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Towards elemental abundance gradients in the thin and thick disk of NGC300 from full spectral fitting

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Motivation

The disk of spiral galaxies can be decomposed into a thin component, which is young and metal-rich and a thick component, which is old, metal-poor but enriched in α-elements. The study of thin-thick structure is mainly performed in the Milky Way and on edge-on spiral galaxies. The disadvantage of edge-on galaxies is that only the regions above/below the disk plane can be probed. We therefore present a novel approach. We have obtained high signal-to-noise spectra at different positions in the face-on spiral galaxy NGC 300. We aim to decompose the stellar populations into an old component, the thick disk, and a young component.

Observations

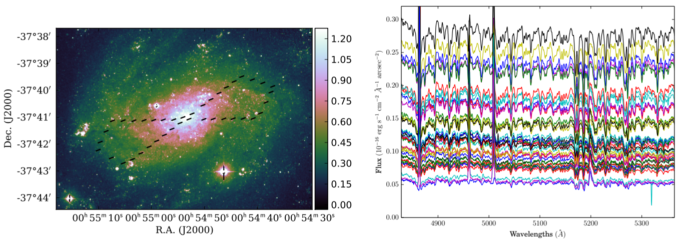

Figure 1: The positioning of the slits on NGC 300 at the left and the reduced spectra at the right.

We obtained a total of 26.5 hours of spectroscopic observation time of the pure disk galaxy NGC 300 with the VLT-FORS2 instrument. Since NGC 300 fills the whole field of view of the VLT-FORS2 instrument, we obtained separate sky observations. Unfortunately, these observations were not made for every night, and the sky subtraction is therefore difficult.

Method

We are fitting these spectra with model spectra using the full spectral fitting code PARADISE. The model spectra that we use are differential stellar population models (Walcher et al. 2009). Differential stellar populations have the advantage of combining good spectra at solar metallicity, which are obtained from semi-empirical libraries, with fully-theoretical models which accurately trace spectral changes from iron and from α-patterns. We use an updated version of the theoretical models from Coelho et al. (2007) that trace the metallicity down to [Fe/H] = -1.3 and ages down to 30 Myr. The fitting can thus be used to both trace the old and metal-poor thick disk and the young and metal-rich thin disk.

Preliminary results

We derived gradients for the overall disk. The age gradient is -1.3 Gyr/kpc. The gradient in [Fe/H] is -0.08 dex/kpc and the gradient in [α/Fe] equals -0.011 dex/kpc. These gradients are calculated from the slitlets in the inner 1.2 kpc. The outer slitlets are likely affected by sky subtraction residuals. Our gradients are comparable to literature gradients. Kudritzki et al. (2008) uses A super-giants to trace the total metallicity and finds a gradient of -0.08 dex/kpc. This is identical with our value for [Fe/H], but their central metallicity of [Z]=-0.06 differs from our central metallicity of [Fe/H]=-0.23. Urbaneja et al. (2005) determined gradients in [Mg/H] from six early B-type supergiants. Their gradient in [Mg/H] of -0.064 dex/kpc is slightly less steep than our gradient of [α/H] = -0.09 dex/kpc. Our central value for [α/H] of -0.48 is slightly lower than their central value for [Mg/H] of -0.39.

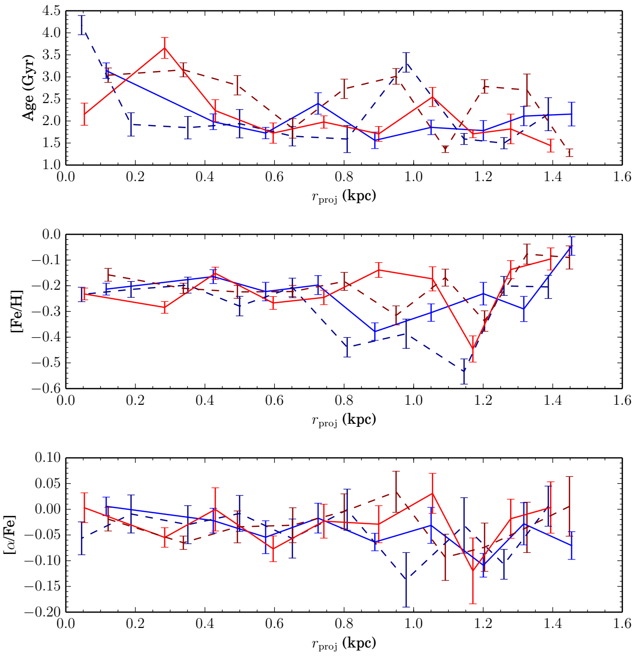

Figure 2: The gradients for age, [Fe/H] and [α/Fe] along the diagonals from the centre.

Summary and outlook

By obtaining the distribution of stars in the three-dimensional space of ages, [Fe/H] and [α/Fe] at different radii, we will obtain different gradients for both the thin and thick disk. We already derived gradients for the disk as a whole. In the future, we will attempt to apply the analysis to late-type galaxies in the CALIFA survey.

References

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