

CDS tutorial

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First Astro-CC Training Event,
Centro de Astrobiología, 2-4 December 2025



Background picture by [Deepanshu Arora](#) on [Unsplash](#)



Observatoire astronomique
de Strasbourg | ObAs



Université
de Strasbourg



Introduction



CDS timeline

- ★ CDS = Centre de Données astronomiques de Strasbourg
- ★ Data center dedicated to the collection and distribution of astronomical data and related information



Presentation outline

- ★ Part 1: Presentation of the main CDS services, using web access
- ★ Part 2: Programmatic access to CDS services, an illustration with carbon stars, using Jupyter notebooks
 - Gather information on a specific object using SIMBAD,
 - Visualise it through survey images using ipyAladin,
 - Find and download a catalogue from Vizier,
 - Cross-match the sources with a large catalogue using X-match.

Carbon stars as standard candles: I. The luminosity function of carbon stars in the Magellanic Clouds

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ABSTRACT

Our goal in this paper is to derive a carbon-star luminosity function that will eventually be used to determine distances to galaxies at 50–60 Mpc and hence yield a value of the Hubble constant. Cool N-type carbon stars exhibit redder near-infrared colours than oxygen-rich stars. Using Two Micron All Sky Survey near-infrared photometry and the *Gaia* Data Release 2, we identify carbon stars in the Magellanic Clouds (MC) and the Milky Way (MW). Carbon stars in the MC appear as a distinct horizontal feature in the near-infrared ($J - K_{\text{MC}}$, M_J) colour-magnitude diagram. We build a colour selection ($1.4 < (J - K_{\text{MC}}) < 2$) and derive the luminosity function of the colour-selected carbon stars. We find the median absolute magnitude and the dispersion, in the J band, for the Large and the Small Magellanic Clouds (LMC/SMC) to be, respectively, $(M_J = -6.284 \pm 0.004$ and $\sigma = 0.352 \pm 0.005)$ and $(M_J = -6.160 \pm 0.015$ and $\sigma = 0.365 \pm 0.014)$. The difference between the MC may be explained by the lower metallicity of the SMC, but in any case it provides limits on the type of galaxy whose distance can be determined with this technique. To account for metallicity effects, we developed a composite magnitude, named C , for which the error-weighted mean C magnitude of the MC are equal. Thanks to the next generation of telescopes (*JWST*, *ELT*, and *TMT*), carbon stars could be detected in MC-type galaxies at distances out to 50–60 Mpc. The final goal is to eventually try and improve the measurement of the Hubble constant while exploring the current tensions related to its value.

Key words: catalogues – stars: carbon – Hertzsprung–Russell and colour-magnitude diagrams – stars: luminosity function, mass function – Magellanic Clouds.

1 INTRODUCTION







Measuring distances has been one of the most crucial, fascinating, and challenging goals in astronomy for centuries. Not only does it enable astronomers to probe the scale of the Universe, it is also key in understanding the physical nature of astronomical objects, which eventually opens up whole new fields of astrophysical research.



Carbon stars were discovered by Secchi (1868) because of a characteristic feature in their spectra: the Swan bands, which are representative of radical diatomic carbon C_2 . Carbon stars are usually luminous red giant stars. Bright carbon stars are located on the asymptotic giant branch (AGB), in the Hertzsprung–Russell diagram. Carbon stars originate from main-sequence stars with masses in the range 1–10 M_{\odot} (Burbaum, Kastner & Zuckerman 1991; Marigo, Girardi & Bragaglia 1999). During the third dredge-up, heavy elements (C, O) are brought to the surface from the stellar interior (Ben & Renzini 1984; Busso, Gallino & Wasserburg

1999). In normal (oxygen) stars O > C (in terms of number of atoms), nearly all of the carbon in the atmosphere is trapped in the stable compound CO. However, if C/O > 1, carbon compounds can appear in the stellar atmosphere of AGB stars, forming carbon stars. In this work, we focus on cool N-type carbon stars; such carbon stars have been known for a long time to show redder near-infrared colours than M-type stars (oxygen-rich stars). Thus, cool carbon stars occupy a specific region of near-infrared colour-magnitude diagrams (CMDs; Richer, Olander & Westerland 1979; Cohen et al. 1981; Hughes & Wood 1990). There is also evidence of similar carbon-star luminosities between the Magellanic Clouds (MC; Caribee, Richer & Westerland 1976; Blanco, McCarthy & Blanco 1980; Richer 1981a, b; Aaronson & Mould 1982; Frogel & Richer 1983; Feast & Whitlock 1992; Demers, Irwin & Kunkel 1993; Demers, Dallaire & Battistini 2002) obtained luminosity functions for a small sample of carbon stars in the MC using a near-infrared technique and a colour selection similar to the one used in this paper. Since carbon stars are very luminous in the infrared and have a characteristic spectrum, the possibility exists that they


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

 PORTAL SIMBAD VIZIER ALADIN XMATCHOTHERS ▼HELP ?

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English ▼



Strasbourg astronomical Data Center

The Strasbourg astronomical Data Center (CDS) is a data center dedicated to the collection and worldwide distribution of astronomical data and related information. It is located at the Strasbourg Astronomical Observatory, France.
[Read more about the CDS](#)

Key numbers	
20,156,921	SIMBAD objects
26,608	VizieR catalogs
1,346	HiPS
39,250	MOCs
452,439	biblio. references
25,949	acronyms



Vera C. Rubin's first light

The Vera C. Rubin Observatory just released its first images. Their Skyviewer visualization tool uses Aladin Lite.

[Read more](#)

● ○ ○ ○ ○ ○ ○ ○ ○ ○

News

- [Catalogs recently added in VizieR](#)
- [Mailbox outage](#)
- [CDS is hiring](#)
- [Harvard mirror unavailable](#)
- [A new version available for VizieR](#)

Screenshot from Sept. 10th 2025

The main CDS services



Objects



Catalogues



Sky atlas



Cross-match



All-in-one

Key numbers

20,156,921 SIMBAD objects



26,608 VizieR catalogs



1,346 HiPS



39,250 MOCs



452,439 biblio. references



25,949 acronyms



SIMBAD



Objects
Dictionary
Bibliography
Name resolver
TAP

- ★ Astronomical database
- ★ Provides basic data such as identifiers, measurements and links to bibliographic studies
- ★ Can be queried by object name, coordinates and various criteria. Lists of objects and scripts can be submitted.

NGC 4039

other query modes : Identifier query Coordinate query Criteria query Reference query Basic query Script submission TAP Output options Object types Help

Query : NGC 4039

Basic data :
NGC 4039 -- Galaxy in Pair of Galaxies

Other object types: [G1P](#) (), [G](#) (2016A6A,ESO,...), [AG7](#) (2020MNRAS), [IG](#) (VV), [PaG](#) (RR95)
ICRS coord. (ep=J2000) : **12 01 53.51 -18 53 10.3** (Optical) [1 1 C 2020MNRAS.494.1784A
FK4 coord. (ep=B1950 eq=1950) : 11 59 19.70 -18 36 28.0 []
Gal coord. (ep=J2000) : 286.96780 +42.44451 []
Radial velocity / Redshift / cz : **V**(km/s) 1637 [9] / **z**(-) 0.005474 [0.000030] / **cz** 1641.00 [9.00]
D 1989ESOLV.C.....0L
Morphological type: **Sc D 2004ApJ...602..231C**
Angular size (arcmin): **3.1 1.6 50** (-) D 2007ApJ...173..185G
Fluxes (2) : **B 11.00 [0.21] D 2007ApJ...173..185G**
R 9.77 [-] D 1989ESOLV.C.....0L

Notes:
• See GALEX UV data in [GALEX data](#) [01-Oct-2009].

Hierarchy : number of linked objects
whatever the membership probability is (see description [here](#)) :

parents : 5 children : 1 siblings : 659 Display criteria : All

Parents
whenever the membership probability is (see description [here](#)) :

Children

Simbad Query around within 2 arcmin

Simbad Query around within 5 arcsec

Simbad Query around within 5 arcsec

VizieR

- ★ Catalogue service
- ★ Provides access to thousands of astronomical catalogs and tables published in academic journals
- ★ Query tools allow the user to select relevant data tables. Then records can be extracted and formatted matching given criteria.

The screenshot shows the VizieR web interface. At the top, there's a navigation bar with logos for CDS, PORTAL, SIMBAD, VizieR, ALADIN, XMATCH, OTHERS, and HELP. The main header says "VizieR" and "Send to VO tools".

On the left, there's a "Search Criteria" panel with sections for "Keywords" (containing "VII/192/arplst" and "NGC 4039"), "Tables" (containing "VII/192...arplst"), "Constraints" (with a "Modify Query" button), "Preferences" (with a "max: 50" dropdown and "HTML Table" dropdown), and "Mirrors" (with "CDS, France" selected).

The main content area shows a search result for "VII/192/arplst" (Arp's Peculiar Galaxies (Webb 1996)). It includes a "Post annotation" link and a "list and info for involved galaxies (592 rows)" link. Below this, there are links for "start AladinLite", "plot the output", and "query using TAP/SQL".

The table below lists astronomical data with columns: Full, RAJ2000, DEJ2000, Arp, Name, YT, u, dim1, dim2, u, MType, Uchart, RAJ2000, DEJ2000, Simbad, and NED. The table contains 25 rows of data, with some rows highlighted in red.

Full	RAJ2000	DEJ2000	Arp	Name	YT	u	dim1	dim2	u	MType	Uchart	RAJ2000	DEJ2000	Simbad	NED
1	00 19.300	+22 59 26.00	249	UGC 12891	16.2							00 00 19.3	+22 59 26	Simbad	NED
2	00 21.600	+22 59 42.00	249	UGC 12891	16.2		1.3	0.5				00 00 21.6	+22 59 42	Simbad	NED
3	01 26.900	+31 26 02.00	112	NGC 7805	13.3		1.2	0.9		SAB0°0: pec	89 00 01 26.9	+31 26 02	Simbad	NED	
4	01 30.200	+31 26 33.00	112	NGC 7806	13.5		1.1	0.8		SA(rs)bc? pec	89 00 01 30.2	+31 26 33	Simbad	NED	
5	02 37.700	+16 39 08.00	130	IC 5378	15.6		0.5			SBc	00 02 37.7	+16 39 08	Simbad	NED	
6	02 37.800	+16 38 37.00	130	IC 5378	15.3					E	00 02 37.8	+16 38 37	Simbad	NED	
7	06 16.800	-13 26 53.00	51	MCG-02-01-24	15.0		0.8				00 06 16.8	-13 26 53	Simbad	NED	
8	06 27.100	-13 24 58.00	144	NGC 7828	14.4		0.9	0.5		Ring A	260 00 06 27.1	-13 24 58	Simbad	NED	
9	06 29.000	-13 25 15.00	144	NGC 7829	14.6		0.7			Ring B pec	260 00 06 29.0	-13 25 15	Simbad	NED	
10	06 44.000	-06 38 07.00	146	ARP 146			0.7	0.6		Ring A	00 06 44.0	-06 38 07	Simbad	NED	
11	06 44.400	-06 38 10.00	146	VV 790						Pec	00 06 44.4	-06 38 10	Simbad	NED	
12	06 44.800	-06 38 14.00	146	ARP 146			0.7	0.6		Ring A	00 06 44.8	-06 38 14	Simbad	NED	
13	06 51.400	+08 21 05.00	246	NGC 7837	14.4		0.4	0.2			170 00 06 51.4	+08 21 05	Simbad	NED	
14	06 53.700	+08 21 00.00	246	NGC 7838	14.3		0.7	0.3			170 00 06 53.7	+08 21 00	Simbad	NED	
15	08 46.200	+15 48 56.00	235	NGC 0014	12.7		2.8	2.1		(R)IB(S)m pec	170 00 08 46.2	+15 48 56	Simbad	NED	
16	18 22.400	+30 04 50.00	113	NGC 0070	14.5		1.4	1.2		SA(rs)c III	89 00 18 22.4	+30 04 50	Simbad	NED	
17	18 50.000	-10 21 42.00	256	MCG-02-01-52	13.6		1.1	0.8		SB(S)c pec	00 18 50.0	-10 21 42	Simbad	NED	
18	18 50.900	-10 22 37.00	256	MCG-02-01-51	14.8		1.1	0.6		SB(S)c pec	00 18 50.9	-10 22 37	Simbad	NED	
19	18 51.400	-10 22 33.00	256	VV 352							00 18 51.4	-10 22 33	Simbad	NED	
20	21 51.700	+22 24 01.00	65	NGC 0091	13.7		2.2			SAB(S)c pec I	126 00 21 51.7	+22 24 01	Simbad	NED	
21	22 21.400	-01 20 47.00	35	UGC 00212	15.5					SP	00 22 21.4	-01 20 47	Simbad	NED	
22	22 23.000	-01 18 13.00	35	UGC 00212	15.0		1.5	0.7		SB	00 22 23.0	-01 18 13	Simbad	NED	
23	23 33.700	-00 29 22.00	201	UGC 00224	16.0		0.5	0.3		Disrupted	00 23 33.7	-00 29 22	Simbad	NED	
24	23 37.700	-00 30 35.00	201	UGC 00224	16.0						00 23 37.7	-00 30 35	Simbad	NED	
25	28 38.100	-11 34 25.00	100	IC 0018	15.0		1.5	0.8			00 28 38.1	-11 34 25	Simbad	NED	

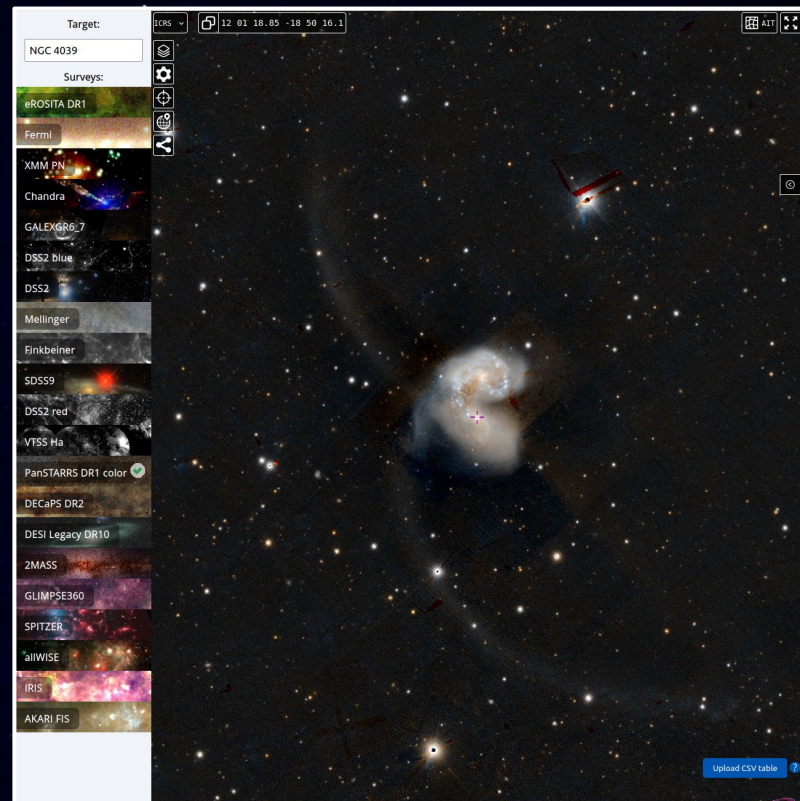
Aladin



Sky Atlas
Data integration
Surveys
HiPS/MOC

+ Aladin Lite Embeddable widget

- ★ Interactive sky atlas
- ★ Access, visualization and analysis of astronomical images surveys catalogs and other databases
- ★ Aladin uses the HiPS (Hierarchical Progressive Survey) technology.



X-match



Catalogue
Cross-matching
service

- ★ Tool to efficiently cross-identify sources between very large catalogues (up to 1 billion rows) or between a user-uploaded list of positions and a large catalogue.
- ★ Available tables include 20,000+ VizieR tables and SIMBAD data.

CDS X-Match Service

Choose tables to cross-match

2MASS X Gaia EDR3 distances

VizieR SIMBAD My store VizieR SIMBAD My store

2MASS All-Sky Catalog of Point Sources (Cutri+ 2003)
470,992,970 rows

Distances to 1.47 billion stars in Gaia EDR3 (Bailer-Jones+, 2021)
1,467,744,818 rows

Show options

Begin the X-Match

Visualize and manage your cross-match jobs

Table 1	Table 2	Options	Begin	Status	Actions
No job in list					

For the selected job(s): Delete

CDS Portal



Mashup application:

- Provide a single entry point to search and access the different CDS services, querying simultaneously SIMBAD, VizieR and Aladin
- Facilitate the workflow between the services

The screenshot displays the CDS Portal interface for the object NGC 4039. The top navigation bar includes links to various CDS services like SIMBAD, VizieR, and Aladin. The main content area is divided into several sections: 1. Object Information: Displays the object's name (NGC 4039), its type (Galaxy in Pair of Galaxies), and its morphological type (Sc). It also shows the redshift (z = 0.005473786802201675) and a link to more information in NED. 2. Images: A section titled 'Images' showing 385 HIPS images available within a 0.20-degree radius. It includes a table of image titles, wavelengths, and sky fractions. 3. Catalogues: A section titled 'Catalogues' showing 780 VizieR catalogues within the same radius. It includes a table of catalogue names, wavelengths, and popularity. 4. Aladin Lite: A small window showing a multi-wavelength image of the galaxy pair, with a color bar indicating the different wavelengths used.

More services

Scientific content curation

Processing of published literature and reference data

Acronyms
Identifiers
Citations
Basic Data
Cross-identifications
Catalogues/Tables
Associated data
All-sky surveys, HiPS
Models/Simulations

Vizier and SIMBAD data ingestion pipelines
Tools: DJIN, COSIM, BCS











Dictionary of Nomenclature of Celestial Objects



Designations of astronomical objects are often confusing. Astronomical designations (also called Object Identifiers) have been collected and published by Lortet and collaborators in Dictionaries of Nomenclature of Celestial Objects outside the solar system.


This Info service is the electronic look-up version of the Dictionary which is updated on a regular basis; it provides full references and usages about 25,984 different acronyms.





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Data publication

The CDS hosts and provides access to different kinds of data. Here are some information, best practices and useful tools for publishing your data at CDS.

Findable


Accessible


Interoperable



Reusable


Best practices

A great overview of best practices for publishing data in astronomy and astrophysics journals has been published in [Chen et al. 2022](#). Authors are strongly encouraged to follow these guidelines, nicely summarized in a checklist in Appendix A of the paper.

HOW'S YOUR DATA?
BEST PRACTICES FOR DATA PUBLICATION IN THE ASTROPHYSICAL LITERATURE

Your data in Vizier



The Vizier database is storing and distributing the astronomical data (tables and associated data) to promote their usage primarily by professional astronomers.

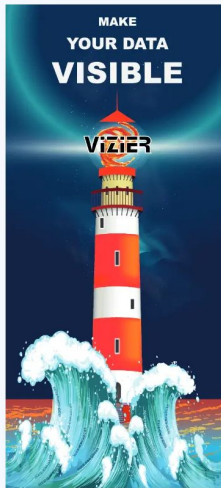

In order to ensure the scientific quality of the data, we therefore require that data are related to a publication in a refereed journal, either as tables or catalogues actually published in a paper describing the data and their context.

Links:

- Authors [instructions on preparing and submitting tabular data](#)
- Authors [tutorial](#)
- Authors submission [FAQ](#)

Image surveys and data cubes

You can easily create your own [HiPS survey](#) (possibly all-sky!) from a set of FITS images or FITS data cubes. This feature has been available in Aladin Desktop versions 7.5 and above. There is also a dedicated tool named [Hipsgen](#) that can be run from the command line.

MAKE YOUR DATA VISIBLE


Aladin Desktop

Let's practice!

- ★ Link: <https://cds.unistra.fr/>
- ★ Go and explore the different CDS services online, using your favorite object or some of the examples below:
 - M101
 - NGC 2024
 - HR 6165
 - 3C 326

The screenshot displays the CDS website interface for the object NGC 4039. The top navigation bar includes links to various CDS services like PORCAL, SIMBAD, VizieR, ALADIN, and XMAPCH. The main search bar shows 'NGC 4039' with a search icon. Below the search bar, there are tabs for 'Object (Simbad)' and 'Object (NED)'. The 'Object (Simbad)' tab is active, showing details such as Main ID (NGC 4039), Object type (Galaxy in Pair of Galaxies), Morphological type (Sc), and Redshift (z = 0.005473786802201675). The 'Images' section shows a list of 385 HIPS images available within a 0.20" radius. The list is filtered by wavelength (Gamma-ray, X-ray, UV, Optical, Infrared) and resolution (Low, Medium, High). The 'Catalogues' section shows a list of 780 VizieR catalogues within the same radius. A large image of NGC 4039 is displayed on the right side of the 'Images' section.

Wavelength	Resolution	Show	Filter	16 entries (filtered from 385 total records)
Fermi Color HEALPix survey	Gamma-ray	100 %		
False color X-ray images (Red=0.5-1 Green=1-2 Blue=2-4.5 Kev)	X-ray	9.2 %		
GALEX GR6 AIS (until March 2014)-Color composition	UV	79.79 %		
GALEX GR6/7 - Color composition	UV	76.97 %		
DSS2 Blue (X+J+S)	Optical	99.72 %		
DSS colored	Optical	100 %		
DSS2 Red (R+I)	Optical	100 %		
Finkbeiner Halpna composite survey	Optical	100 %		
Mellinger color optical survey	Optical	100 %		
PanSTARRS DR1 color (from bands z and g)	Optical	78.12 %		
PanSTARRS DR1 color (from bands r and i)	Optical	75.82 %		

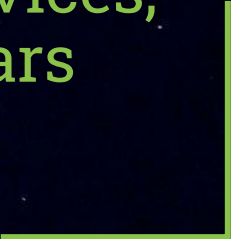
Wavelength	Popularity	Search: Title	Mission
Millimeter		Gaia DR3 Part 1. Main source (Gaia Collaboration, 2022) (gaiadr3)	
Infrared		2MASS All-Sky Catalog of Point Sources (Cutri+ 2003)	
Gamma-ray		ALLWISE Data Release (Cutri+ 2013) (allwise)	
X-ray		The Pan-STARRS release 1 (PS1) Survey - DR1 (Chambers+ 2016) (ps1)	
UV			
Optical			



Tutorial



Programmatic access to CDS services,
an illustration with carbon stars





Tutorial: link

<https://cds.unistra.fr/meetings/voschool2025>

Requirements: A browser - not Chrome (no installation needed!)

Tutorial: Outline (1/2)

★ Programmatic access to CDS services, an illustration with carbon stars, using Jupyter notebooks

- Tutorial inspired by a paper from [Ripoche et al. 2020](#)
- Gather information on a specific object using SIMBAD,
- Visualise it through survey images using ipyAladin,
- Find and download a catalogue from VizierR,
- Cross-match the sources with a large catalogue using X-match.

Link: <https://cds.unistra.fr/meetings/voschool2025>

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Carbon stars as standard candles: I. The luminosity function of carbon stars in the Magellanic Clouds

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ABSTRACT

Our goal in this paper is to derive a carbon-star luminosity function that will eventually be used to determine distances to galaxies at 50–60 Mpc and hence yield a value of the Hubble constant. Cool N-type carbon stars exhibit redder near-infrared colours than oxygen-rich stars. Using Two Micron All Sky Survey near-infrared photometry and the *Gaia* Data Release 2, we identify carbon stars in the Magellanic Clouds (MC) and the Milky Way (MW). Carbon stars in the MC appear as a distinct horizontal feature in the near-infrared ($J - K_{\text{MC}}$, M_J) colour-magnitude diagram. We build a colour selection ($1.4 < (J - K_{\text{MC}}) < 2$) and derive the luminosity function of the colour-selected carbon stars. We find the median absolute magnitude and the dispersion, in the J band, for the Large and the Small Magellanic Clouds (LMC/SMC) to be, respectively, ($M_J = -6.284 \pm 0.004$ and $\sigma = 0.352 \pm 0.005$) and ($M_J = -6.160 \pm 0.015$ and $\sigma = 0.365 \pm 0.014$). The difference between the MC may be explained by the lower metallicity of the SMC, but in any case it provides limits on the type of galaxy whose distance can be determined with this technique. To account for metallicity effects, we developed a composite magnitude, named C , for which the error-weighted mean C magnitude of the MC are equal. Thanks to the next generation of telescopes (*JWST*, *ELT*, and *TMT*), carbon stars could be detected in MC-type galaxies at distances out to 50–60 Mpc. The final goal is to eventually try and improve the measurement of the Hubble constant while exploring the current tensions related to its value.

Key words: catalogues – stars: carbon – Hertzsprung–Russell and colour-magnitude diagrams – stars: luminosity function, mass function – Magellanic Clouds.

1 INTRODUCTION

Measuring distances has been one of the most crucial, fascinating, and challenging goals in astronomy for centuries. Not only does it enable astronomers to probe the scale of the Universe, it is also key in understanding the physical nature of astronomical objects, which eventually opens up whole new fields of astrophysical research.

Carbon stars were discovered by Secchi (1868) because of a characteristic feature in their spectra: the Swan bands, which are representative of radical diatomic carbon C_2 . Carbon stars are usually luminous red giant stars. Bright carbon stars are located on the asymptotic giant branch (AGB), in the Hertzsprung–Russell diagram. Carbon stars originate from main-sequence stars with masses in the range 1–10 M_{\odot} (Burbaum, Kassin & Zuckerman 1991; Marigo, Girardi & Bragaglia 1999). During the third dredge-up, heavy elements (C, O) are brought to the surface from the stellar interior (Ben & Renzini 1984; Busso, Gallino & Wasserburg

1999). In normal (oxygen) stars $O > C$ (in terms of number of atoms), nearly all of the carbon in the atmosphere is tied up in the stable compound CO. However, if $C/O > 1$, carbon compounds can appear in the stellar atmosphere of AGB stars, forming carbon stars. In this work, we focus on cool N-type carbon stars; such carbon stars have been known for a long time to show redder near-infrared colours than M-type stars (oxygen-rich stars). Thus, cool carbon stars occupy a specific region of near-infrared colour-magnitude diagrams (CMDs; Richer, Olander & Westerland 1979; Cohen et al. 1981; Hughes & Wood 1990). There is also evidence of similar carbon-star luminosities between the Magellanic Clouds (MC; Carrión, Richer & Westerland 1976; Blanco, McCarthy & Blanco 1980; Richer 1981a, b; Aaronson & Mould 1982; Frogel & Richer 1983; Feast & Whitlock 1992; Demers, Irwin & Kunkel 1993; Demers, Baldaire & Battistini 2002) obtained luminosity functions for a small sample of carbon stars in the MC using a near-infrared technique and a colour selection similar to the one used in this paper. Since carbon stars are very luminous in the infrared and have a characteristic spectrum, the possibility exists that they

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Tutorial: Outline (2/2)

Step #1: Carbon stars in SIMBAD

Simbad

SIMBAD is a compilation of the literature. It is edited each working day by a team of astronomers and documentalists.

Figure I-1: SIMBAD compiles the literature in a single database.

Let
of identifications,
measurements
and bibliography
for astronomical
data



CW Leo in the SIMBAD database

Step #2: Using the ipyaladin widget

Aladin

Let's now visualise the source on the Aladin sky atlas.

Figure II-1:

The Aladin software suite allows to display and manipulate surveys, coverages, and catalogs.



The suite has three flavors:

- **Aladin desktop.** It is the most complete version and offers a complete graphic interface to find catalogs and HIPS surveys and manipulate them (cutouts, operations, stacks...).
- **Aladin Lite.** Is a lighter version that runs in the browser. With the advance of browser technologies, it is gaining more and more functionalities every day.
- **iPyAladin.** It is a port of Aladin Lite in python notebooks. This is the flavor we'll use here.

Step #3: Catalogues manipulation with Vizier and X-match

Simbad Aladin Vizier Xmatch

Introduction

The remaining of the tutorial is inspired by a work from Ripoche and collaborators, where they used "Carbon stars as standard candles":

- Ripoche et al. 2020, [2020MNRAS.495.2858R](#) (Paper I)
- Parada et al. 2021, [2021MNRAS.501..933P](#) (Paper II)
- Parada et al. 2023, [2023MNRAS.522..195P](#) (Paper III)

Their idea is to derive a carbon-star luminosity function that will eventually be used to determine distances to galaxies at 50-60 Mpc and hence yield a value of the Hubble constant.

To do, they focused primarily on the Large and Small Magellanic clouds (LMC and SMC). Later they expanded their sample with Local group galaxies (eg. NGC 6822, IC 1613, Wolf-Lundmeyer).

Data selection / datasets

- To build their sample in Paper I, Ripoche et al. 2020 queried ZMASS over a polygon centered on the LMC and SMC.
- They removed the foreground contamination from Milky Way stars, by cross-matching the ZMASS stars with those found in Gaia DR2.
- They used proper motions to select stars considered to be LMC and SMC members.
- Finally, they corrected the apparent magnitudes for extinction and reddening, and included the true distance moduli to these galaxies.




Tutorial



Let's dig into steps 1-2

<https://cds.unistra.fr/meetings/voschool2025>



A close-up photograph of a squirrel perched on a tree branch, eating a nut. The squirrel's tail is large, bushy, and has a distinctive white or light-colored tip. The background is a clear blue sky with some bare tree branches visible. The text "Take a break!" is overlaid on the bottom right of the image.

Take a break!



Tutorial



Let's continue step 3

<https://cds.unistra.fr/meetings/voschool2025>



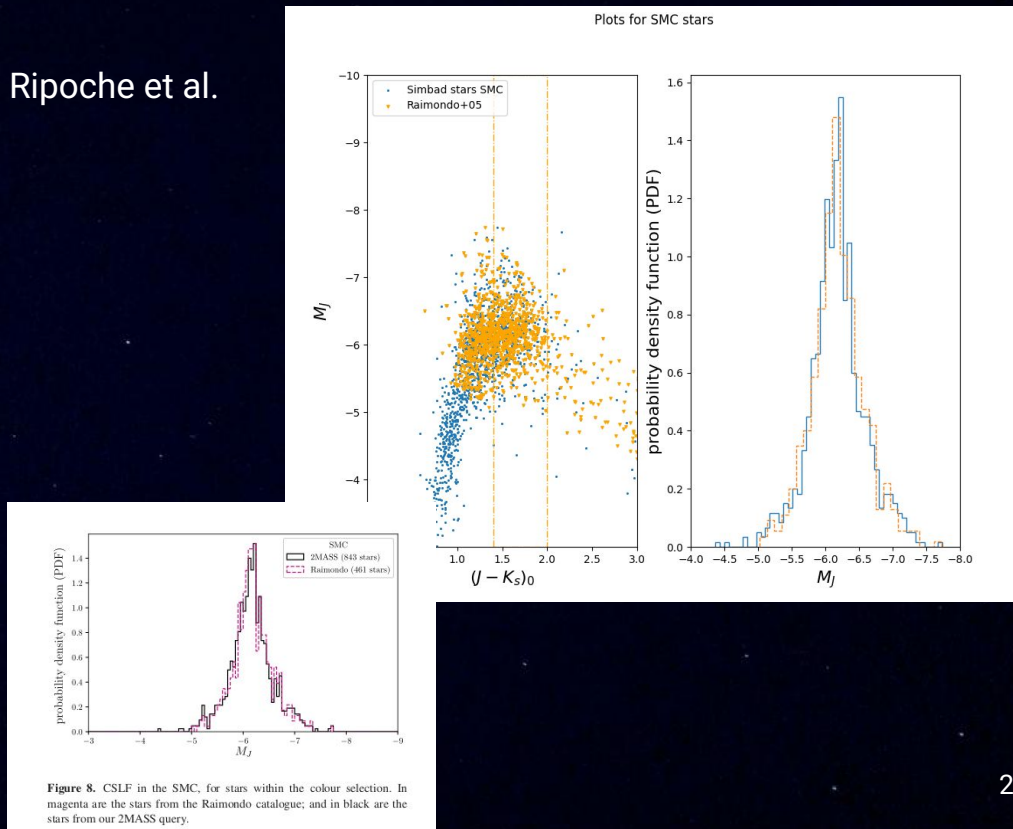


Wrap-up



Wrap-up

- ★ Luminosity functions agree with the ones from Ripoché et al. 2020
- ★ CDS services used in this tutorial:
 - SIMBAD, Aladin, VizieR, X-match
- ★ VO standards introduced in this tutorial:
 - HiPS, MOC, TAP/ADQL
- ★ Jupyter notebook reusable
- ★ Design similar queries for your own research!



Any questions?



Credit: P. Vonfle

Thanks for your attention

Useful links

- ★ CDS: <https://cds.unistra.fr/>
- ★ Presentation of CDS (from Dr. Sébastien Derrière): <https://www.youtube.com/watch?v=dGssNN-YZkY>
- ★ Great video about the major CDS services (from Dr. Pooja Sharma):
<https://www.youtube.com/watch?v=2dC1R7PnuU4>
- ★ CDS tutorials: <https://cds.unistra.fr/help/tutorials/>