Origin of the metallicity distribution in the thick disk

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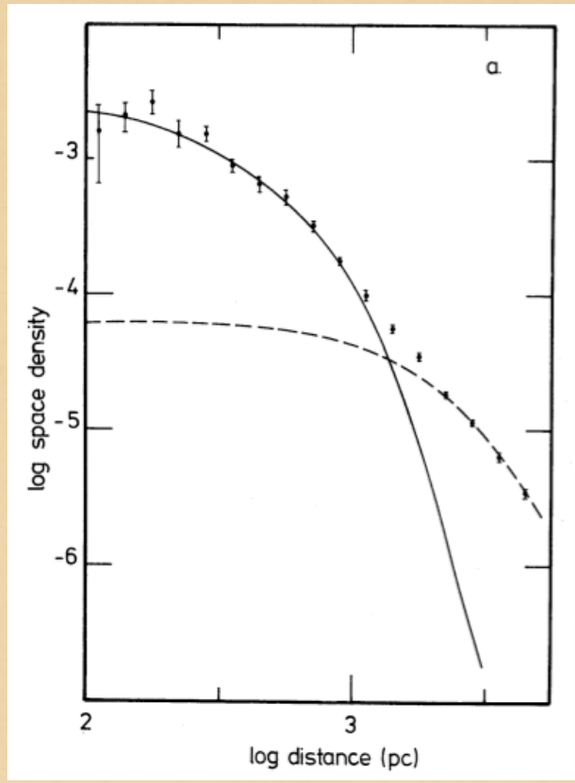
Introduction

✦Gilmore & Reid (1983) ➡ thin disk
thick disk



Gilmore & Reid (1983)

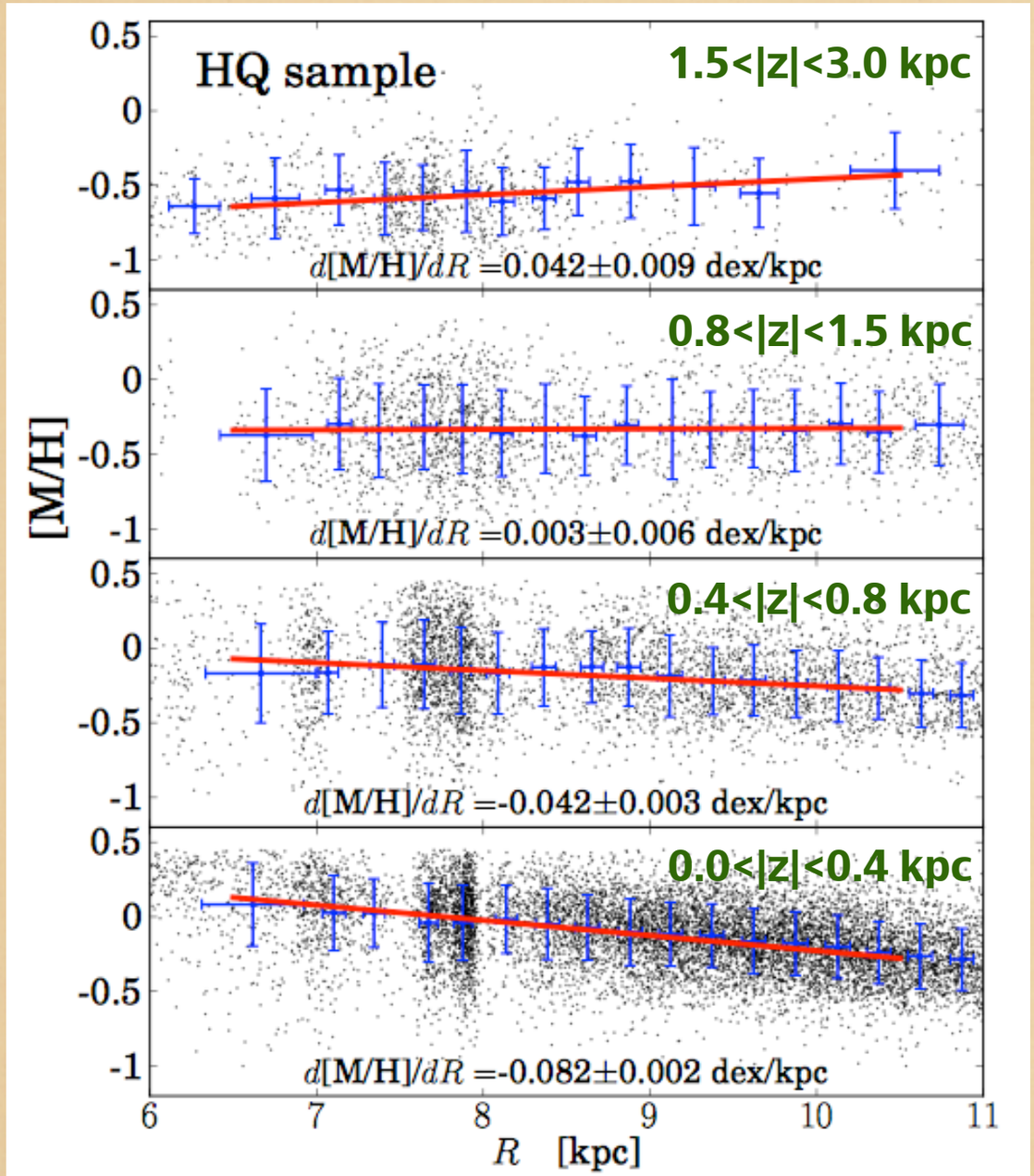
✦Shaver+ 1983 ➡ metals not homogeneously distributed

✦Metallicity gradients allow to test galaxy formation and evolution scenarios

✦Do thin and thick disks follow the same metallicity trends?

Motivation

- APOGEE data
- Red giant sample



Anders+ 2014

- Negative gradient in the plane
- Positive gradient at high |z|
- Why?
- Do simulations follow those trends?
- Try to explain the formation and evolution of the MW

Simulations

✦Spiral galaxies with comparable mass to the MW

MaGICC-g1536

✦MUGS (g1536, g15784)
-SPH code gasoline
-Conventional feedback

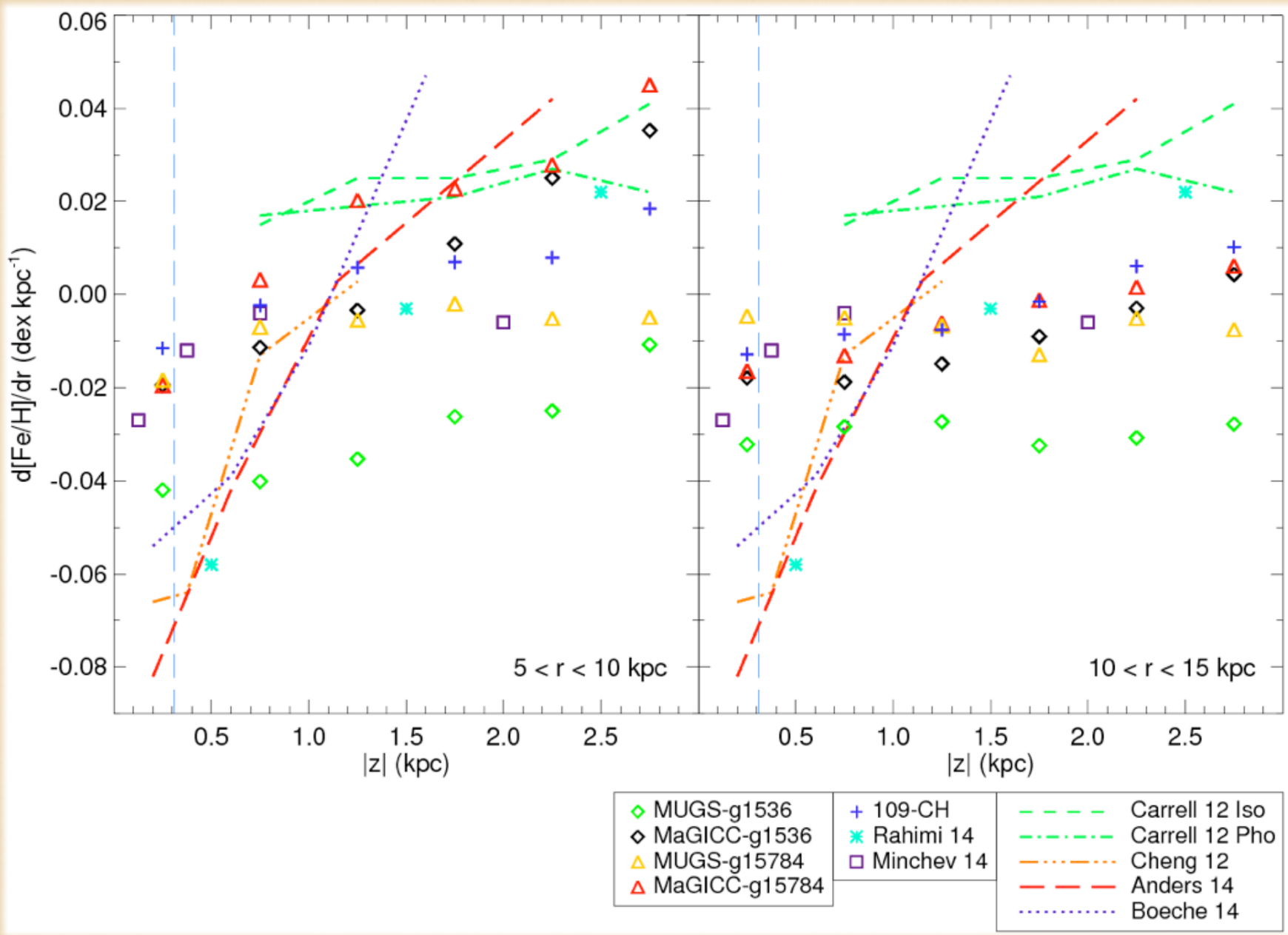
✦MaGICC (g1536, g15784)
-SPH code gasoline
-Enhanced feedback

✦RaDES (109-CH)
-AMR code RAMSES-CH
-Hybrid feedback

Radial [Fe/H] gradient

✦Gradient increases with |z| and inverts at ~1kpc

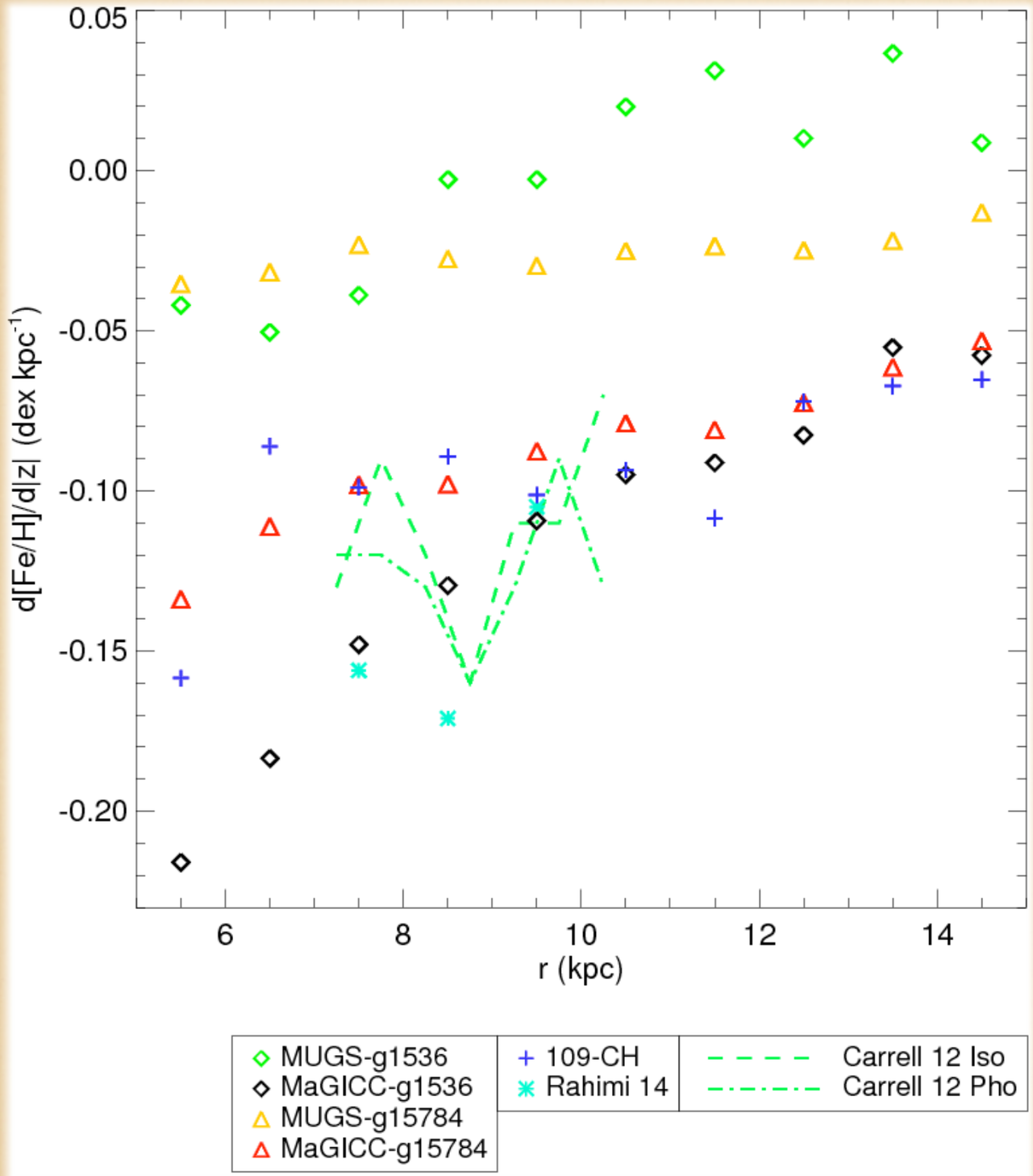
✦At high radius: flatten



✦Best fit:

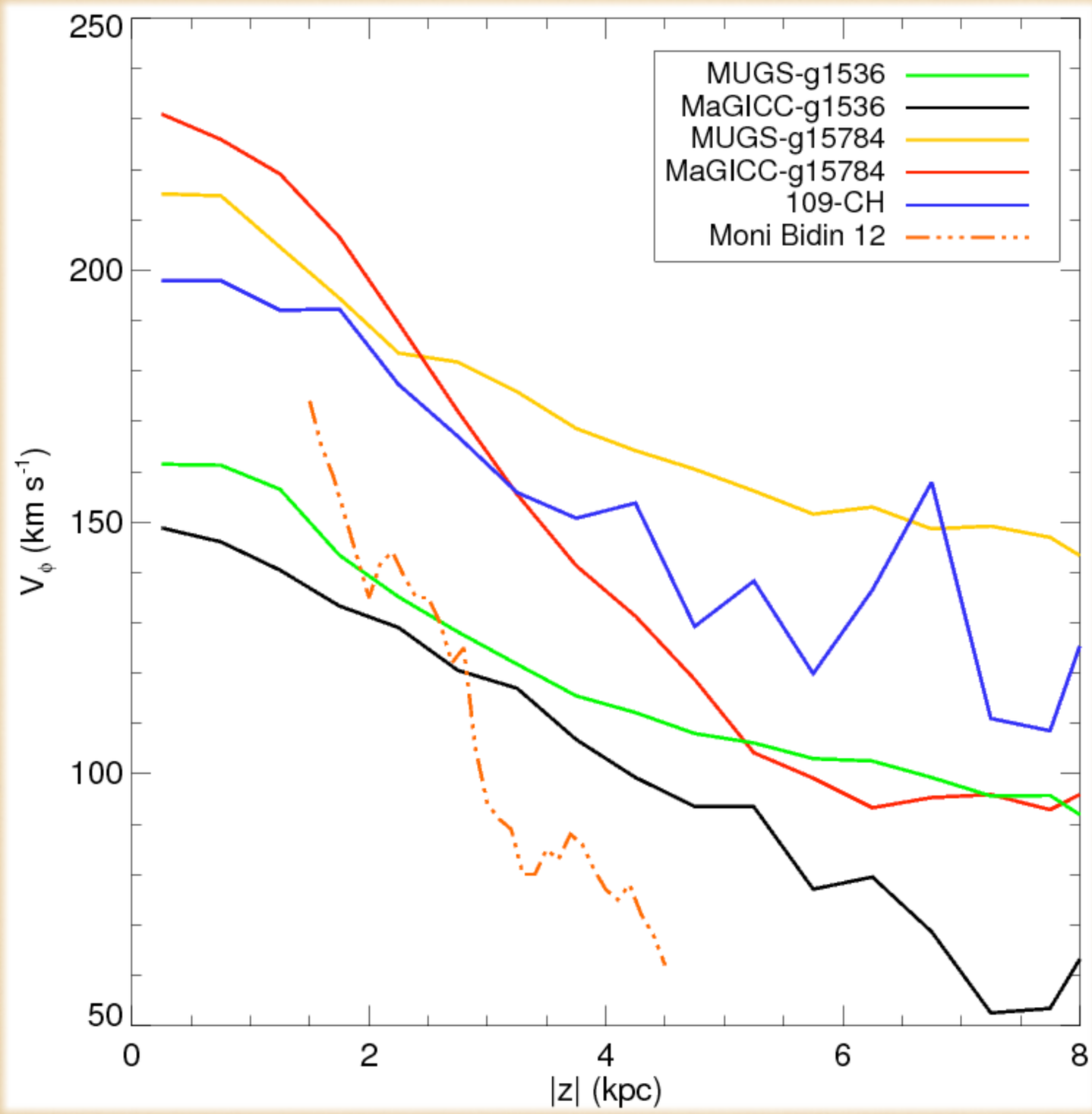
galaxies with higher feedback -MaGICC -109-CH

Vertical [Fe/H] gradient



- 1<|z|<3 kpc, thick disk
- No clear trends
- Best fit: galaxies with higher feedback
  - -MaGICC
  - -109-CH

Rotational velocity gradient



- **Solar neighbourhood: 7<r<10 kpc**
- **Best fit: MaGICC-g15784**

Answers?

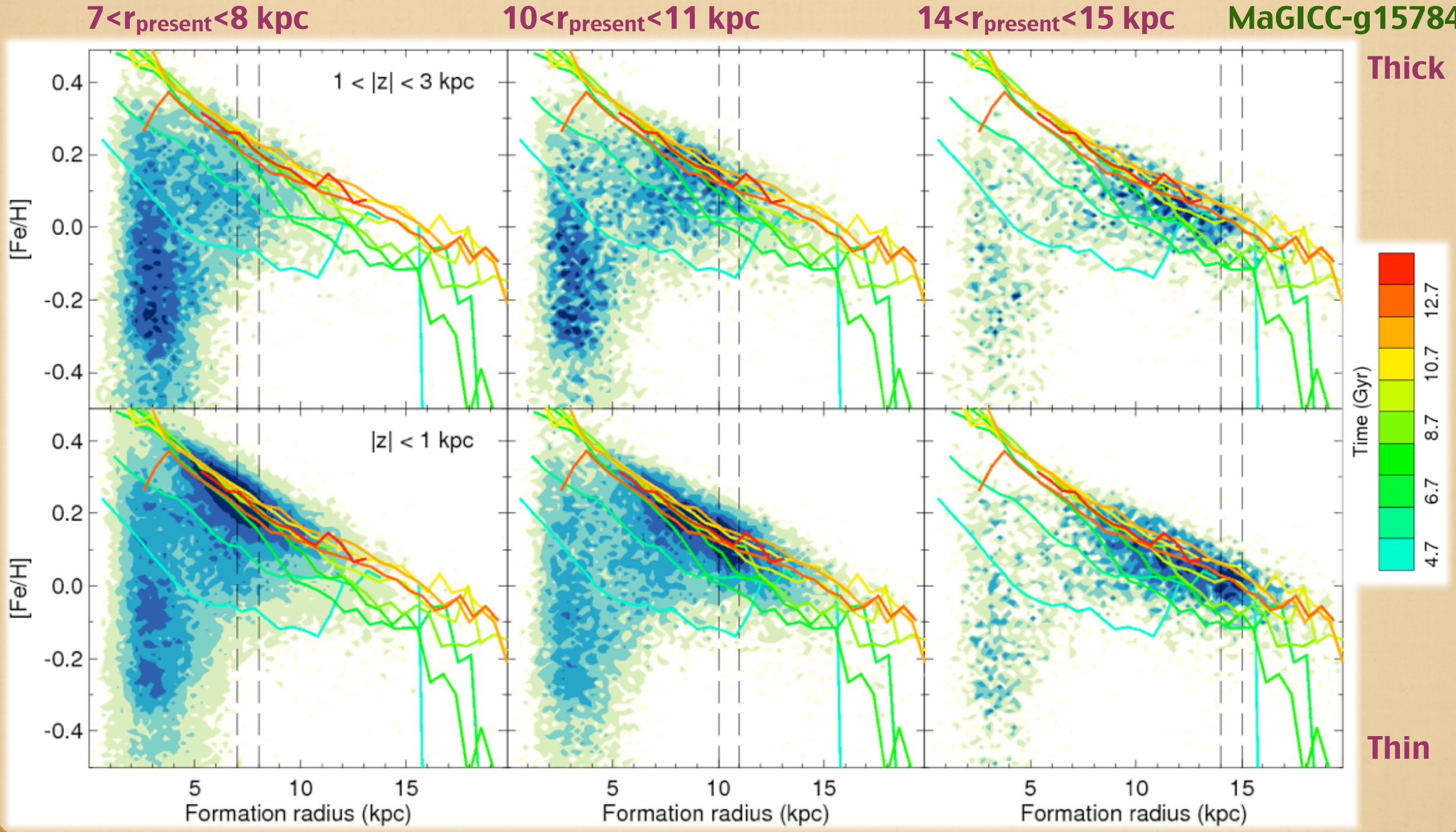
✦Why does the radial gradient get inverted?

✦Use of MaGICC-g15784

✦Combine radial migration with metallicity gradients and star formation history

[Fe/H] vs Formation radius

✦Positive gradient in thick disk: increased in situ population in the outer galaxy



Summary

✦Five simulations

✦Radial metallicity gradient vs height
-Inverts at high |z|
-Flattens at high radius

✦Vertical metallicity gradients vs radius
-No dependence

✦Best galaxy: MaGICC-g15784

✦Big influence from stars that have migrated

✦Inversion of radial gradient ➡ Increased in situ population