The SExOSS Project with S-PLUS:

Search of Extended Objects in the Southern Sky

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OBJECTIVES

- Study the extended sources in the Southern sky to better understand their overall behavior.
- Test well-know photometric relations from broad-band filters for large samples of the southern sky.
- Use narrow-band filters to better characterize these sources and their completeness.

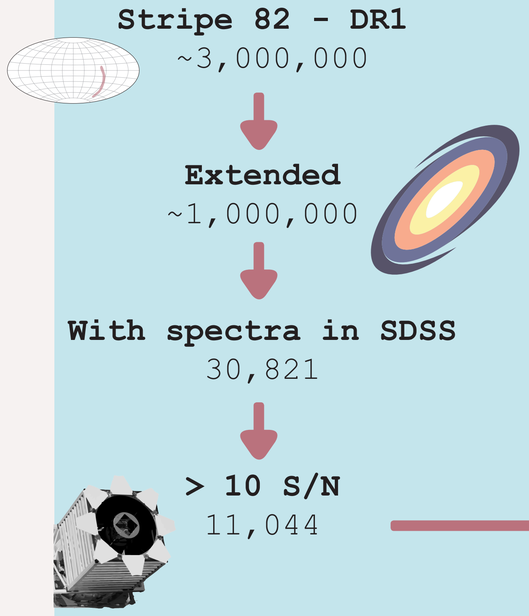
BACKGROUND

Using a robotic 0.8 m-aperture telescope at the Cerro Tololo Interamerican Observatory (CTIO), Chile, **S-PLUS** will collect an unprecedented amount of good quality photometric data in the Southern Hemisphere, thanks to its deepness in 12 (narrow and broad) photometric bands and its sky coverage (it is expected to cover 8000 deg^2).[1]

Since the Southern sky is quite less explored than the Northern one, this is a good opportunity to complete a deep study of the whole celestial sphere.

We propose to analyze the distribution and photometric behavior of the different types of **extended sources** observed with S-PLUS, like Costa-Duarte+[2] did for point sources. Understanding this behavior will allow to explore new possible relations, especially using the **narrow band** information available in this survey.

METHODS



In order to build our samples, we took the first Data Release (DR1) of S-PLUS because it matches with the Stripe 82 from SDSS. We use the sources listed as extended (according to SExtractor) and with **spectra from SDSS**. From this sample, we choose to work with entries that have S/N > 10 for the broad band filter.

We divided the sample into two samples:

- Sample A: all the narrow bands magnitude with S/N < 10.
- Sample B: at least one narrow band magnitude with S/N > 10.

Currently, we are using the available SDSS spectra to perform a blind classification process searching for the following categories:

- Galaxy with emission lines: *shows at least one emission line*
- Quiescent galaxy: *shows no emission lines*
- Quasar: *dominant blue continuum + broad emission lines*
- Blazar: *dominant blue continuum + not or few narrow emission lines*
- Star: *Thermal (Planck-like) continuum + absorption lines at z=0.*

INITIAL RESULTS

As a first step, we built two samples including randomly distributed sources within the DR1. Each subsample has ~250 sources, which we then classified. In Fig. 1 we show the classification distribution for these subsamples.

In Fig. 2 we show the color-magnitude diagram. Our results are in agreement with literature[3] with the caveat that we are not doing a direct morphological analysis. As expected, quiescent galaxies define a sequence while emission line galaxies locate towards bluer photometric colors. This is an indication that our classification in these two classes is reliable.

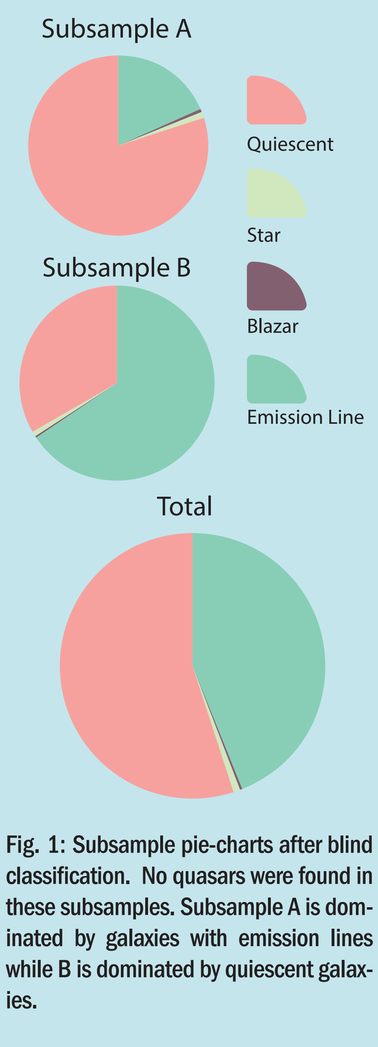


Fig. 1: Subsample pie-charts after blind classification. No quasars were found in these subsamples. Subsample A is dominated by galaxies with emission lines while B is dominated by quiescent galaxies.

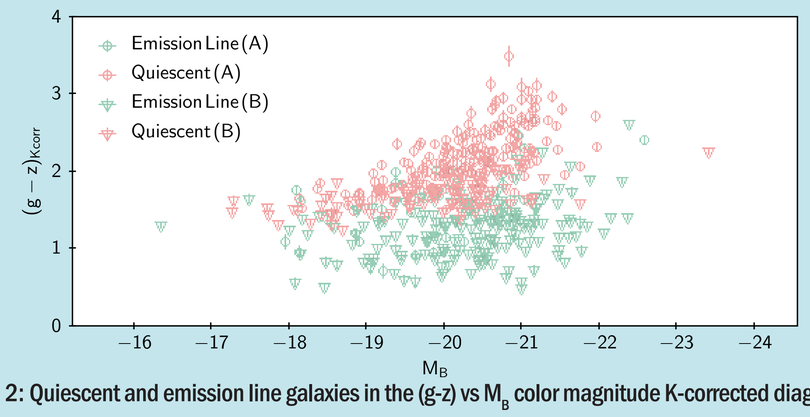


Fig. 2: Quiescent and emission line galaxies in the (g-z) vs M_B color magnitude K-corrected diagram.

We explore new color-magnitude relations, especially focused in narrow band magnitudes from S-PLUS. In Fig. 3 we propose a color-Hα magnitude diagram, in which we find a tendency of quiescent and emission line galaxies to separate from each other in each subsample.

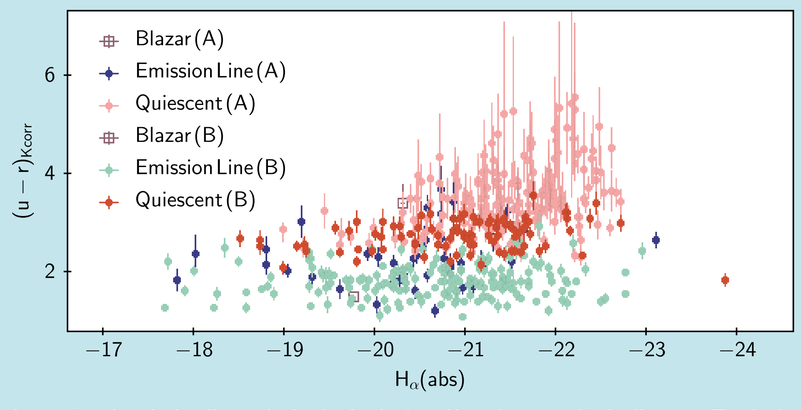


Fig. 3: Quiescent and emission line galaxies in the (u-r) vs. Hα color magnitude diagram. The (u-r) color index is K corrected, while Hα is an absolute magnitude derived from the photometric redshift provided by S-PLUS.

NEXT DIRECTION

- Complete the classification the total sample. Once it is done, we will obtain the distribution of extended objects over the entire stripe 82.
- Continue studying the tendency shown in the Fig. 3, and properly assess the stadistics behind it.
- Explore possible new photometric relations which can enable the development of new classification methods.
- Improve the categories in the classification (eg AGNs, star-formation galaxies, etc)
- Follow up all sources that show uncommon characteristics.

REFERENCES

[1] Mendes de Oliveira, C., et al., 2019, MNRAS, 489, 241
[2] Costa-Duarte, M. V., et al., 2019, MNRAS, 489, 241
[3] Tempel, E., et al., 2011, A&A, 529, 14

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