

# New Online Database of Symbiotic Variables

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# Symbiotic binaries

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Symbiotic variable stars are **strongly interacting systems**, in which physical mechanisms related to transfer and accretion of matter cause observable activity (see e.g. review by Mikołajewska, 2012).

- ▶ they manifest **increases of brightness** (about 2 – 5 mag) and significant changes in their spectra
- ▶ their stages of activity may last from a **few days to decades**
- ▶ these binaries consist of a **cool giant** of spectral type K - M and hot compact star, mostly a **white dwarf** (WD)
- ▶ the mass transfer most likely takes place by the **stellar wind** of the cool giant, which is also the source of a dense **circumbinary envelope**
- ▶ symbiotic systems are **open binaries** with orbital periods of **hundreds to thousands** of days



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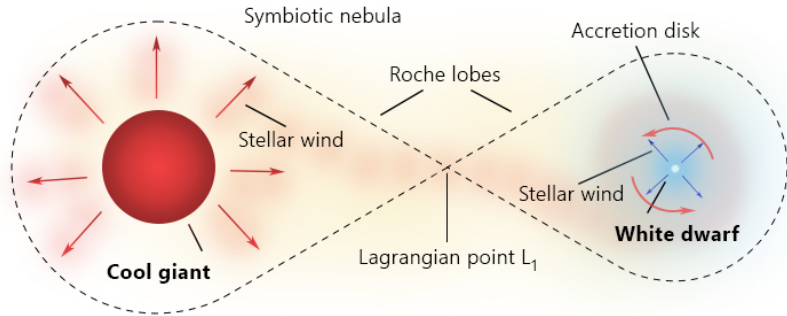


Figure: Simplified model of the symbiotic binary star.





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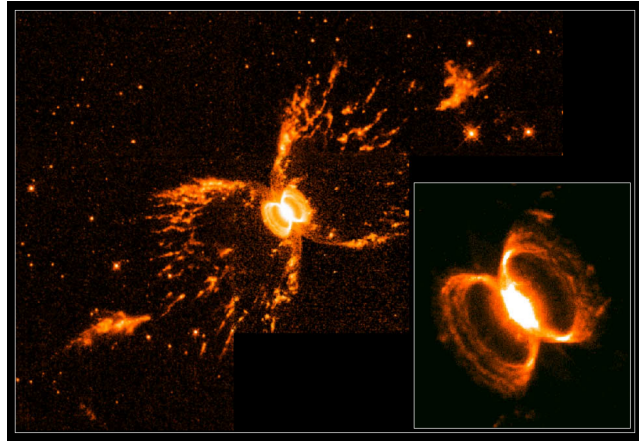
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**Figure:** He2-104 (Southern Crab Nebula) observed by Hubble Space Telescope. Credits: R. Corradi, M. Livio, U. Munari, H. Schwarz, NASA, and ESA.



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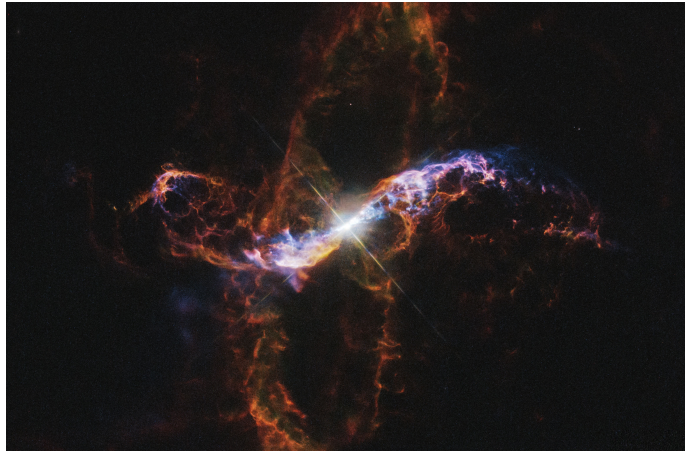
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**Figure:** R Aquari observed by Hubble Space Telescope. Credits: NASA, and ESA.



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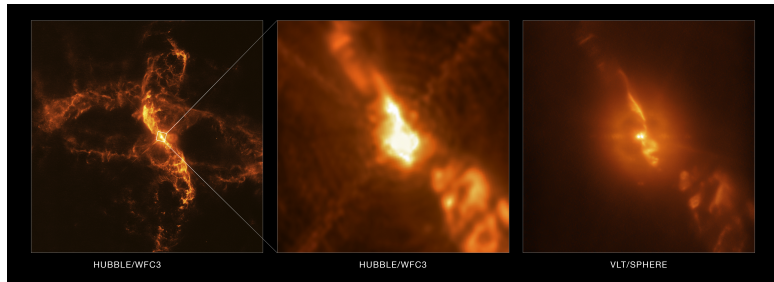
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**Figure:** R Aquari observed by Hubble Space Telescope and SPHERE planet-hunting instrument on ESO's Very Large telescope. Credits: ESO, Schmid et al., 2017, NASA, and ESA.



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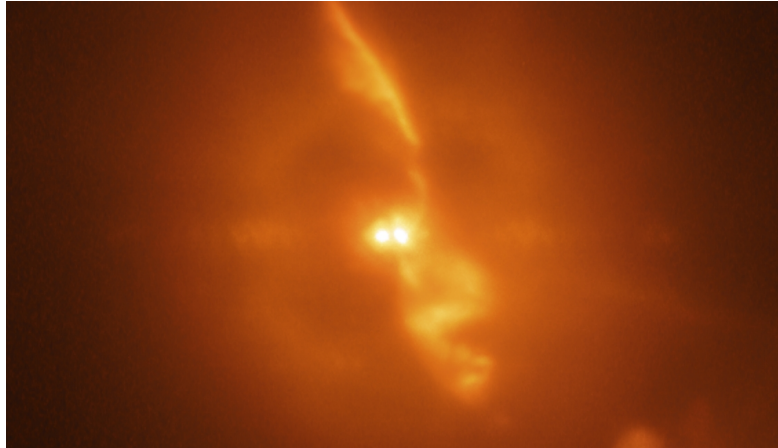
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**Figure:** R Aquari observed by SPHERE planet-hunting instrument on ESO's Very Large telescope. Credits: ESO, Schmid et al., 2017.



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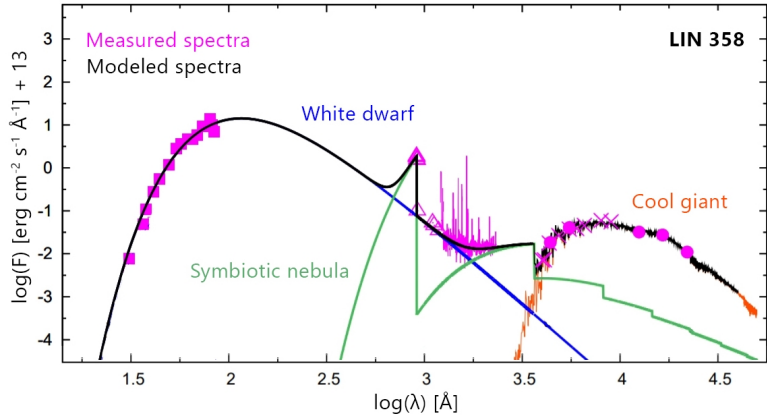
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**Figure:** A comparison of the measured and modeled SED of LIN 358. Adopted from Skopal et al., 2015.



# Search for symbiotic binaries

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In the previous century, most of the symbiotic binaries were found **accidentally**, but in the last decades, **systematic search** for such objects have begun. This effort has brought **the first results**.

- ▶ the surveys have led to discoveries of many **new objects** and dozens of candidates in the **Milky Way** (e.g. Miszalski et al., 2013; Miszalski & Mikołajewska, 2014) and the **Local Group** (e.g. Gonçalves et al., 2008, 2012, 2015; Kniazev et al., 2009; Mikołajewska et al., 2014, 2017; Roth et al. 2018)
- ▶ subsequently, the number of known systems is **growing rapidly**
- ▶ although **new approaches and techniques** are explored in order to identify new systems (e.g. machine-learning algorithms; Akras et al., 2019a), the majority of the surveys is still based on **spectroscopic methods**
- ▶ the **latest catalog** of symbiotic stars was published in **2000** by Belczyński et al. consisting of 188 confirmed symbiotic stars



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We have decided to prepare a new, **online database** of the galactic and extragalactic symbiotic systems (Merc et al., 2019).

- ▶ in addition to the **catalog of data** for all known symbiotic systems with consistent references, we created a **web-portal for easy access** to this information
- ▶ the database contains data about the **position** of the objects, their **brightness** in different spectral regions and bands and other **observational properties** (e.g. presence of outbursts, flickering, detectable X-ray or radio emission, symbiotic type), **orbital properties** (orbital period, orbital ephemeris, presence of eclipses, etc.) and **parameters of the binary components** (their spectral types, effective temperatures, masses, radii, luminosities, presence of pulsations, etc.)
- ▶ the database is available at **[astronomy.science.upjs.sk/symbiotics](http://astronomy.science.upjs.sk/symbiotics)**



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The database is divided into **two main parts** according to the location of symbiotic variables.

- ▶ the first part consists of 74 confirmed and 88 suspected **extragalactic symbiotic systems** which are located in 14 galaxies (LMC, SMC, Draco Dwarf, IC 10, M31, M33, M81, M87, NGC 55, NGC 185, NGC 205, NGC 300, NGC 2403, NGC 6822)
- ▶ the second part of the database, consisting of more than **480 galactic objects** will be fully released later this year
- ▶ however, the **list of galactic symbiotic** was already published on the website recently
- ▶ the data of symbiotic variables are presented in the **form of tables**, which can be explored directly through the **web-portal** or can be downloaded and used offline in different formats (csv, xlsx, txt and pdf)
- ▶ moreover, for all symbiotic binaries included in the database, we have prepared their **object pages** covering all available information, references, notes, and useful links

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ALL CONFIRMED SUSPECTED

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### What's new?

**May 16, 2019** - List of galactic objects added

**May 15, 2019** - New objects added

Basic Data Identifiers Observations Position Orbit Cool Component Hot Component

Column visibility Copy CSV Excel PDF Print

Show 10 entries

Search:

Star Name	Confirmed	Galaxy	$\alpha$ (°)	$\delta$ (°)	B (mag)	V (mag)	R (mag)	I (mag)
[RP2006] 490	✓	LMC	84.381322	-71.179952		16.98	15.91	
LMC N19	✓	LMC	75.848970	-67.942676		16.40	15.34	14.27
LMC N67	✓	LMC	84.031584	-64.722593	16.90	15.90	14.70	12.70
LMC S147	✓	LMC	73.514465	-70.992264	12.80	15.47	15.57	13.90

Figure: Catalog data for symbiotic stars in LMC.

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## LIN 9

**CONFIRMED** **SMC**

Equatorial coordinates  
 $\alpha = 7.530781 \pm 0.031503$  |  $00\ 30\ 07.385688$   
 $\delta = -73.621971 \pm 0.026315$  |  $-73\ 37\ 19.082127$

### Utilities

[Cross-identification with other catalogs](#)

Constellation	Tucana
Symbiotic IR Type	S <sup>o</sup>
Spectral Type	K5
Magnitude range (V)	14.8-16.3 <sup>nd</sup>
Outbursts	Z And

### What's new?

**May 16, 2019** – List of galactic objects added  
**May 15, 2019** – New objects added

### Identifiers

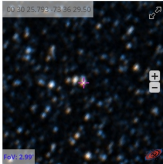


Figure: Example of the object page of symbiotic star LIN 9.



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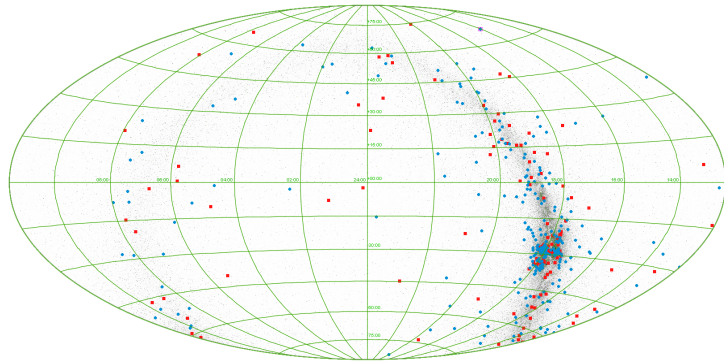
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**Figure:** Distribution of the galactic symbiotic stars overlaid on the 2MASS infrared image of the sky. Confirmed and suspected symbiotic stars are denoted by blue dots and red squares, respectively.



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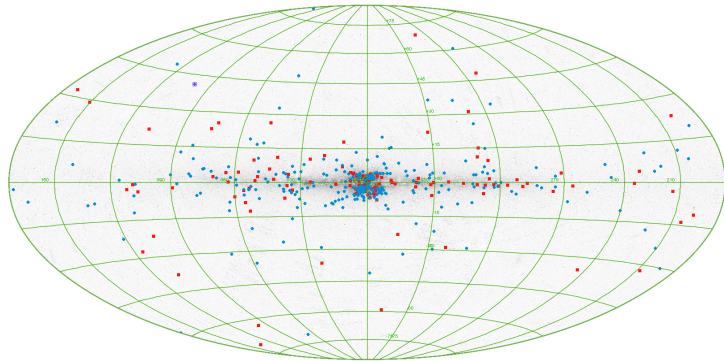
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**Figure:** Distribution of the galactic symbiotic stars overlaid on the 2MASS infrared image of the sky. Confirmed and suspected symbiotic stars are denoted by blue dots and red squares, respectively.



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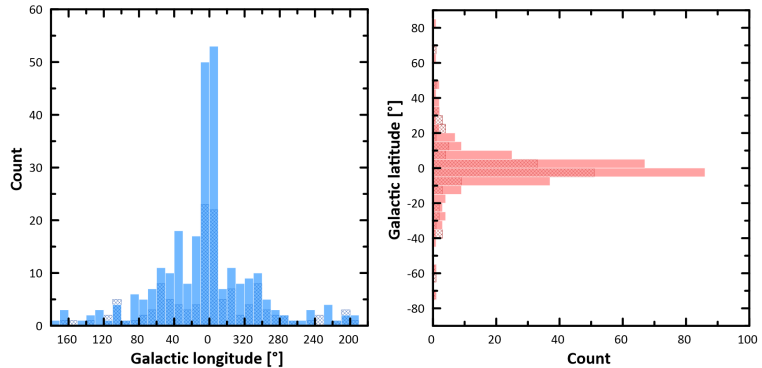
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**Figure:** Histograms showing the distribution of symbiotic stars over the galactic coordinates.



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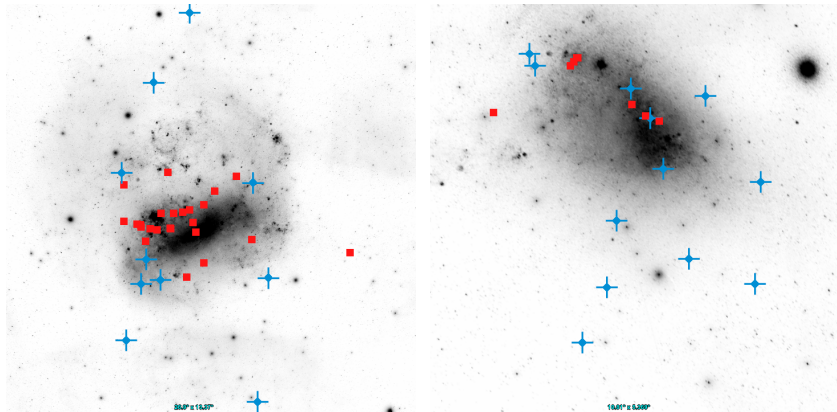
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**Figure:** Position of the extragalactic symbiotic stars in their host galaxies (left: LMC, right: SMC). Confirmed and suspected symbiotic stars are denoted by blue dots and red squares, respectively.



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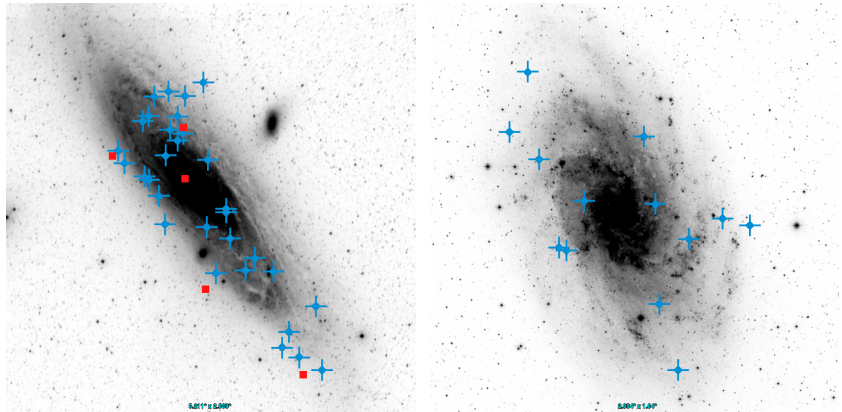
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**Figure:** Position of the extragalactic symbiotic stars in their host galaxies (left: M31, right: M33). Confirmed and suspected symbiotic stars are denoted by blue dots and red squares, respectively.

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The database is **available online**, allowing the addition of **new objects** as soon as they are discovered, and **add or update data** when available.

- ▶ in this way, **up-to-date lists** of symbiotic variables and information about particular objects can be available to the community at any time
- ▶ the aim of the web-portal is not only to provide the researchers information about a specific symbiotic binary or a group of objects but also to serve **observers, professional or amateur**, who are looking for the information they need to plan their observation programs
- ▶ several systems are **poorly studied**
- ▶ moreover, for some systems, which were **suspected** to be symbiotic based on their **photometric properties**, long-term photometry and spectroscopic information is completely missing

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We have presented a **new catalog** of symbiotics, which is available **online** to the whole community.

- ▶ the data are available in format of **tables** (for online and offline use)
- ▶ in addition, every system in the database has its own **object page** with information, references, notes and links
- ▶ the database could be useful for both, **researchers and observers**
- ▶ for example we plan to add direct links to the measurements of individual symbiotic variables obtained from sky surveys such as **OGLE, MACHO and ASAS-SN**
- ▶ **comments and suggestions** are welcomed

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Thank you for your attention.

