon flux'). There are input fields for 'Electron Temperature  $T_e$ (eV):', 'Electron Density  $N_e$ (cm<sup>-3</sup>):', and 'Ion Temperature  $T_i$ (eV):' (with a note '(if  $T_i \neq T_e$ )'). A 'Doppler-broadened spectrum' checkbox is also present. On the right, the 'Grotrian Diagram' section has a 'Make Grotrian Diagram' button (indicated by a red arrow).

# Atomic data archives for stellar spectroscopy

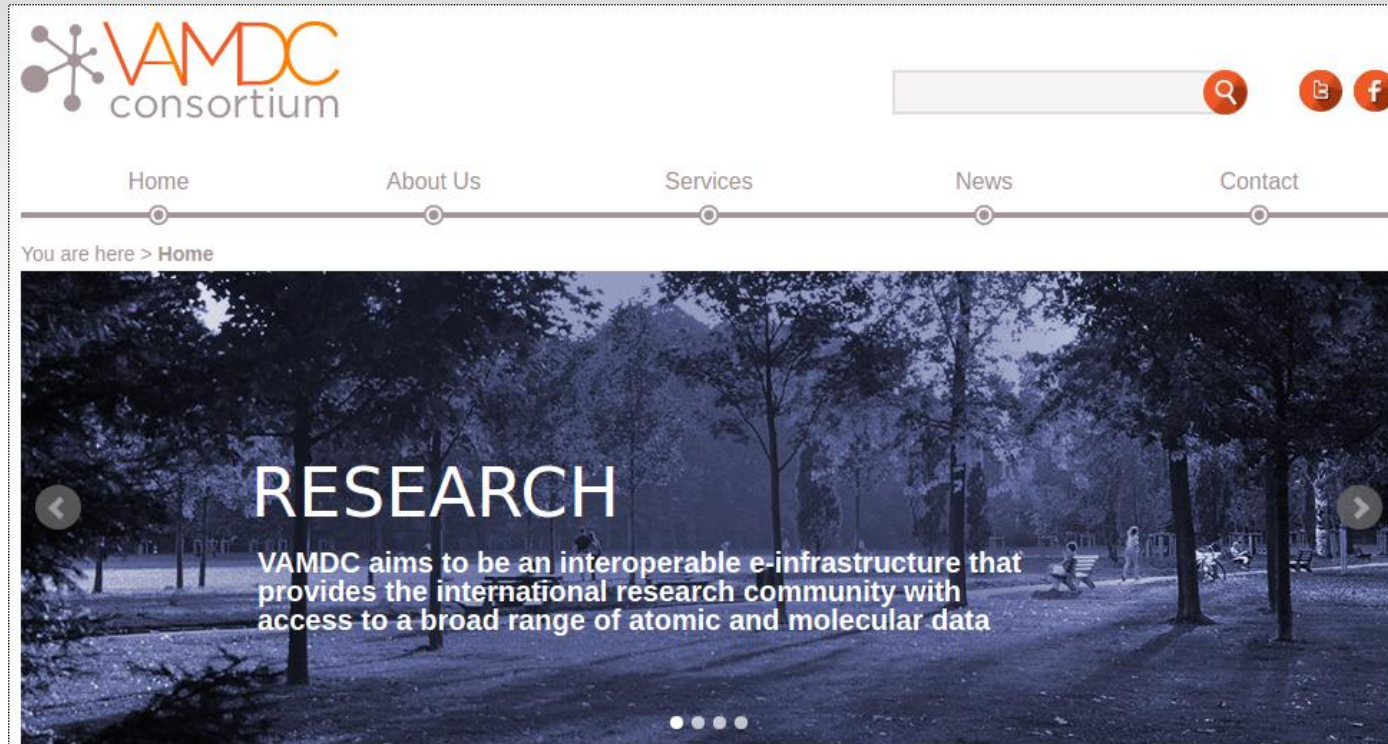
NIST Atomic Spectra Database Lines/Levels Form

<https://www.nist.gov/pml/atomic-spectra-database>



# Atomic data archives for stellar spectroscopy

VAMDC Virtual Atomic and Molecular Data Centre <https://vamdc.org/>  
Consortium Portal



[Home](#) [VAMDC databases](#) [Guided query](#) [Advanced query](#) [Saved queries](#) | [Disclaimer](#) [Citation policy](#) [Privacy policy](#) [Info](#) [Tools](#)

## Welcome to the VAMDC portal!

VAMDC aims to be an interoperable e-infrastructure that provides the international research community with access to a broad range of atomic and molecular (A&M) data compiled within a set of A&M databases accessible through the provision of this portal and of user software. Furthermore VAMDC aims to provide A&M data providers and compilers with a large dissemination platform for their work.

VAMDC infrastructure was established to provide a service to a wide international research community and has been developed in conjunction with consultations and advice from the A&M user community.

[Currently we have 39 databases running and ready to serve you with the data.](#)

# Atomic data archives for stellar spectroscopy

VAMDC Virtual Atomic and Molecular Data Centre <https://vamdc.org/>  
Consortium Portal Advanced Query by Species Atom

**VAMDC consortium**

Home VAMDC databases Guided query Advanced query Saved queries | Disclaimer Citation policy Privacy policy Info Tools Login Register

Query by...  
Species  
Processes  
Environment  
Advanced

Atom 1 Clear Remove form «

Atom symbol

Mass number  to

Nuclear charge  to

Ion charge  to

InChIKey

State energy  to  1/cm ▾

Equivalent to 1/cm

Find data

**Legend**

available, can answer  
available, don't support query  
unsupported keyword

- Carbon Dioxide Spectroscopic Databank 4000K (VAMDC-TAP)
- Carbon Dioxide Spectroscopic Databank 296K (VAMDC-TAP)
- BASECOL2015: VAMDC-TAP interface
- Stark-b
- VALD sub-set in Moscow (obs)
- Chianti
- TIPbase : VAMDC-TAP interface
- AMBDAS: Atomic and Molecular Bibliographic Data System
- VAMDC species-DB
- TOPbase : VAMDC-TAP interface
- AMDIS Ionization
- GeCaSDa: Gemane Calculated Spectroscopic Database
- Water internet Accessible Distributed Information System
- TFMeCaSDa - CF4 Calculated Spectroscopic Database
- OACT - LASP Database
- Belgrade electron/atom(molecule) database (BEAMDB)
- MeCaSDa - Methane Calculated Spectroscopic Database
- Theoretical spectral database of polycyclic aromatic hydrocarbons
- VALD (atoms)
- NIST Atomic Spectra Database**
- Carbon Dioxide Spectroscopic Databank 1000K (VAMDC-TAP)
- TFSiCaSDa : Tetra-Fluoro Silane Calculated Spectroscopic Database
- Carbon Dioxide Spectroscopic Databank (VAMDC-TAP)
- IDEADB - Innsbruck Dissociative Electron Attachment Database
- Spectr-W3
- CDMS
- SpEctroScopy of Atoms and Molecules

This database provides access and search capability for NIST critically evaluated data on atomic energy levels, wavelengths, and transition probabilities

# Atomic data archives for stellar spectroscopy

VAMDC Virtual Atomic and Molecular Data Centre <https://vamdc.org/>  
Consortium Portal Advanced Query by Species Atom

Home VAMDC databases Guided query Advanced query Saved queries | Disclaimer Citation policy Privacy policy Info Tools Login Register

### Query Execution

**Done**

Modify query Stop waiting Save query

### Comments

### Your request

```
select * where ((AtomSymbol = 'Fe'))
```

### Results by node

Name	View data	Response	Last database update	Download	Species	States	Processes	Radiative	Collisions	Non Radiative
VALD (atoms)	-- Choose display --	OK	24/01/2020 00:00	XSAMS file	0	0	57108051	57108051	0	0
TOPbase : VAMDC-TAP interface	-- Choose display --	OK	21/12/2021 00:00	XSAMS file	24	17113	1014840	1014840	0	0
Chianti	-- Choose display --	OK	Not available	XSAMS file	25	5389	269479	269479	0	0
VALD sub-set in Moscow (obs)	-- Choose display --	OK	23/01/2020 22:00	XSAMS file	9	4484	266265	266265	0	0
TIPbase : VAMDC-TAP interface	-- Choose display --	OK	21/12/2021 00:00	XSAMS file	20	1192	66321	0	66321	0
Spectr-W3	-- Choose display --	OK	11/12/2013 19:00	XSAMS file	5	720	1146	1146	0	0
KIDA: Kinetic Database for Astrochemistry - TAP service	-- Choose display --	OK	Not available	XSAMS file	94	0	52	0	52	0
Stark-b	-- Choose display --	OK	28/09/2022 00:00	XSAMS file	2	11	9	9	0	0
CDMS	-- Choose display --	OK	27/11/2019 15:49	XSAMS file	2	12	8	8	0	0

# Atomic data archives for stellar spectroscopy

VAMDC Virtual Atomic and Molecular Data Centre <https://vamdc.org/>  
 Consortium Portal Advanced Query by Species Atom

Menu

Export as CSV

Export as JSON

Export as VOTable

Send with sample

Reset page

## Sources

Id	Title	Origin	Authors	Year	Link
Bvald-B	Arc measurements of Fe II oscillator strengths	inproceedings	J.M. Bridges;	1973	
Bvald-K		unpublished	R.L. Kurucz;	1975	
Bvald-M	Transition Probabilities in the Spectra of Ne I, Ar I, and Kr I	article : Journal of the Optical Society of America (1917-1983) ( Vol : 58 , Page Begin : 1200 , Page End : + )	P.W. Murphy;	1968	
Bvald-P	Measurements of the Hyperfine Structure of Atomic Energy Levels in CO i	article : Astrophysical Journal Supplement Series ( Vol : 107 , Page Begin : 811 )	J.C. Pickering;	1996	
Bvald-R	Oscillator strengths for Y III and Zr III in the IUE region	article : aap ( Vol : 249 , Page Begin : 589 , Page End : 593 )	A. Redfors;	1991	

## Results from vald VAMDC node

<input type="checkbox"/> Unselect all	Spec ion	Wavelength (A)	Wavelength reference	Log10 Weighted Oscillator Strength	Lower state description	Lower energy(1/cm)	Lower parity	Lower total angular momentum	Lower coupling	Upper state description	Upper energy(1/cm)	Upper parity	Upper total angular momentum	Upper coupling
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1621.70989524	<a href="#">Bvald-K07</a>	-9.706	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<1/2>).6h 2[11/2]*	61663.3100	odd	5.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1624.70415965	<a href="#">Bvald-K07</a>	-9.845	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<3/2>).6h 2[11/2]*	61549.6670	odd	5.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1629.88186290	<a href="#">Bvald-K07</a>	-8.029	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<5/2>).6h 2[9/2]*	61354.1400	odd	4.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1629.89190459	<a href="#">Bvald-K07</a>	-8.920	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<5/2>).6h 2[7/2]*	61353.7620	odd	4.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1641.00660198	<a href="#">Bvald-K07</a>	-8.641	3p6.3d6.4s2 a5D	415.9330	even	3.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<5/2>).6h 2[9/2]*	61354.1400	odd	4.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1641.01678122	<a href="#">Bvald-K07</a>	-9.549	3p6.3d6.4s2 a5D	415.9330	even	3.0	L=2 S=2.0	3p6.3d6.(5D).4s.(6D<5/2>).6h 2[7/2]*	61353.7620	odd	4.0	
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1644.55653596	<a href="#">Bvald-K07</a>	-1.916	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(a3F).4s.4p.(1P*) 3D*	60806.6660	odd	3.0	L=2 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1645.88484679	<a href="#">Bvald-K07</a>	-8.279	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(3H).4s.4p.(1P*) t3H*	60757.5920	odd	4.0	L=5 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1651.15652782	<a href="#">Bvald-K07</a>	-3.622	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(a3F).4s.4p.(1P) 3G*	60563.6100	odd	3.0	L=4 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1651.55188403	<a href="#">Bvald-K07</a>	-4.470	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(3H).4s.4p.(1P*) t3H*	60549.1120	odd	5.0	L=5 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1653.81760641	<a href="#">Bvald-K07</a>	-4.825	3p6.3d6.4s2 a5D	0	even	4.0	L=2 S=2.0	3p6.3d6.(a3F).4s.4p.(1P) 3G*	60466.1600	odd	4.0	L=4 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1655.88319652	<a href="#">Bvald-K07</a>	-3.266	3p6.3d6.4s2 a5D	415.9330	even	3.0	L=2 S=2.0	3p6.3d6.(a3F).4s.4p.(1P*) 3D*	60806.6660	odd	3.0	L=2 S=1.0
<input checked="" type="checkbox"/>	<a href="#">Fe 1</a>	1657.22987497	<a href="#">Bvald-K07</a>	-5.216	3p6.3d6.4s2 a5D	415.9330	even	3.0	L=2 S=2.0	3p6.3d6.(2H).4s.4p.(1P) 3D*	60757.5920	odd	4.0	L=5 S=1.0

# Atomic data archives for stellar spectroscopy

EXOMOL <https://www.exomol.com/data/molecules/>

Search for di-atomic, tri-atomic, and poly-atomic molecules by formula or name

The screenshot shows the ExoMol website interface. At the top, there is a search bar with the text 'Search', a dropdown menu set to 'Everything', and a 'Go' button. Below the search bar is a navigation menu with links for 'Data', 'Software', 'Activities', 'Outreach', 'About', and 'Contact'. On the right side of the navigation menu are 'Log in' and 'Sign up' buttons. The main content area is titled 'Molecules' and features a search bar with the placeholder text 'Search by formula'. To the left of the main content is a sidebar menu with options: 'Search', 'By Molecule' (which is highlighted), 'By Data Type', 'Bibliography', and 'Licence'. The main content area is divided into several columns and rows of molecular categories, each containing a list of chemical formulas in yellow boxes. The categories and their contents are: 'metal hydrides' (MgH, NaH, NiH, AlH, CrH, CaH, BeH, TiH, FeH, LiH, ScH), 'other hydrides' (NH, CH, OH, HCl, SiH, SH, HF, PH, HBr), 'metal oxides' (VO, AlO, YO, MgO, TiO, SiO, CaO, NaO, LaO, ZrO), 'other oxides' (CO, NO, SO, PO, O<sub>2</sub>), 'larger molecules' (CH<sub>4</sub>, NH<sub>3</sub>), 'ions' (LiH<sup>+</sup>), and 'triatomic molecules' (H<sub>2</sub>O, CO<sub>2</sub>, SO<sub>2</sub>, HCN, N<sub>2</sub>O, H<sub>2</sub>S).



# Atomic data archives for stellar spectroscopy

CDMS Cologne Database for Molecular Spectroscopy

<https://cdms.astro.uni-koeln.de/cgi-bin/cdmssearch>

## Search and Conversion Form of the Cologne Database for Molecular Spectroscopy

Please enter the frequency range: min:  max:  units are in:  GHz or   $\text{cm}^{-1}$ .

If GHz is checked, the format of the output will be in standard catalog form (with **MHz** units).

If  $\text{cm}^{-1}$  is checked, the frequency and error fields of the output will be in  $\text{cm}^{-1}$ .

What is the common log of the **minimum** strength in catalog units?

What molecules should be included ?  
(Use mouse to select entry, including all or [special groups of molecules](#);  
use mouse control click to select multiple values.)

**Note:**

if the species tag is marked with an asterisk at the end,  
the temperature independent  $S\mu^2$  is given  
instead of the intensity **I** at 300K (or other value)

025500 CCH,  $\nu_3=1$   
025507 CCH,  $\nu_2$   
025508 CCH,  $\nu_3$   
025509 CCH,  $\nu_2+\nu_3$   
025510 CCH,  $5\nu_2$   
026501 CCD  
026502 C-13-CH  
026503 CC-13-H  
**026504 CN,  $\nu=0,1$**   
026505 C<sub>2</sub>H<sub>2</sub>,  $\nu_5-\nu_4$   
026506 CN-  
026507 B-10-O  
027501 HCN,  $\nu=0$

all species  
ISM/CSM  
ISM  
atomic fine structure  
Anions  
Cations  
CnH  
CnH<sub>2</sub>  
Complex molecules  
Cyano Comp.  
Cyclic Species  
Deuterated Species

Calculate the  A values,   $S\mu^2$  or intensities with temperature  300 K  225 K  150 K  75 K

37.5 K  18.75 K  9.375 K

Output as  text sort by  frequency  intensity  energie  molecules (by  tag  alphabetically)

intensity values as  log values

or  graphic (  autoscale).

the query.  the form.

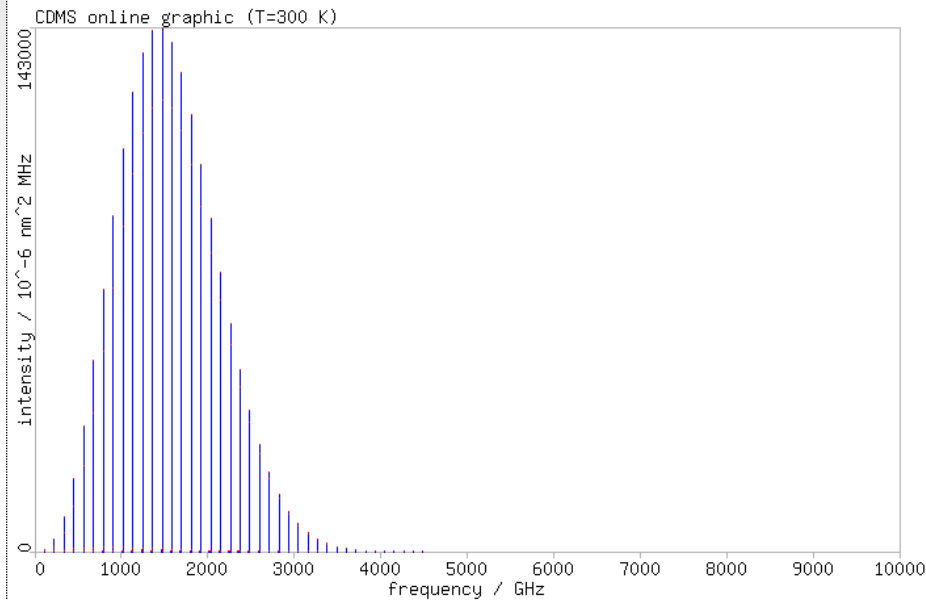
**Note:** There are several entries in our catalog with high line densities.  
We recommend to inquire for lines of all molecules in small frequency regions only.

# Atomic data archives for stellar spectroscopy

CDMS Cologne Database for Molecular Spectroscopy

<https://cdms.astro.uni-koeln.de/cgi-bin/cdmssearch>

## Search and Conversion Form of the Cologne Database for Molecular Spectroscopy



00 units are in:  GHz or   $\text{cm}^{-1}$ .

g form (with MHz units).  
be in  $\text{cm}^{-1}$ .

-10

les;

025500 CCH, nu3=1	
025507 CCH, nu2	
025508 CCH, nu3	
025509 CCH, nu2+nu3	
025510 CCH, 5nu2	
026501 CCD	
026502 C-13-CH	
026503 CC-13-H	
<b>026504 CN, v=0,1</b>	
026505 C2H2, nu5-nu4	
026506 CN-	
026507 B-10-O	
027501 HCN, v=0	

- all species
- ISM/CSM
- ISM
- atomic fine structure
- Anions
- Cations
- CnH
- CnH2
- Complex molecules
- Cyano Comp.
- Cyclic Species
- Deuterated Species

300 K  225 K  150 K  75 K  
 37.5 K  18.75 K  9.375 K

Output as  text sort by  frequency  intensity  energie  molecules (by  tag  alphabetically)  
intensity values as  log values  
or  graphic (  autoscale).

the query.  the form.

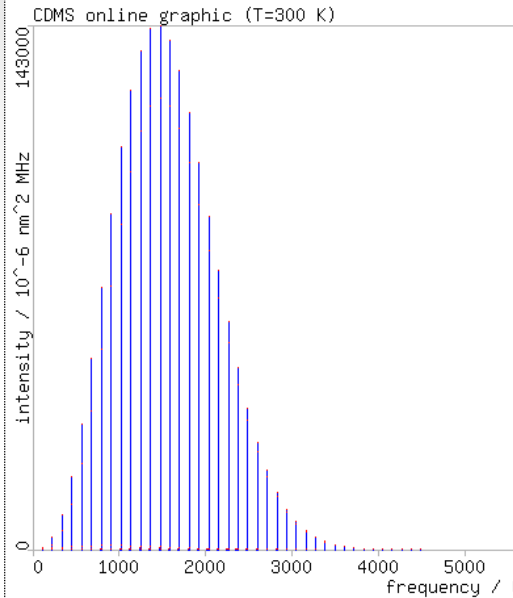
**Note:** There are several entries in our catalog with high line densities.  
We recommend to inquire for lines of all molecules in small frequency regions only.

# Atomic data archives for stellar spectroscopy

CDMS Cologne Database for Molecular Spectroscopy

<https://cdms.astro.uni-koeln.de/cgi-bin/cdmssearch>

## Search and Conversion Form of the Cologne Database for Molecular Spectroscopy



total number of lines found = 648

total number of species found = 1

species found (follow link to highlight species):

[026504 CN, v=0,1](#)

Calculate the  A values,  Sp...

Output as  text  graphic

sort by  freq

intensity values

or  graphic ( autoscale)

Submit

the query.

Reset

the for

Note: There are several entries in our  
We recommend to inquire for lines of

00 units are in:  GHz or  cm<sup>-1</sup>.

g form (with MHz units).

be in cm<sup>-1</sup>.

-10

(For units and further details on the catalog entries see the [General](#) section.)

frequency | uncert. | intens. | | E.lower | | tag | | quantum nos: up-low | molecule

112101.6560	0.05	-8.0612	2	2042.4216	2	-265041234	1	1	1	0	1	1	2	CN, v=0,1	
112128.9890	0.05	-8.069	2	2042.4222	4	-265041234	1	1	1	2	0	1	1	1	CN, v=0,1
112148.5030	0.05	-7.9593	2	2042.4216	4	-265041234	1	1	1	2	0	1	1	2	CN, v=0,1
112442.8060	0.05	-7.9569	2	2042.4222	4	-265041234	1	1	2	2	0	1	1	1	CN, v=0,1
112445.0150	0.05	-7.5311	2	2042.4216	6	-265041234	1	1	2	3	0	1	1	2	CN, v=0,1
112453.8760	0.05	-8.0586	2	2042.4222	2	-265041234	1	1	2	1	0	1	1	1	CN, v=0,1
112462.2920	0.05	-8.0664	2	2042.4216	4	-265041234	1	1	2	2	0	1	1	2	CN, v=0,1
113123.3701	0.0058	-4.7118	2	0.0007	2	265041234	1	0	1	1	0	0	1	1	CN, v=0,1
113144.1573	0.0057	-3.7989	2	-0.0000	2	265041234	1	0	1	1	0	0	1	2	CN, v=0,1
113170.4915	0.0039	-3.809	2	0.0007	4	265041234	1	0	1	2	0	0	1	1	CN, v=0,1
113191.2787	0.0034	-3.6955	2	-0.0000	4	265041234	1	0	1	2	0	0	1	2	CN, v=0,1
113488.1202	0.0033	-3.6932	2	0.0007	4	265041234	1	0	2	2	0	0	1	1	CN, v=0,1
113490.9702	0.0024	-3.2691	2	-0.0000	6	265041234	1	0	2	3	0	0	1	2	CN, v=0,1
113499.6443	0.0028	-3.7962	2	0.0007	2	265041234	1	0	2	1	0	0	1	1	CN, v=0,1
113508.9074	0.0028	-3.8065	2	-0.0000	4	265041234	1	0	2	2	0	0	1	2	CN, v=0,1
113520.4315	0.0044	-4.709	2	-0.0000	2	265041234	1	0	2	1	0	0	1	2	CN, v=0,1
224274.6210	0.0272	-7.7139	2	2046.1724	6	265041234	2	1	2	3	1	1	2	3	CN, v=0,1
224544.1920	0.05	-7.4672	2	2046.1625	4	-265041234	2	1	2	2	1	1	1	2	CN, v=0,1
224571.1920	0.05	-6.9431	2	2046.1625	6	-265041234	2	1	2	3	1	1	1	2	CN, v=0,1
224575.6480	0.05	-7.4695	2	2046.1609	2	-265041234	2	1	2	1	1	1	1	1	CN, v=0,1
224591.0970	0.05	-7.3739	2	2046.1609	4	-265041234	2	1	2	2	1	1	1	1	CN, v=0,1
224783.6436	0.0115	-6.9371	2	2046.1729	6	265041234	2	1	3	3	1	1	2	2	CN, v=0,1
224784.0969	0.0111	-6.7371	2	2046.1724	8	265041234	2	1	3	4	1	1	2	3	CN, v=0,1
224785.3010	0.05	-7.1625	2	2046.1733	4	-265041234	2	1	3	2	1	1	2	1	CN, v=0,1
224796.3600	0.05	-7.6593	2	2046.1729	4	-265041234	2	1	3	2	1	1	2	2	CN, v=0,1
224800.8960	0.05	-7.6613	2	2046.1724	6	-265041234	2	1	3	3	1	1	2	3	CN, v=0,1
226287.4185	0.0069	-4.1214	2	3.7866	2	265041234	2	0	2	1	1	0	2	1	CN, v=0,1
226298.9427	0.0068	-4.2189	2	3.7862	2	265041234	2	0	2	1	1	0	2	2	CN, v=0,1
226303.0372	0.0064	-4.2131	2	3.7866	4	265041234	2	0	2	2	1	0	2	1	CN, v=0,1

# Atomic data archives for stellar spectroscopy

BRASS <http://brass.sdf.org/brassmain.html>

BRASS.SDF.ORG



Status News Publications

## The Belgian Repository of fundamental Atomic Data and Stellar Spectra



Enter BRASS

### BRASS RELEASE 2021

#### BRASS Rationale

The Belgian Repository of Atomic data and Stellar Spectra - BRASS is a Science Research Networking Project of the Belgian Federal Science Policy Office - BRAIN.be. The project is a large scientific collaboration on astrophysics research of the Royal Observatory of Belgium (ROB), University of Leuven (KUL), European Southern Observatory (ESO) at Paranal, Chile, and Université Libre de Bruxelles (ULB), University of Antwerp (UA), and the Vereniging voor Sterrenkunde (VVS).

BRASS takes a crucial step towards removing all systematic errors in atomic input data required for quantitative stellar spectroscopy. The project thoroughly assesses the quality of fundamental atomic data available in the largest repositories by comparing very high-quality observed stellar spectra with state-of-the-art theoretical spectra.

More information about the context, major research questions, methodology, interdisciplinary, and research results of the BRASS project is provided [here](#).

View a [BRASS screenshot](#).

# Atomic data archives for stellar spectroscopy

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BRASS Spectra and Data Display

**BENCHMARK STARS**

K-stars  
HERMES Arcturus   
HERMES Eps Eri

G-stars  
HERMES 70 Oph   
HERMES 70 Vir   
KPNO-FTS Sun   
HERMES 51 Peg

F-stars  
HERMES 10 Tau   
HERMES Beta Com   
HERMES Procyon

A-stars  
HERMES Astar TBC   
VLT-UVES Bstar TBC

**WAVELENGTH REGIONS**

112 6530-6550 A   
113 6560-6590 A   
114 6590-6620 A   
115 6620-6650 A   
116 6650-6680 A   
117 6680-6710 A   
118 6710-6740 A   
119 6740-6770 A   
120 6770-6800 A

**LOADED WAVELENGTH REGIONS**

REGION #1 REGION #2 REGION #3 REGION #4 ATOMIC DATA QUALITY GAUSS LINE FIT

Load Region #1 Set wavelength zoom Locked  Unlocked

Shift top labels Up  Down

Reset Zoom

**SUN reg119**

Normalized flux

Stellar rest wavelength [Å]

6752.08: Broadened: 0.9985 Unbroadened: 0.9987

1078 1108 1081 1082 1084 1085 1086

8783 8787 8788 8789 8791 8796 8797 8798 8801 8802 8805 8808 8810 8811 8812

send to top Gauss pane

**51-PEG reg119**

Normalized flux

Stellar rest wavelength [Å]

6752.08: Broadened: 0.9977 Unbroadened: 0.9980

1078 1108 1081 1082 1084 1085 1086

8783 8787 8788 8789 8791 8796 8797 8798 8801 8802 8805 8808 8810 8811 8812

Shift bottom labels Up  Down

send to bottom Gauss pane

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**ATOMIC DATA SPECTRUM 1**

Save my list to file: brasslines1.html

Clear lines list Clear graded list Clear my list

SUN  
8797 Fe 1 6750.15  
logg= -2.720  
Ref= SpectroWeb  
Elow= 2.4241 eV  
Rad= 6.690  
Stark= -6.130  
Landes= 1.500  
Cal depth= 0.642

SUN  
1082 Fe 1 6750.15  
log(gf)= -2.596  
Ref= BRASS 2019  
Elow= 2.424 eV  
Cal depth= 0.53  
Line blending= 0.2 %  
Obs. EW= 74.01 mÅ  
Obs. EW corr= 75.27 mÅ  
Quality assessed  
Robust assessment  
View data quality

**ATOMIC DATA SPECTRUM 2**

Save my list to file: brasslines2.html

Clear lines list Clear graded list Clear my list

51-PEG  
8811 Ni 1 6767.77  
logg= -2.170  
Ref= SpectroWeb  
Elow= 1.8260 eV  
Rad= 8.013  
Stark= -6.145  
Landes= 1.430  
Cal depth= 0.644

51-PEG  
1086 Ni 1 6767.77  
log(gf)= -2.181  
Ref= BRASS 2019  
Elow= 1.826 eV  
Cal depth= 0.49  
Line blending= 0.2 %  
Obs. EW= 89.41 mÅ  
Obs. EW corr= 92.26 mÅ  
Quality assessed  
Robust assessment  
View data quality

Display Toggle Custom Theme

# Atomic data archives for stellar spectroscopy

BRASS <http://brass.sdf.org/brassmain.html>

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BRASS Spectra and Data Display

**BENCHMARK STARS**

K-stars  
 HERMES Arcturus    
 HERMES Eps Eri

G-stars  
 HERMES 70 Oph    
 HERMES 70 Vir    
 KPNO-FTS Sun    
 HERMES 51 Peg

F-stars  
 HERMES 10 Tau    
 HERMES Beta Com    
 HERMES Procyon

A-stars  
 HERMES 68 Tau

**REFERENCE STARS**

A-stars  
 HERMES Astar TBC

B-stars  
 VLT-UVES Bstar TBC

**WAVELENGTH REGIONS**

113 6560-6590 A   
 114 6590-6620 A   
 115 6620-6650 A   
 116 6650-6680 A   
 117 6680-6710 A   
 118 6710-6740 A   
 119 6740-6770 A   
 120 6770-6800 A

**LOADED WAVELENGTH REGIONS**

REGION #1 REGION #2 REGION #3 REGION #4 **ATOMIC DATA QUALITY** GAUSS LINE FIT

INVESTIGATED LINE TABLE INVESTIGATED LINE DATA LIT. REFERENCES

Show / collapse table info

Select investigated species:  
 C I Na I Mg I Al I Si I Si II S I Ca I Ca II Sc I Sc II Ti I Ti II V I V II Cr I Cr II Mn I Fe I Fe II Co I Ni I Zn I Sr I Y II Ba II La II Ce II

red label number	Wavelength (Å)	$E_{low}$ (eV)	$\log(g f)$ derived by BRASS	BRASS quality flags		Tested literature $\log(g f)$ values										
				Quality Assessable	Analysis Independent	Recommended literature numbers										
Input $\lambda$	$\Delta\lambda_{grid}$	cog curve-of-growth	grid line profile fits			NIST	SpectroWeb	VALD	Spec-W <sup>3</sup>	CHIANTI	TipBASE	TopBASE				
409	5052.144	0.002 $_{\pm 0.006}$	7.685	-1.12 $_{\pm 0.11}$	-1.29 $_{\pm 0.12}$	✓	X	-1.30 <sup>1</sup>	-1.30 <sup>1</sup>	-1.30 <sup>2</sup>	-1.30 <sup>3</sup>	-1.49 <sup>4</sup>	-	-	-1.45 <sup>5</sup>	1, 2, 3, 4
358	4982.814	0.004 $_{\pm 0.002}$	2.104	-0.76 $_{\pm 0.08}$	-0.86 $_{\pm 0.11}$	✓	X	-0.92 <sup>6</sup>	-	-0.96 <sup>2</sup>	-	-	-	-	-	2, 6
901	6154.225	-0.006 $_{\pm 0.002}$	2.102	-1.42 $_{\pm 0.06}$	-1.45 $_{\pm 0.04}$	✓	✓	-1.55 <sup>7</sup>	-1.55 <sup>7</sup>	-1.56 <sup>2</sup>	-1.55 <sup>3</sup>	-	-	-	-1.55 <sup>5</sup>	-
905	6160.747	-0.004 $_{\pm 0.002}$	2.104	-1.12 $_{\pm 0.07}$	-1.12 $_{\pm 0.08}$	✓	✓	-1.25 <sup>6</sup>	-1.25 <sup>7</sup>	-1.26 <sup>2</sup>	-1.25 <sup>3</sup>	-	-	-	-1.25 <sup>5</sup>	-
125	4571.096	-0.008 $_{\pm 0.003}$	0.000	-5.46 $_{\pm 0.09}$	-5.57 $_{\pm 0.09}$	✓	X	-5.62 <sup>3</sup>	-5.62 <sup>3</sup>	-5.69 <sup>2</sup>	-5.62 <sup>3</sup>	-	-	-	-	3, 8
227	4730.029	0.001 $_{\pm 0.003}$	4.346	-2.17 $_{\pm 0.10}$	-2.23 $_{\pm 0.08}$	✓	X	-2.35 <sup>3</sup>	-2.35 <sup>9</sup>	-2.32 <sup>2</sup>	-2.35 <sup>3</sup>	-	-	-	-2.34 <sup>5</sup>	-
760	5785.313	-0.039 $_{\pm 0.002}$	5.108	-1.83 $_{\pm 0.07}$	-1.77 $_{\pm 0.06}$	✓	X	-2.11 <sup>10</sup>	-	-1.71 <sup>2</sup>	-2.11 <sup>10</sup>	-	-	-	-2.59 <sup>5</sup>	2
978	6318.717	-0.011 $_{\pm 0.009}$	5.108	-1.83 $_{\pm 0.08}$	-1.87 $_{\pm 0.07}$	✓	✓	-2.10 <sup>11</sup>	-2.10 <sup>11</sup>	-	-2.10 <sup>3</sup>	-	-	-	-2.10 <sup>5</sup>	-
979	6319.237	-0.003 $_{\pm 0.011}$	5.108	-2.07 $_{\pm 0.05}$	-2.10 $_{\pm 0.04}$	✓	✓	-2.32 <sup>11</sup>	-2.32 <sup>11</sup>	-	-2.32 <sup>3</sup>	-	-	-	-2.33 <sup>5</sup>	-
1056	6696.023	-0.006 $_{\pm 0.002}$	3.143	-1.40 $_{\pm 0.08}$	-1.45 $_{\pm 0.07}$	✓	X	-1.57 <sup>12</sup>	-1.57 <sup>12</sup>	-2.85 <sup>2</sup>	-1.35 <sup>13</sup>	-1.34 <sup>4</sup>	-	-	-1.57 <sup>5</sup>	-
1057	6698.673	-0.007 $_{\pm 0.003}$	3.143	-1.74 $_{\pm 0.07}$	-1.76 $_{\pm 0.04}$	✓	✓	-1.87 <sup>12</sup>	-1.87 <sup>12</sup>	-2.65 <sup>2</sup>	-1.65 <sup>13</sup>	-1.64 <sup>4</sup>	-	-	-1.87 <sup>5</sup>	-
340	4947.607	-0.009 $_{\pm 0.002}$	5.082	-2.16 $_{\pm 0.05}$	-2.18 $_{\pm 0.05}$	✓	✓	-1.76 <sup>14</sup>	-	-2.20 <sup>2</sup>	-1.76 <sup>14</sup>	-1.81 <sup>4</sup>	-	-	-	2
415	5070.950	-0.026 $_{\pm 0.016}$	5.082	-2.81 $_{\pm 0.22}$	-3.22 $_{\pm 0.10}$	X	X	-2.25 <sup>14</sup>	-	-4.00 <sup>2</sup>	-2.25 <sup>14</sup>	-	-	-	-	X
571	5421.168	-0.007 $_{\pm 0.004}$	5.619	-1.21 $_{\pm 0.06}$	-1.28 $_{\pm 0.05}$	✓	X	-2.01 <sup>14</sup>	-	-1.35 <sup>2</sup>	-2.01 <sup>14</sup>	-	-	-	-	-
594	5488.983	-0.015 $_{\pm 0.003}$	5.614	-1.68 $_{\pm 0.06}$	-1.75 $_{\pm 0.06}$	✓	X	-2.30 <sup>14</sup>	-	-1.90 <sup>2</sup>	-2.31 <sup>14</sup>	-	-	-	-	-
610	5517.533	0.000 $_{\pm 0.003}$	5.082	-2.38 $_{\pm 0.05}$	-2.42 $_{\pm 0.05}$	✓	✓	-2.61 <sup>14</sup>	-	-2.61 <sup>2</sup>	-2.61 <sup>14</sup>	-	-	-	-	-
647	5622.220	0.014 $_{\pm 0.009}$	4.930	-2.87 $_{\pm 0.07}$	-3.07 $_{\pm 0.06}$	X	X	-2.61 <sup>14</sup>	-1.64 <sup>15</sup>	-3.06 <sup>2</sup>	-2.61 <sup>14</sup>	-1.64 <sup>4</sup>	-	-	-2.00 <sup>5</sup>	X

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# Atomic data archives for stellar spectroscopy

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**BRASS Spectra and Data Display**

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**Line: Si I -  $\lambda$ 4947.6**

Quality assessable? **Yes** | Robust against analysis method? **Yes**

Line considered quality assessable if  $\log(gf)_{\text{grid}}$  and  $\log(gf)_{\text{coq}}$  within error of each other. Line considered robust against analysis method if  $\log(gf)_{\text{grid}}$  and  $\log(gf)_{\text{coq}}$  within 0.04dex of each other.

$\log(gf)_{\text{grid}}$ :  $-2.18 \pm 0.05$      $\log(gf)_{\text{coq}}$ :  $-2.16 \pm 0.05$

### Cross-matched literature data

Database	$\lambda$ (Å)	$\log(gf)$	label $l_{\text{ow}}$	label $u_{\text{p}}$	$E_{\text{low}}$ (eV)	$E_{\text{up}}$ (eV)	$J_{\text{low}}$	$J_{\text{up}}$
BRASSv1	4947.607	-1.760	LS 3s2.3p.4s 1P*	JJ 3s2.3p.(2P*<3/2>).6p.<3/2> (3/2,3/2)	5.082	7.588	1.0	0.0
VALD	4947.607	-1.760	LS 3s2.3p.4s 1P*	JJ 3s2.3p.(2P*<3/2>).6p.<3/2> (3/2,3/2)	5.082	7.588	1.0	0.0
SpectroWeb	4947.607	-2.200	-	-	5.082	7.587	-	-
SpectrW3	4947.600	-1.812	-	-	5.081	7.587	1.0	0.0

### Line profile plots per G-type benchmark star

**Information** Radio buttons can be used to choose which database  $\log(gf)$  values and line profiles to view. Interactive plot controls can be found to the top right of plotting panels.

**Top left panel:** Points represent the individual stellar  $\log(gf)$  values plotted as a function of effective temperature. Lines represent the mean  $\log(gf)$  values and the literature  $\log(gf)$  values. Shaded areas represent the uncertainty associated with a given  $\log(gf)$  value.

**Remaining panels:** Observed line profiles are shown by black dotted lines for each of the 7 FGK-type benchmark stars. Synthetic line profiles, calculated using the mean  $\log(gf)$  values and the literature  $\log(gf)$  values, are shown by the solid coloured lines. Shaded areas represent the uncertainty in line profile flux due to the corresponding  $\log(gf)$  values.

BRASSv2 GRID (inc. err)     Gaussian fits     BRASSv1     VALD     SpectrW3  
 BRASSv2 COG (inc. err)     SpectroWeb

### Quality assessment

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# Atomic data archives for stellar spectroscopy

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BRASS Spectra and Data Display

BENCHMARK STARS

K-stars  
HERMES Arcturus  
HERMES Eps Eri

G-stars  
HERMES 70 Oph  
HERMES 70 Vir  
KPNO-FTS Sun  
HERMES 51 Peg

F-stars  
HERMES 10 Tau  
HERMES Beta Com

A-stars  
HERMES Procyon  
HERMES 08 Tau  
HERMES A bench 2

B-stars  
HERMES HR 7512  
HERMES B bench 2

LOADED WAVELENGTH REGIONS

REGION #1 REGION #2 REGION #3 REGION #4 ATOMIC DATA QUALITY GAUSS LINE

INVESTIGATED LINE TABLE INVESTIGATED LINE DATA LIT. REFERENCES

BRASSv2 GRID (inc. err)  Gaussian fits

BRASSv1  VALD  SpectroWeb  SpectrW3

log(gf) values vs Teff

Quality assessment

Database	$\lambda$ (Å)	$\Delta\lambda$ (w.r.t GRID) (Å)	log(gf)	$\Delta\log(gf)$ (w.r.t GRID)	Within error of log(gf) <sub>grid</sub> ?
BRASSv2 GRID	4947.598 ± 0.002	-	-2.18 ± 0.05	-	-
BRASSv2 COG	-	-	-2.16 ± 0.03	-0.02	Yes
BRASSv1	4947.607	-0.009	-1.76	-0.42	No
VALD	4947.607	-0.009	-1.76	-0.42	No
SpectroWeb	4947.607	-0.009	-2.20	0.02	Yes
SpectrW3	4947.600	-0.002	-1.81	-0.37	No

Equivalent widths

	$W_\lambda$ EpsEri (mÅ)	$W_\lambda$ 70 Oph (mÅ)	$W_\lambda$ 70 Vir (mÅ)	$W_\lambda$ Sun (mÅ)	$W_\lambda$ 51 Peg (mÅ)	$W_\lambda$ 10 Tau (mÅ)	$W_\lambda$ BetCom (mÅ)
Measured	18.72	21.79	21.63	21.34	31.67	18.41	19.05
$\Delta W_\lambda$ CORR	+1.37	+1.08	+0.44	+0.84	+0.85	+0.03	+0.18
<b>Databases</b>							
BRASSv2 GRID	19.98	25.98	22.37	22.58	33.14	21.76	27.63
BRASSv2 COG	20.81	26.96	23.20	23.42	34.22	22.49	28.52
BRASSv1	41.95	50.08	42.75	43.41	57.99	40.29	49.09
VALD	41.95	50.08	42.75	43.41	57.99	40.29	49.09
SpectroWeb	19.43	25.32	21.81	22.03	32.42	21.27	27.05

WAVELENGTH REGIONS

77 5480-5510 Å  
78 5510-5540 Å  
79 5540-5570 Å  
80 5570-5600 Å  
81 5600-5630 Å  
82 5630-5660 Å  
83 5660-5690 Å  
84 5690-5720 Å  
85 5720-5750 Å  
86 5750-5780 Å  
87 5780-5810 Å

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# Atomic data archives for stellar spectroscopy

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**BENCHMARK STARS**

- HERMES 70 Oph
- HERMES 70 Vir
- KPNO-FTS Sun
- HERMES 51 Peg
- F-stars
- HERMES 10 Tau
- HERMES Beta Com
- HERMES Procyon
- A-stars
- HERMES 68 Tau
- HERMES A bench 2
- B-stars

**REFERENCE STARS**

- A-stars
- HERMES Astar TBC
- B-stars
- VLT-UVES Bstar TBC

**WAVELENGTH REGIONS**

- 76 5450-5480 A
- 77 5480-5510 A
- 78 5510-5540 A
- 79 5540-5570 A
- 80 5570-5600 A
- 81 5600-5630 A
- 82 5630-5660 A
- 83 5660-5690 A

**LOADED WAVELENGTH REGIONS**

REGION #1 REGION #2 REGION #3 REGION #4 ATOMIC DATA QUALITY GAUSS LINE FIT

Load Region #1 Set wavelength zoom Locked  Unlocked

Shift top labels Up  Down

**SUN reg80**

Normalized flux

Stellar rest wavelength [Å]

6993

— Observ  
— Broadened  
-- Unbroadened

send to top Gauss pane Refresh

**Procyon reg80**

Normalized flux

Stellar rest wavelength [Å]

6123

— Observ  
— Broadened  
-- Unbroadened

send to bottom Gauss pane

**ATOMIC DATA SPECTRUM 1**

Save my list to file: brasslines1.html

Clear lines list Clear graded list Clear my list

SUN  
6993 Fe 1 5576.09  
loggf=-0.851  
Ref= SpectroWeb  
Elow= 3.4302 eV  
Rad= 8.060  
Stark= -5.390  
Lande= -0.010  
Cal depth= 0.795

**ATOMIC DATA SPECTRUM 2**

Save my list to file: brasslines2.html

Clear lines list Clear graded list Clear my list

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# Atomic data archives for stellar spectroscopy

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BRASS Spectra and Data Display

**BENCHMARK STARS**

- HERMES 70 Oph
- HERMES 70 Vir
- KPNO-FTS Sun
- HERMES 51 Peg
- F-stars
  - HERMES 10 Tau
  - HERMES Beta Com
  - HERMES Procyon
- A-stars
  - HERMES 68 Tau
  - HERMES A bench 2

**REFERENCE STARS**

- A-stars
  - HERMES Astar TBC
- B-stars
  - VLT-UVES Bstar TBC

**LOADED WAVELENGTH REGIONS**

REGION #1 REGION #2 REGION #3 REGION #4 ATOMIC DATA QUALITY **GAUSS LINE FIT**

run top Gauss fit Reset zoom Shift top labels Up Down Add top fit to my list Refresh

**SUN reg80**

Normalized flux

Stellar rest wavelength [Å]

**Procyon reg80**

Normalized flux

Stellar rest wavelength [Å]

run bottom Gauss fit Reset zoom Shift bottom labels Up Down Add bottom fit to my list

**ATOMIC DATA SPECTRUM 1**

Save my list to file: brasslines1.html

Clear lines list Clear graded list Clear my list

SUN  
6993 Fe 1 5576.09  
loggf = -0.851  
Ref: SpectroWeb  
Elow = 3.4302 eV  
Rad = 8.060  
Stark = -5.390  
Lande = -0.010  
Cal depth = 0.795

SUN reg80  
Single Gauss best fit parms.  
Line wavel. = 5576.0870 Å  
Bkgr. flux level = 0.9595  
Gauss sigma = 62.02 mÅ  
Norm. line depth = 0.7134  
Eqv. width = 110.91 mÅ  
Eqv. width error = 6.30 mÅ  
Used fit points = 99  
Fit quality = 0.98820

**ATOMIC DATA SPECTRUM 2**

Save my list to file: brasslines2.html

Clear lines list Clear graded list Clear my list

Display Toggle Custom Theme

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# Local and online database development

MySQL Workbench <https://www.mysql.com/products/workbench/>

Local db development using command line interface replaced by Workbench

The screenshot displays the MySQL Workbench environment. On the left, a terminal window shows the command `mysql -u root -palexmysql` and the MySQL prompt. The main interface shows a query window with the following SQL statement:

```
1 • SELECT * FROM `alobel1_brass-lines-four`.brass_ascii;
```

A red arrow points to the query. Below the query window, the Result Grid displays the following data:

#	mysqlid	element	ion	isotope	wavelength	wave_ref	loggf	loggf_err	ref	loggf_flag	conf_low	conf_up	ev_low	ev_low_ref	i_low	ev_up	e
1	1	Ti	1	NaN	4200.0194	K10	-2.491	NaN	K10	NaN	LS 3d3.(2G).4s a3G	LS 3d3.(2G).4p x1G*	1.879	K10	4	4.83	K
2	2	Nd	2	NaN	4200.022	MC	-1.64	NaN	MC	NaN	LS 4f4.(5I).6s 6I	*	0.064	MC	4.5	3.015	M
3	3	W	1	NaN	4200.028	CB	-0.99	NaN	CB	NaN	LS 5d4.6s2 a3G	*	2.037	CB	4	4.988	C
4	4	U	2	NaN	4200.086	MC	-1.467	NaN	MC	NaN	LS 5f3.(4I<0>).6d.(2D).7s 4L*		0.779	MC	6.5	3.73	M
5	5	Fe	1	NaN	4200.0872	K07	-1.13	NaN	FMW	NaN	LS 3p6.3d6.(5D).4s.4p.(3P*) z3D*	LS 3p6.3d7.(4F).4d f3F	3.884	K07	3	6.835	K
6	6	Cr	1	NaN	4200.101	WLHK	-1.035	NaN	K10	NaN	LS 3d5.(4G).4s a3G	LS 3d4.(a3F).4s.4p.(3P*) 3F*	3.079	WLHK	3	6.03	V
7	7	Co	1	NaN	4200.102	K08	-1.012	NaN	K08	NaN	LS 3p6.3d8.(3F).4p y4F*	3d8.(3F).5d 56644e	4.072	K08	4.5	7.023	K
8	8	Fe	2	NaN	4200.1613	K13	-3.648	NaN	RU	NaN	LS 3d6.(3H).4p z2G*	LS 3d6.(5D).4d e4F	7.727	K13	3.5	10.678	K
9	9	Cr	1	NaN	4200.1689	K10	-0.86	NaN	K10	NaN	LS 3d5.(2D3).4s b3D	LS 3d5.(4G).5p v3H*	3.845	K10	3	6.796	K
10	10	V	1	NaN	4200.1777	K09	-2.29	NaN	MFV	NaN	LS 3d4.(5D).4s a6D	LS 3d3.(4F).4s.4p.(3P*) z2G*	0.275	K09	2.5	3.226	K
11	11	Mo	1	NaN	4200.196	WBb	-1.706	NaN	WBb	NaN	LS 4d5.(2I).5s a3I	LS 4d4.5s.(4H).5p y3I*	3.168	WBb	6	6.119	V
12	12	Mn	2	NaN	4200.2695	K09	-1.727	NaN	K09	NaN	LS 3d5.(4F).4s c3F	LS 3d5.(4D).4p y3F*	6.185	K09	4	9.136	K
13	13	Ti	2	NaN	4200.4135	K10	-3.567	NaN	K10	NaN	LS 3d2.(3P).4s b2P	LS 3d2.(3P).4p y4D*	2.061	K10	1.5	5.012	K
14	14	Ni	1	NaN	4200.4541	K08	-1.36	NaN	FMW	NaN	LS 3d8.(3F).4s.4p.(3P*) z5D*	LS 3d8.4s.(4F).5s f3F	3.306	K08	3	6.257	K
15	15	Fe	1	NaN	4200.4627	K07	-3.374	NaN	K07	NaN	LS 3p6.3d7.(4F).4p y5D*	LS 3p6.3d6.(5D).4s. (6D).5...	4.154	K07	3	7.105	K
16	16	Fe	1	NaN	4200.4977	K07	-4.521	NaN	K07	NaN	LS 3p6.3d8 c3F	LS 3p6.3d6.(3D).4s.4p.(3P...	4.186	K07	2	7.137	K
17	17	Fe	2	NaN	4200.5174	K13	-0.41	NaN	K13	NaN	LS 3d6.(5D).5p 6F*	LS 3d6.(5D).6d 4G	11.167	K13	4.5	14.118	K

The bottom of the interface shows the Object Info panel for the 'brass\_ascii' table and the Action Output panel, which displays the execution message: 'SELECT \* FROM `alobel1\_brass-lines-four`.brass\_ascii LIMIT 0, ... 100 row(s) returned'.

# Local and online database development

DbVisualizer <https://www.dbvis.com/>

SQL GUI can connect to local and remote db servers.

The screenshot displays the DbVisualizer Free 10.0.4 interface. The main window shows a SQL query: `1 SELECT * FROM brass_ascii;` with a red arrow pointing to the `FROM` clause. The results are displayed in a table with the following columns: `* mysqlid element ion isotope wavelength wave_ref loggf loggf_err ref loggf_flag conf_low conf_up ev_low ev_low`. The table contains 25 rows of data, including elements like Ti, Nd, W, U, Fe, Cr, V, Mo, Mn, Ni, Fe, Fe, Fe, Mo, Si, Mn, Ar, Ti, Fe, and V.

*	mysqlid	element	ion	isotope	wavelength	wave_ref	loggf	loggf_err	ref	loggf_flag	conf_low	conf_up	ev_low	ev_low
1	1	Ti	1	NaN	4200.0194	K10	-2.491	NaN	K10	NaN	LS 3d3.(2G).4s a3G	LS 3d3.(2G).4p x1G*	1.879	K10
2	2	Nd	2	NaN	4200.022	MC	-1.64	NaN	MC	NaN	LS 4f4.(5I).6s 6I	*	0.064	MC
3	3	W	1	NaN	4200.028	CB	-0.99	NaN	CB	NaN	LS 5d4.6s2 a3G	*	2.037	CB
4	4	U	2	NaN	4200.086	MC	-1.467	NaN	MC	NaN	LS 5f3.(4I<0>).6d.(2D).7s 4L*		0.779	MC
5	5	Fe	1	NaN	4200.0872	K07	-1.13	NaN	FMW	NaN	LS 3p6.3d6.(5D).4s.4p.(3P*) z3D*	LS 3p6.3d7.(4F).4d f3F	3.884	K07
6	6	Cr	1	NaN	4200.101	WLHK	-1.035	NaN	K10	NaN	LS 3d5.(4G).4s a3G	LS 3d4.(a3F).4s.4p.(3P*) 3F*	3.079	WLHK
7	7	Co	1	NaN	4200.102	K08	-1.012	NaN	K08	NaN	LS 3p6.3d8.(3F).4p y4F*	3d8.(3F).5d 56644e	4.072	K08
8	8	Fe	2	NaN	4200.1613	K13	-3.648	NaN	RU	NaN	LS 3d6.(3H).4p z2G*	LS 3d6.(5D).4d e4F	7.727	K13
9	9	Cr	1	NaN	4200.1689	K10	-0.86	NaN	K10	NaN	LS 3d5.(2D3).4s b3D	LS 3d5.(4G).5p v3H*	3.845	K10
10	10	V	1	NaN	4200.1777	K09	-2.29	NaN	MFW	NaN	LS 3d4.(5D).4s a6D	LS 3d3.(4F).4s.4p.(3P*) z2G*	0.275	K09
11	11	Mo	1	NaN	4200.196	WBb	-1.706	NaN	WBb	NaN	LS 4d5.(2I).5s a3I	LS 4d4.5s.(4H).5p y3I*	3.168	WBb
12	12	Mn	2	NaN	4200.2695	K09	-1.727	NaN	K09	NaN	LS 3d5.(4F).4s c3F	LS 3d5.(4D).4p y3F*	6.185	K09
13	13	Ti	2	NaN	4200.4135	K10	-3.567	NaN	K10	NaN	LS 3d2.(3P).4s b2P	LS 3d2.(3P).4p y4D*	2.061	K10
14	14	Ni	1	NaN	4200.4541	K08	-1.36	NaN	FMW	NaN	LS 3d8.(3F).4s.4p.(3P*) z5D*	LS 3d8.4s.(4F).5s f3F	3.306	K08
15	15	Fe	1	NaN	4200.4627	K07	-3.374	NaN	K07	NaN	LS 3p6.3d7.(4F).4p y5D*	LS 3p6.3d6.(5D).4s.(6D).5d 7F	4.154	K07
16	16	Fe	1	NaN	4200.4977	K07	-4.521	NaN	K07	NaN	LS 3p6.3d8 c3F	LS 3p6.3d6.(3D).4s.4p.(3P) 3D*	4.186	K07
17	17	Fe	2	NaN	4200.5174	K13	-0.41	NaN	K13	NaN	LS 3d6.(5D).5p 6F*	LS 3d6.(5D).6d 4G	11.167	K13
18	18	Mo	1	NaN	4200.57	WBb	-1.723	NaN	WBb	NaN	LS 4d5.(4P).5s a5P	LS 4d5.(4D).5p w5D*	2.276	WBb
19	19	Fe	1	NaN	4200.626	K07	-4.46	NaN	K07	NaN	LS 3p6.3d7.(4F).4p z3G*	JK 3p6.3d6.(5D).4s.(6D<5/2>).6d 2[7/2]	4.473	K07
20	20	Si	2	NaN	4200.6578	K12	-0.889	NaN	NIST10	NaN	LS 3s2.(1S).4d 2D*	LS 3s2.(1S).8f 2F	12.525	K12
21	21	Mn	1	NaN	4200.6664	K07	-4.075	NaN	K07	NaN	LS 3d5.4s2 b4D	LS 3d5.(4P).4s.4p.(3P*) z4S*	3.772	K07
22	22	Ar	1	NaN	4200.675	KP	-1.4	NaN	KP	NaN	JK 3s2.3p5.(2P*<3/2>).4s 2[3/2]*	JK 3s2.3p5.(2P*<3/2>).5p 2[5/2]	11.548	KP
23	23	Ti	1	NaN	4200.7444	K10	-0.447	NaN	K10	NaN	LS 3d3.(2P).4s b3P	LS 3d3.(2P).4p u3P*	2.25	K10
24	24	Fe	1	NaN	4200.7776	K07	-3.979	NaN	K07	NaN	LS 3p6.3d7.(4F).4s a3F	LS 3p6.3d6.(5D).4s.4p.(1P*) y5P*	1.608	K07
25	25	V	1	NaN	4200.8961	K09	-2.91	NaN	MFW	NaN	LS 3d3.4s2 a4F	LS 3d3.(4F).4s.4p.(3P*) z2D*	0.017	K09

# Local and online database development

DbVisualizer <https://www.dbvis.com/>

SQL GUI can connect to local and remote db servers. Supports a large variety of data formats: MariaDB, MySQL, PostgreSQL, SQLite, H2, Sybase SQL, and more.

The screenshot displays the DbVisualizer Free 10.0.4 interface. The main window shows a database connection to 'alobel1\_brass-lines-four' with the following query:

```
1 SELECT * FROM brass_ascii;
```

The query result is displayed in a table with the following columns: \* (row number), mysqlId, element, ion, isotope, wavelength, wave\_ref, loggf, loggf\_err, and ref. The data is as follows:

*	mysqlId	element	ion	isotope	wavelength	wave_ref	loggf	loggf_err	ref
1	1	Ti	1	NaN	4200.0194	K10	-2.491	NaN	K10
2	2	Nd	2	NaN	4200.022	MC	-1.64	NaN	MC
3	3	W	1	NaN	4200.028	CB	-0.99	NaN	CB
4	4	U	2	NaN	4200.086	MC	-1.467	NaN	MC
5	5	Fe	1	NaN	4200.0872	K07	-1.13	NaN	FMW
6	6	Cr	1	NaN	4200.101	WLHK	-1.035	NaN	K10
7	7	Co	1	NaN	4200.102	K08	-1.012	NaN	K08
8	8	Fe	2	NaN	4200.1613	K13	-3.648	NaN	RU
9	9	Cr	1	NaN	4200.1689	K10	-0.86	NaN	K10
10	10	V	1	NaN	4200.1777	K09	-2.29	NaN	MFW
11	11	Mo	1	NaN	4200.196	WBb	-1.706	NaN	WBb
12	12	Mn	2	NaN	4200.2695	K09	-1.727	NaN	K09
13	13	Ti	2	NaN	4200.4135	K10	-3.567	NaN	K10
14	14	Ni	1	NaN	4200.4541	K08	-1.36	NaN	FMW
15	15	Fe	1	NaN	4200.4627	K07	-3.374	NaN	K07
16	16	Fe	1	NaN	4200.4977	K07	-4.521	NaN	K07
17	17	Fe	2	NaN	4200.5174	K13	-0.41	NaN	K13
18	18	Mo	1	NaN	4200.57	WBb	-1.723	NaN	WBb
19	19	Fe	1	NaN	4200.626	K07	-4.46	NaN	K07
20	20	Si	2	NaN	4200.6578	K12	-0.889	NaN	NIST10
21	21	Mn	1	NaN	4200.6664	K07	-4.075	NaN	K07
22	22	Ar	1	NaN	4200.675	KP	-1.4	NaN	KP
23	23	Ti	1	NaN	4200.7444	K10	-0.447	NaN	K10
24	24	Fe	1	NaN	4200.7776	K07	-3.979	NaN	K07
25	25	V	1	NaN	4200.8961	K09	-2.91	NaN	MFW

The 'Tool Properties' dialog box is open, showing the 'Database' tab. The 'Database' list includes various database types, with 'SQL Server' selected. The 'Permission Mode' section is set to 'Development'. The 'Connect when "Connect All"' checkbox is unchecked.

# Local and online database development

phpMyAdmin <https://www.phpmyadmin.net/>

Bringing MySQL to the web. Online db administration and development using free software tools for remote db servers (Tomcat, AWS) of MySQL & MariaDB.

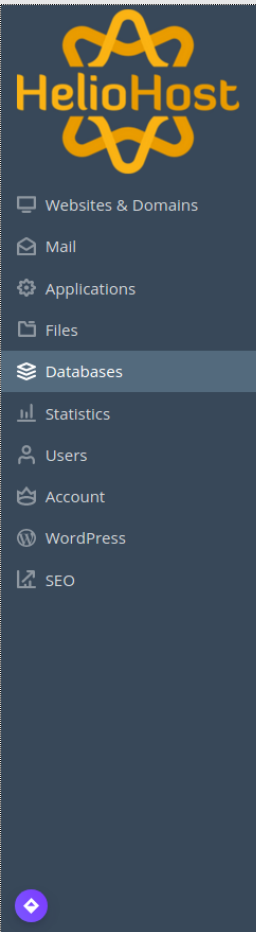
The screenshot displays the phpMyAdmin interface for a database named 'alobel1\_brass-lines-four'. The table 'brass\_ascii' is selected, and a SQL query is shown: `SELECT * FROM `brass_ascii` ORDER BY `brass_ascii`.`wavelength` ASC`. A red arrow points to the query. The table view shows 14 rows of data with columns: `mysqlId`, `element`, `ion`, `isotope`, `wavelength`, `wave_ref`, `loggf`, `loggf_err`, `ref`, `loggf_flag`, `conf_low`, `conf_up`, `ev_low`, `ev_low_ref`, `j_low`, `ev_up`, and `ev_up`. A tooltip indicates that values can be edited by double-clicking.

mysqlId	element	ion	isotope	wavelength	wave_ref	loggf	loggf_err	ref	loggf_flag	conf_low	conf_up	ev_low	ev_low_ref	j_low	ev_up	ev_up
1	Ti	1	NaN	4200.0194	K10	-2.491	NaN	K10	NaN	LS 3d3.(2G).4s a3G	LS 3d3.(2G).4p x1G*	1.879	K10	4	4.83	K10
2	Nd	2	NaN	4200.022	MC	-1.64	NaN	MC	NaN	LS 4f4.(5I).6s 6I	*	0.064	MC	4.5	3.015	MC
3	W	1	NaN	4200.028	CB	-0.99	NaN	CB	NaN	LS 5d4.6s2 a3G	*	2.037	CB	4	4.988	CB
4	U	2	NaN	4200.086	MC	-1.467	NaN	MC	NaN	LS 5f3.(4i<0>).6d.(2D).7s 4L*		0.779	MC	6.5	3.73	MC
5	Fe	1	NaN	4200.0872	K07	-1.13	NaN	FMW	NaN	LS 3p6.3d6.(5D).4s.4p.(3P*) z3D*	LS 3p6.3d7.(4F).4d f3F	3.884	K07	3	6.835	K07
6	Cr	1	NaN	4200.101	WLHK	-1.035	NaN	K10	NaN	LS 3d5.(4G).4s a3G	LS 3d4.(a3F).4s.4p.(3P*) 3F*	3.079	WLHK	3	6.03	WLHK
7	Co	1	NaN	4200.102	K08	-1.012	NaN	K08	NaN	LS 3p6.3d8.(3F).4p y4F*	3d8.(3F).5d 56644e	4.072	K08	4.5	7.023	K08
8	Fe	2	NaN	4200.1613	K13	-3.648	NaN	RU	NaN	LS 3d6.(3H).4p z2G*	LS 3d6.(5D).4d e4F	7.727	K13	3.5	10.678	K13
9	Cr	1	NaN	4200.1689	K10	-0.86	NaN	K10	NaN	LS 3d5.(2D3).4s b3D	LS 3d5.(4G).5p v3H*	3.845	K10	3	6.796	K10
10	V	1	NaN	4200.1777	K09	-2.29	NaN	MFW	NaN	LS 3d4.(5D).4s a6D	LS 3d3.(4F).4s.4p.(3P*) z2G*	0.275	K09	2.5	3.226	K09
11	Mo	1	NaN	4200.196	WBb	-1.706	NaN	WBb	NaN	LS 4d5.(2I).5s a3I	LS 4d4.5s.(4H).5p y3I*	3.168	WBb	6	6.119	WBb
12	Mn	2	NaN	4200.2695	K09	-1.727	NaN	K09	NaN	LS 3d5.(4F).4s c3F	LS 3d5.(4D).4p y3F*	6.185	K09	4	9.136	K09
13	Ti	2	NaN	4200.4135	K10	-3.567	NaN	K10	NaN	LS 3d2.(3P).4s b2P	LS 3d2.(3P).4p y4D*	2.061	K10	1.5	5.012	K10
14	Ni	1	NaN	4200.4541	K08	-1.36	NaN	FMW	NaN	LS 3d8.(3F).4s.4p.(3P*) z5D*	LS 3d8.4s.(4F).5s f3F	3.306	K08	3	6.257	K08

# Local and online database development

phpMyAdmin <https://www.phpmyadmin.net/>

Bringing MySQL to the web. Online db administration and development using free software tools for remote db servers (Tomcat, AWS) of MySQL & MariaDB.



The screenshot shows the phpMyAdmin web interface for a HelioHost account. The main heading is "Databases for brass.heliohost.org". Below this, there are two database entries: "alobel1\_brass-lines-four" and "alobel1\_mybrass". Each entry shows its host (localhost:3306), user, number of tables, and size. For "alobel1\_brass-lines-four", there are 32 tables and a size of 174 MB. For "alobel1\_mybrass", there is 1 table and a size of 16.0 KB. Each database entry has a set of action buttons: phpMyAdmin, Connection Info, Copy, Export Dump, Import Dump, and Check and Repair. A "Remove Database" button is also present for each. The interface includes a search bar at the top, a user profile dropdown, and a sidebar with navigation options like "User Management" and "Backup Manager".

```
3338 var fitgauss1 = eval("(" + "\"" + "." + fitgauss1in + "\"" + ")");
3339 $(fitgauss1).click(function () {
3340 // Only run the gauss fit over visible points.
3341 var rangely = gsal.xAxisRange();
3342 var rangely = gsal.yAxisRange();
3343 var minwav = rangely[0];
3344 var maxwav = rangely[1];
3345 var minflu = rangely[0];
3346 var maxflu = rangely[1];
3347 var numrlz = gsal.numRows();
3348 // fill the fit arrays with the visible points only
3349 var xarrlz = [];
3350 var yarrlz = [];
3351 var marrlz = [];
3352 var marr1t = [];
3353 var j1 = 0;
3354 for (var i = 0; i < numrlz; i++) {
3355 var zoomwav = gsal.getValue(i,0);
3356 var zoomflx = gsal.getValue(i,1);
3357 if (zoomwav >= minwav && zoomwav <= maxwav && zoomflx != null){
3358 xarrlz[j1] = zoomwav;
3359 yarrlz[j1] = zoomflx;
3360 marrlz[j1] = [zoomwav, zoomflx];
3361 marr1t.push({zoomwav, zoomflx});
3362 j1++;
3363 };
3364 };
3365 meanflx1 = d3.median(marr1t, function (d) { return d.zoomflx; });
3366 meanwav1 = d3.median(marr1t, function (d) { return d.zoomwav; });
3367 var marr1r = [];
3368 var j1 = 0;
3369 for (var i = 0; i < numrlz; i++) {
3370 var shwav = gsal.getValue(i,1);
3371 var sshflx = gsal.getValue(i,1);
3372 if (shwav >= minwav && shwav <= maxwav && sshflx != null){
3373 shwav = gsal.getValue(i,0) - meanwav1;
3374 marr1r.push({sshwav, sshflx});
3375 j1++;
3376 };
3377 };
3378 };
3379 xrange = [-1, 1];
3380 chi = function (p) {
3381 var i, chi = [];
3382 if (Math.abs(p[1]) > (xrange[1] - xrange[0]) ||
3383 p[2] > xrange[1] || p[2] < xrange[0]) {
3384 for (i = 0; i < marr1r.length; i++) {
3385 chi.push(1e10);
3386 }
3387 }
3388 for (i = 0; i < marr1r.length; i++) {
3389 chi.push((marr1r[i].sshflx - model(p, marr1r[i].sshwav))[0]);
3390 }
3391 return chi;
3392 };
3393 };
```

Software writing for developping db web applications (war archive):

- HTML & JavaScript (client-side)
- Java Persistence API and Apache Maven (server-side)
- Spring Model-View-Controller Hibernate MySQL Integration



# Excercise 2

## Excercise 2: Measure the Teff temperature of Procyon from an online equivalent line width measurement of an Fe I absorption line.

There is a well-known relationship between the equivalent width of a spectral absorption line and the  $\log(gf)$ -value called the 'curve-of-growth (c-o-g)'. This equation expresses how the total amount of absorption in a spectral line depends on the atomic oscillator strength  $f$  of the transition. For example, for neutral Fe lines (Fe I) we can measure in the Sun over the linear portion of the c-o-g (typically the weak lines):

$$\log(W_{\text{lam}} / 5000) \approx \log(gf) + \log(\text{lam}/5000) - \text{Chi}_{\text{low}} 5040 / T_{\text{ex}} + \text{const} \quad (1)$$

Here  $T_{\text{ex}}$  is the 'excitation temperature' of Fe I transitions in the solar atmosphere,  $W_{\text{lam}}$  is the line equivalent width in Angstrom,  $\text{lam}$  is the rest wavelength of the line in Angstrom, and  $\text{Chi}_{\text{low}}$  is the energy of the lower level of the transition in the Fe I atom given in eV. Note that  $\log(gf)$  and  $f$  are values provided in various atomic databases (where  $g$  is the statistical weight of the lower energy level).

In the atmosphere of dwarf stars like the Sun and Procyon the  $T_{\text{ex}}$  is actually very close to the local gas kinetic temperature  $T$  at an optical depth of  $\text{Tau}_{\text{Ross}} = 2/3$ , which corresponds to the effective temperature  $T_{\text{eff}}$  and the average depth where medium- and high-excitation photospheric metal lines form in their atmospheres.

For the Sun the  $\text{const} = c_s = -0.854$   
and for Procyon the  $\text{const} = c_p = -1.296$

Find the  $T_{\text{eff}}$  of Procyon by measuring the  $W_{\text{lam}}$  of the Fe I line at  $\text{lam}=5576.09 \text{ \AA}$  in Procyon and in the Sun using the BRASS database. For this Fe I line  $\log(gf) = -0.851$  and  $\text{Chi}_{\text{low}} = 3.4302 \text{ eV}$ .

Follow the steps below for measuring the  $W_{\text{lam}}$  of this Fe I line in the Sun and Procyon. Note that in case we adopt the  $T_{\text{eff}}$ -value commonly used for the Sun of 5777 K, equation (1) can be re-written:

$$T_{\text{eff}}(\text{Procyon}) = \text{Chi}_{\text{low}} 5040 / ( \log(W_{\text{s}}/W_{\text{p}}) + (c_p - c_s) + \text{Chi}_{\text{low}} 5040 / T_{\text{eff}}(\text{Sun}) )$$

where the  $\log(gf)$ - and  $\text{lam}$ -values in (1) drop from the calculation as they are the same for the same Fe I line in the Sun and Procyon.

Visit <http://brass.sdf.org/brassmain.html>

In the left-hand menu select the radio-buttons in the subpanels

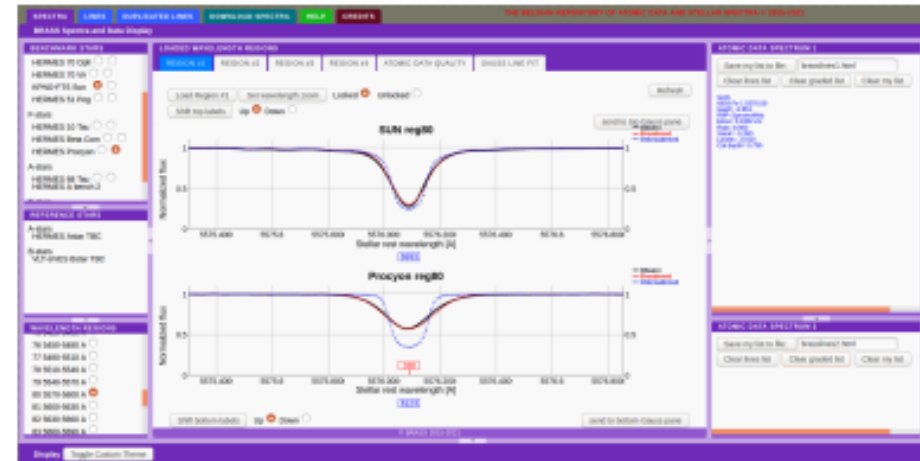
Benchmark stars:  
KPNO-FTS Sunday    
and  
Hermes Procyon

and below Wavelength regions:  
80 5570-5600 \AA

Click in the central top panel  
Load Region #1

Use the mouse to click on the spectrum and slide over the region around the Fe I line 5576.09 \AA. The plot will zoom in on the line in the middle top and bottom panels. You can view some atomic data provided for this line by clicking the blue label shown below the line with No. 6993.

To prepare the lines for your interactive equivalent width measurements press the 'send to top Gauss pane' and 'send to bottom Gauss pane' button at the top and bottom of the central panel.



Next click on GAUSS LINE FIT in the top menu. Zoom in with the mouse on the top spectrum around the Fe I 5576 line after selecting a rather symmetrical line profile around the middle of the zoomed wavelength region (blue label No. 6993). Next press the 'run top Gauss fit' button. The fitted and measured  $W_{\text{lam}}$ -value appears in red color to the right (Eqv. Width = XXX m\AA). Note that the  $W_{\text{lam}}$ -values are provided in milli-Angstroms (m\AA). Repeat this for the Fe I 5576 line in Procyon shown in the bottom panel (blue label No. 6123).



# Excercise 1

## Exercise 1: Determine the pulsation period of a Ib supergiant classical Cepheid from Gaia G magnitude and radial velocity time-series.

The goal is to first download the G magnitude time-series and radial velocity (RV) time-series from the Gaia Data Archive. They come in ASCII text comma-separated (CSV) files you can view with any text editor such as `gedit`. Choose one of the stars from the list below and fetch the two files from the Gaia Archive as is explained below. Then upload the RV time-series file in the online IRSA Time Series Tool. Follow the steps below to determine the pulsation period using its online phase-folding algorithm. Do the same for the G-magnitude time-series file. Try to compare the phased RV- and G-curves plotted in the tool and both periods you find.

1. Choose one star from this list of 5 F-G supergiants:

SV Vul (F7Iab) [https://en.wikipedia.org/wiki/SV\\_Vulpeculae](https://en.wikipedia.org/wiki/SV_Vulpeculae)  
BG Cru (F7Ib) [https://en.wikipedia.org/wiki/BG\\_Crucis](https://en.wikipedia.org/wiki/BG_Crucis)  
R Mus (F7Ib) [https://en.wikipedia.org/wiki/R\\_Muscae](https://en.wikipedia.org/wiki/R_Muscae)  
S Nor (F8Ib) [https://en.wikipedia.org/wiki/S\\_Normae](https://en.wikipedia.org/wiki/S_Normae)  
RS Pup (G2Ib) [https://en.wikipedia.org/wiki/RS\\_Puppis](https://en.wikipedia.org/wiki/RS_Puppis)

2. Look up its Gaia DR3 source Identification number in Simbad

<https://simbad.unistra.fr/simbad/>

SV Vul = Gaia DR3 2027951173435143680  
BG Cru = Gaia DR3 6058439910929477120  
R Mus = Gaia DR3 5855468247702904704  
S Nor = Gaia DR3 5985676640941632384  
RS Pup = Gaia DR3 5557401915377587328

3. Go to

<https://gea.esac.esa.int/archive/>

press the SINGLE OBJECT tab  
fill your Gaia DR3 target identifier on top and inspect the G, Bp, Rp magnitude time-series in the Epoch Photometry panel.

4.  
press SEARCH tab  
press Advanced (ADQL) tab  
and in the central white ADQL query box type:

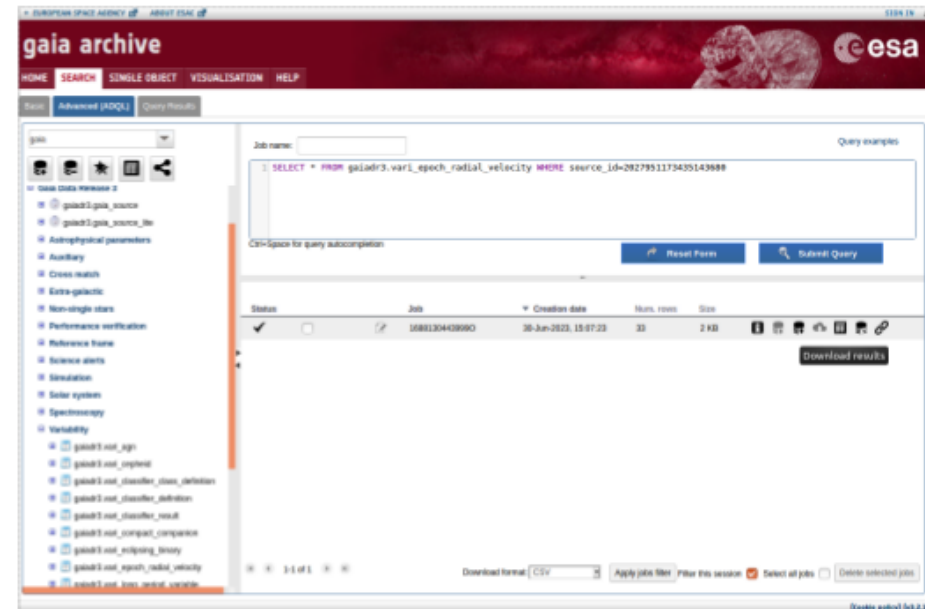
*For the RV time-series download:*

```
SELECT * FROM gaiadr3.vari_epoch_radial_velocity WHERE source_id=2027951173435143680
```

and press button Submit Query.

A results line will appear below showing the Status of your query, Job Nr., Creation date, Nr, rows, Size.

To download the RV time-series file to your local disk choose down the page the option CSV as Download format; then click on the Download results icon to the right and save the file XXXXXXO-result.csv to your disk.



The screenshot shows the Gaia Archive interface. At the top, there are navigation tabs: HOME, SEARCH, SINGLE OBJECT, VISUALISATION, HELP. Below that, there's a search bar and a query box. The query entered is: `SELECT * FROM gaiadr3.vari_epoch_radial_velocity WHERE source_id=2027951173435143680`. Below the query box, there are buttons for "Reset Form" and "Submit Query". A table below shows the query results:

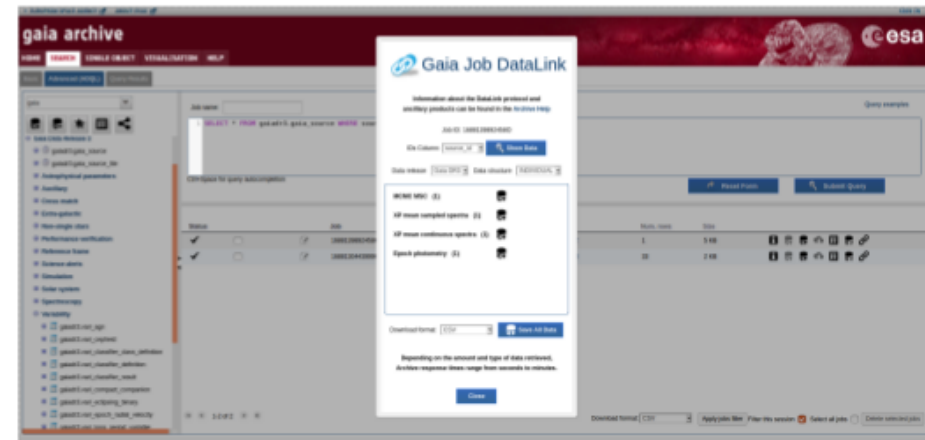
Status	Job	Creation date	Nr. rows	Size
✓	1088130438990	28-Jun-2023, 15:07:23	33	2 KB

At the bottom right of the table, there is a "Download results" button. Below the table, there are options for "Download format" (set to CSV) and "Apply jobs filter" (Filter this session).

*For the G time-series download:*

```
SELECT * FROM gaiadr3.gaiia_source WHERE source_id=2027951173435143680
```

To download these time-series click on the chain (Datalink) icon to the far right. Select CSV as Download format. Next select Epoch Photometry (1) by clicking the download icon to its right and save the file named anonymousXXXX.zip to your disk. Go into your local directory where you saved this file and unzip it. It will get the name EPOCH\_PHOTOMETRY-GaiaXXX.csv.



The screenshot shows the Gaia Archive interface with a query result for source\_id=2027951173435143680. The query is: `SELECT * FROM gaiadr3.gaiia_source WHERE source_id=2027951173435143680`. The results table shows 1 row, 1 file, and a size of 2 KB. A "Gaia Job DataLink" dialog box is open, showing options for downloading the data. The dialog box has a "Download" button at the bottom.

