

# Photometric searches for metal-poor stars in the Sculptor and Tucana II dwarf galaxies

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## Introduction

Metal-poor stars in dwarf galaxies have provided key insights on early chemical evolution. However, searches for metal-poor stars in dwarf galaxies have excluded the faintest stars ( $V > 19$ ) and are affected by the preponderance of halo stars due to efficiency limitations from spectroscopy.

Searching for and characterizing metal-poor stars with photometry (imaging) is a promising venue to address these bottlenecks. Collecting photometry is less time-intensive than spectroscopy and orders of magnitude more stars can be observed simultaneously. However, extracting chemical information from photometry requires novel filters and analysis.

## Observations

- We obtained photometry of Tucana II and Sculptor using the SkyMapper filter-set (see below figure)
- The flux through the novel SkyMapper v-filter, which covers the prominent Ca II K line at 393.37nm, is particularly sensitive to stellar metallicity
- We obtained R~700 grism spectra of 1000 stars in Sculptor and R~8000 spectra of 40 stars in the Tucana 2 field. We use these data to obtain independent metallicity estimates

## Methods

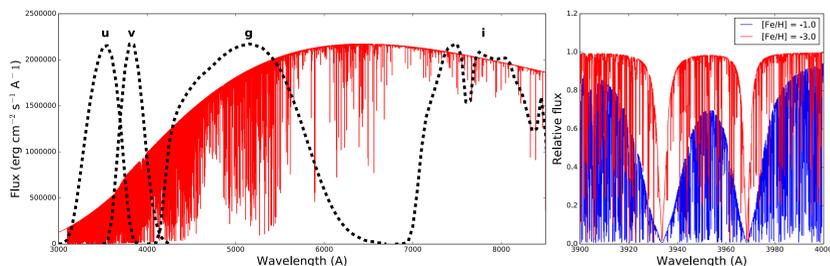


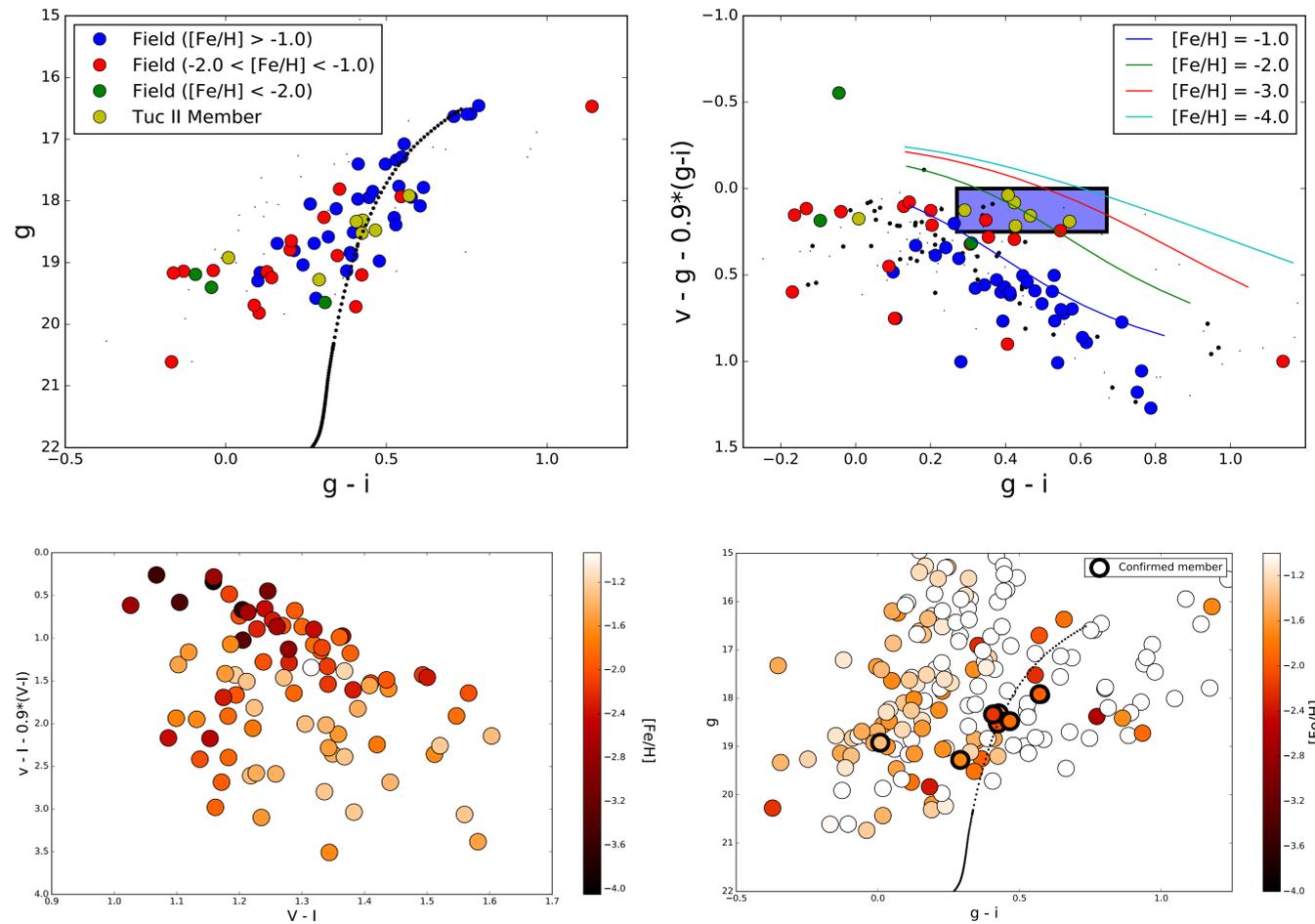
Table 1: Flux calibrated synthetic spectra

Parameter	Minimum	Maximum	Step
$\lambda$	3000 Å	8500 Å	0.01 Å
$T_{\text{eff}}$	4000 K	5700 K	100 K
$\log g$	1.00 dex	2.00 dex	0.50 dex
[Fe/H]	-4.00 dex	-0.50 dex	0.50 dex

- To quantitatively relate fluxes to a metallicity, we computed predicted fluxes on a library of flux-calibrated synthetic spectra generated using the Turbospectrum code (see above table).

- Preliminary results suggest that our SkyMapper data reduction gives uncertainties of  $\sim 0.05$  mag at  $g \sim 19$ , which our grid suggests is a metallicity uncertainty of 0.40 dex. However, this is expected given the coarse metallicity step size in our grid

## Results



**Top left:** CMD of Tucana II from SkyMapper photometry. **Top right:** Color-color plot of stars in the Tucana II field of view. Metal-poor stars and Tucana II members inhabit the shaded region. Metallicities and members are from Walker et al. 2016. Synthetic photometry curves are over-plotted. **Bottom left:** Color-color plot of Sculptor with literature metallicities as the color scale. Only v band data was observed for Sculptor, so supplemental photometry from Coleman et al. (2005) was used. **Bottom right:** Tucana II CMD overlaid with our metallicity measurements using the sample from Walker et al. as reference (rms $\sim 0.4$  dex).

- Preliminary results suggest that our photometry of Tucana II permits us determine metallicities of stars down to  $g \sim 19$  to a precision of 0.40 dex
- Based on observations, this precision appears sufficient to determine whether stars are members of Tucana II solely on the basis of chemical information
- Future work will attempt to refine the metallicity calibration by extending the synthetic grid to a broader stellar parameter range and refining the step size, using existing spectroscopic observations, and incorporating fluxes from the SkyMapper u-band filter

## References

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