Spectral classification & physical parameters of the IPHAS CBe stars in the BCD system.

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Classical Be stars



- Classical Be (CBe) stars are O-B and early A-type stars which have Balmer Hydrogen and other lines in emission, or they had in the past.
- CBe stars as very rapidly rotating and non-radially pulsating B stars, forming a decretion disk.
- **Decretion disk** is an outwardly diffusing gaseous Keplerian disk.
- **Decretion disk** is fed by mass ejected from the central star, and its further fate, after formation, is governed by viscosity.
- Binarity or magnetic fields, are under investigation.
- Mass-transfer mechanism between star and disk is still unclear.



IPHAS survey

IPHAS point sources

More than 100 million have been detected at a typical seeing of 1.1 arcsec:

The important object classes that IPHAS data readily distinguishes are:

- compact planetary and symbiotic nebulae; rapidly evolving post-AGB stars
- Be stars of all types (including young Herbig stars, and B[e] supergiants)
- dMe stars; clusters of lower mass young stellar objects
- a range of interacting binary stars (symbiotics, `supersoft' compact binaries, WD/NS/BH accreting binaries generally)
- H-rich white dwarfs
- · large numbers of near-main-sequence A stars and M giants





more info: iphas.org

IPHAS survey

IPHAS bright sample with FLWO/FAST

- Follow up spectroscopy at Fred Lawrence Whipple with the 1.5m telescope and the FAST spectrograph
- Started at 2005 and finished at 2012

- 2627 Spectra of which <u>≈</u>70% are CBe stars
- The limits in r magnitude are between 13-17

Spectra classification



BCD classification system

- The basic parameters that describe the energy around BD are:
 - D, the Balmer jump depth(dex), an effective temperature indicator.
 - λ_1 , the average position of the BD, given as the difference λ_1 -3700Å, very sensitive to log g.
 - ϕ_b , the color gradient, which is the continuum near the BD.
 - ϕ_{uv} , the slope of the Balmer continuum.





BCD classification system

Each star is defined by a unique point (D, λ_1 , ϕ_b)



(Zorec J. et al. 1991)

(Chalonge & Divan 1953)

BCD classification system <u>for emission line spectra</u>



 $\lambda^{0.45}$ $\lambda(\mu m)$

0.5

0.55

0.6

0

0

0.1

0.2

0.2

0.35

0.4

0.6

0.35

0.4

0.55

 $_{\lambda(\mu m)}^{0.45}$

0.5

0.55

 $^{0.45}_{\lambda(\mu {
m m})}$

0.5

0.0

0.35

0.4

(Gkouvelis et al. 2016)

0.3

D_{uv}(dex)

0.4

0.5













rotational velocities





* Chandrasekhar & Münch (1950)

<u>Disc rotation</u>

= 1 Conservation of angular momentum





<u>Spatial distribution</u>





<u>Conclusions & future work</u>

- We give the largest homogeneous Be star catalogue.
- We increase the number of known Be stars up to 40%
- Provide an automatic procedure of emission and non emission O, B type stars.
- Statistical analysis of the largest sample on the evolution status, rotational effects.
- Galactic structure of the anti-centric Galactic disck.
- Investigate the distant Be stars.
- The proper caracterization of those stars will be combined with the GAIA trigometric paralaxes.
- Preparing the WEAVE multi-fiber spectroscopic survey.