S-PLUS: Searching for Be stars using multi-band photometry

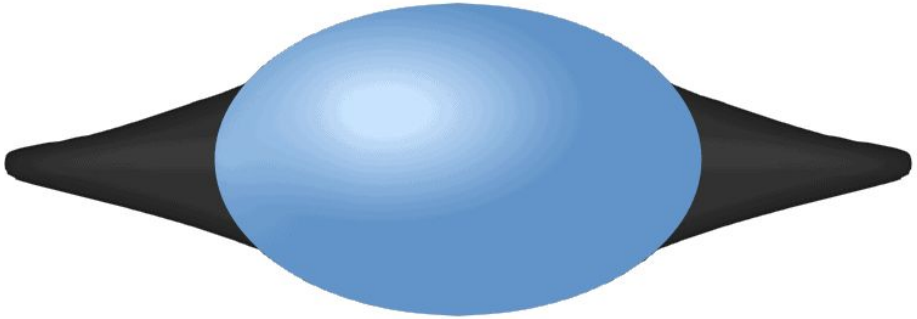
Universidade de São Paulo
Departamento de Astronomia

Speaker: Pedro Ticiani dos Santos
Contact: pedroticiani@usp.br

Be stars? What are they?

What’s their importance?

How can we detect Be stars in different environments?



Proposition: Usage of the S-PLUS survey, together with state-of-the-art models of Be stars (BeAtlas) to search for, identify, and classify Be stars in different environments, both in the Galaxy and in nearby regions, such as the Magellanic clouds.

Available Data and Tools: S-PLUS

- Five sub-surveys;
- 12-filter system (both broad and narrow filters);
- 6 data releases (DR1, DR2, iDR3, and more to come)

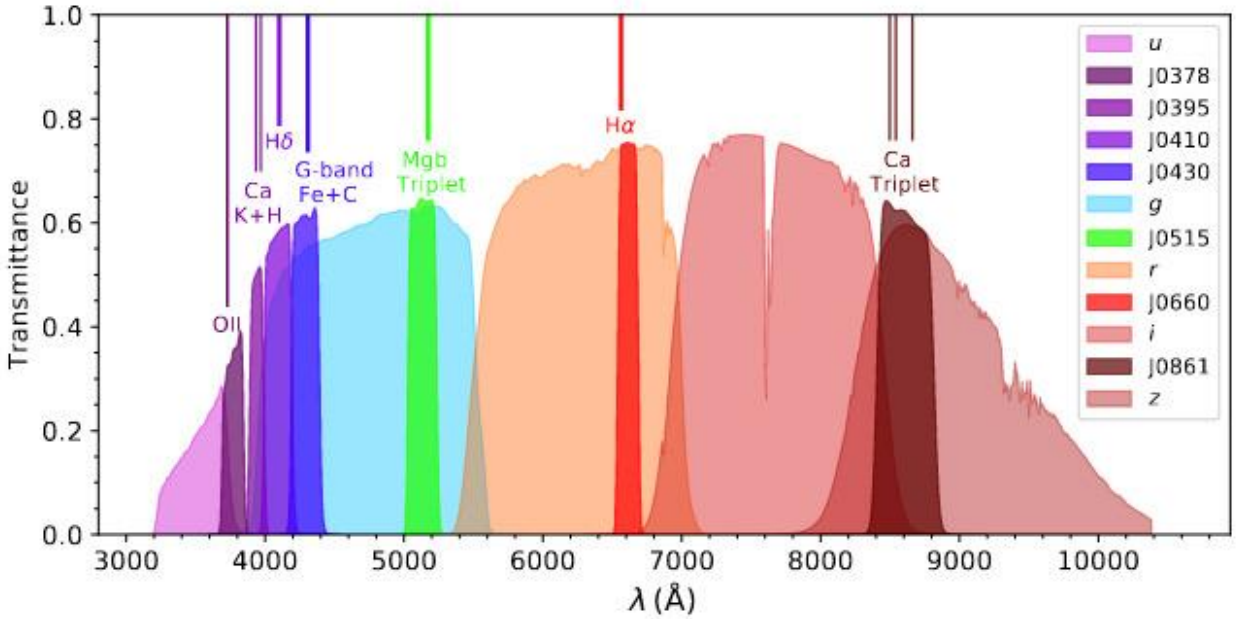


Figure 1: S-PLUS Javalambre photometric filter system. Figure extracted from Almeida-Fernandes et al. 2021.

Available Data and Tools: BeAtlas

BeAtlas (Mota, 2019) is a grid of models of B and Be stars created using the HDUST code (Carciofi and Bjorkman, 2006).

It will provide the necessary models to develop the planned synthetic population of B and Be stars, allowing us to produce diagnostics based on the S-PLUS colors combinations to find Be stars in a variety of Galactic environments and in the Magellanic Clouds.

There are mainly two grids:

- One contains models without disk (i.e., purely photospheric);
- The other one is composed of models of Be stars with disks.

Methodology

The following action items are proposed for this MSc research project:

1) Develop the ability to create, using BeAtlas, stellar populations that include A, B and O normal stars as well as Be stars;
2) Create synthetic S-PLUS colors for these populations, producing a set of diagnostic tools (see Figure 2);
3) Investigate the diagnostic tools to identify the ones that most accu and completely recover the original fraction of B/(B+Be) stars in the sample;
4) Apply these diagnostic tools in real data, using S-PLUS DR2.

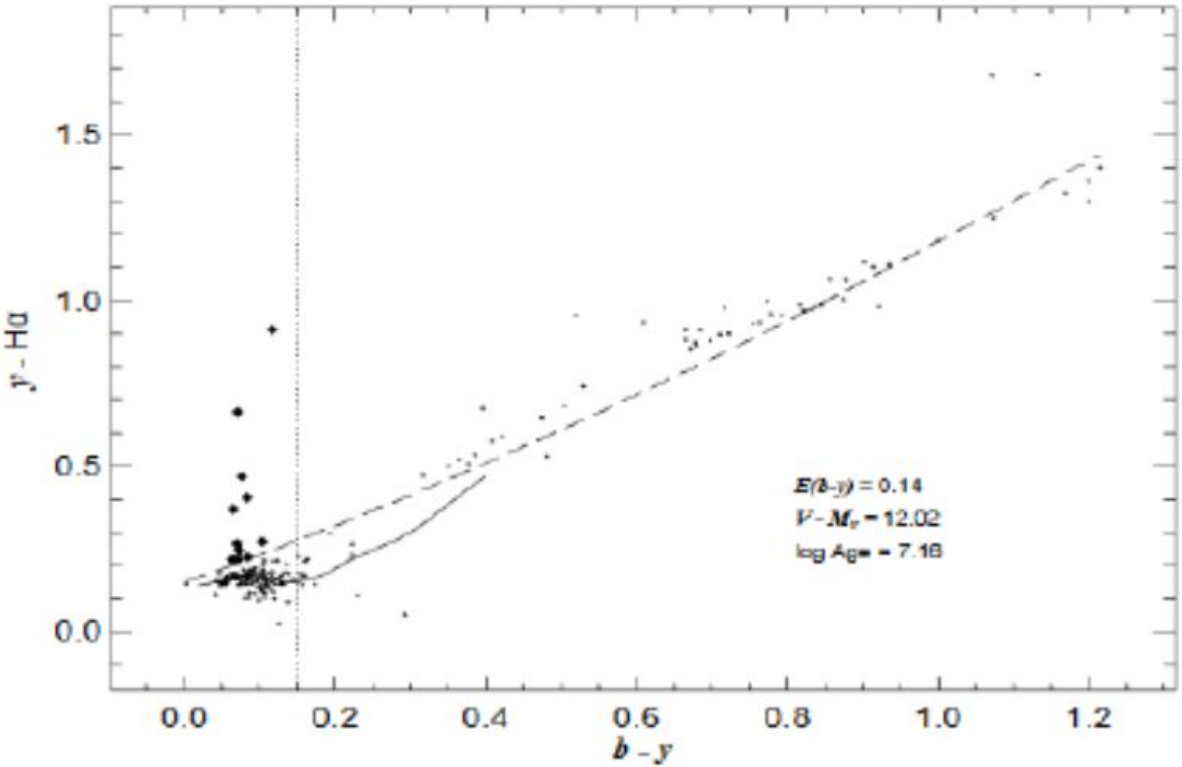


Figure 2: Color-color diagram (CCD) of the NGC 3766 cluster. The color-color fit from the Kurucz model fluxes (solid line), the parabolic fit for unreddened MS and evolved stars from Jacoby et. al. 1984 (dashed line) and E(b-y) (dotted line) are also indicated. The Be stars are distinguished as larger diamonds. Figure extracted from McSwain and Gies (2005).

Expected Results

The first expected result for this project is the development of a methodology to identify, in an accurate way, B + Be stars in a variety of Galactic environments and in the Magellanic Clouds. The S-PLUS survey is particularly suitable for this purpose, as it contains narrow-band Ha observations. This methodology will make usage of the most up-to-date models of Be stars and normal A, B and O stars.

Once ready, the new method will be applied to real data. However, if proven successful, the here-developed methodology will be applied not only in future S-PLUS data, but also data from LSST and other surveys.

References

- F. Almeida-Fernandes et. al. Data release 2 of s-plus: accurate template-fitting based photometry covering~1000 square degrees in 12 optical filters, 2021.

- Mota. BeAtlas: A grid of synthetic spectra for Be stars. PhD thesis, IAG-USP, May 2019

- A. C. Carciofi and J. E. Bjorkman. Non-LTE monte carlo radiative transfer. i. the thermal properties of keplerian disks around classical be stars. ApJ, 639(2):1081–1094, 2006.

- M. V. McSwain and D. R. Gies. A photometric method to search for be stars in open clusters. ApJ, 622(2):1052–1057, 2005.

- Jacoby et. al. A library of stellar spectra. ApJ, Suppl. Ser., Vol. 56, p. 257-281, 1984

Thank you!

Contact: pedroticiani@usp.br
Contact: carciofi@usp.br

PS: This is an undergoing MSc project advised by Professor Alex Cavaliéri Carciofi. We greatly thank you for visiting our presentation.