

Search for new symbiotic stars using the *Gaia* DR3 data

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Motivation

- Can we use ***Gaia* DR3 data** to identify promising symbiotic candidates?
- Is ***Gaia* H α measurement** useful in the search for **new SySts**?
- Can we define **reliable selection criteria** to find sources with **H α emission** and **late-type star** continuum?
- Opportunity: **Spectral confirmation** of samples can be carried out using **2SPOT facilities** in both hemispheres.

Aims

Step 1: Validation of the Syst candidates from the Gaia DR3

Step 2: Selection criteria tuning using samples from GALEX, Henize, and Wray catalogs

Step 3: Selection and observation of promising candidates from the *Gaia* LPV catalog

Step 4: (in the future) Search for candidates not included in the LPV catalog (H α emission measurements published for 235 millions sources)

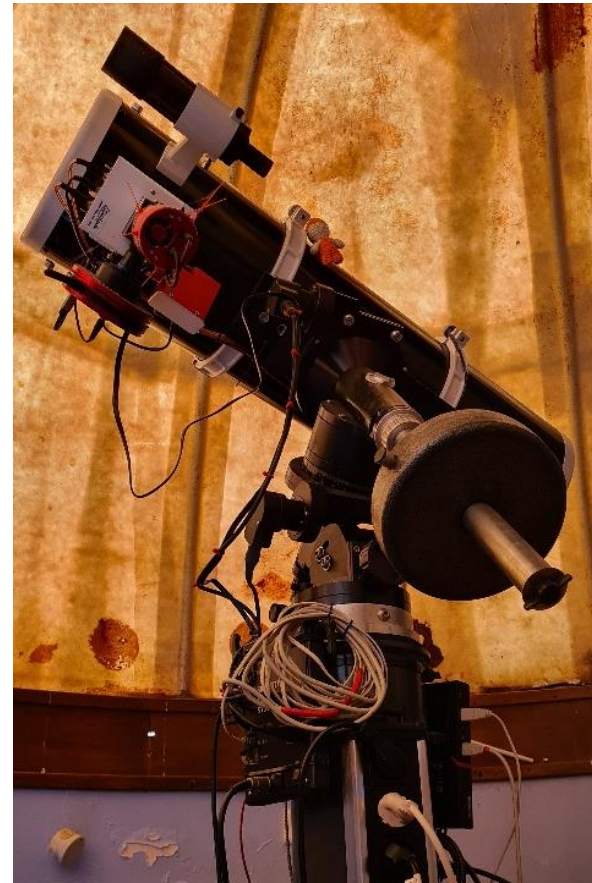
2SPOT equipment used for spectral confirmation

Chile-based Setup
Hosted at Deep Sky Chile



**0.3 m Newtonian
Telescope**
Alpy600 Spectroscope
(R=600)

France-based Setup
Hosted at L. Bernasconi Obs.



**0.2 m Newtonian
Telescope**
Alpy600 Spectroscope
(R=600)

250 hours of observation since the beginning of the project

Step 1: Gaia DR3 SySt candidates

- *Gaia* DR3 lists **340 new SySt candidates**
- sources located among **giants** in the *Gaia* **HR diagram** and among **SySts** in **IR color-color diagram**
- distribution of **H α pseudo-equivalent width** is **different** from the **known symbiotic stars**

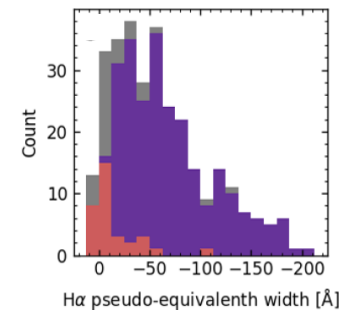
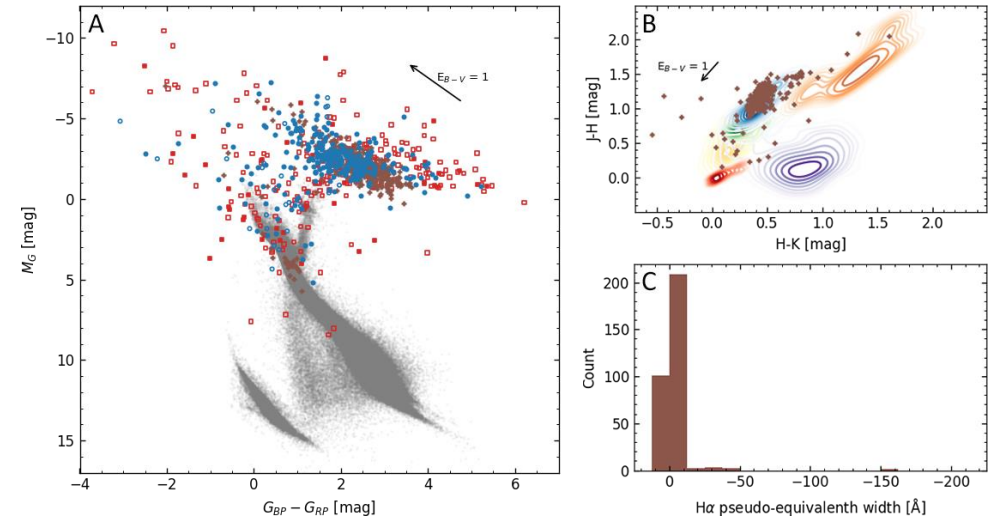


Figure: Distribution of H α pseudo-equivalent width of known shell-burning (purple) and acc-only (red) symbiotic stars.

Step 1: Gaia DR3 SySt candidates

- only **8 sources** with **strong Gaia H α** emission: we **confirmed** that most of them are **new SySts**
- **many of the remaining stars** are probably **single pulsating giants** (several observed within our '**control sample**')
- very **low success rate** due to datasets used for the classification (light curves, colors, astrometry, but no **H α pseudo-equivalent width**)

Step 2: Selection criteria tuning using the samples from GALEX, Henize, and Wray catalogs

- Selection criteria:
 - **Crossmatch** with **LPV** catalog
 - H α emission in Gaia DR3 ($pEwH\alpha < -10 \text{ \AA}$)
 - **2MASS IR cuts**
 - Objects with **unknown nature** in literature
 - **65 objects** found in **Galex, Henize, Wray catalogs**
- Results:
 - **>70 %** of our candidates show **H α in emission**,
 - **35%** of our candidates show **M-Type continuum + H α in emission**
- Contaminants:
 - Reddened **Be stars (H α detected)** – no filter in this step,
 - **Pulsating red giants**: Miras, SRs pulsating with large amplitude (**H α undetected**)
- Lessons learned:
 - Most of the **pulsating stars** can be **filtered out** when the **uncertainty of the H α pseudo-equivalent width** is considered

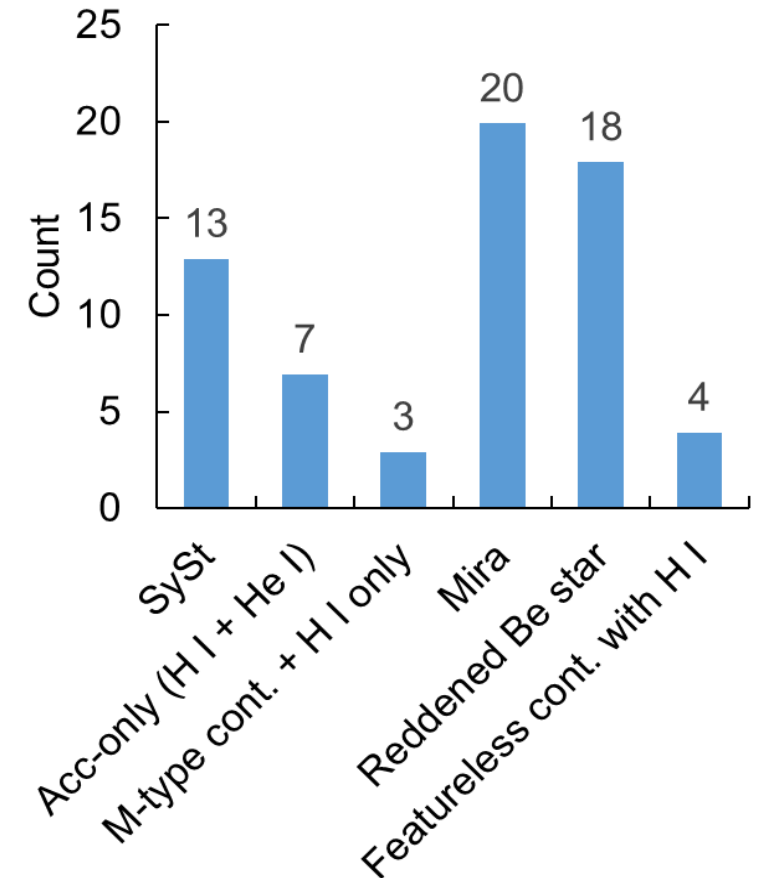
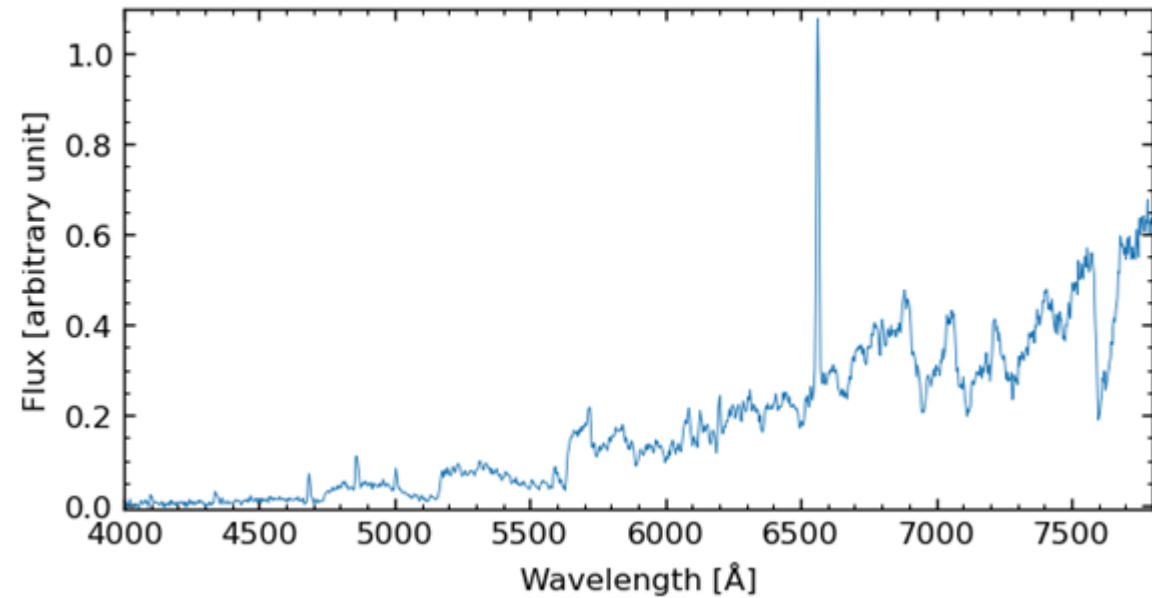


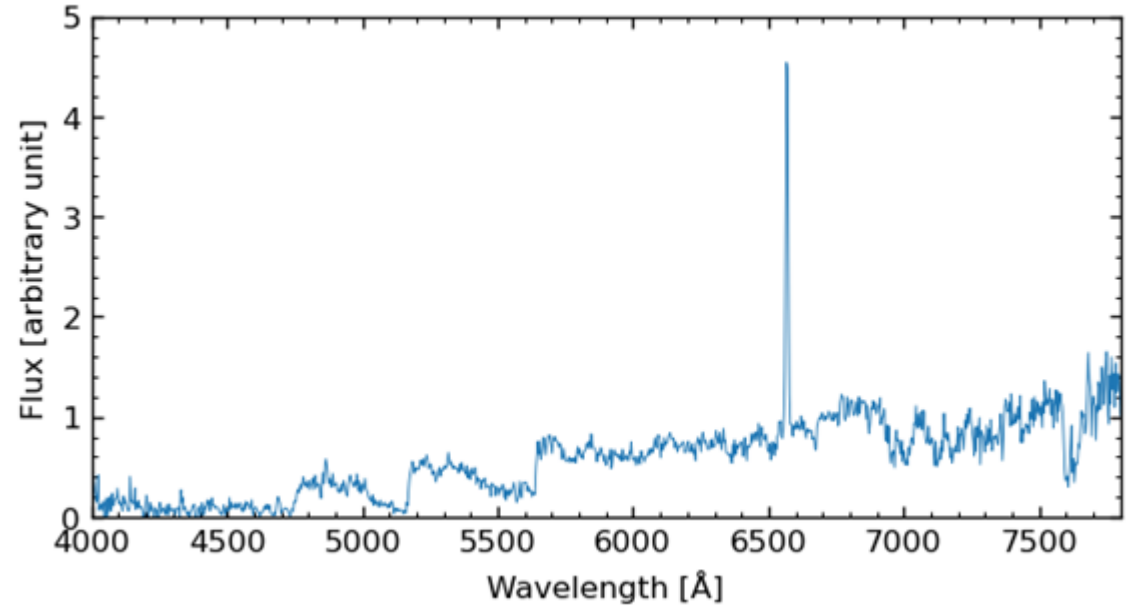
Figure: Preliminary results on the nature of our candidates from Galex, Henize and Wray catalogs

Step 2: Selection criteria tuning using the samples from GALEX, Henize, and Wray catalogs

SyStC1 - 4 x 1200 s - RC12 Alpy600 Atik414EX - 2SPOT - DSC
Start Obs date : 2023 04 15.023



SyStC2 - 4 x 1200 s - RC12 - Alpy600 - Atik 414ex - 2SPOT - DSC
Start Obs date : 2022 08 23.072



Discovery of **2 new carbon SySts** (only 10 were known in the Milky Way)

Step 3: Selection and observation of promising candidates from the Gaia LPV catalog

- Major selection criteria:
 - **Tuned pEW $H\alpha$** and its **relative error**
 - 2MASS IR cuts
 - Objects with **unknown nature** in literature
 - **Gmag cut** (< 15)
 - Golden Sample: **64 very promising candidates (all observed)**
 - **Hundreds of less promising candidates (observation in progress)**

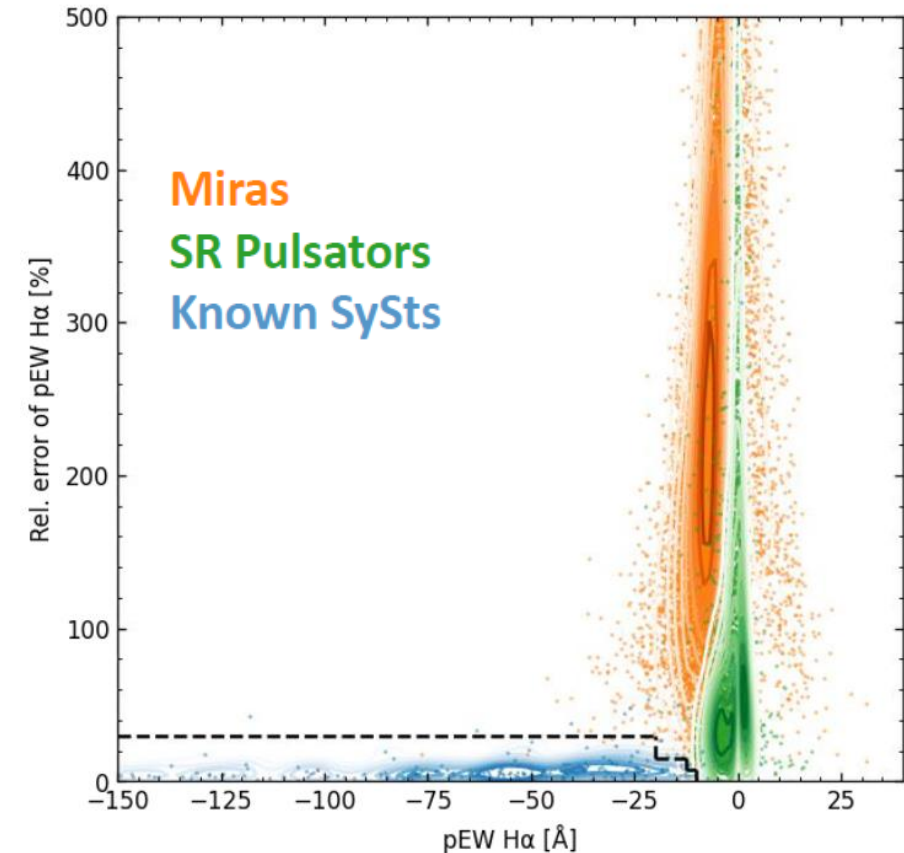


Figure : Position of Miras (orange), SRs(green), and known galactic symbiotic stars (blue) in the rel. error of pEW $H\alpha$ vs. pEW $H\alpha$ plane. The black dashed lines denote the limits applied to LPV catalog in Step 3 of the search.

Step 3: Selection and observation of promising candidates from the Gaia LPV catalog

- **High success rate** on the Golden sample:
 - **94 %** of our candidates show **H α in emission**
 - **80 %** of our candidates show **M-type continuum** and **H α in emission**
 - **Only 6 %** of our candidates **do not show any H α in emission**
- **Work in progress:**
 - Observation of **less promising candidates** (new **SySts** already found **but with more contaminants**)
 - **pEWH α / Rel. Err. tuning** in the region where pulsating red giants and SySts coexist
 - **Paper about to be submitted** for steps 1, 2 and first part of step 3

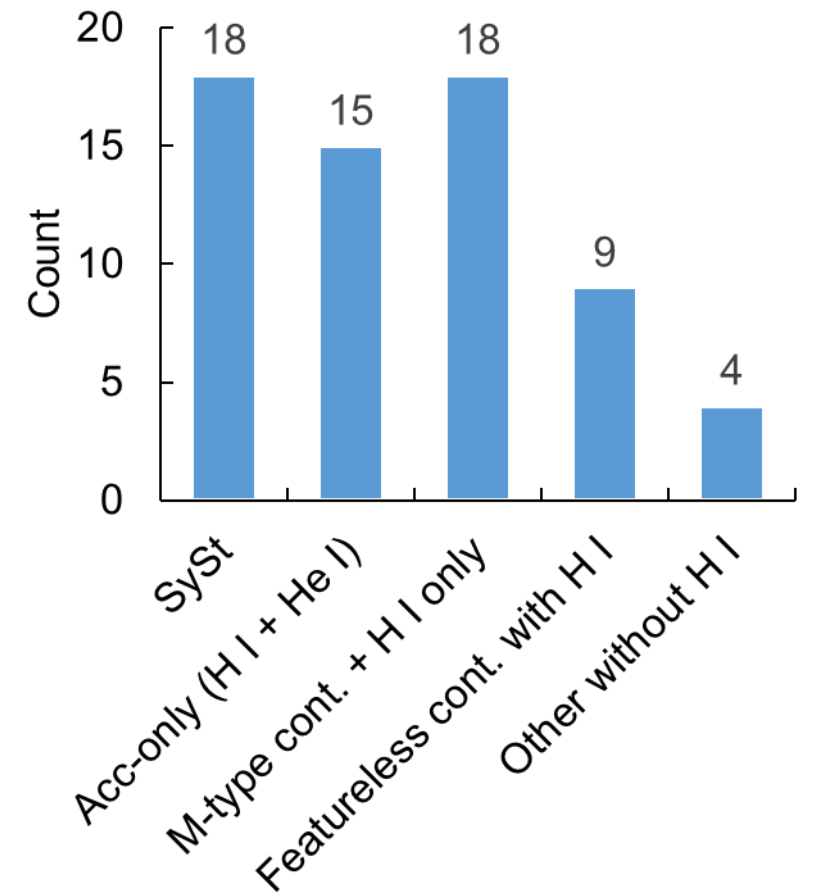


Figure : Preliminary results on the nature of our Golden Gaia LPV candidates

Thanks for your attention !

Any questions ?