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

Tinker & Wetzel 2009

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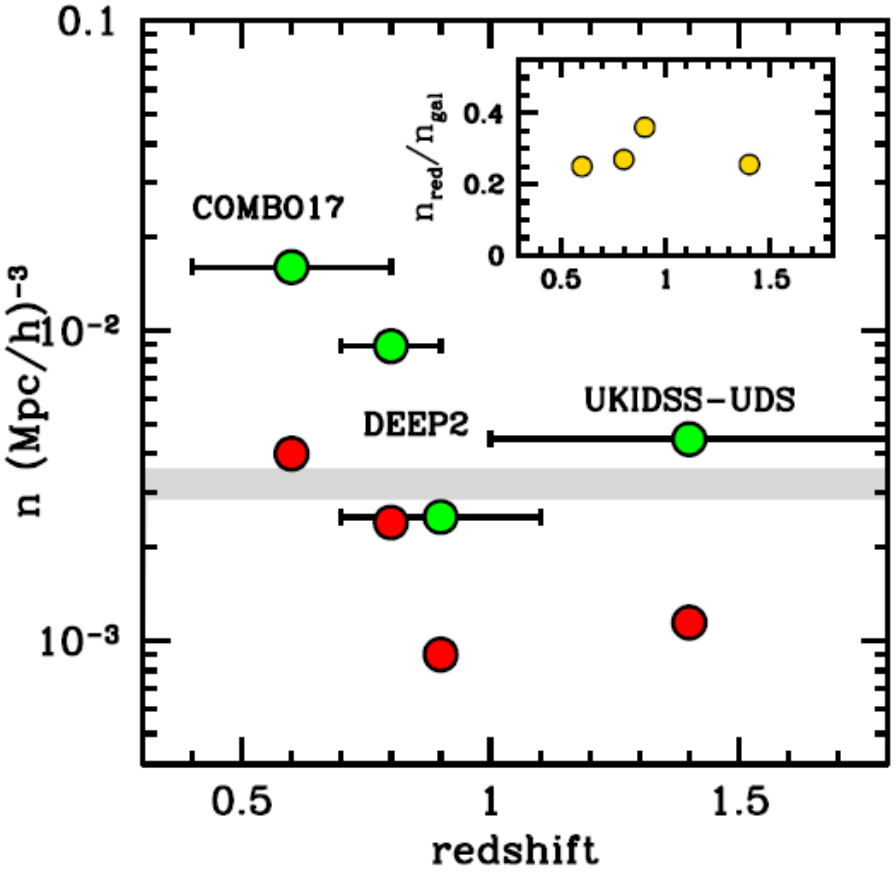
Outline

- 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

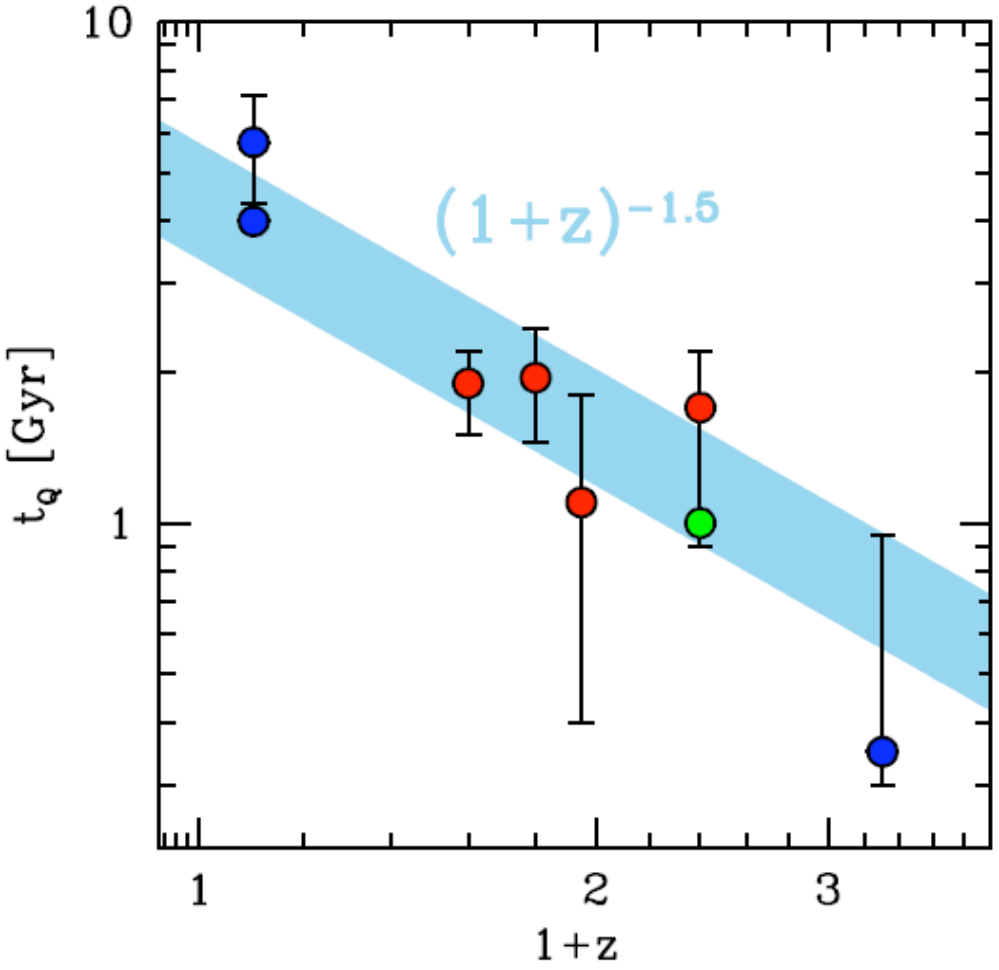
- f_{Rsat}

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

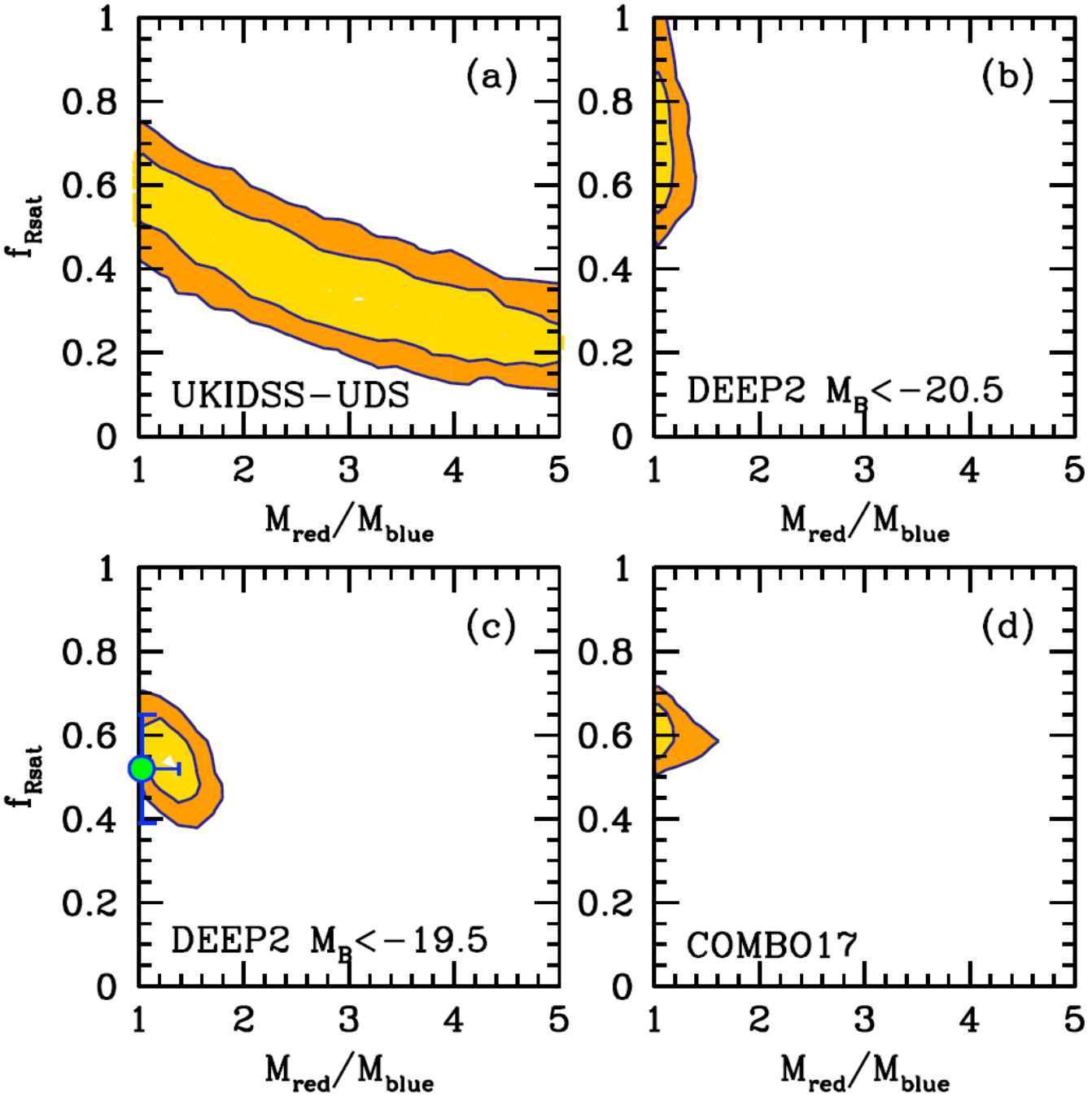
  - M_{min} = halo mass with 50% chance of having a central galaxy bright enough to detect

$$f_{\mathrm{Q}} = \frac{f_{\mathrm{Rsat}}\bar{n}_{\mathrm{sat}} - \bar{n}_{\mathrm{prev}}}{\bar{n}_{\mathrm{sat}} - \bar{n}_{\mathrm{prev}}}$$

Quenching Time

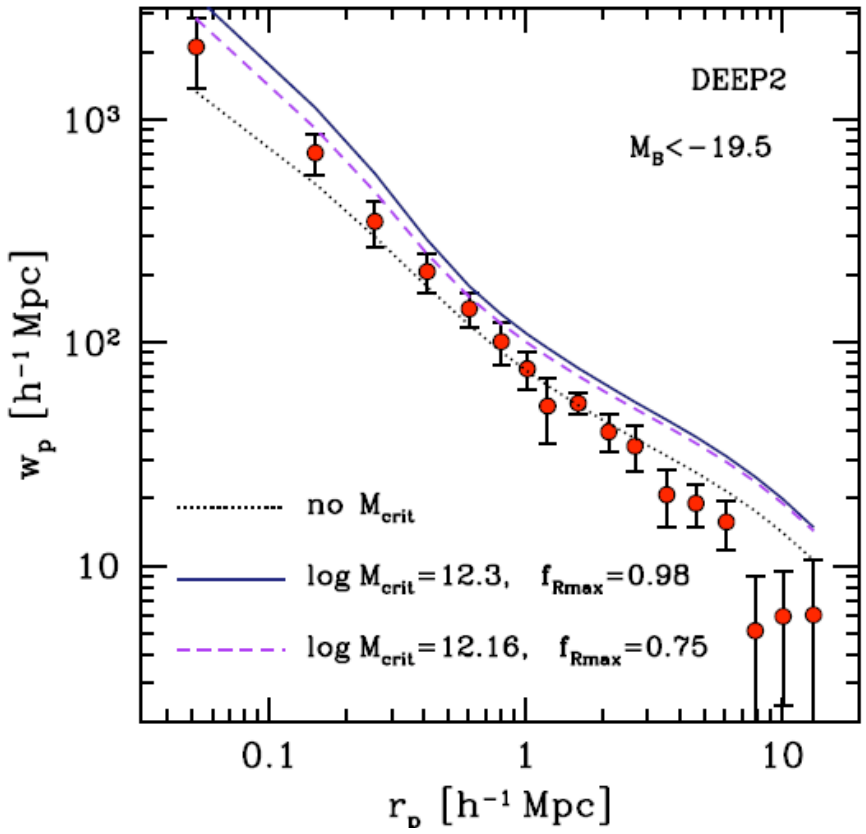


- 4 Red points are: COMBO-17, DEEP2 faint, DEEP2 bright, UDS
- tQ ~ 1.8 Gyr for four samples
- tQ ~(1+z)^-1.5


(a)
UKIDSS−UDS
(b)
DEEP2 M_B<−20.5
(c)
DEEP2 M_B<−19.5
(d)
COMBO17
f_Rsat
M_red/M_blue
0
0.2
0.4
0.6
0.8
1
1
2
3
4
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_{red}/M_{blue}.
  - For DEEP-2, $M_{red}/M_{blue} = 5.2$, which is too large.

Satellite Galaxies and the Red Sequence

- ~30% of Red sequence are satellites
  - About ¾ 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