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S-PLUS: An atlas of integrated Hα fluxes for planetary nebulae in the Magellanic Clouds

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ABSTRACT

We present an atlas of integrated Halpha fluxes for planetary nebulae of the Magellanic Clouds (MC PNe) with measurements from the Southern Photometric Local Universe Survey (S-PLUS), a 12 band (7 narrow and 5 broad) imaging survey that allows us to perform an spatial analysis of the Halpha emission. Aperture photometry on the continuum-subtracted images was performed to extract Halpha + [N II] fluxes of the MC PNe observed by S-PLUS. The dust attenuation and [N II] contribution was corrected with empirical relations. Amongst its many applications, it can provide baseline data for photoionization and hydrodynamical modelling, and allow better estimates of Zanstra temperatures for PN central stars with accurate optical photometry. The weak nebular emission of the PNe were also analyzed to investigate the structure of the MC PNe further, for which the Halpha surface brightness was estimated. The densities in the nebulae of the PNe were also measured using the previously estimated surface brightness. These results were compared with previous measurements from the literature. The preliminary results of this study are present in this contribution.

Key words: planetary nebulae: general – ISM: lines and bands – surveys

1 INTRODUCTION

The Small Magellanic Cloud (SMC) is a gas-rich late-type dwarf galaxy (Bolatto et al. 2007) with a gas-to-dust ratio 30 times higher than the Milky Way (Stanimirovic et al. 2000). The SMC is one of the closest and most prominent neighbors of the Milky Way, is a southern hemisphere dwarf galaxy of low mass ($M_{\rm dyn} \sim 2.4 \times 10^9 M\odot$; Stanimirović et al. 2004) and and small size ($R_* \sim 3$ kpc). It is a member of the Local Group and is classified as an irregular galaxy (ImIV−V) (Sandage et al. 1994). The SMC is at a distance of 60.6±3.8 kpc (Hilditch et al. 2005) from the Galaxy which makes the spatial scale ∼0.3 pc/arcsec.

2 METHODOLOGY

2.1 Observations: the S-PLUS project

This manuscript uses data from the S-PLUS DR4, which covers 3,000 square degrees of the southern sky. The S-PLUS DR4 can be accessed in the database of the project, `S-PLUS Cloud`[1]. S-PLUS is being carried out by a dedicated 0.83m robotic telescope located at Cerro Tololo, Chile (Mendes de Oliveira et al. 2019). The project is surveying the southern sky using the 12 filters from the so-called Javalambre filter system (Marín-Franch et al. 2012), which spans the wavelength range from 3000Å to 10000Å. The system includes seven narrow-band filters (*J*0378, *J*0395, *J*0410, *J*0430, *J*0515, *J*0660, and *J*0861) and five broad-band Sloan-like (Fukugita et al. 1996) filters (see Fig. 1). The narrow-band *J*0660 filter used in S-PLUS is centred at lambda 6614 Å and has a width of about 147 Å (Table 2 of Mendes de Oliveira et al. 2019), and therefore it covers both the Hα and the doublet [N II] $\lambda\lambda$6548, 6584 spectral lines for sources up to a redshift of approximately 0.02.

2.2 PNe in the Magellanic Clouds

3 RESULTS

4 CONCLUSIONS

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The Acknowledgements section is not numbered. Here you can thank helpful colleagues, acknowledge funding agencies, telescopes and facilities used etc. Try to keep it short.

DATA AVAILABILITY

The inclusion of a Data Availability Statement is a requirement for articles published in MNRAS. Data Availability Statements provide a standardised format for readers to understand the availability of data underlying the research results described in the article. The statement may refer to original data generated in the course of the study or to third-party data analysed in the article. The statement should describe and provide means of access, where possible, by linking to the data or providing the required accession numbers for the relevant databases or DOIs.

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[1] https://splus.cloud/

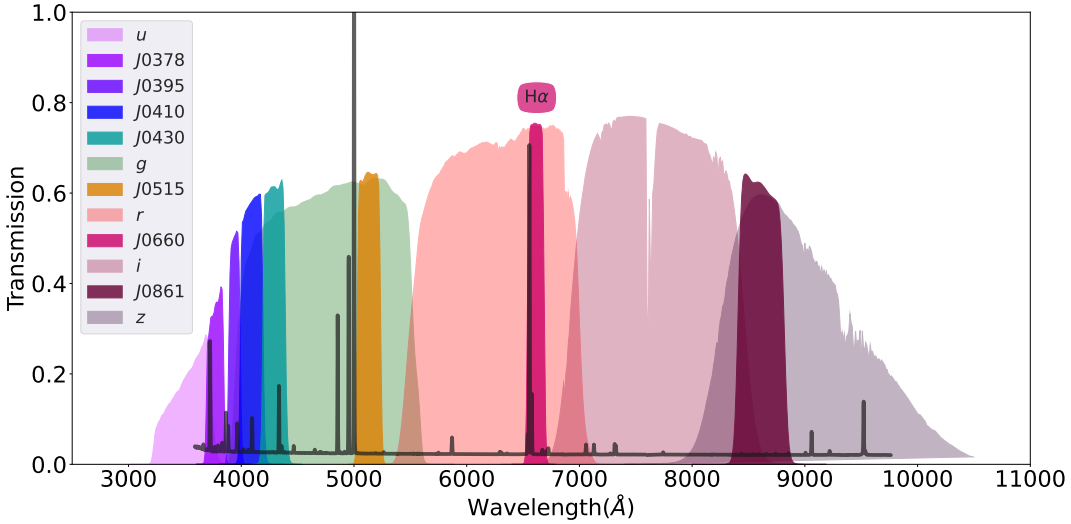

Figure 1. Transmission curves of the S-PLUS filter set. The narrow-band filter $J0660$ includes the Hα emission line. Over-plotted is a spectra of typical SMC PN.

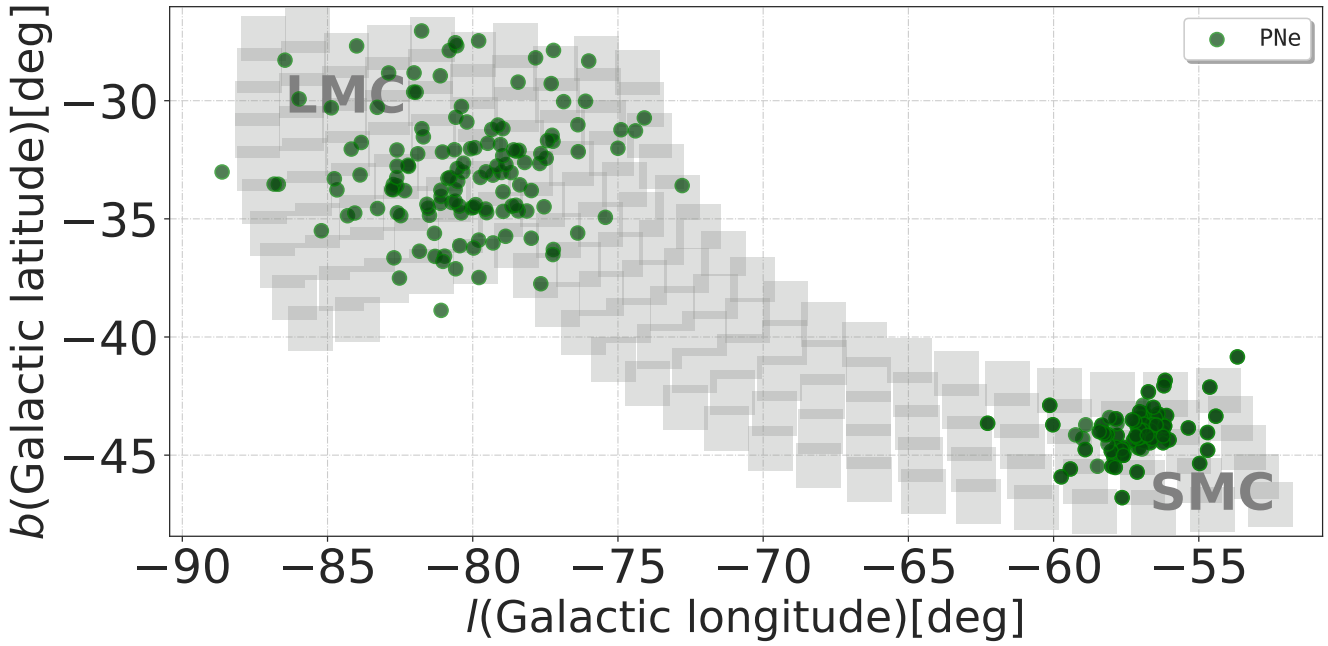

Figure 2. Transmission curves of the S-PLUS filter set. The narrow-band filter $J0660$ includes the Hα emission line. Over-plotted is a spectra of typical SMC PN.

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APPENDIX A: SOME EXTRA MATERIAL

If you want to present additional material which would interrupt the flow of the main paper, it can be placed in an Appendix which appears after the list of references.

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