Halo Substructure and Milky Way Formation

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ΛCDM on Small Scales

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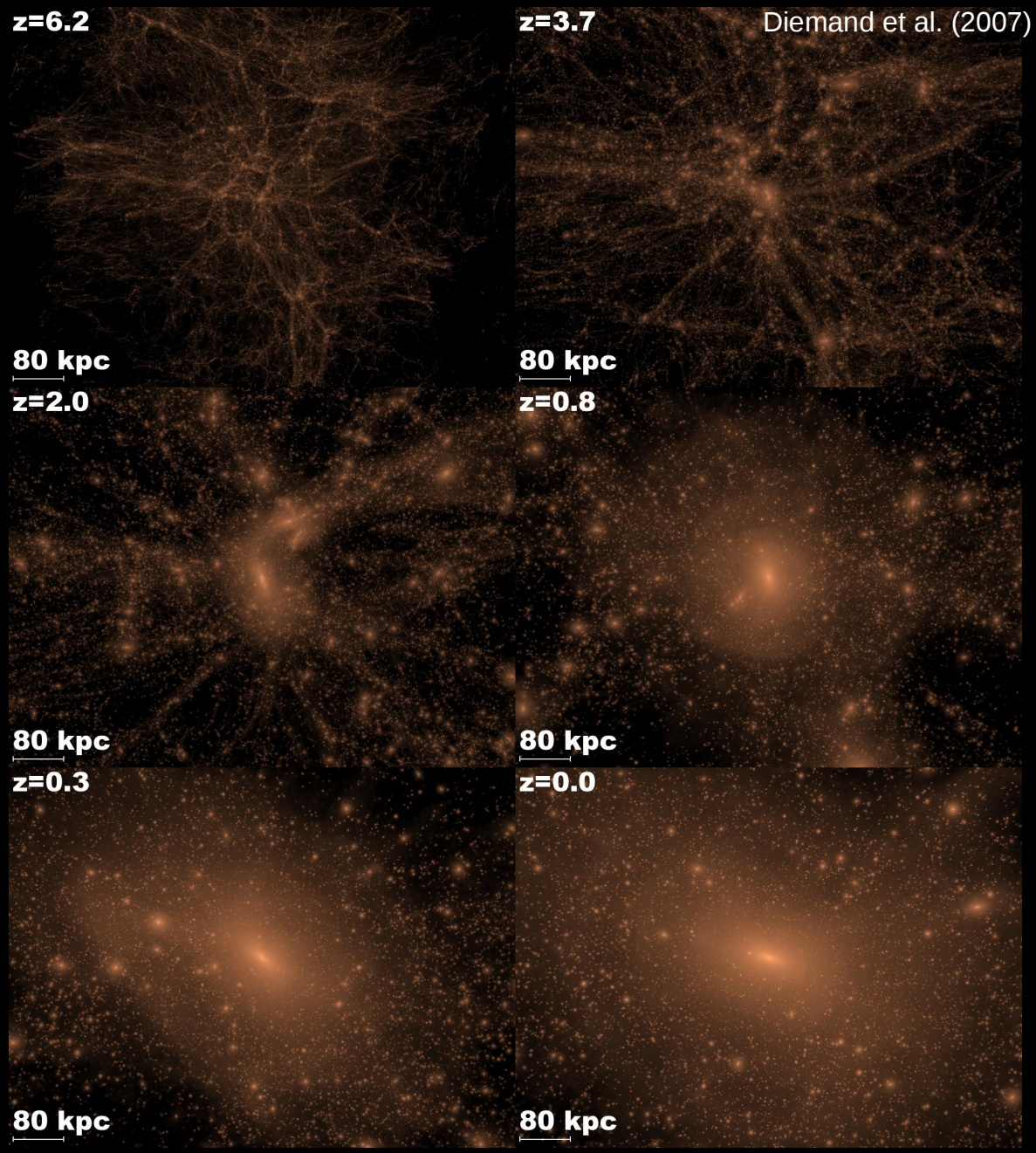
Three Facts:

(1) On the smallest galactic and sub-galactic scales, the agreement between ΛCDM and observation is very sub-grid model dependent

(2) Different models have different strengths and weaknesses and make different predictions about the existence, properties, and degree of baryonic halo substructure

(3) Observations of the Milky Way can calibrate theoretical models of galaxy formation

The models are for Milky Way analogs, not the Milky Way itself. For that reason the observations meant to test these predictions must be statistical.



ECHOS Exist

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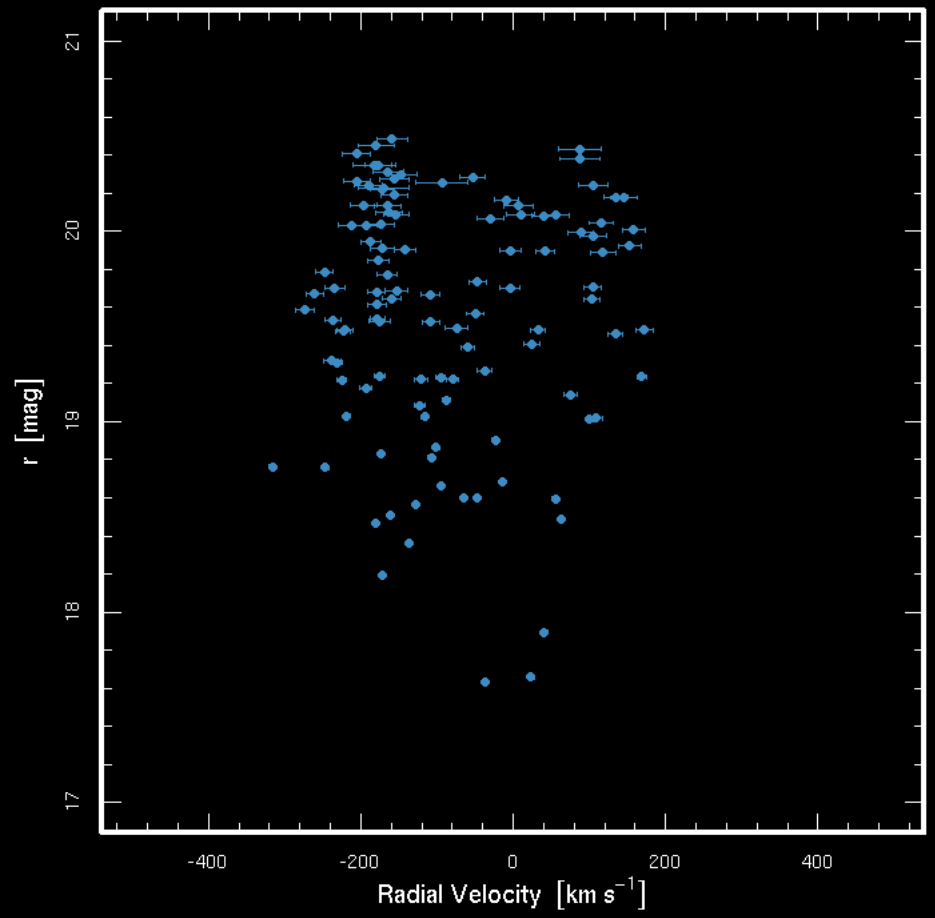
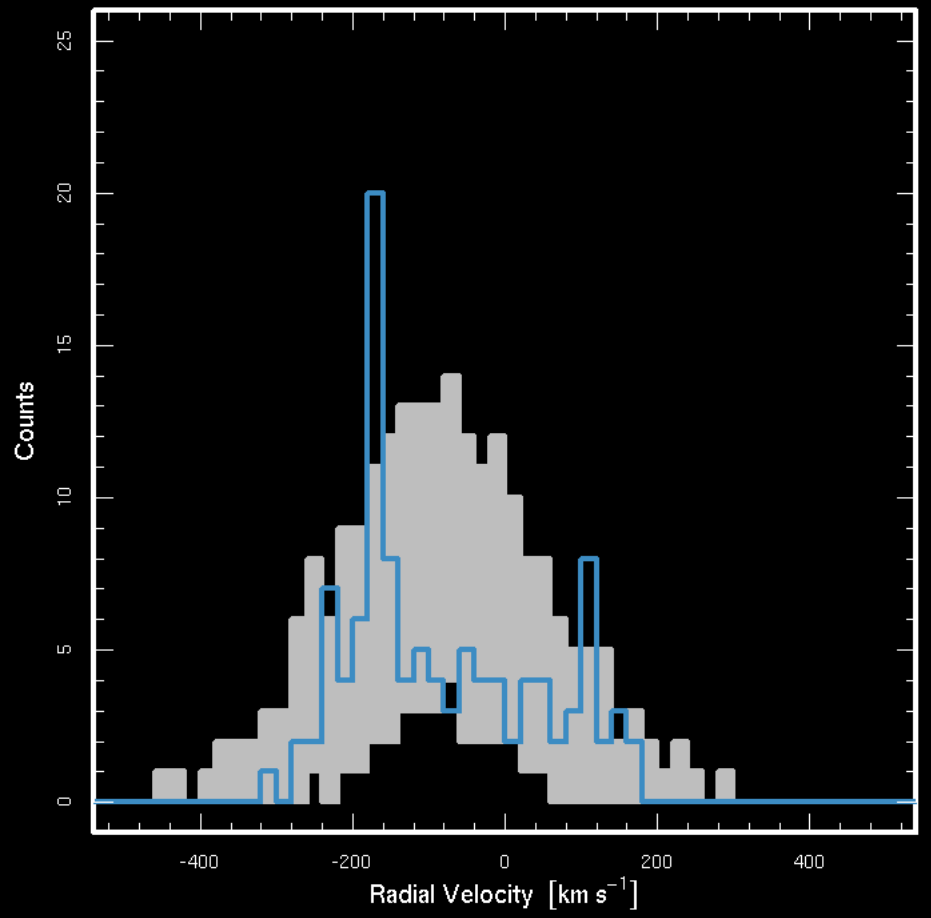
Schlaufman et al. (2009)

Elements of cold halo substructure (ECHOS) are radial velocity overdensities in the inner halo of the Milky Way.





The Smooth Halo

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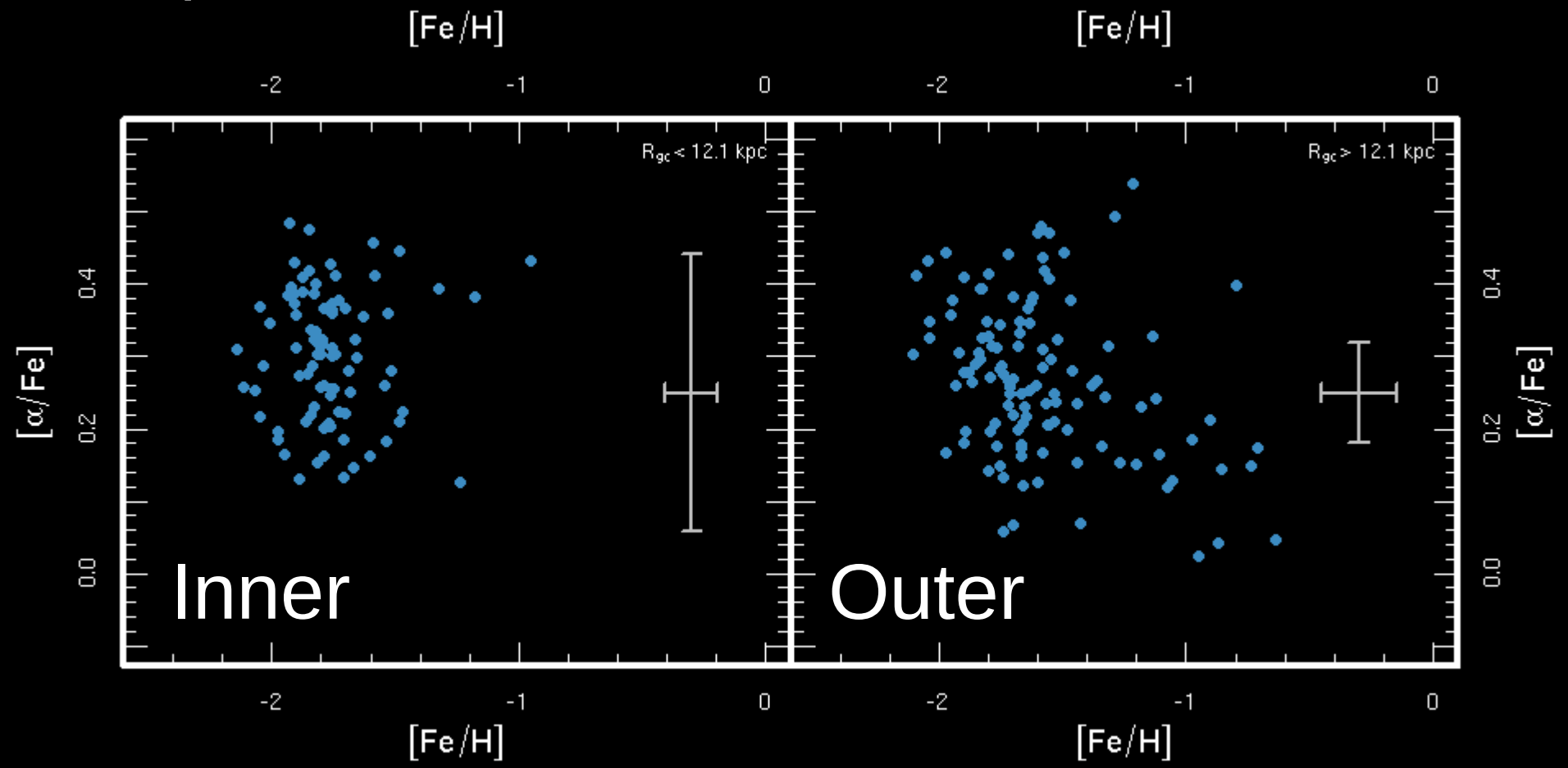
Schlaufman et al. (2011a)

The phase-mixed component of the **inner part** of the inner halo is chemically homogeneous, while the **outer part** of the inner halo has a dSph-like component as well.



Metallicity Correlation Function

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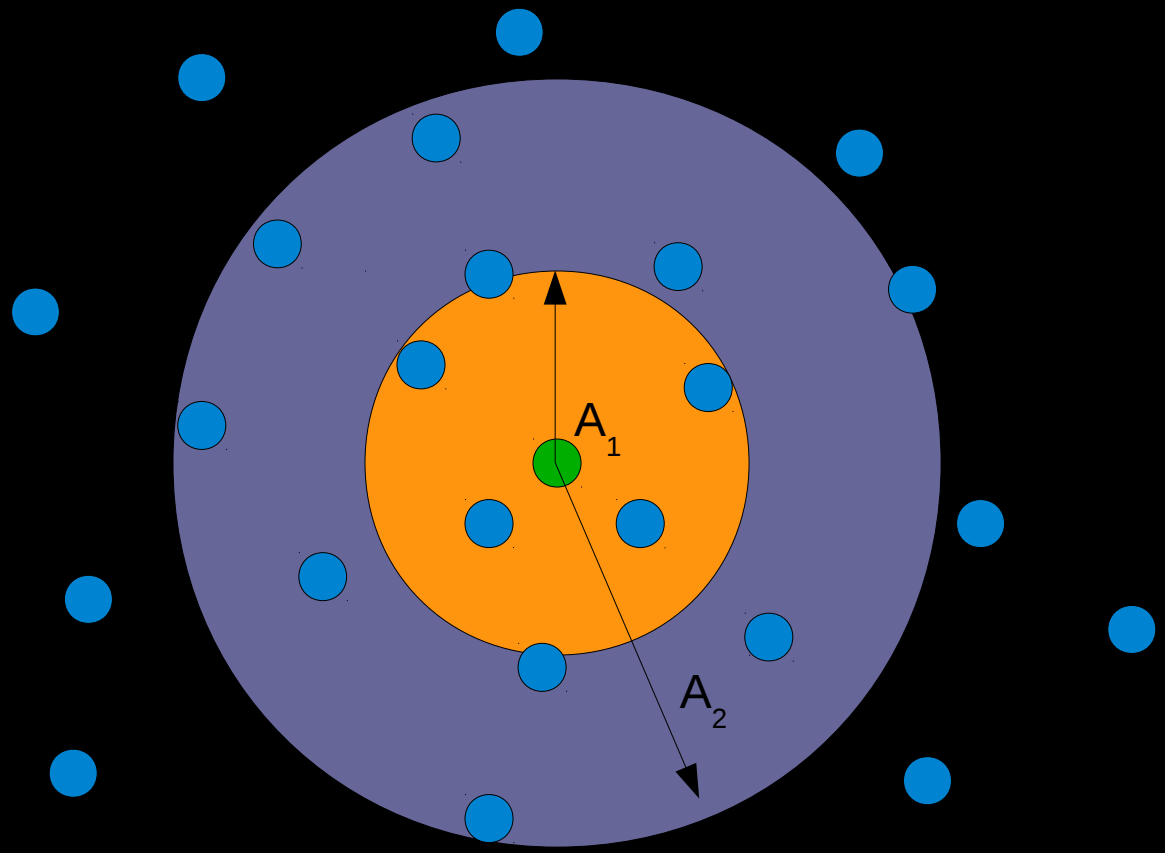

$$\Theta = \sum_{A_i} \left([\mathrm{Fe/H}] - [\mathrm{Fe/H}]_i \right)^2$$

Metallicity Correlation Function

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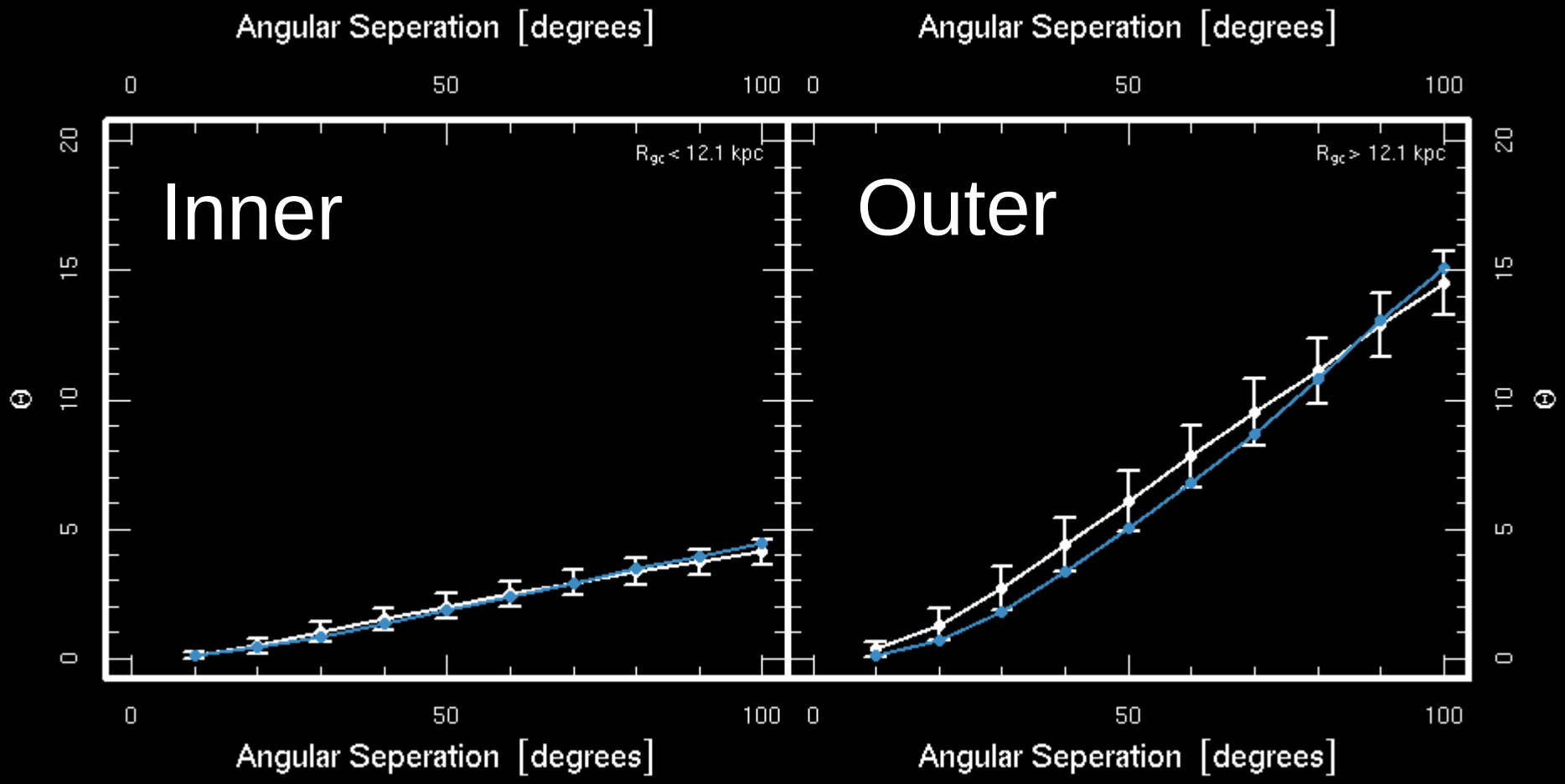
Schlaufman et al. (2010b)

There is no spatial correlation within 12 kpc, while there is significant spatial correlation beyond 12 kpc



Model Comparison

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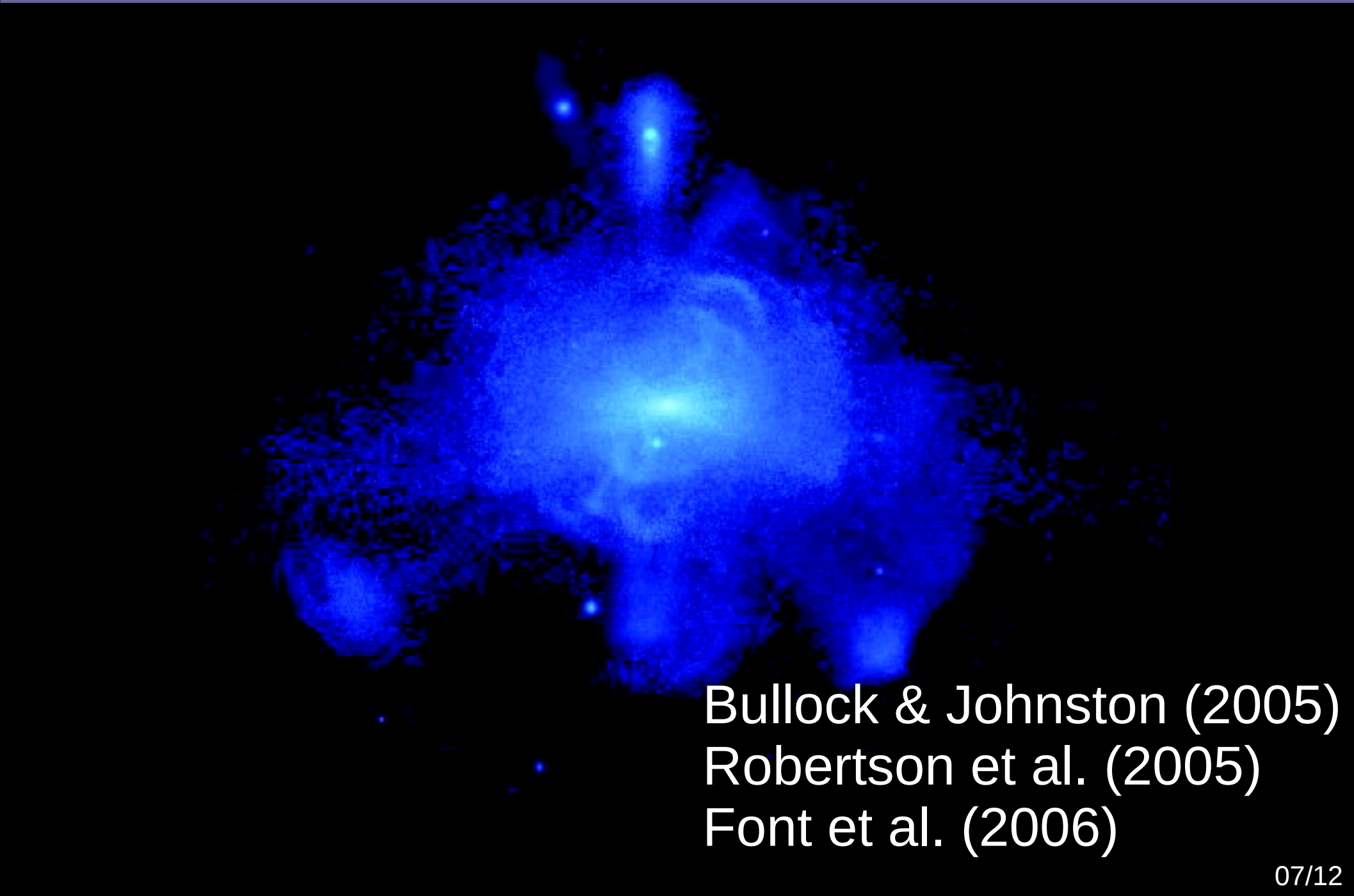

Bullock & Johnston (2005)
Robertson et al. (2005)
Font et al. (2006)

Model Comparison

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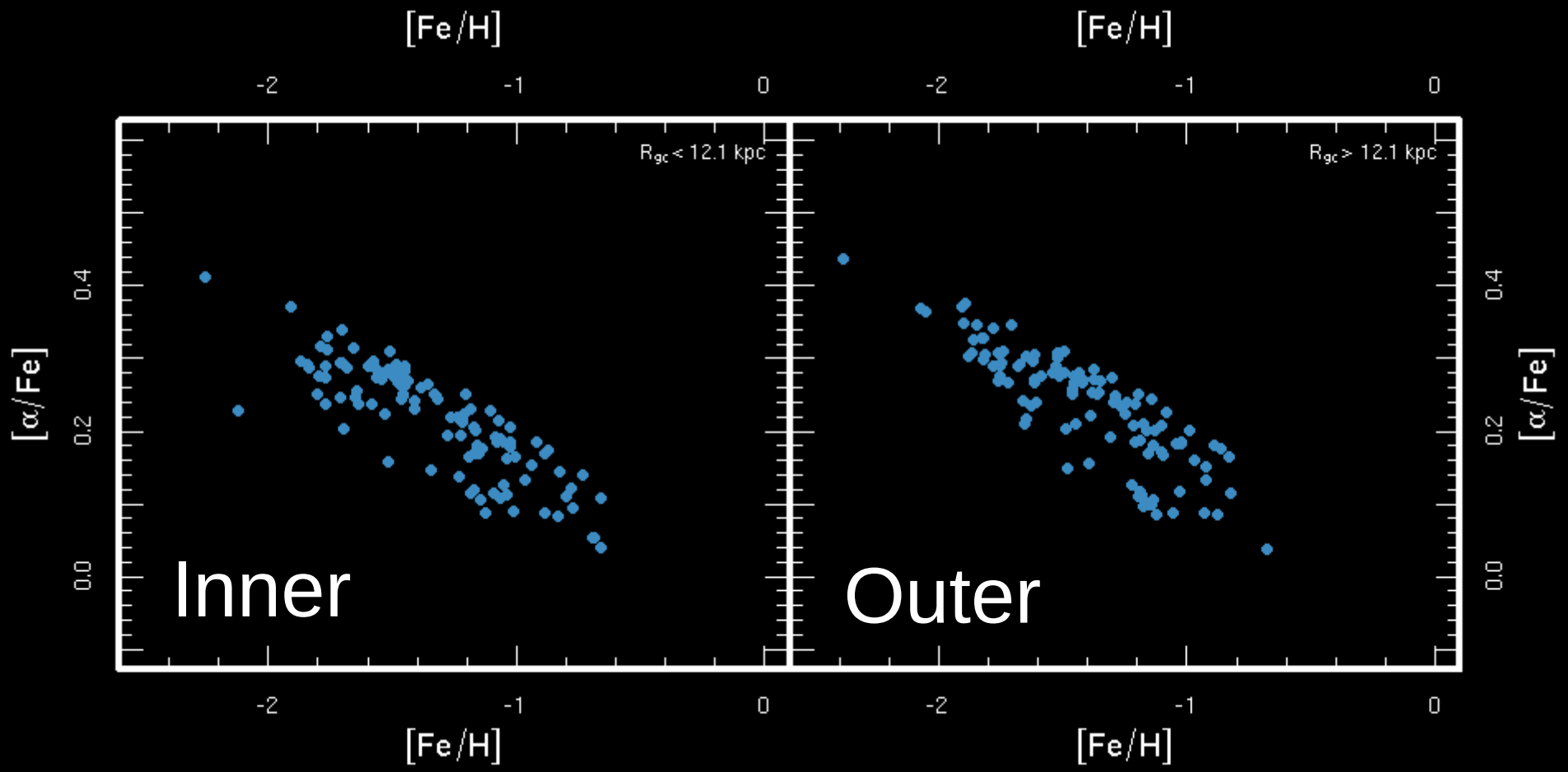
Schlaufman et al. (2010b)



Theory

Model Comparison

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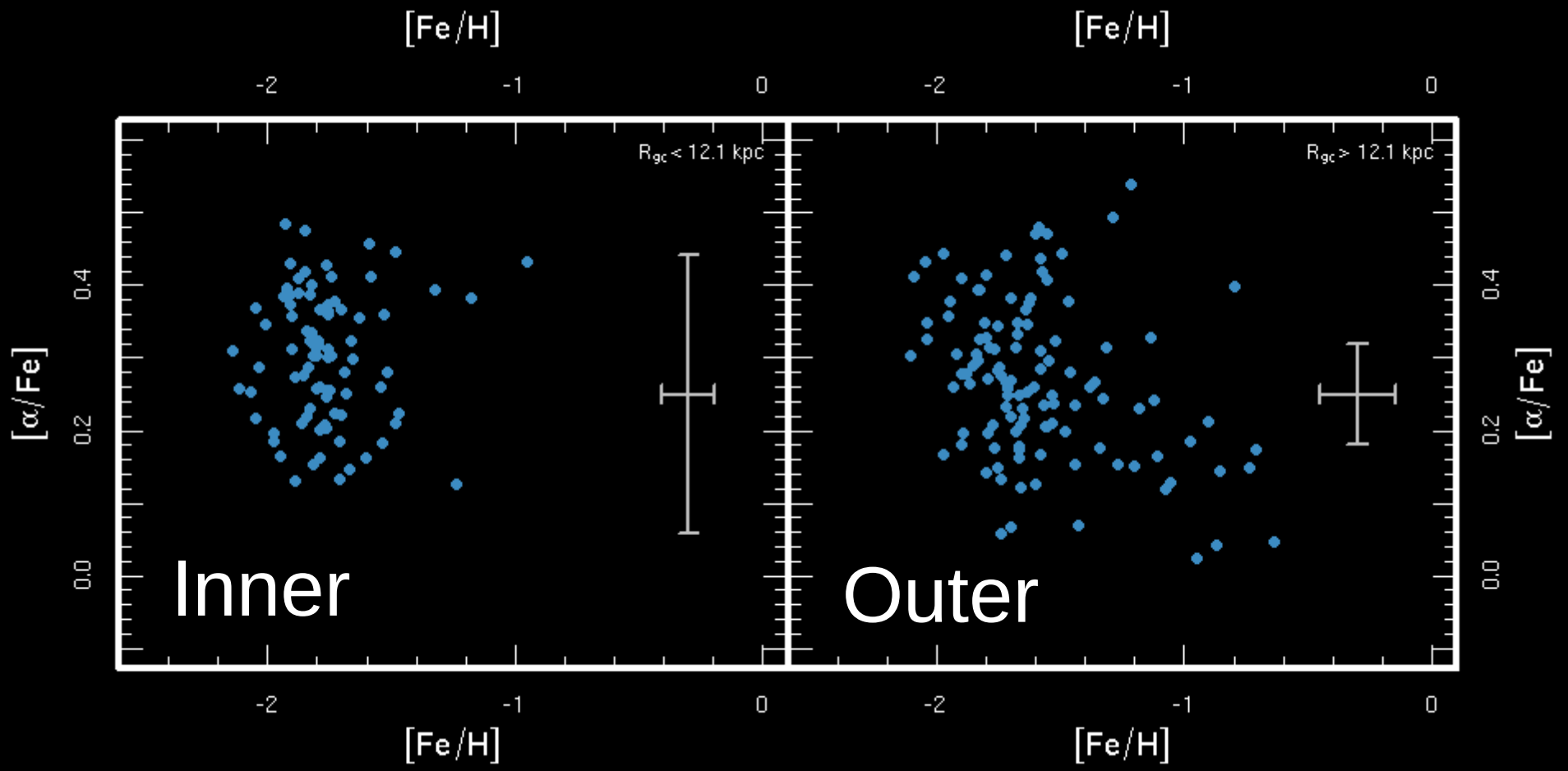

Observation

Model Comparison

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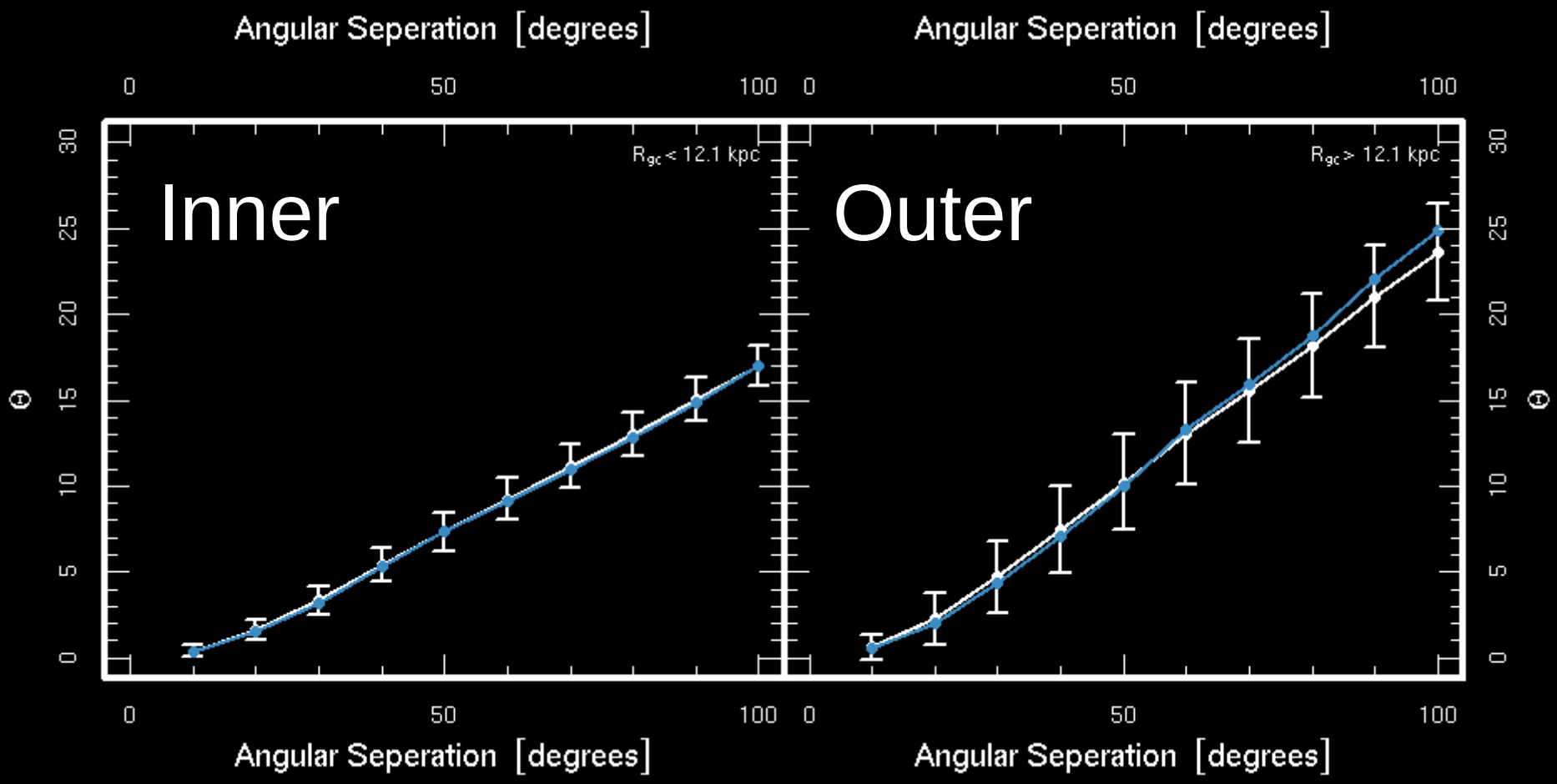

Theory

Model Comparison

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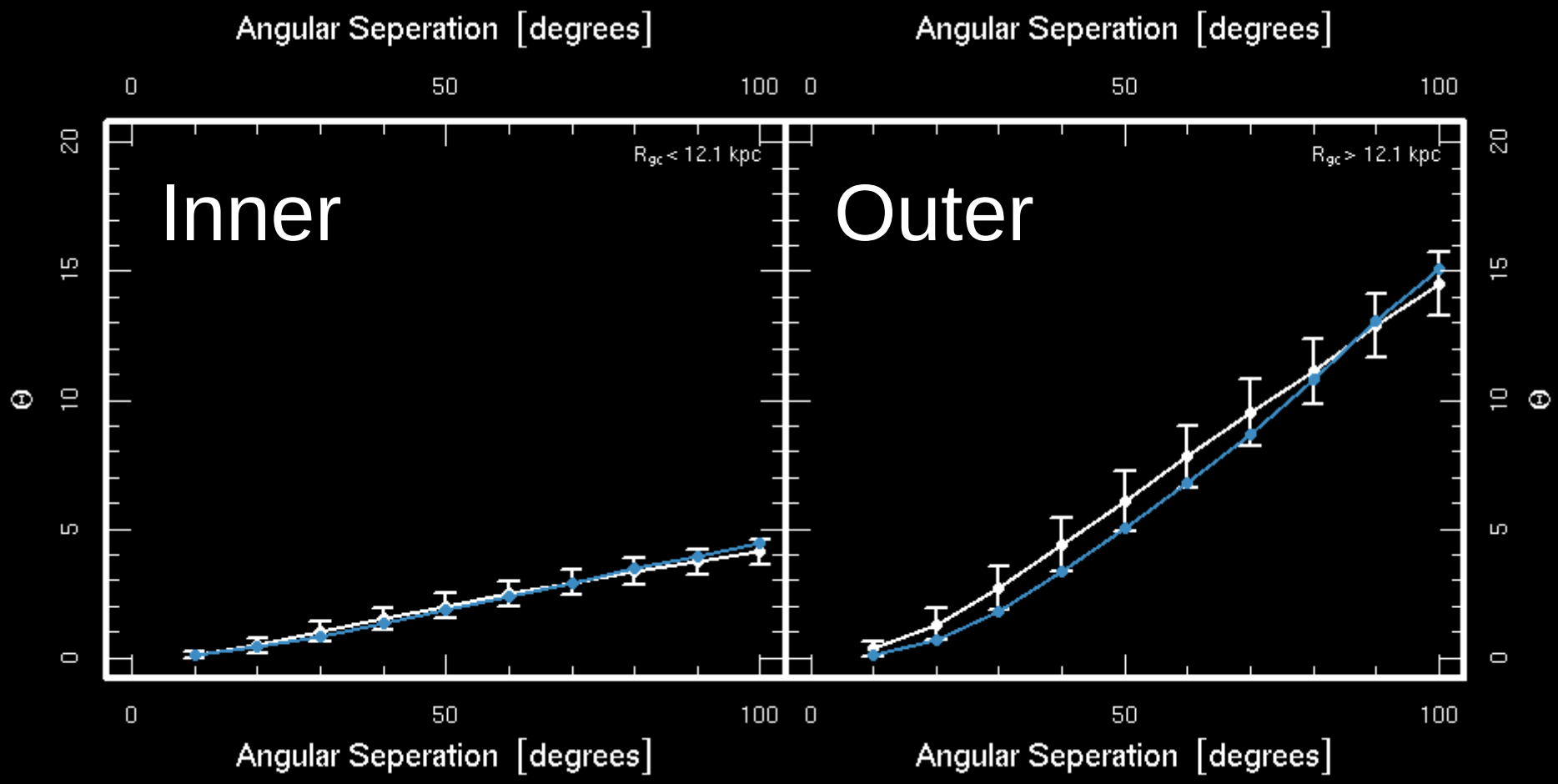

Observation

In Summary

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Schlaufman et al. (2009), Schlaufman et al. (2011a)

(1) The **inner part** of the inner halo is *spatially chemically homogeneous*, while there is more diversity in the **outer part** of the inner halo.

(2) There is *no spatial correlation in metallicity* in the **inner part** of the inner halo; *significant spatial correlations* do exist in the **outer part** of the inner halo.