Identification of red supergiants in the Local Group with mid-IR photometry

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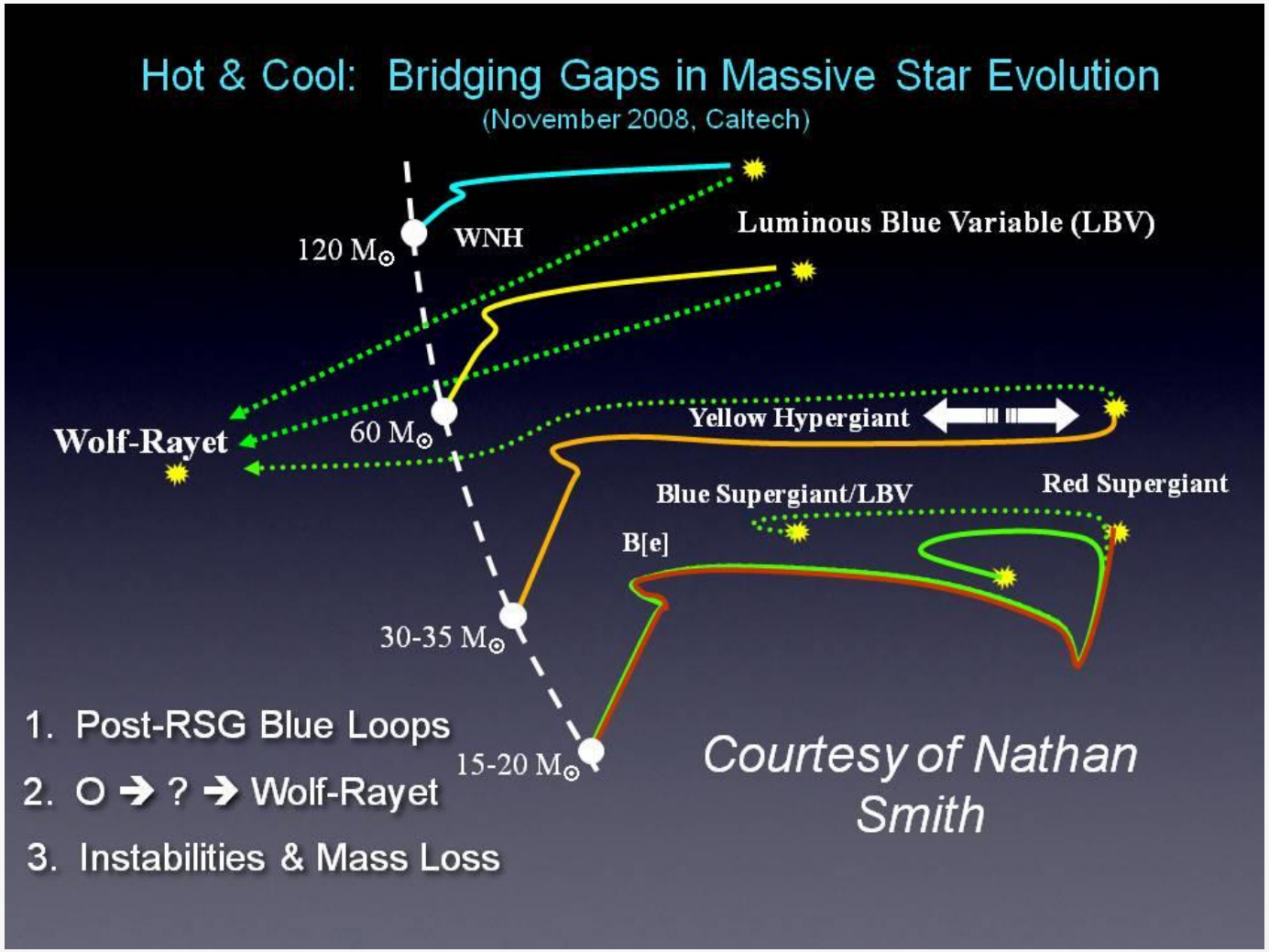
NOA supervisor: Dr. Alceste Bonanos

UoA supervisor: Assoc. Prof. Despina Hatzidimitriou

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Κοινωνικό Ταμείο
ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
ΕΚΠΑΙΔΕΥΣΗ ΚΑΙ ΔΙΑ ΒΙΟΥ ΜΑΘΗΣΗ
επένδυση στην κοινωνία της γνώσης
ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ, ΔΙΑ ΒΙΟΥ ΜΑΘΗΣΗΣ ΚΑΙ ΘΡΗΣΚΕΥΜΑΤΩΝ
ΕΙΔΙΚΗ ΥΠΗΡΕΣΙΑ ΔΙΑΧΕΙΡΙΣΗΣ
ΕΣΠΑ 2007-2013
πρόγραμμα για την ανάπτυξη
ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΩΝΙΚΟ ΤΑΜΕΙΟ
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

Motivation: “Mind the Gap”

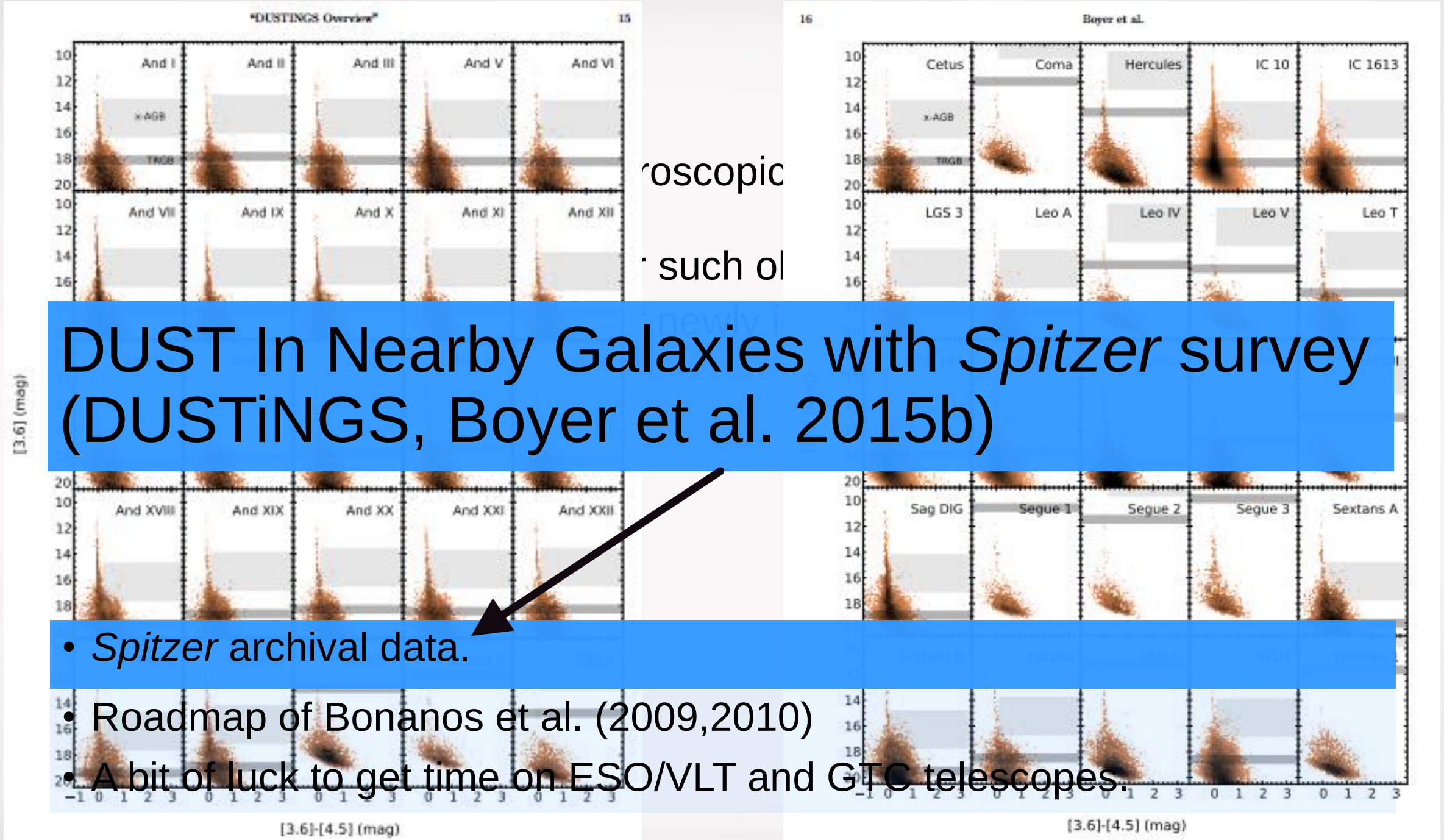


Our goals:

- Increase the statistics of spectroscopically confirmed dusty massive stars in the Local Group.
- Revise the selection criteria for such objects.
- Get the physical parameters of newly identified RSGs.

Our tools:

- *Spitzer* archival data.
- Roadmap of Bonanos et al. (2009, 2010)
- A bit of luck to get time on ESO/VLT and GTC telescopes.



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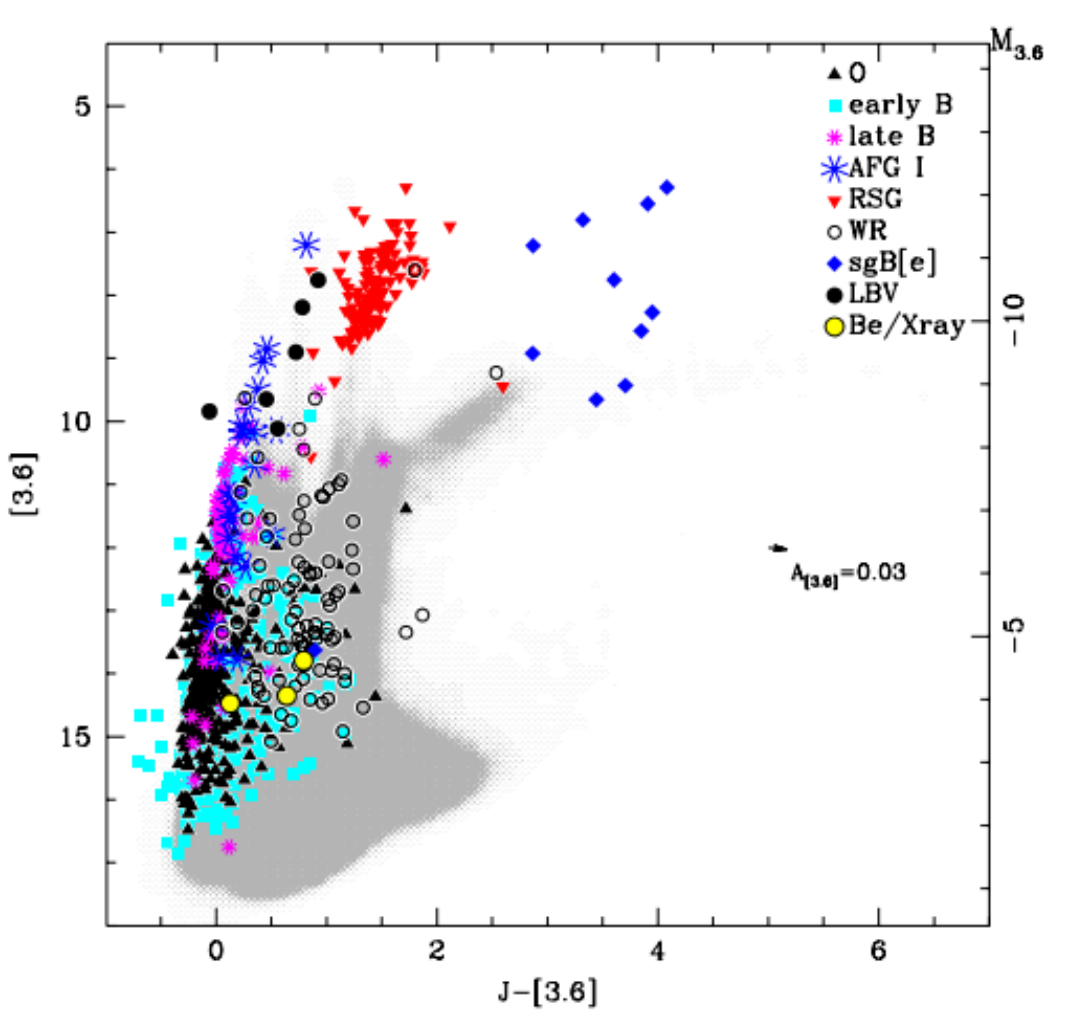
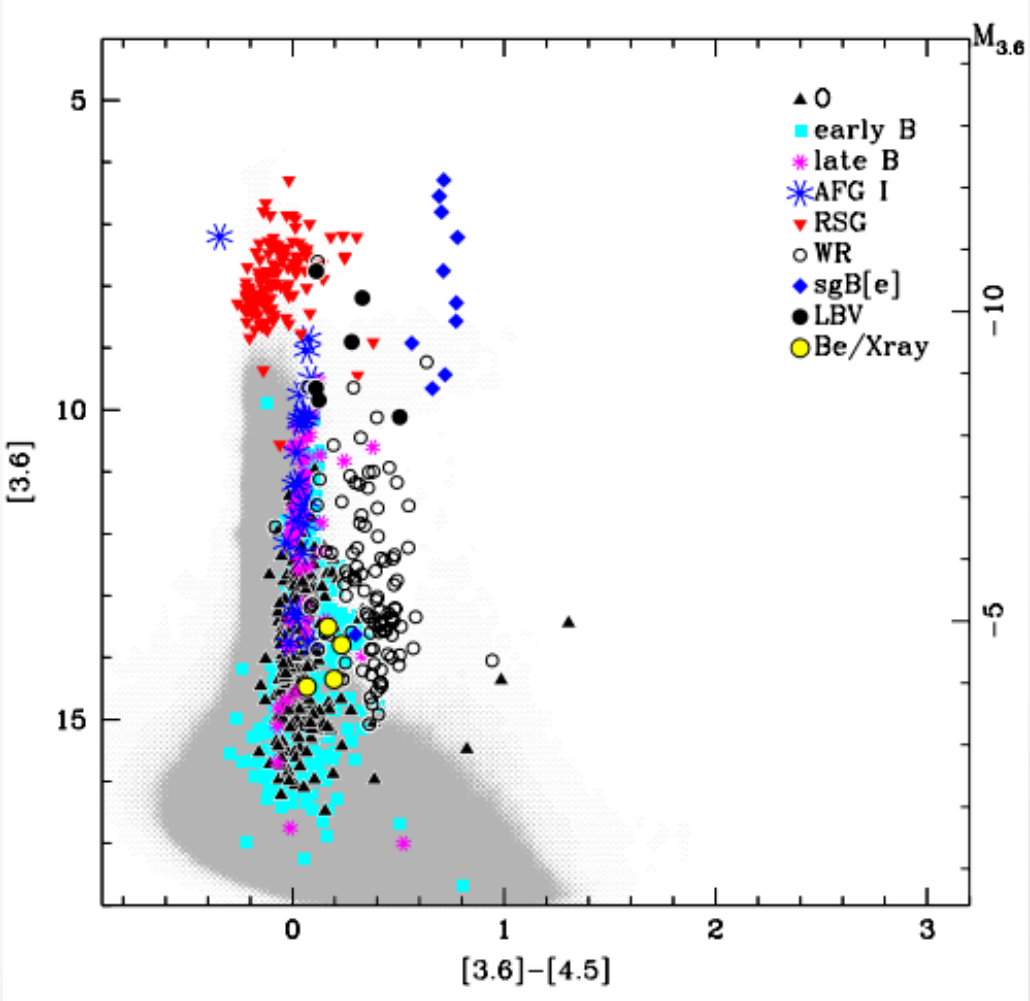
DUST In Nearby Galaxies with *Spitzer* survey (DUSTiNGS, Boyer et al. 2015b)

- *Spitzer* archival data.
- Roadmap of Bonanos et al. (2009,2010)
- A bit of luck to get time on ESO/VLT and GTC telescopes.

Selection criteria

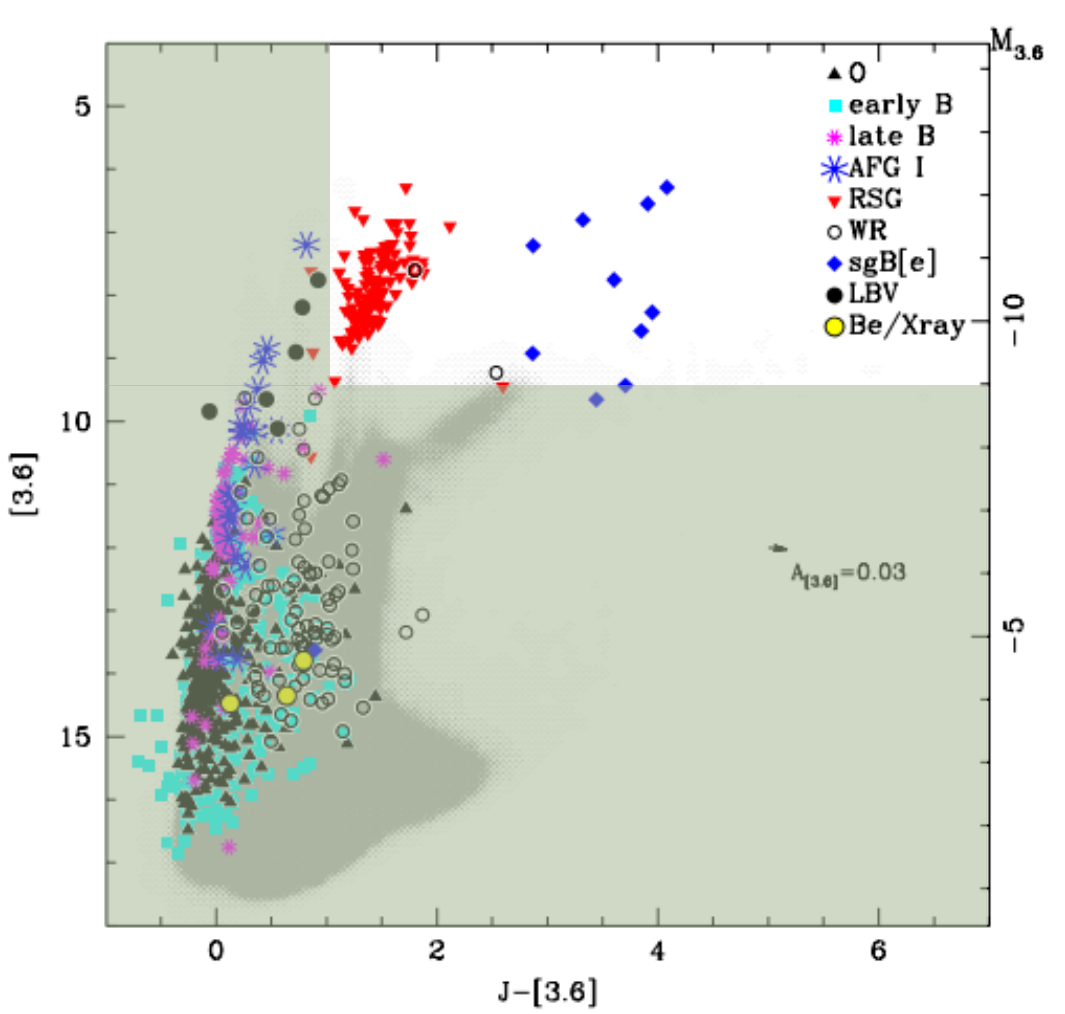
Spectroscopically confirmed population of massive stars in the LMC and SMC (Bonanos et al. 2009, 2010)

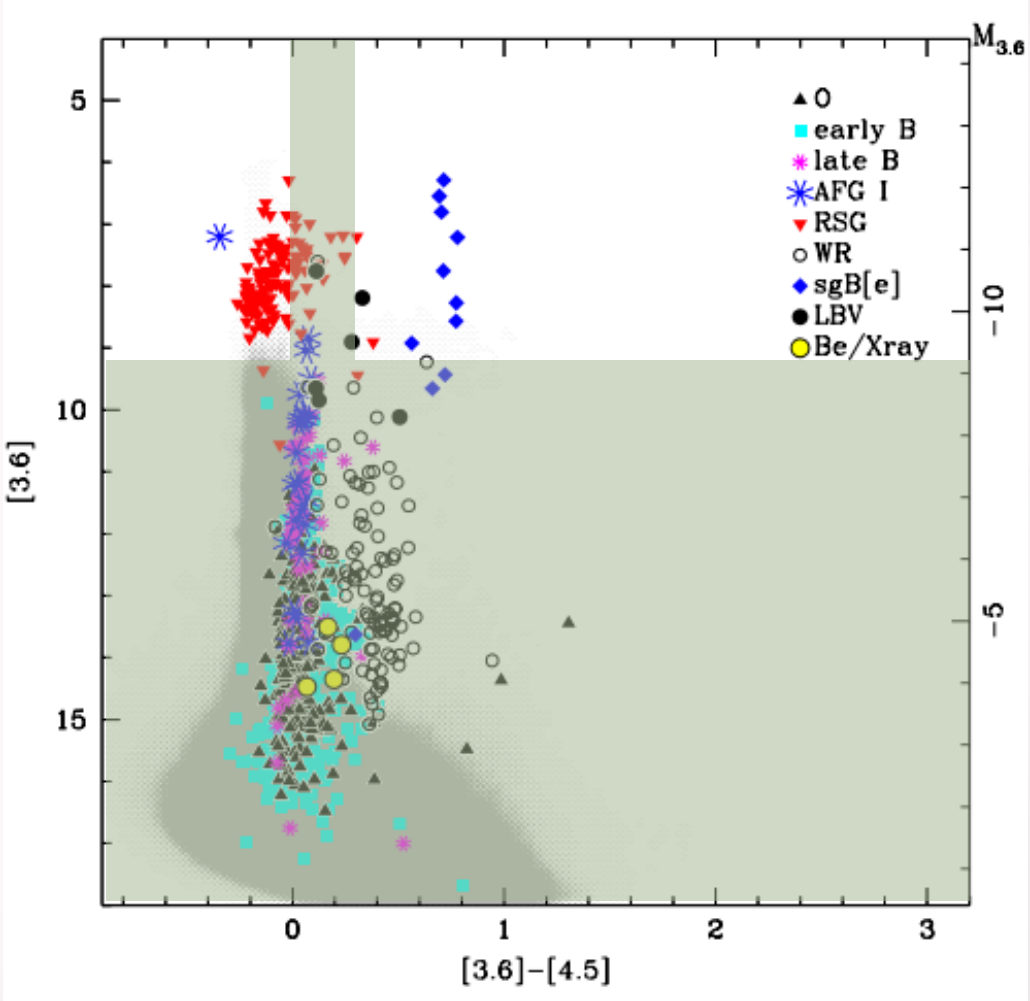




Selection criteria

$M_{3.6}$ < -9 mag. RSGs: J-[3.6] > 1 and [3.6] - [4.5] < 0
LBVs: [3.6] – [4.5] > 0.15





Program galaxies

7 dIrr galaxies (13 in total) in the Local Group with high star formation rate:

- Pegasus
- Phoenix
- Sextans A
- Sextans B
- WLM
- IC 10
- IC 1613

Program galaxies

7 dIrr galaxies in the Local Group with high star formation rate:

	Number of targets:
•Pegasus	19
•Phoenix	14
•Sextans A	15
•Sextans B	5
•WLM	31
•IC 10	12
•IC 1613	8
	Total: 104

Observations

Longslit and multi-object spectroscopy modes on:

- GTC - OSIRIS (2014B observed semester, 10.6h)
- Du Pont – WFCCD (private communication, J. Prieto)
- ESO/VLT - FORS2 (P90/P91 observed semesters, 11h + 3.4h)

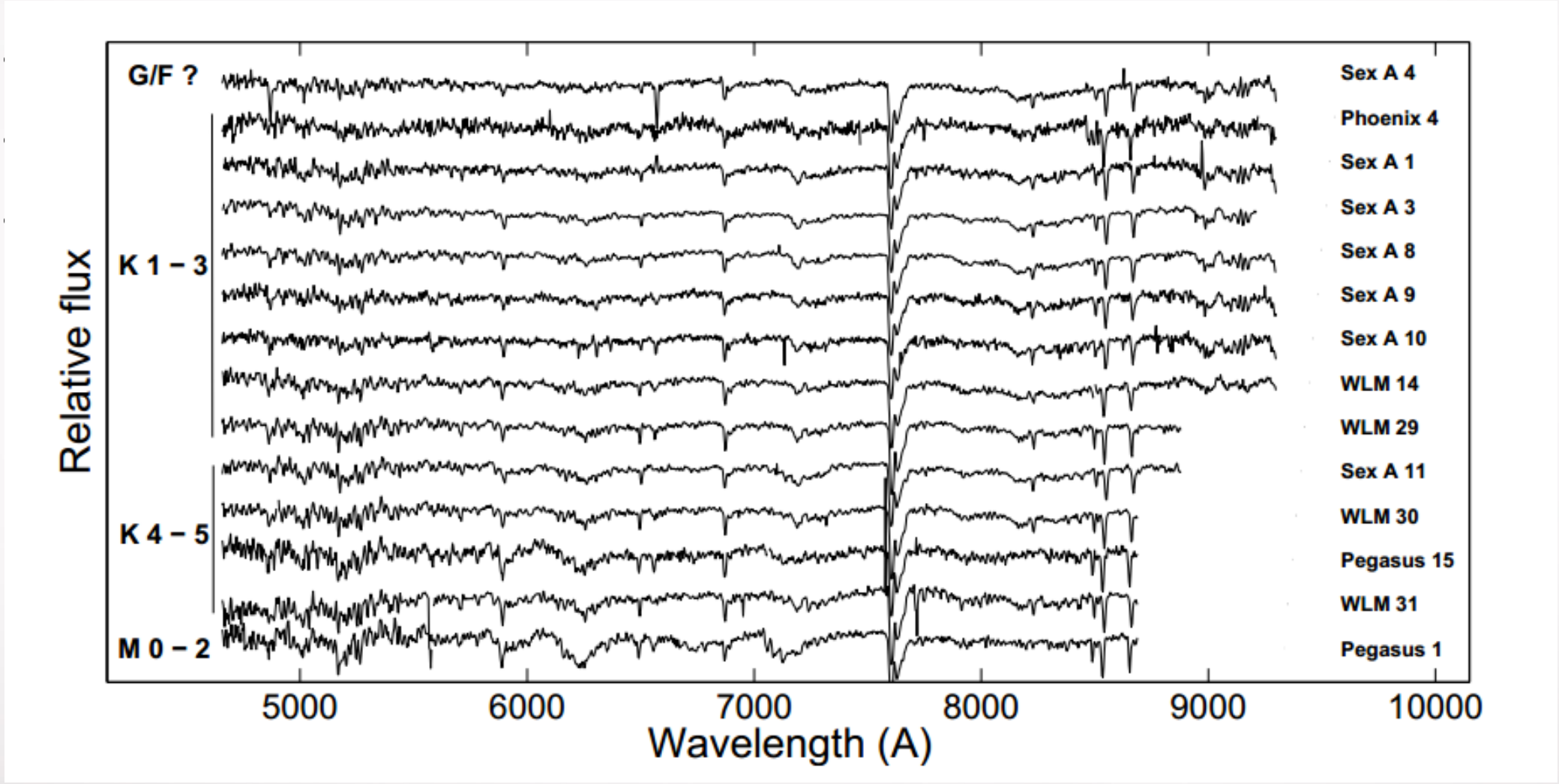
Resolution R ≤ 1000

Signal-to-Noise up to 60

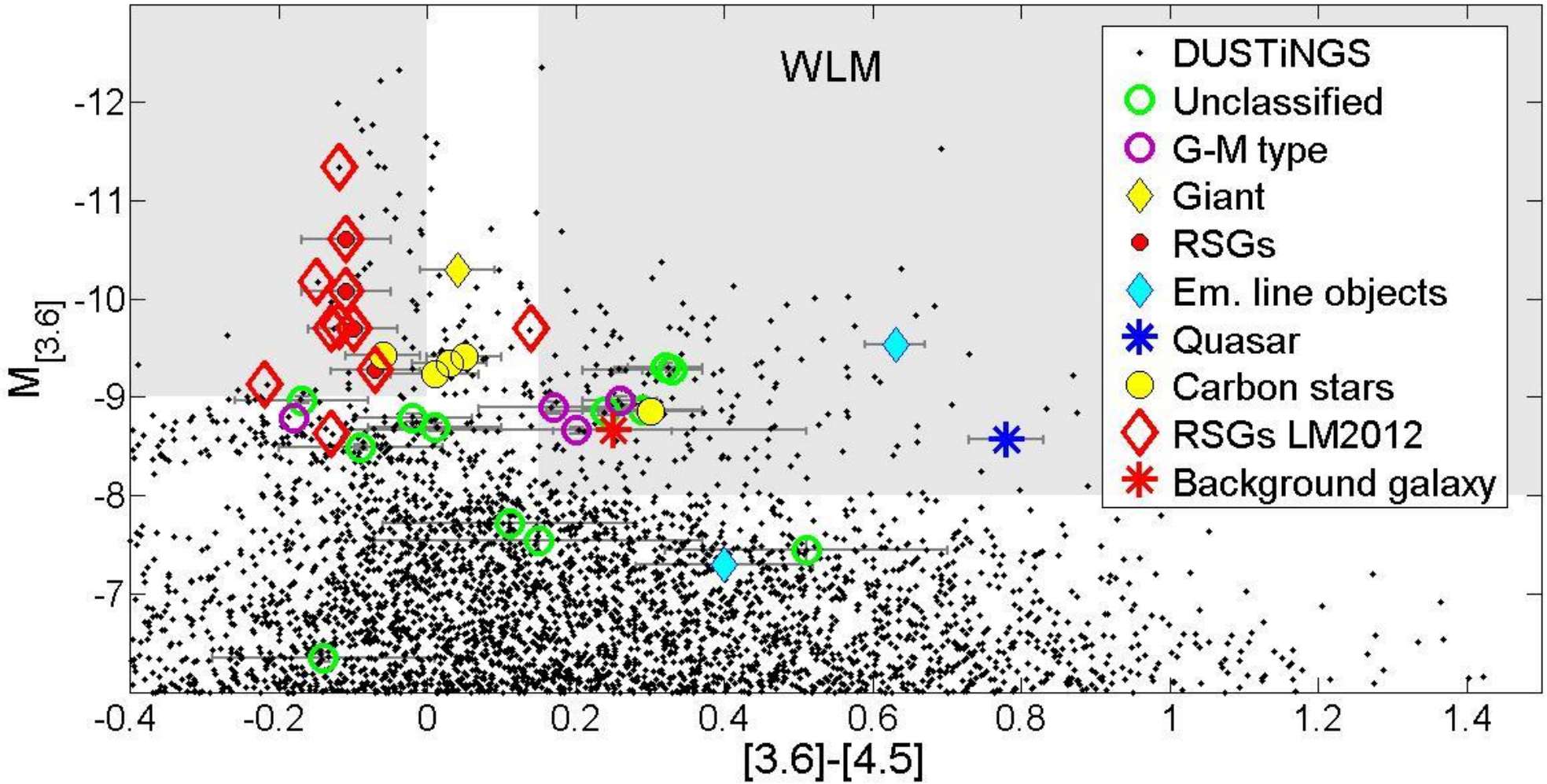
Spectral analysis

- Radial velocity <- Cross correlation of Ca II triplet
- Spectral type <- Fitting of TiO bands
- Luminosity class <- Fitting of Ca II triplet

Spectral analysis



An example of the stellar population Zoo



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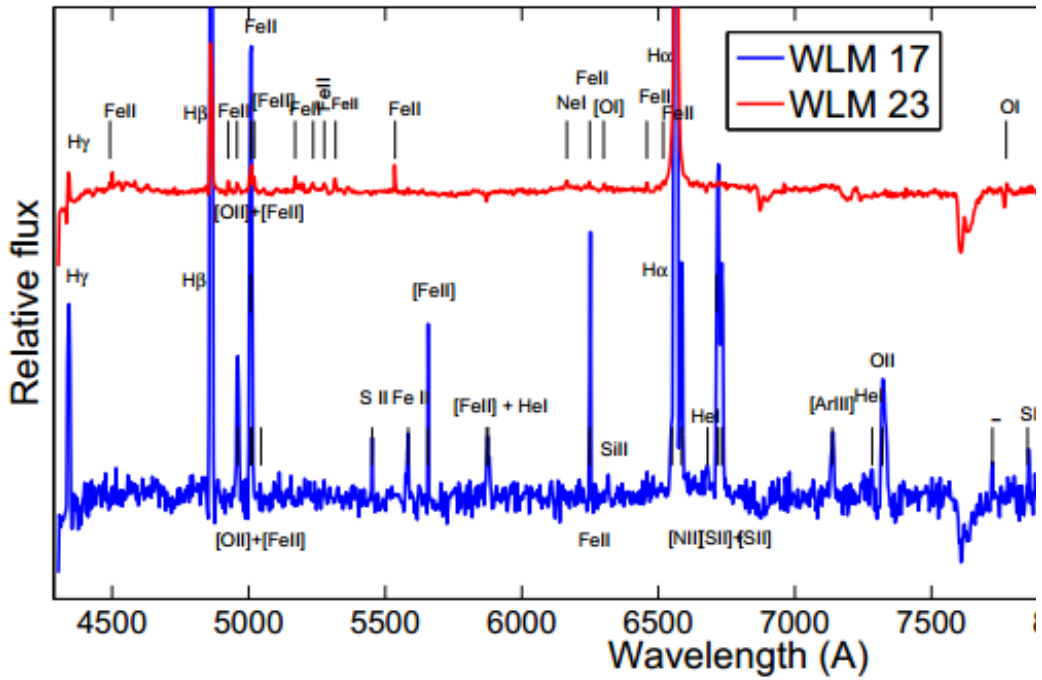

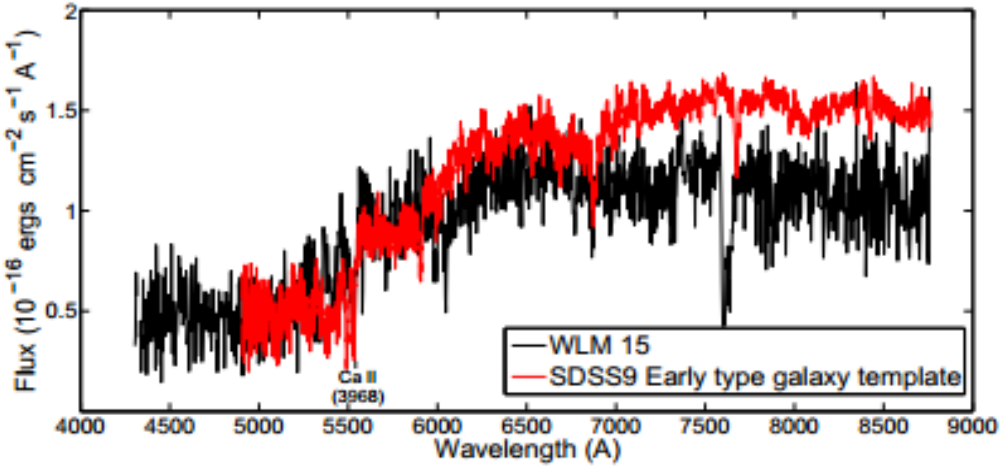

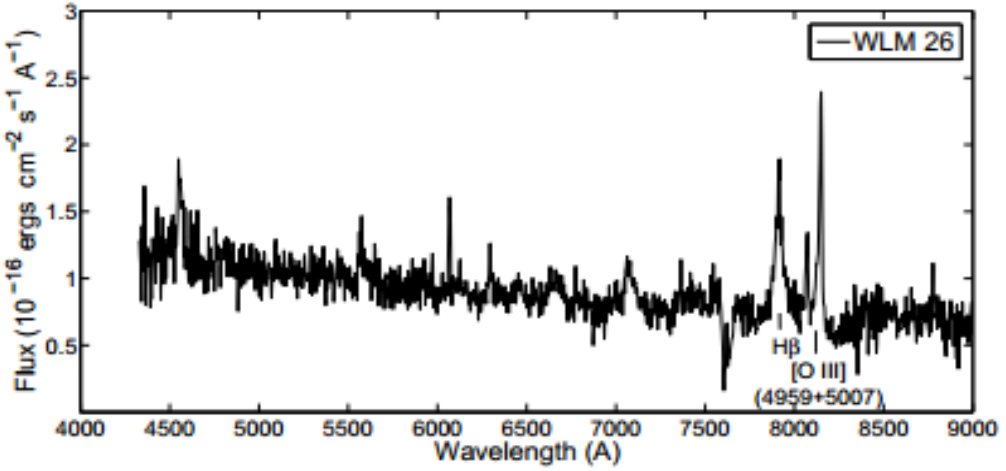

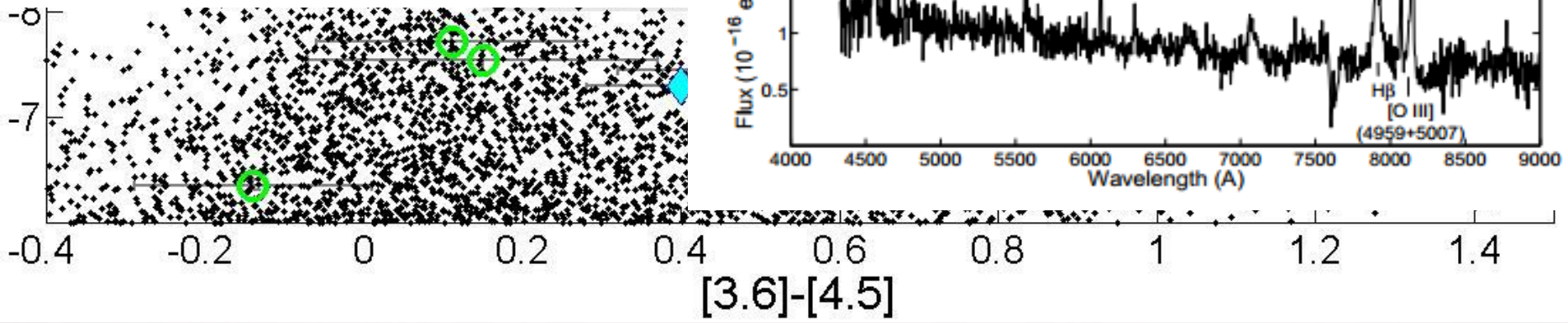

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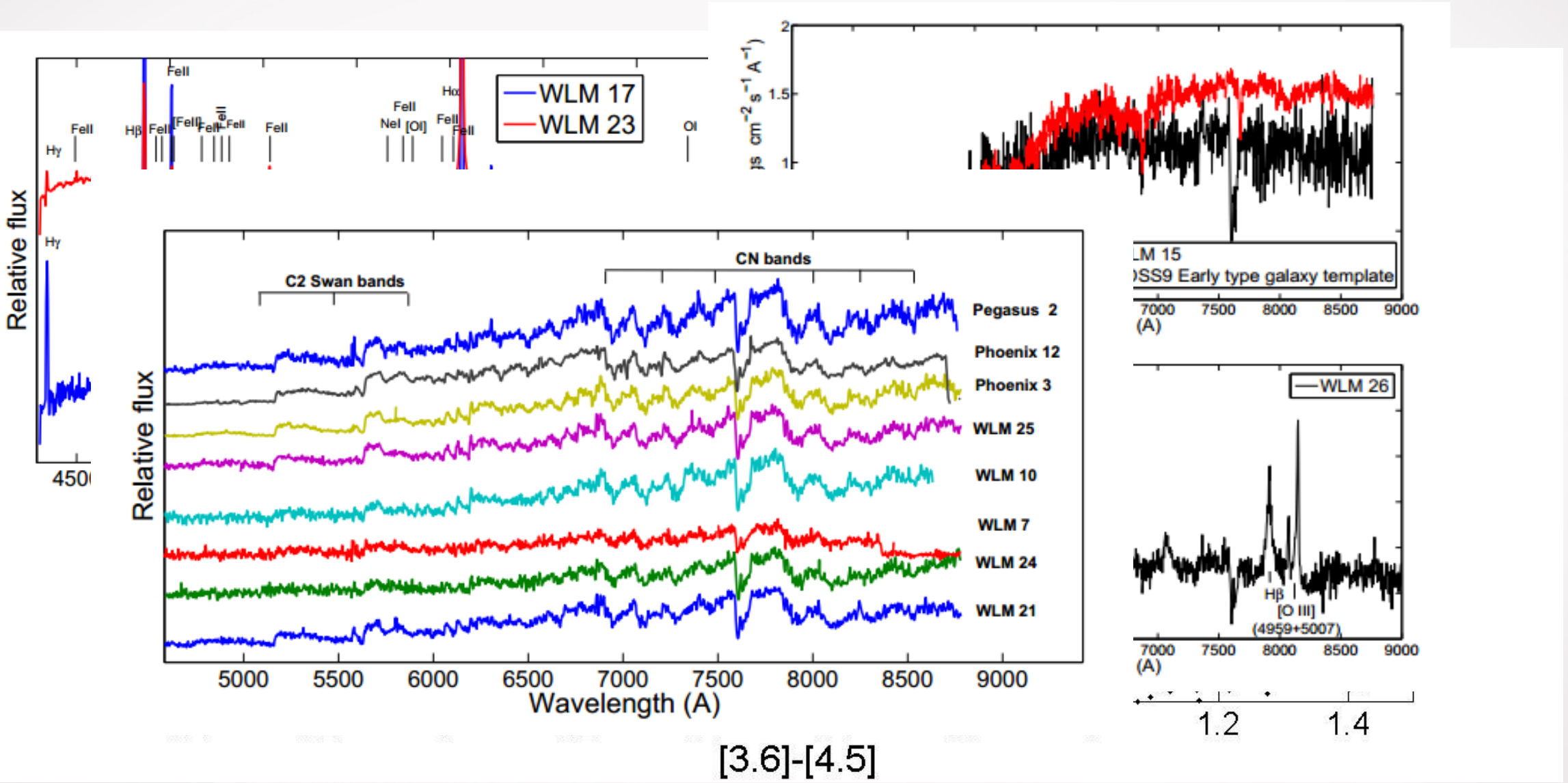

Target classification

ID	All observed targets	Unclassified	Spectral type only	Giants	RSGs	Em. line objects	Background objects	Carbon stars
Pegasus	**11** (+8)	**2** (+7)	**3**	**4**	**2**	**0**	**0**	(+1)
Phoenix	**2** (+12)	**0** (+5)	**2** (+2)	**0** (+2)	**0** (+1)	**0**	**0**	(+2)
Sextans A	**15**	**5**	**2**	**1**	**7**	**0**	**0**	(0)
WLM	**15** (+16)	**5** (+8)	**3** (+1)	**0** (+1)	**4**	**2**	**1** (+1)	(+5)
IC 10	**12**	**0**	**0**	**6**	**6**	**0**	**0**	**0**
IC 1613	**8**	**3**	**2**	**0**	**3**	**0**	**0**	**0**
Sextans B	**5**	**0**	**0**	**3**	**2**	**0**	**0**	**0**
Total	**68** (+36)	**15** (+20)	**12** (+3)	**14** (+3)	**24** (+1)	**2**	**1** (+1)	(+8)
%	**100**	**22**	**18**	**21**	**35**	**3**	**1**	–

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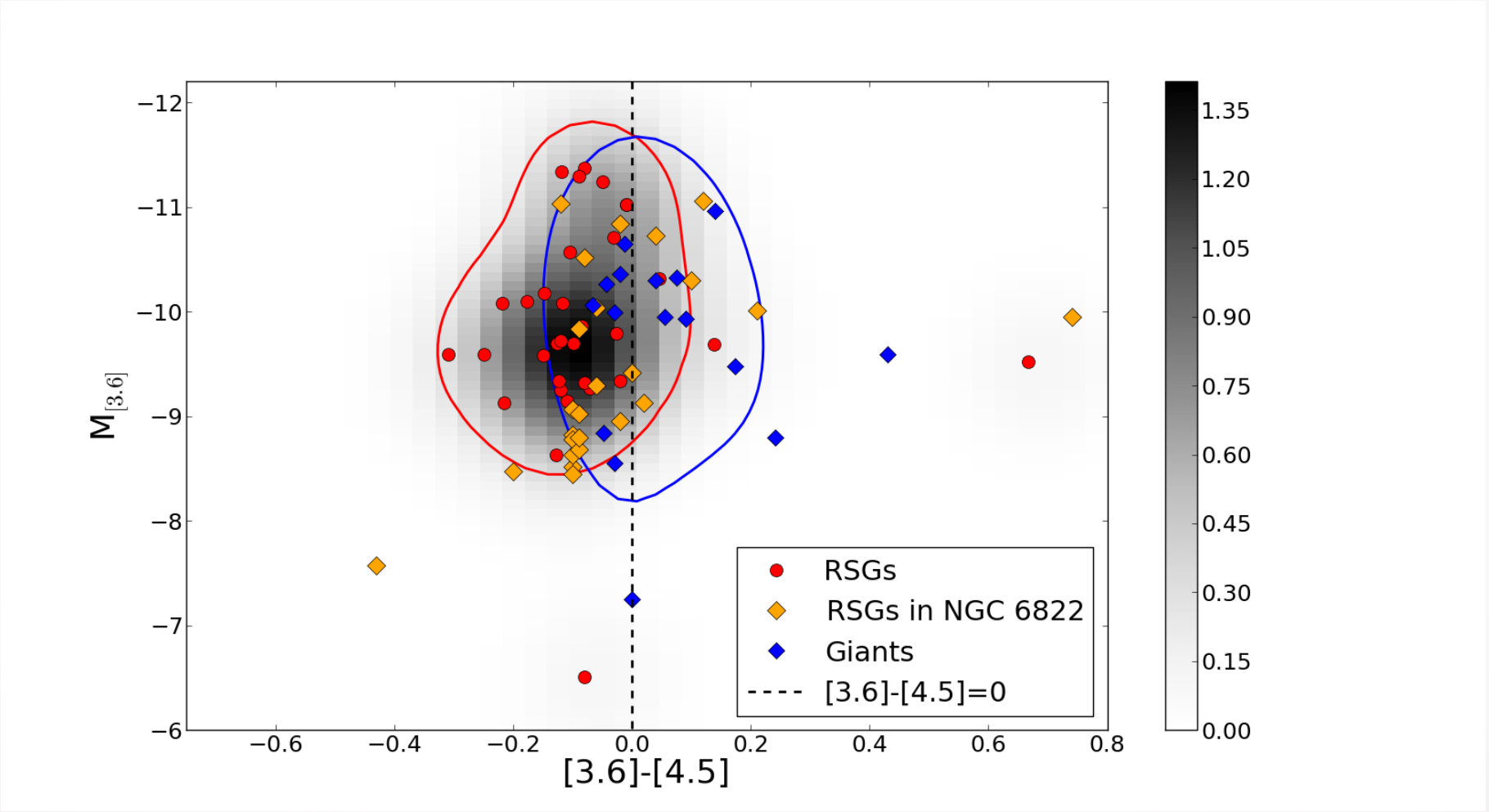
Spectroscopically confirmed RSGs in the Local Group*



* Warning! Excluding M31, M33, SMC and LMC.

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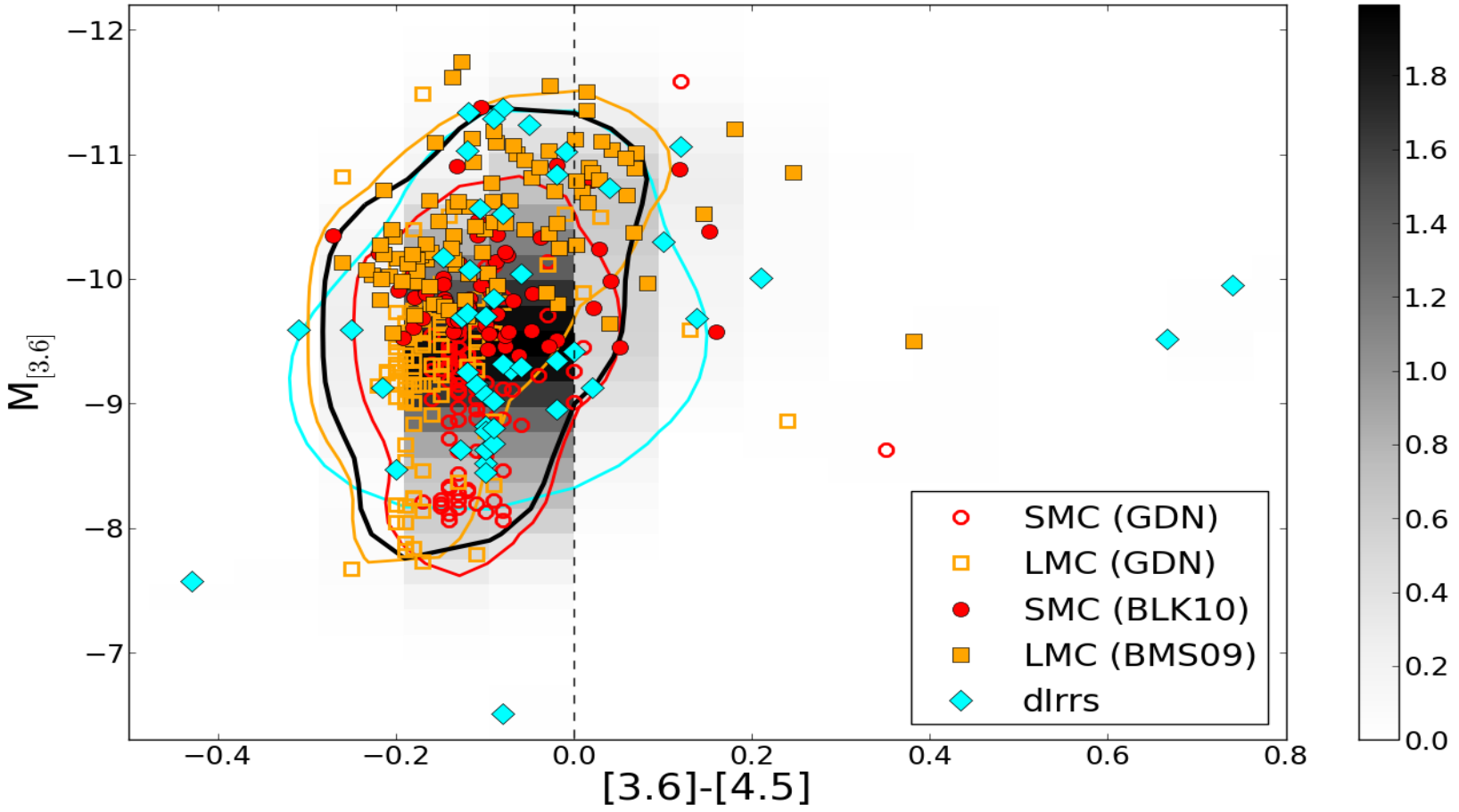

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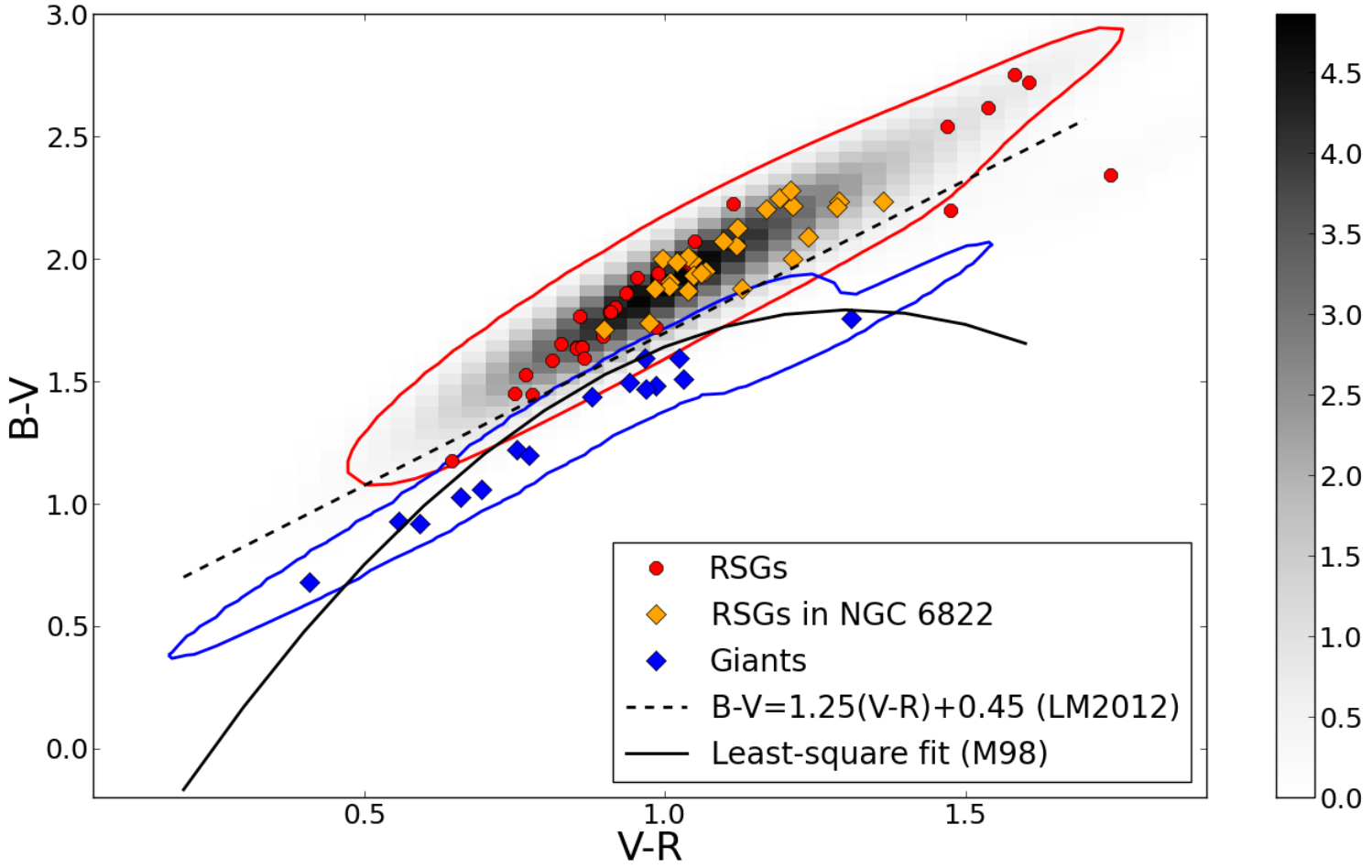

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Future perspectives:

1. Get the physical parameters of newly identified RSGs, such as:
   Radius, effective temperature, gravity, metallicity ...

2. Compare their position on the H-R diagram with evolutionary models.

3. Complete the census of RSGs in the star forming dIrrs in the Local Group (we expect to receive more VLT/FORS2 spectra from WLM during the P95 semester).

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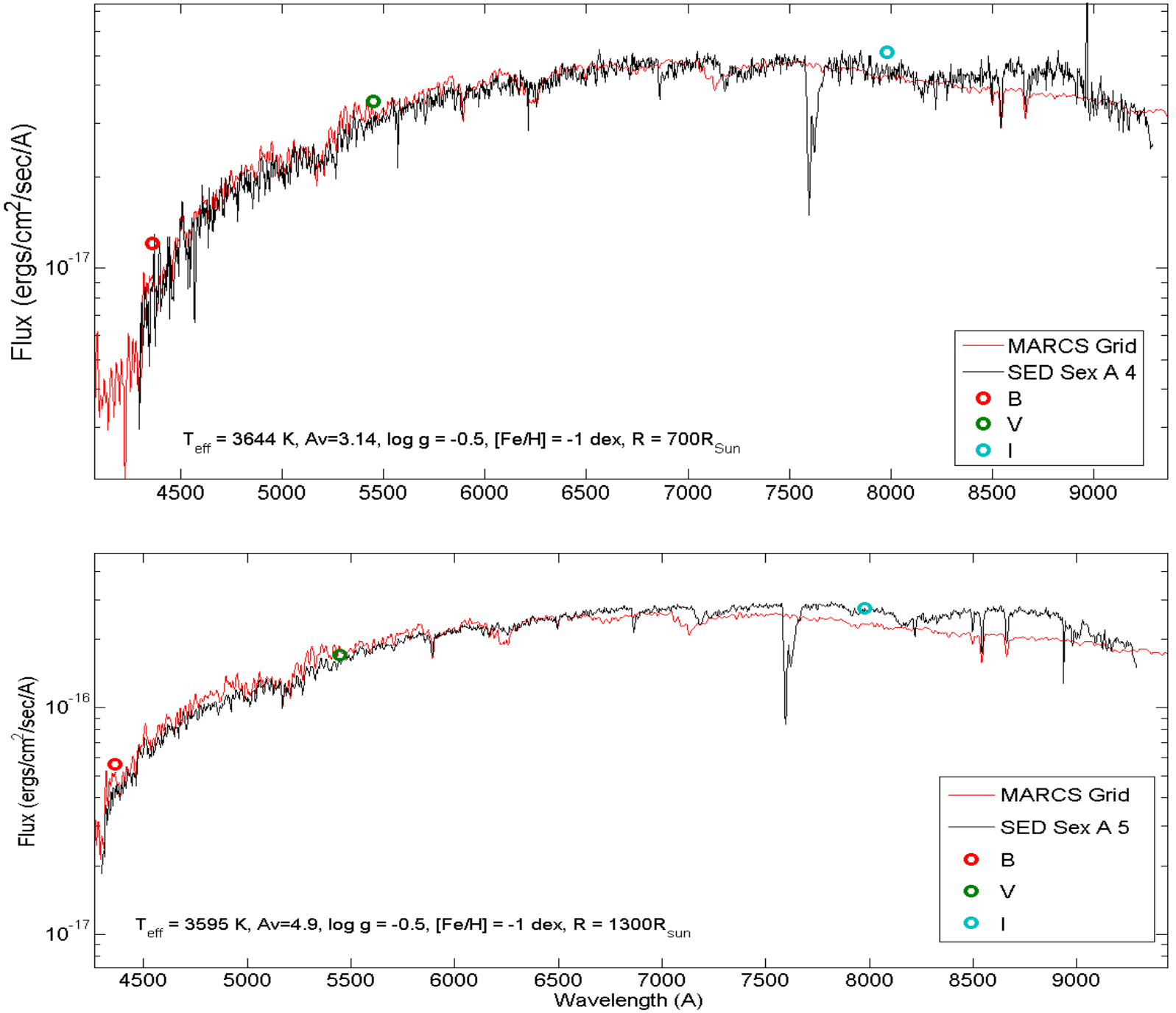

Results

1. **We identified 25 RSGs and 2 emission line objects in 7 star-forming dIrrs galaxies in the Local Group.**

   This work increased the sample of spectroscopically confirmed RSGs in dIrr galaxies in the Local Group by 21 (47 %). Prior to these works, there where 44 RSGs spectroscopically confirmed in dIrrs of the Local Group: 33 RSGs were known in NGC 6822 and 11 RSGs were known in WLM.

2. We performed the revision of optical and mid-IR selections criteria for RSGs.

3. We demonstrated the algorithm of how to use the IR survey for a searching of dusty massive stars in the Local Group...

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This work is published in:

1. Britavskiy et al. 2014A&A...562A..75B

Identification of red supergiants in nearby galaxies with mid-IR photometry.

2. Britavskiy et al. A&A, submitted on April 2015

Identification of dusty massive stars in star-forming dwarf irregular galaxies in the Local Group with mid-IR photometry.

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