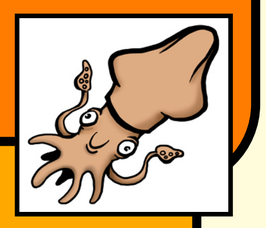
Tunable Filter Absorption Line Spectroscopy of the Galactic Bar
Metallicity gradients



The CALAMARES[1] collaboration:

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1: CALcium triplet And Metallicity Analysis in two REgions of the galactic bar with tunable filter pseudo-Spectra

Abstract

The stellar metallicity distribution of stars can be a very useful tool to constrain the chemical evolution models reproducing different formation scenarios for the Galactic bulge. However, classical spectroscopy of individual stars is observationally expensive, and the surveys done so far have been unsuccessful due to the low number statistics. Recently, the advent of tunable filter tomography has opened a new way to obtain low resolution spectroscopy of large samples of stars. Here, we present preliminary results on an ongoing study to measure the stellar metallicity at two different positions along the Milky Way bar (l=15deg and l=27deg) using the GTC-OSIRIS red etalon. Our metallicity measurements will be based on the Ca II triplet observed in red clump giants, which has been proved a good tracer of metallicity, and has been calibrated with the [Fe/H] content in previous investigations.

Observations

- Two different fields in the galactic plane were observed using the Tunable Filter mode of OSIRIS@GTC.
- These two fields, located at (l=27, b=0) and (l=15, b=0), are intended to survey the central and external part of the Milky Way bar.
- Every field was scanned at 25 different wavelengths, separated by 10 Å, and with a FWHM ~10 Å.
- TF scans typically cover the wavelength range from 8400- 8700 Å.
- We obtain a sample of 5900 stars for field l=27 and 1600 stars for field l=15.

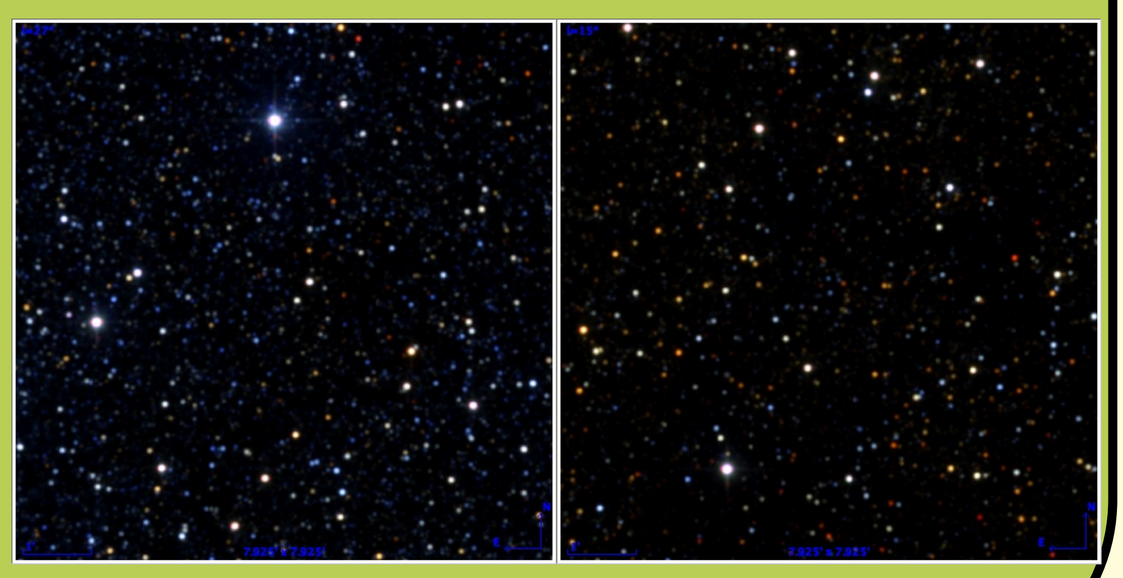

Fig. 1: Infrared images of our selected fields at l=27° (left) and l=15° (right)

Metallicity calibrators

- Following Cabrera-Lavers et al. (2007, A&A, 465, 825), we identified the Red Clump Giant stars in our observed fields using the near-infrared color-magnitude diagram *J-K vs K*, built from UKIDSS photometry.
- We finally obtained a subsample of 600 red clump giants in field l=27 and 110 in field l=15.
- The selected stars will be used for the metallicity measurements.

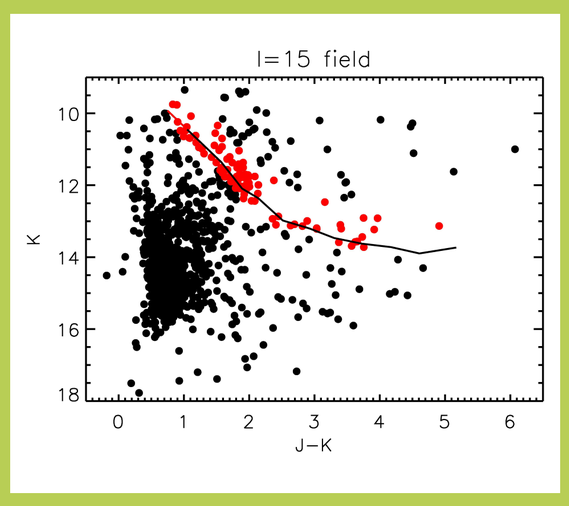

Fig. 3: Near-infrared color magnitude diagram of the l=15° field, used to select Red Clump Giant stars from our sample of observed sources.

Pseudo-spectra

After applying basic data reduction procedures and the astrometric solution, PSF photometry was performed on the separate images to produce instrumental magnitudes for all sources in each TF scan (i.e. wavelength). These were merged to produce a final catalog per field, which lists the measured fluxes from all images for all targets in the observed region. Estimated instrumental errors amount to less than 0.03mag in all filters.

These data, plotted against the wavelength corresponding to the position of the star in each TF scan, form a pseudo-spectrum. The flux datapoints were calibrated relative to a MARCS model with Teff=4500 K and log *g*=3 (http://marcs.astro.uu.se/).

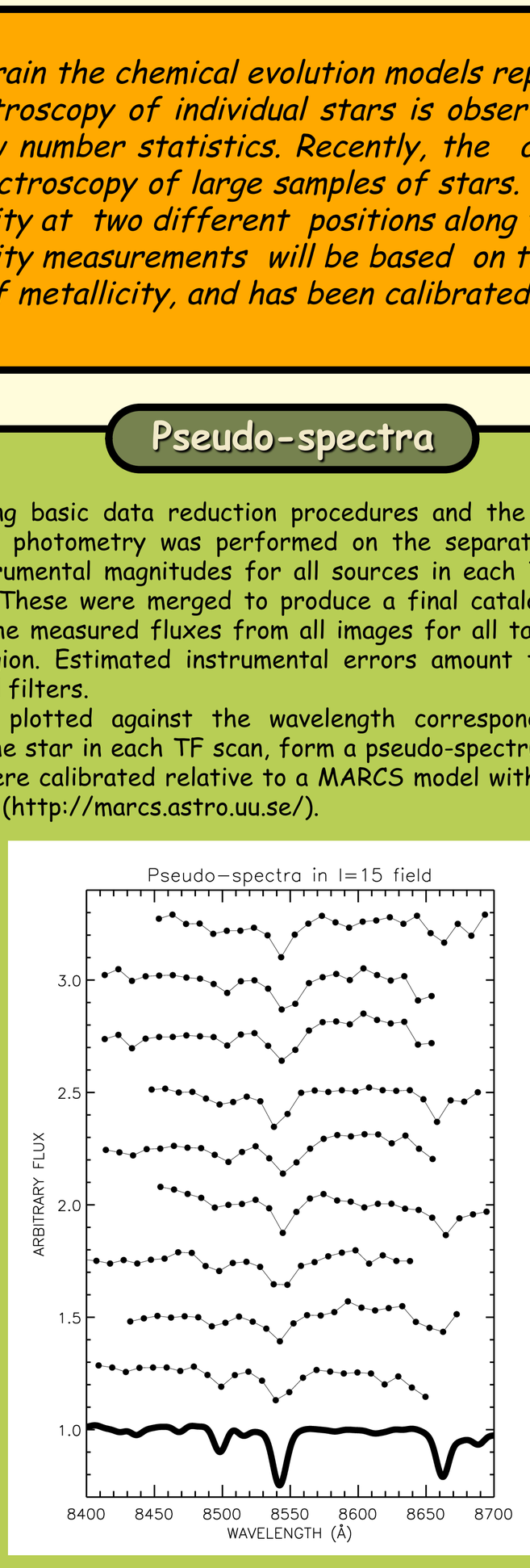

Fig.2: Example pseudo-spectra for 9 red-clump giants observed in field l=15. Each point represents the calibrated flux measured in each TF-scan. The solid line shows the MARCS model used for the flux calibration. The Ca II absorption lines are visible in the pseudo-spectra.

Future Work

- Measure the equivalent width of the Ca II lines in the selected Red Clump Giant stars.
- Use an empirical calibration (Cole et al. 2004; Starkenburg et al. 2010) to derive the stellar metallicity, and produce an estimate of the [Fe/H] content at the two different regions.
- Test the existence of a metallicity gradient within the bar of our galaxy.
- Compare the results with the model predictions, and provide constraints on the formation of the bulge and the bar.

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