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What the Milky Way bulge reveals about the initial metallicity gradients in the disc

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Abstract. We examine the metallicity trends in the Milky Way (MW) bulge – using APOGEE DR13 data – and explore their origin by comparing two N-body models of isolated galaxies which develop a bar and a boxy/peanut (b/p) bulge. Both models have been proposed as scenarios for reconciling a disc origin of the MW bulge with a negative vertical metallicity gradient. The first is a superposition of co-spatial disc populations, different scaleheights and metallicities (with flat gradients) where the thick, metal-poor populations contribute significantly to the stellar mass budget in the inner galaxy. The second model is a single disc with an initial steep radial metallicity gradient which gets mapped by the bar into the b/p bulge in such a way that the vertical metallicity gradient of the MW bulge is reproduced – as shown already in previous works in the literature. As we show here, the latter model does not reproduce the positive longitudinal metallicity gradient of the inner disc, nor the metal-poor innermost regions seen in the data. The model with co-spatial thin and thick disc populations reproduces all the aforementioned trends. We therefore see that it is possible to reconcile a (primarily) disc origin for the MW bulge with the observed trends in metallicity by mapping the inner thin and thick discs of the MW into a b/p.

Keywords. Galaxy: bulge, Galaxy: abundances, Galaxy: disk

1. Results

We show in Fig. 1 the metallicity map for the Milky Way (MW) bulge from APOGEE DR13 and for the two models considered. We see that while M2 (Martinez-Valpuesta *et al.* 2013) can reproduce the vertical metallicity gradient in the bulge it does not reproduce the global metallicity trends. On the other hand, we see that M1 reproduces well all the trends seen in the data, such as the vertical and longitudinal gradients, and

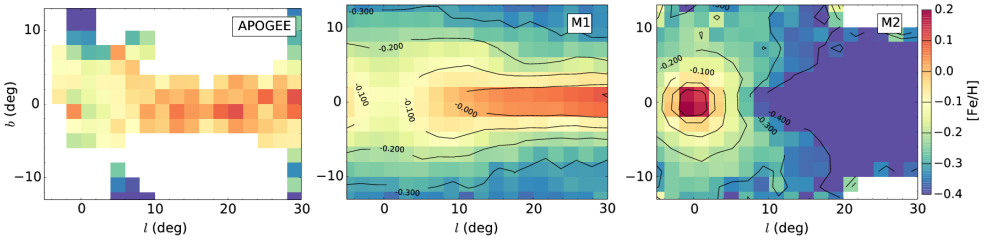

Figure 1. Mean metallicity along the line of sight as a function of galactic longitude l and galactic latitude b for the APOGEE DR13 data (left), model `M1` (middle) and model `M2` (right).

the metal-poor inner regions. We can thus reconcile the disc-origin of the MW bulge with a thin+thick disc model, without the need for an initial steep metallicity gradient.

Reference

Martinez-Valpuesta, I.,& Gerhard, O. 2013, *ApJ*, 776, L3

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