What Does Clustering Tell Us About the Buildup of the Red Sequence

Tinker & Wetzel 2009

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Outline

• Clustering of Red and Blue Galaxies
  – Determining evolution to Red sequence
• The data: UDS, DEEP2, COMBO-17
  – Data spans redshift: 0.4<z<2
• The methods for analysis
• Implications about the Red sequence
The Data

- UDS $1 < z < 2$
- DEEP2 $0.7 < z < 1.2$
- COMBO-17 $0.4 < z < 0.8$
Methods- Halo Occupation Distribution (HOD)

- HOD is used to analyze the data
- HOD is the connection between halos and galaxies
  - Constrained by a two point correlation function
- Two parts:
  - Galaxies at the center of the halo (central galaxies)
  - Galaxies in the halo (satellite galaxies)
Three Important Fractions

- $f_{Rsat}$

$$f_{Rcen}(M) = f_{Rmax} \exp \left[ \frac{-\beta \kappa M_{min}}{M - \beta M_{min}} \right]$$

- $M_{\text{min}}$ = halo mass with 50% chance of having a central galaxy bright enough to detect

$$f_Q = \frac{f_{Rsat} \bar{n}_{\text{sat}} - \bar{n}_{\text{prev}}}{\bar{n}_{\text{sat}} - \bar{n}_{\text{prev}}}$$
Quenching Time

- 4 Red points are: COMBO-17, DEEP2 faint, DEEP2 bright, UDS
- $t_Q \sim 1.8$ Gyr for four samples
- $t_Q \sim (1+z)^{-1.5}$
Critical Mass Scenario

• Faint DEEP-2 graph of correlation vs. distance
• The Critical Mass curves don’t fit the data
• Similar results for COMBO-17 and the bright DEEP-2 data
Merger Scenario

- Mergers also don’t fit the DEEP-2 and COMBO-17 data
- Mergers do not produce enough central galaxies to match DEEP-2 and COMBO-17
  - In order to correct for that, must increase $M_{\text{red}}/M_{\text{blue}}$.
  - For DEEP-2, $M_{\text{red}}/M_{\text{blue}} = 5.2$, which is too large.
Satellite Galaxies and the Red Sequence

- ~30% of Red sequence are satellites
  - About \( \frac{3}{4} \) of them became red after accretion

- Surprisingly, the same results for \( z=0 \)
  - The satellites are not the same in both samples!
Conclusions

- Contrary to literature, no dependence between Halo mass and red galaxies at $z > 0.6$
  - Critical Mass models do not agree with the data
- Mergers also produce results outside 2 sigma errors at $z > 0.5$
- Satellite galaxies play a role in the red sequence