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The thick disc according to Gaia-ESO

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Abstract. In the era of large spectroscopic surveys, it is vital that selection effects are taken into account when making conclusions about the stellar populations of the Galaxy. Here we use the Galactic disc sample of stars from the Gaia-ESO Survey internal data release 4 (GES iDR4), applying the published selection function to characterise the vertical extent of the chemically defined thick and thin discs.

Keywords. Galaxy: disk, Galaxy: structure, Galaxy: stellar content, Galaxy: abundances

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Gaia-ESO (Gilmore *et al.* 2012) has observed and analysed more than 12 000 field stars so far in the Milky Way disc using FLAMES/GIRAFFE on the VLT. The majority of these stars are out of the Galactic plane, making the sample an excellent probe of the vertical gradients in the thin and thick discs. Here we have used the measurements for Mg and Fe to examine the differences between the chemically defined disc, where alpha-rich are considered thick disc, and alpha-poor are considered thin disc. As can be seen in Figure 1, the sample covers both regions of abundance space, without a clear separation between the two. The separating line is taken from similar past studies (e.g., Bensby *et al.* 2014; Recio-Blanco *et al.* 2014; Kordopatis *et al.* 2015).

In creating Figure 1, crucially each star has been given a weight, taken from Stonkutė *et al.* (2016), to counter the effect that the survey's selection may have had on the trends. Distances are calculated using the BeSPP (Serenelli *et al.* 2013). Each star is represented by a probability distribution, calculated based on the likelihood of the star falling in a certain region of space (e.g., $6.0 < R < 7.5$ and $|Z| < 0.3$ kpc), the weight given to the star by the selection function, and the size of the error bars in [Fe/H] and [α/Fe] (represented as Gaussians). Each plot has more than 150 stars.

Close to the plane, nearly all stars are metal-rich, alpha-poor. Only at a height of ~ 0.5 kpc does an alpha-rich population start to grow. This transition occurs more quickly in the inner disc (blue), which also has a much larger variation in [Fe/H] as one moves above the plane. The sample does not seem to include many thin disc stars at metallicities lower than Solar, perhaps due to the targeting of fields out of the plane. Thick disc stars make up the majority of the population in the inner disc region above 0.5 kpc, but for $R > 8.5$ kpc, the thin disc forms a significant population at all heights, including $|Z| > 2.0$ kpc. These results agree with previous work by Bensby *et al.* (2011), and the APOGEE survey (Hayden *et al.* 2015).

The lack of separation between the thin and thick disc components could be real, however the large uncertainties in the distances to these stars mean that it is impossible to tell. Parallaxes from *Gaia* DR2 (*Gaia* Collaboration *et al.* 2016) will allow us to reduce these significantly, and so resolve the crucial detail in these abundance plots.

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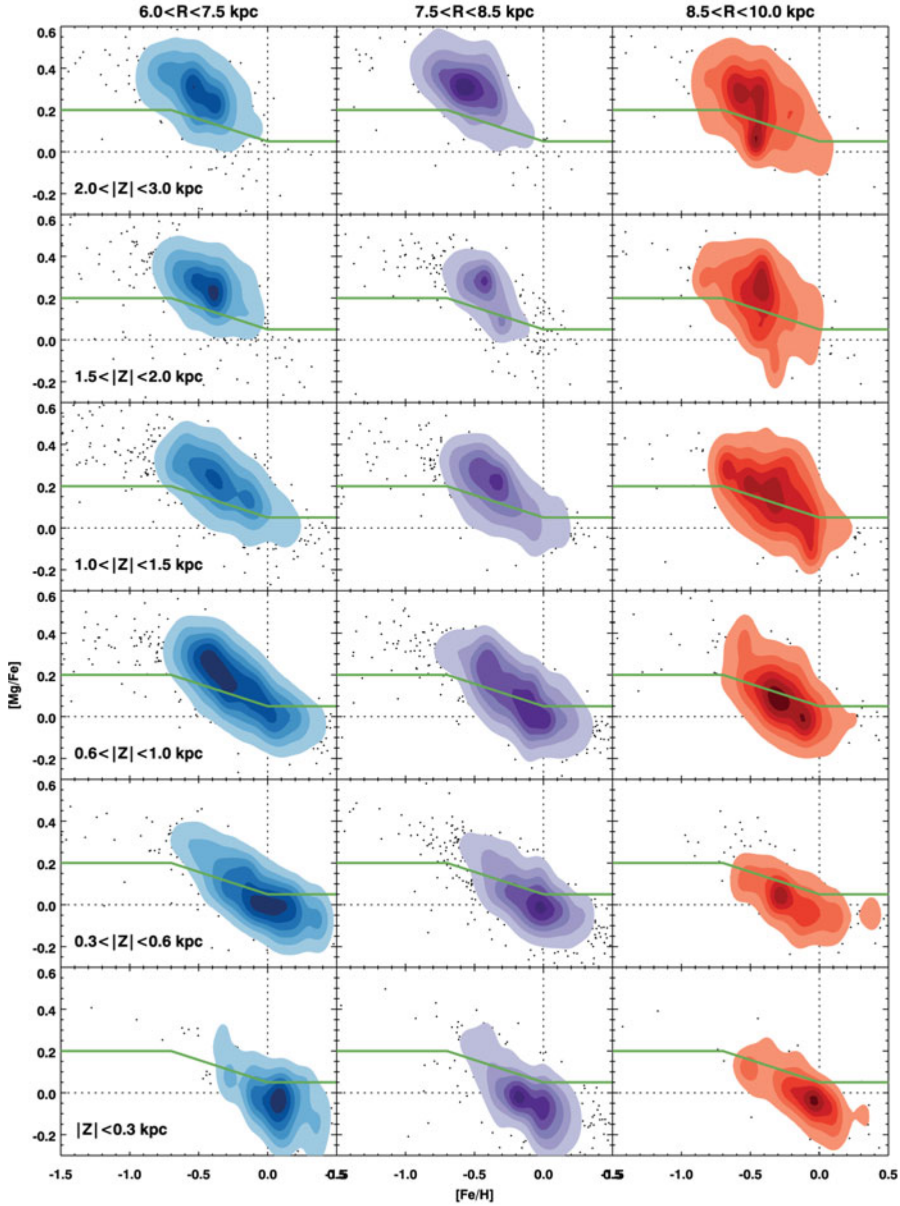

Figure 1. Abundance plot split into bins according to position in the Galaxy. Each star is represented by a probability distribution function of its distance from the Sun; each bin contains the fraction of the PDF that falls in that bin, summed over all stars.

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