New Online Database of Symbiotic Variables

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Introduction to symbiotic binaries

Symbiotic stars are **strongly interacting binaries**, which consist of a **cool giant** of spectral type M (less commonly K in so-called yellow symbiotics) and a hot compact star, mostly a **white dwarf** (see e.g. the review by Mikołajewska, 2012). Their orbital periods range from **hundreds to thousands of days**. The mass transfer takes place via the Roche-lobe overflow or via the stellar wind of the cool giant, which is also the source of the dense circumbinary envelope of these systems (see Fig. 1).

Symbiotic binaries are **unique astrophysical laboratories** in the study of the stellar evolution, mass transfer and accretion processes, stellar winds, jets, dust formation, or thermonuclear outbursts.

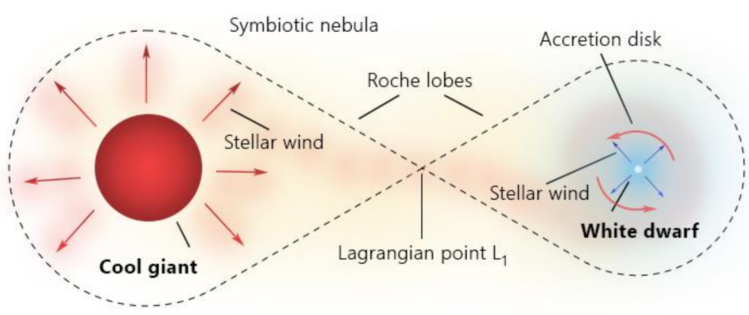

Figure 1: *A simplified model of a symbiotic binary system consisting of a white dwarf as an accretor and a cool giant as a donor of matter.*

Symbiotic activity

Depending on the activity observed in symbiotic binaries, they can be divided into two main classes (e.g. Mikołajewska, 2007):

- **classical symbiotic stars** (Z And-type; Fig. 2) for which an alternation of quiescent and active stages accompanied by outbursts on time scales of months to years is typical, and
- **symbiotic novae** consisting of **slow novae** whose outbursts last for several years or decades and **recurrent symbiotic novae** showing very short (few days) and prominent outbursts.

In addition to the outburst activity, the light curves of symbiotics show **various other changes** related to the **orbital motion** of the binaries and **intrinsic variability** of both components (e.g. Munari, 2019).

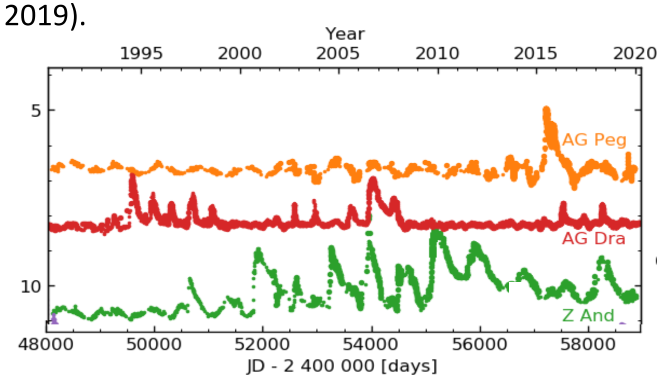

Figure 2: *Long-term light curves of selected symbiotic binaries.*

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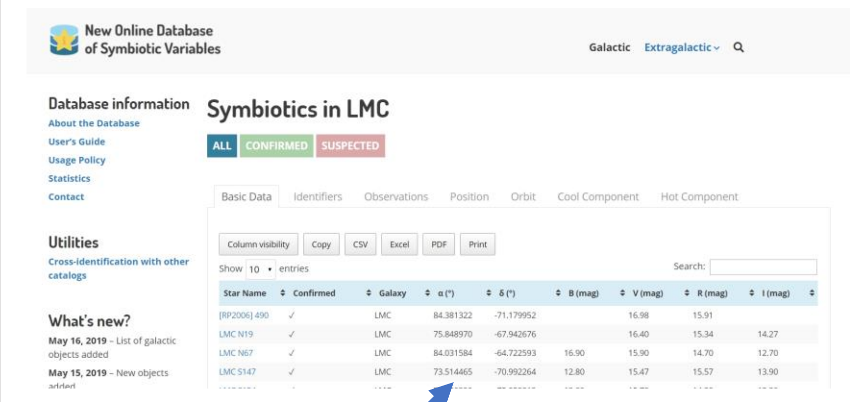
Surveys and cataloguing of symbiotic stars

Most of the symbiotic **discoveries** in the previous century were made **serendipitously** - due to their outbursts or as a by-product of objective prism spectroscopic surveys. Many of them were originally classified as **planetary nebulae**. Recently, a **systematic search** for symbiotic binaries has begun (see Merc et al., 2019 and references therein). Thanks to these surveys, the number of known symbiotic systems is growing rapidly. Until 2019, **the last catalogue** was published by Belczynski et al. (2000). In the meantime, it became outdated.

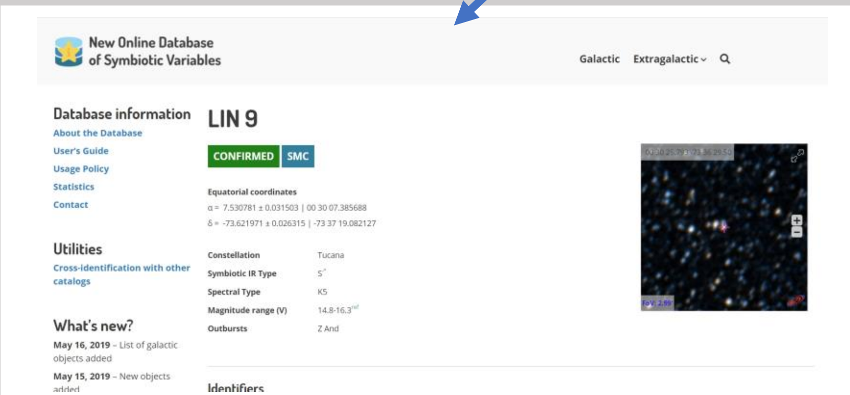
New Online Database of Symbiotic Variables

Based on the recent progress in the study of symbiotic stars, we have decided to prepare a **new database** of these interacting binaries (Merc et al., 2019). The purpose of the database is not only to serve as a **catalogue of data for all known symbiotics** with consistent references, but we have also prepared a **web-portal** for easy access to this information. For the catalogued symbiotic stars, we have prepared **specific object pages** covering all available information included in the database. Making the database **online** allows us to add new objects as soon as they are discovered and update data when new information becomes available.



Tables with data

Object pages



http://astronomy.science.upjs.sk/symbiotics/

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Galactic symbiotic population

The database is divided into **two main parts** according to the location of symbiotic variables. The first part consists of more than **400 galactic objects** whose list with the observational data is already present on the website of the database. The rest of the data on particular objects will be fully released later this year.

The second part of the database consists of **74 confirmed and 84 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 current version of the New Online Database of Symbiotic Variables consists of **276 confirmed galactic symbiotics** and another 132 objects suspected of having symbiotic nature based on various observational indications. Although the number increased significantly in the last two decades, it is still well **below the estimated numbers** for the Milky Way (e.g. Lü et al., 2006).

The **distribution of galactic symbiotics** in the sky is shown in Fig. 3 (in galactic coordinates). Almost all galactic symbiotics are **located around the Milky Way equator**. This is partly a result of the selective effect, as surveys tend to focus around the galactic equator (Merc et al., 2020).

Many of the known symbiotic stars are only **poorly studied**. Ongoing proper **characterisation of both symbiotic components** in a number of symbiotic stars will allow a better understanding of the whole population. At the same time, the analysis of the candidates is needed in order to provide a clean sample of symbiotic stars in the Milky Way.

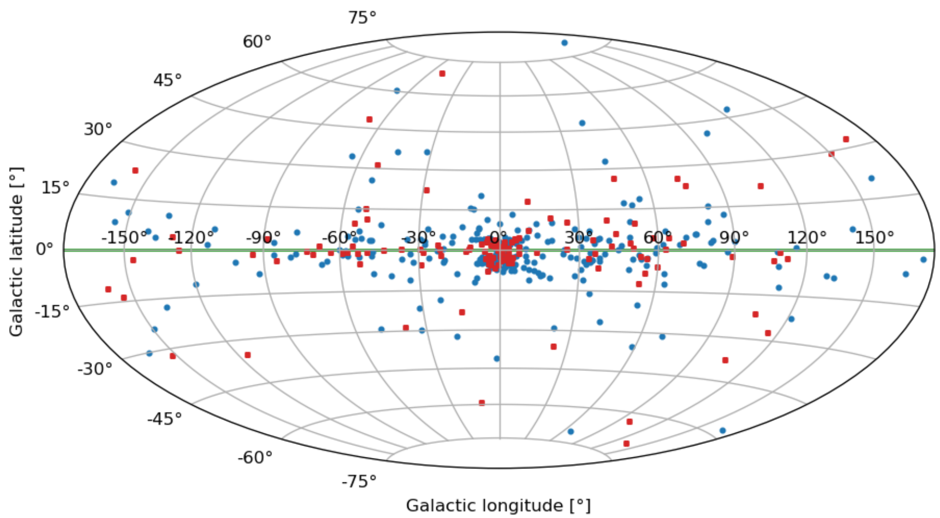

Figure 3: *Distribution of galactic symbiotic stars in the sky. The map is in the galactic coordinates. Confirmed and suspected symbiotic stars are denoted by blue and red symbols, respectively (Merc et al., 2020).*

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Extragalactic symbiotics

The number of extragalactic symbiotic stars and candidates have **increased by the factor of 9** since the beginning of this century (Merc et al., 2019). The position of symbiotics in selected galaxies is shown in Fig. 4. The greatest advantage of studying extragalactic objects is that their **distances are usually known** with sufficient precision. The parameters of the components could be determined **more precisely**, which is very useful for **comparing observational features with theoretical models**.

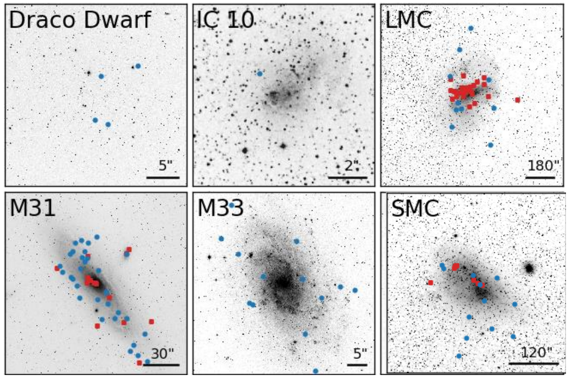

Figure 4: *Position of the extragalactic symbiotics in their host galaxies. Confirmed and suspected symbiotic stars are shown by blue and red symbols, respectively.*

Conclusions

We present the **new catalogue of symbiotic stars**. For the included objects, data on the location, brightness in various passbands and other observational properties, orbital parameters and parameters of the components are presented in the **format of tables** (for online and offline use) and every system in the database has its **own object page** with information, references, notes and links.

Our catalogue can serve as a basis for the **systematic studies of the symbiotic population** in the Milky Way and in the galaxies of the Local Group, where the objects evolved in the environment with different chemical composition. The database could be also useful as an input for **modern approaches of searching for symbiotics**, e.g. using machine learning.

The database is available **online** to the whole community. It can be **updated** whenever needed. We aim to provide the **most up-to-date lists of known symbiotic stars** and of the candidates needing follow-up observations.

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