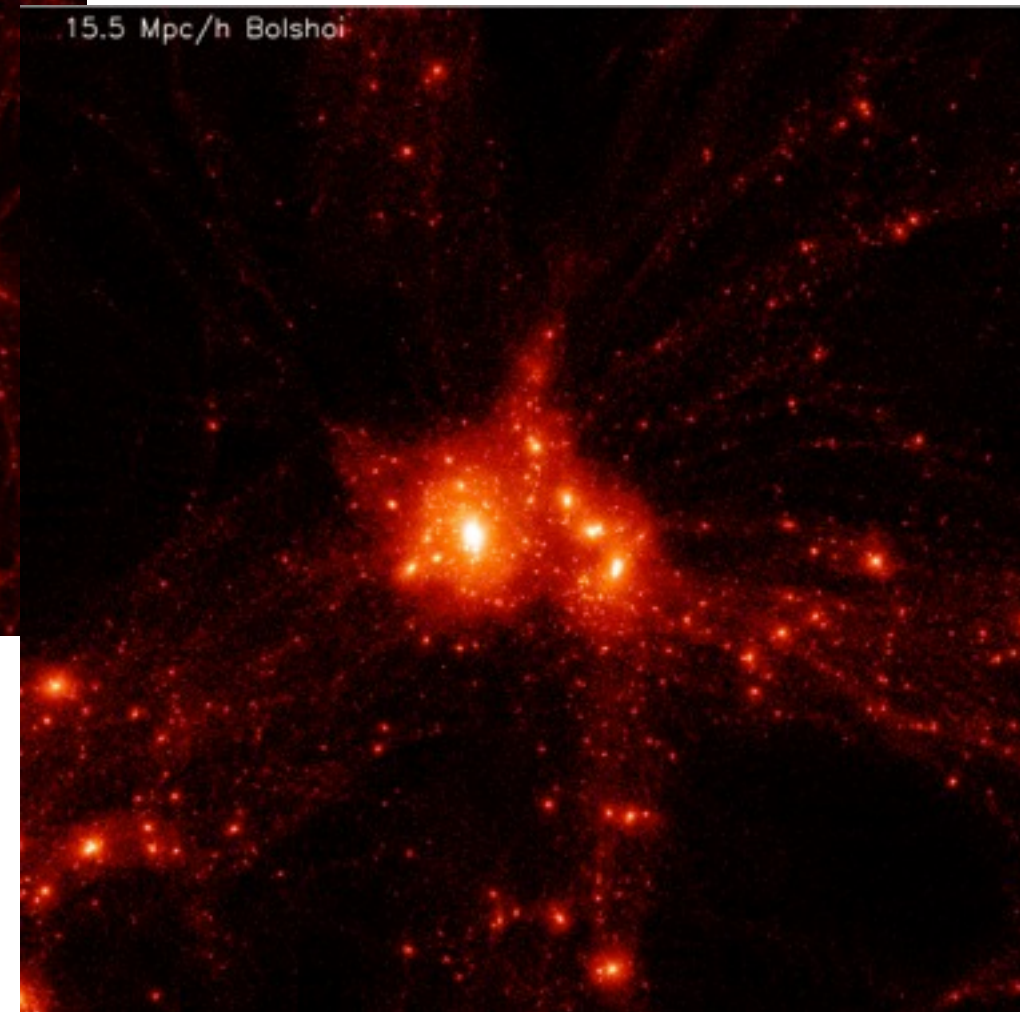
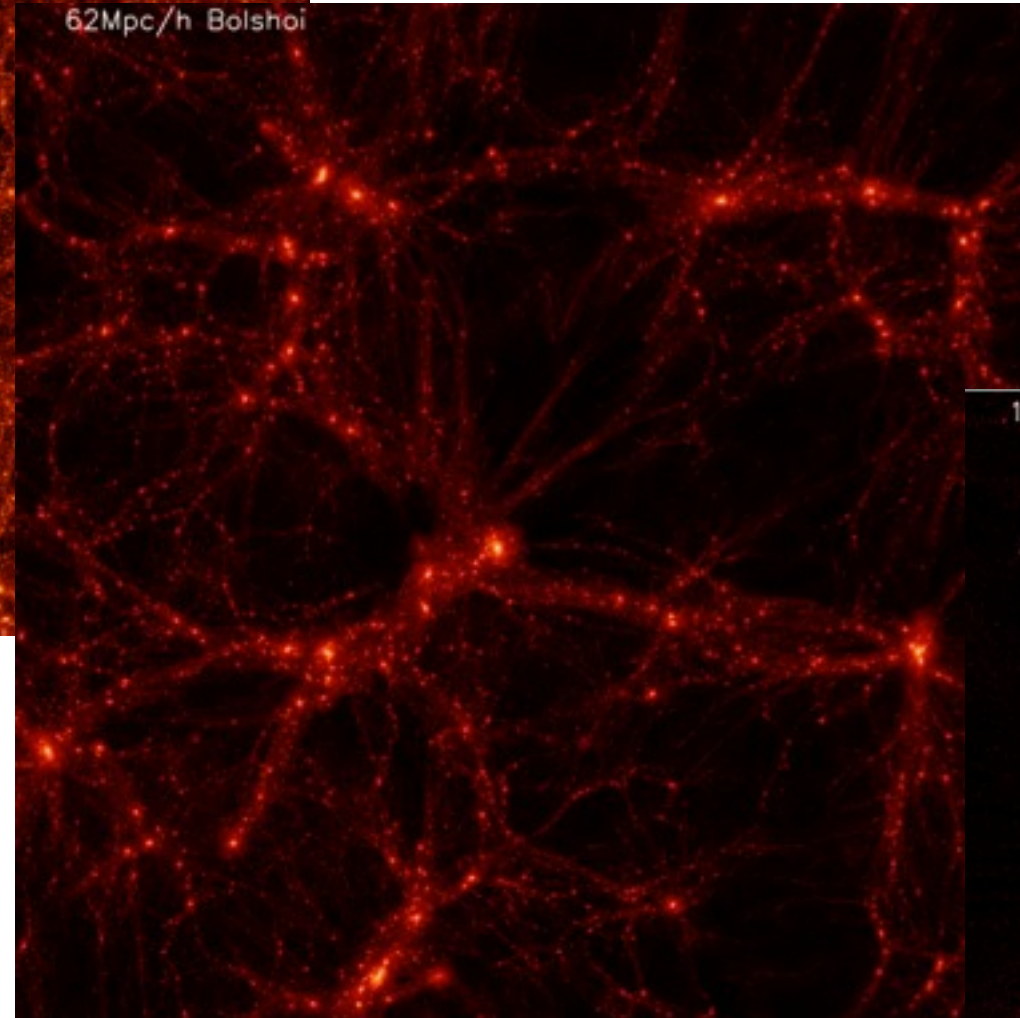
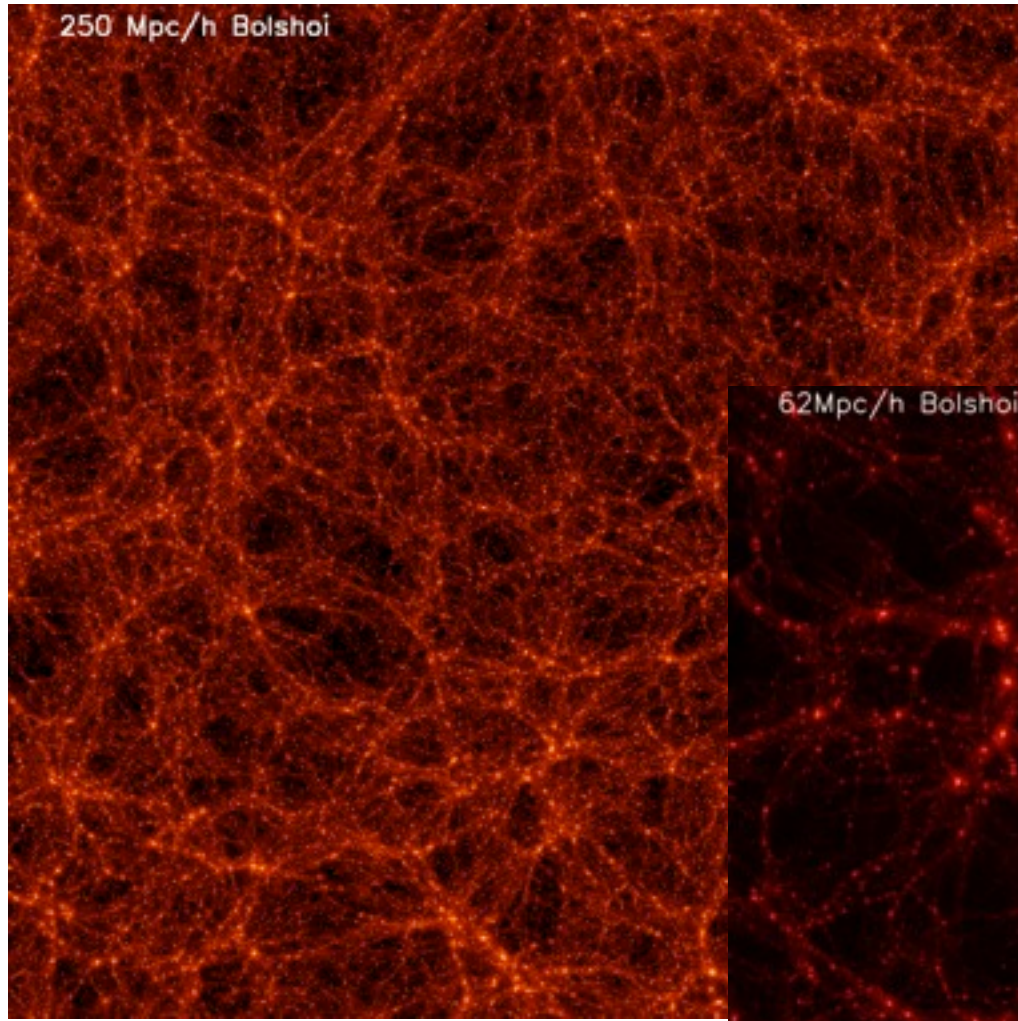


Breaking Degeneracies between Quasar Halo
Occupation Distribution Models :
**Extending Direct Measurements of the Mean
Occupation Function to Redshift 0.6**

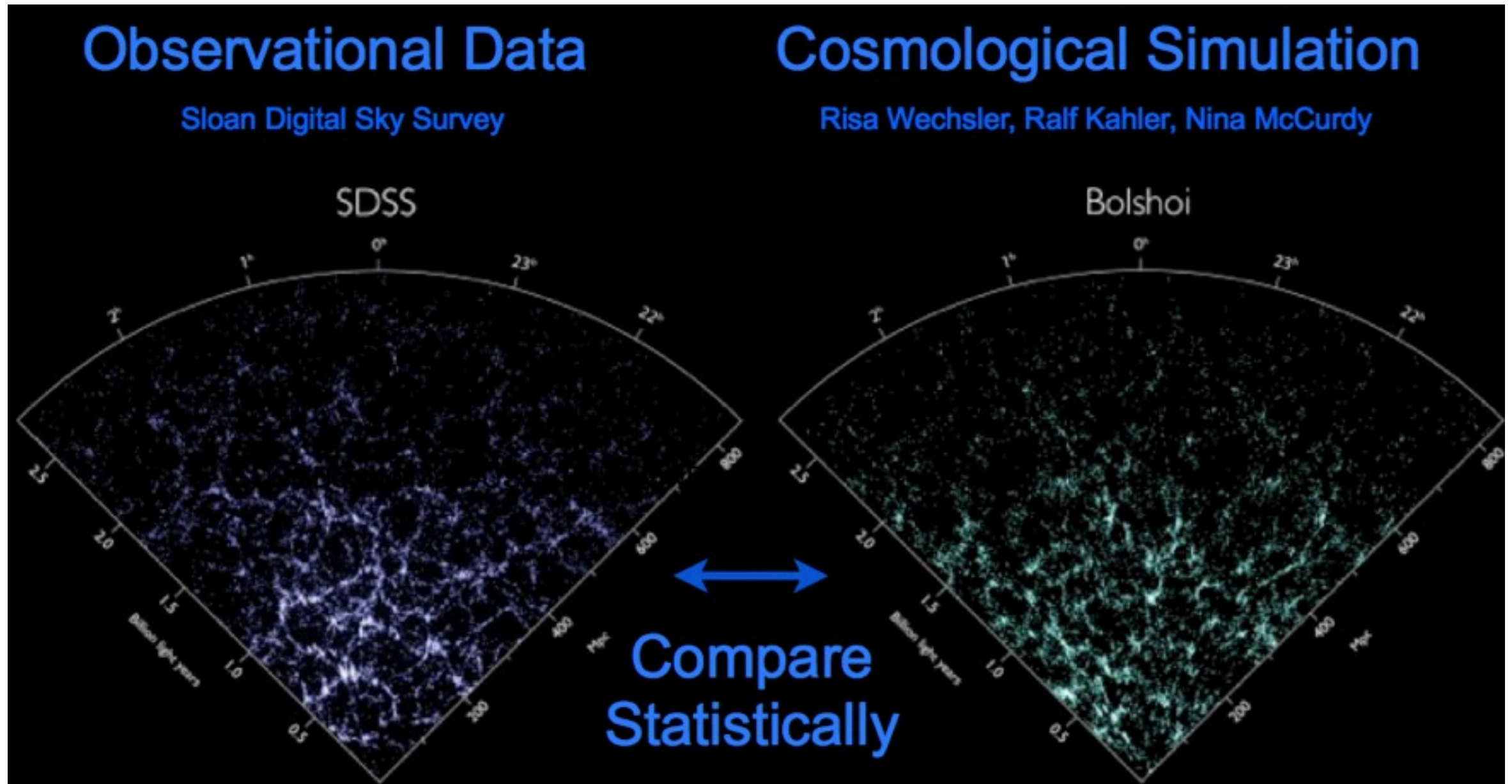
My L. Nguyen
University of Wyoming

Dark Matter



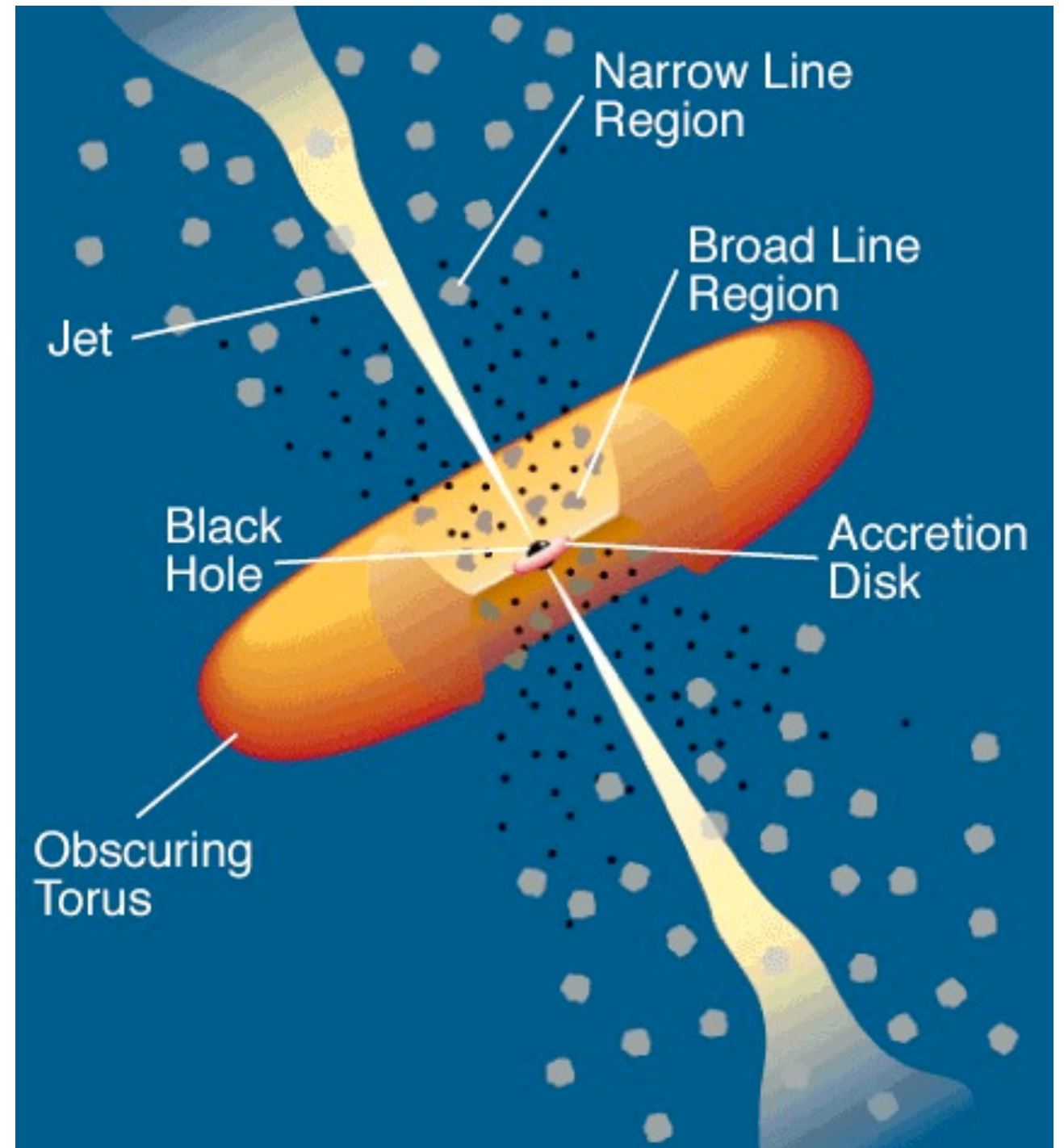
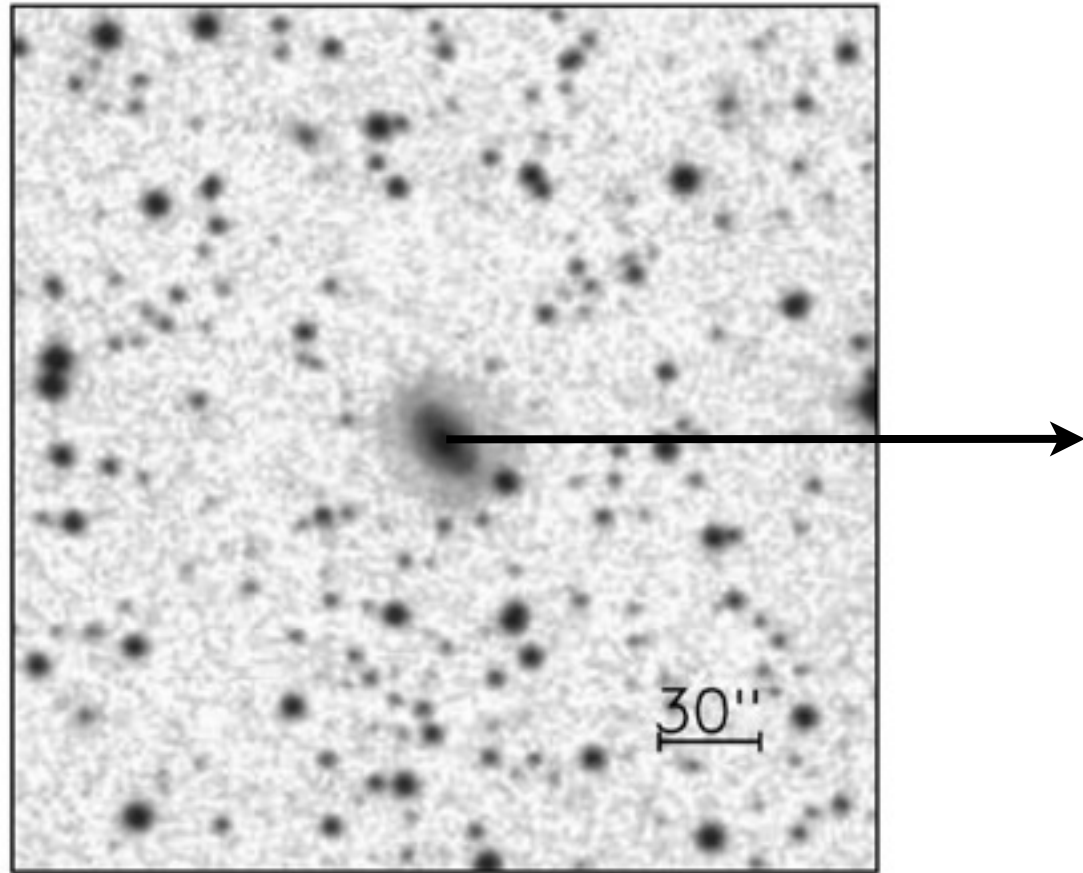
$z = 0$

Klypin, Trujillo-Gomez & Primack 2011



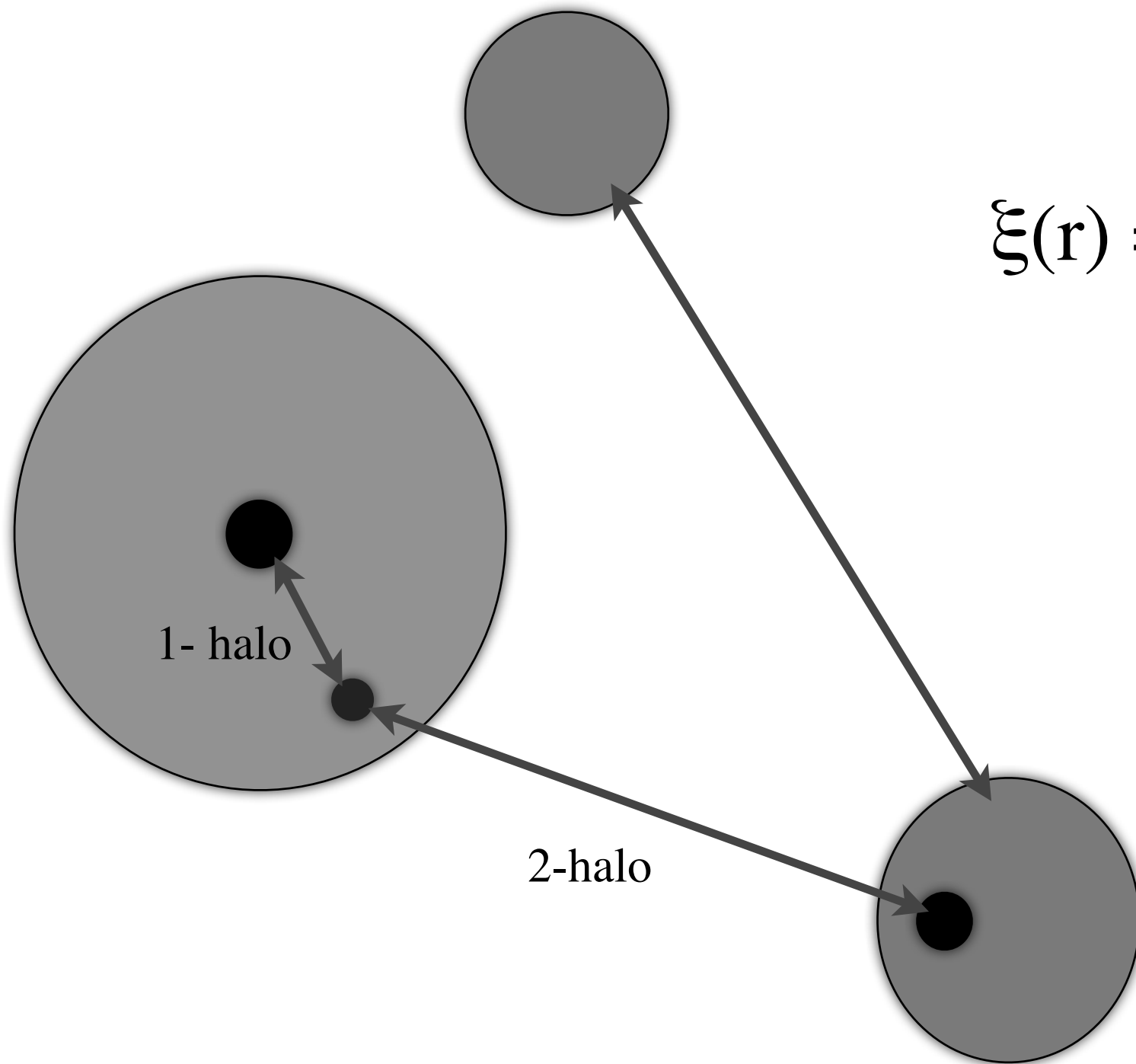
↓
“BIAS”

Quasars



Barth et al. 2011

Urry & Padovani 1995



Pair Statistics

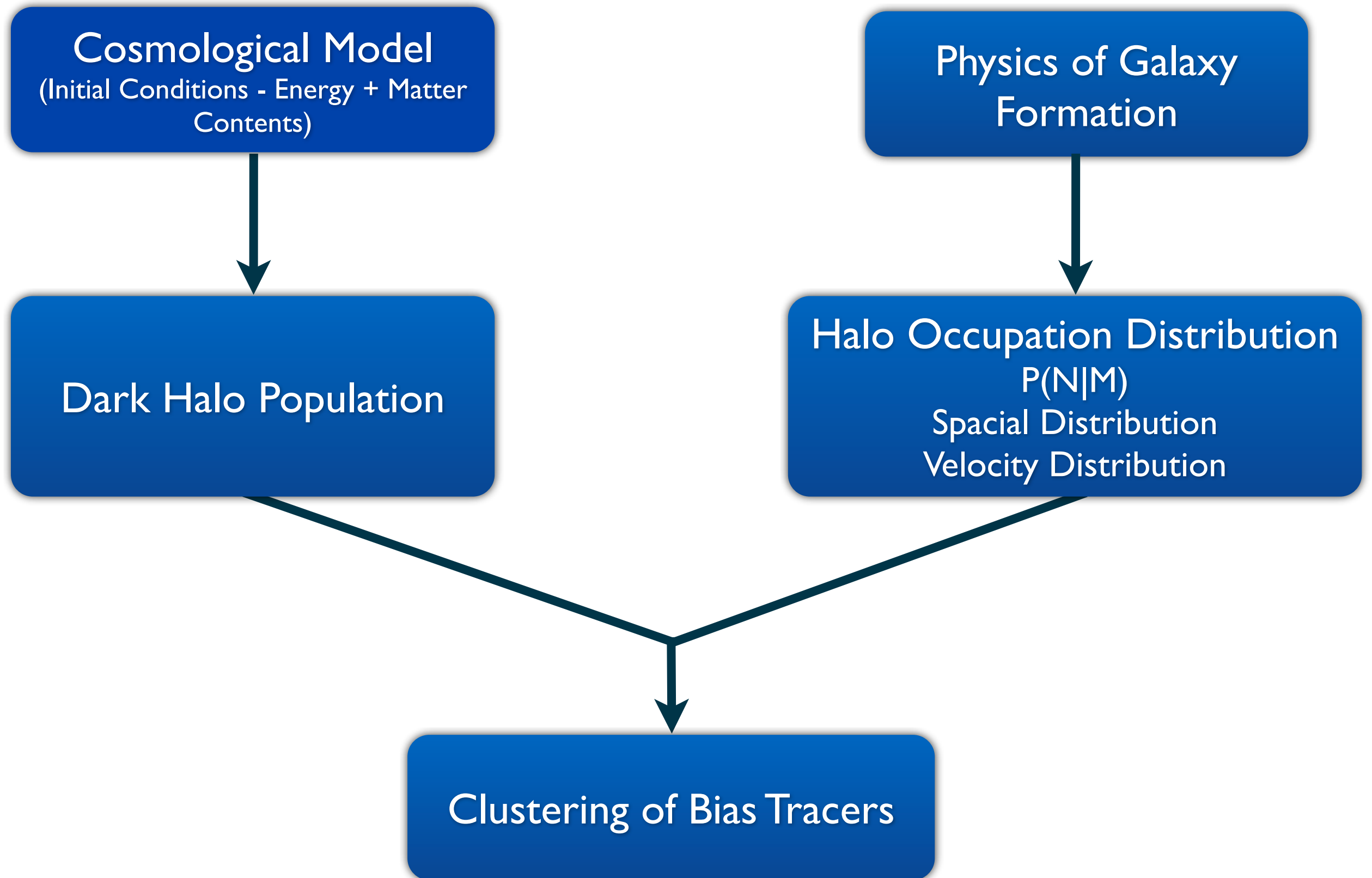
$$\xi(r) = [1 + \xi_{1h}(r)] + \xi_{2h}(r)$$

1-halo term

2-halo term

e.g., Ma & Fry 2000, Berlind & Weinberg 2002, Zheng & Weinberg 2007, Myers et al. 2007.

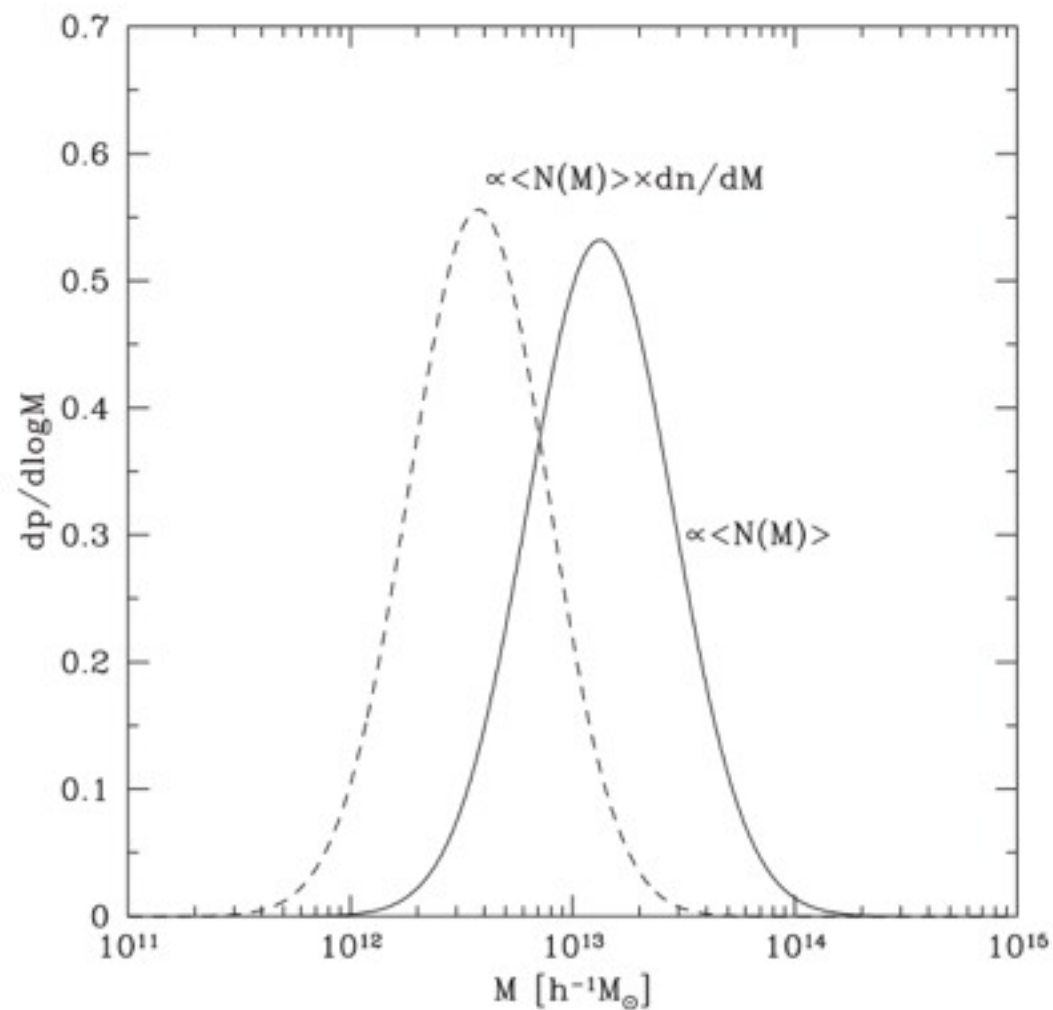
Halo Occupation Distribution



e.g, Berlind & Weinberg 2002, Zheng et al. 2005

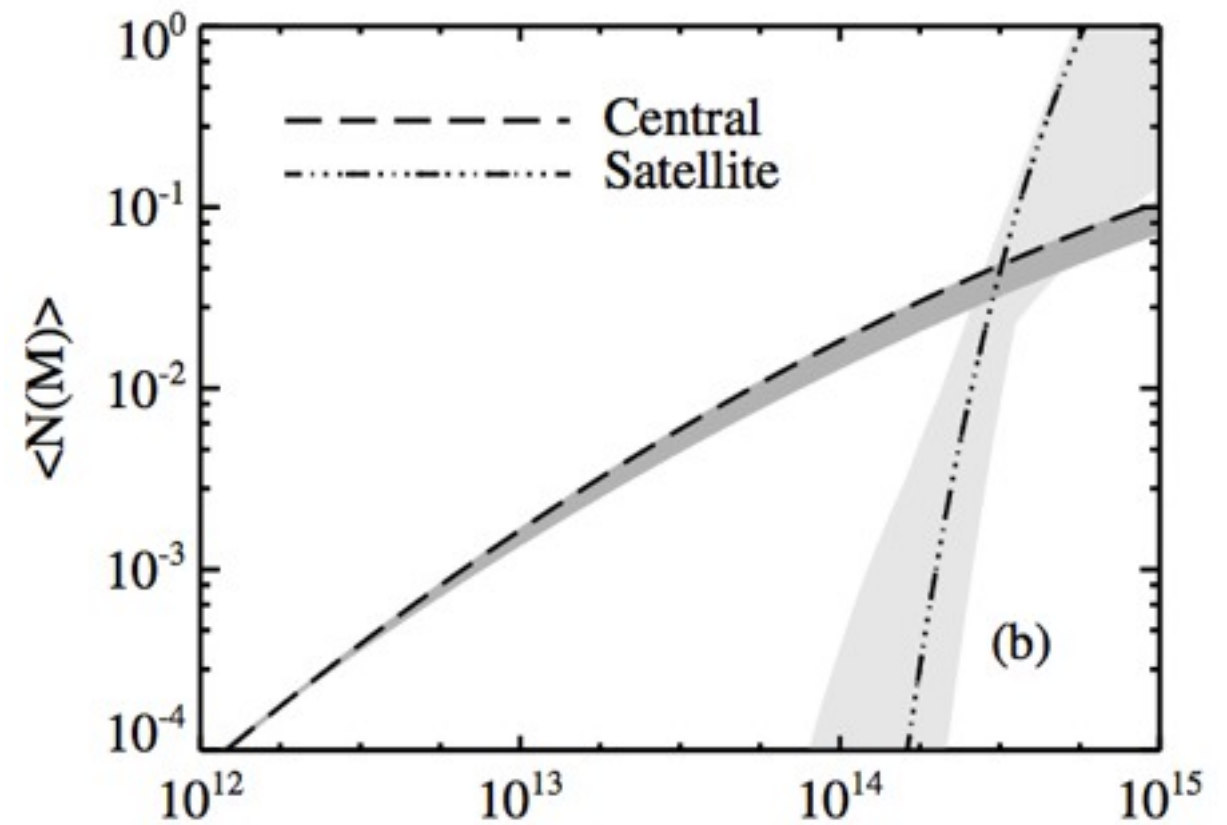
Kayo & Oguri 2012

$$\langle N(M) \rangle = f_N \times \frac{1}{\sqrt{2\pi} \Delta_m} \exp \left[-\frac{\ln^2(M/M_m)}{2\Delta_m^2} \right]$$



Richardson et al. 2012

$$\langle N(M) \rangle = \frac{1}{2} \left[1 + \operatorname{erf} \left(\frac{\log M - \log M_{\min}}{\sigma_{\log M}} \right) \right] + \left(\frac{M}{M_1} \right)^\alpha \exp \left(-\frac{M_{\text{cut}}}{M} \right).$$

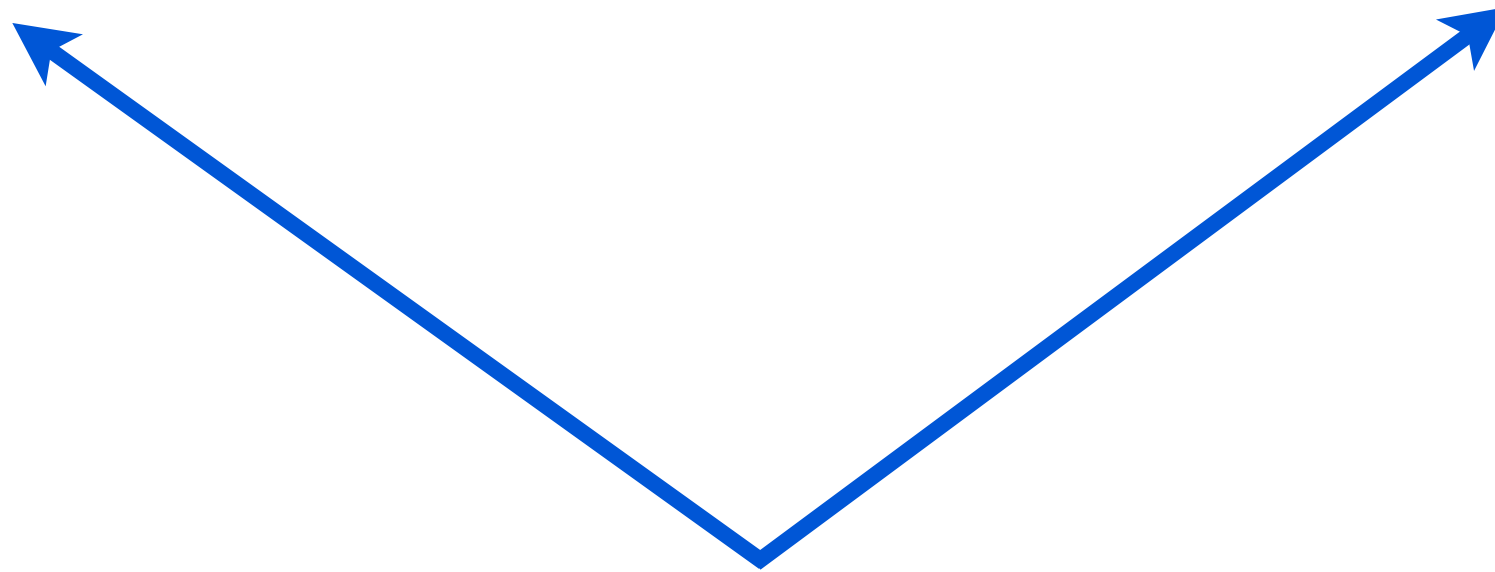


Kayo & Oguri 2012

$$\langle N(M) \rangle = f_N \times \frac{1}{\sqrt{2\pi} \Delta_m} \exp \left[-\frac{\ln^2(M/M_m)}{2\Delta_m^2} \right]$$

Richardson et al. 2012

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Degeneracy between HOD models!

Key Outline

How are quasars distributed in the large scale structure?



Clustering Statistics



Halo Occupation Distribution



Direct Measurement

Collaborators

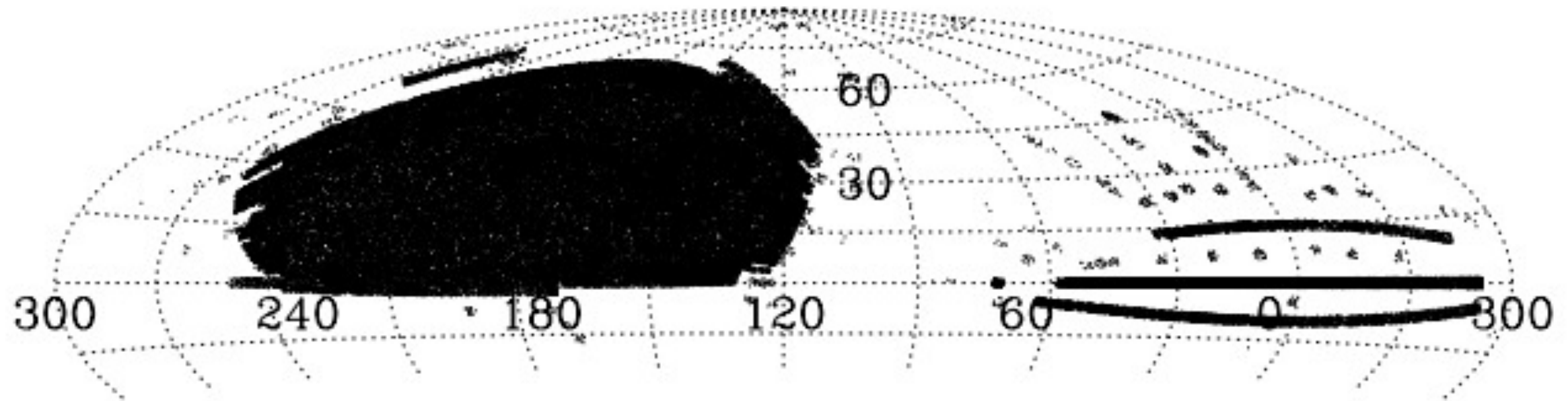
Adam Myers - University of Wyoming

Zheng Zheng - University of Utah

Suchetana Chatterjee - Presidency University

Eduardo Rozo - Stanford

Eli Rykoff - Stanford



Schneider et al. 2010

SDSS DR7

~ 105,800 quasars

$0.065 < z < 5.46$

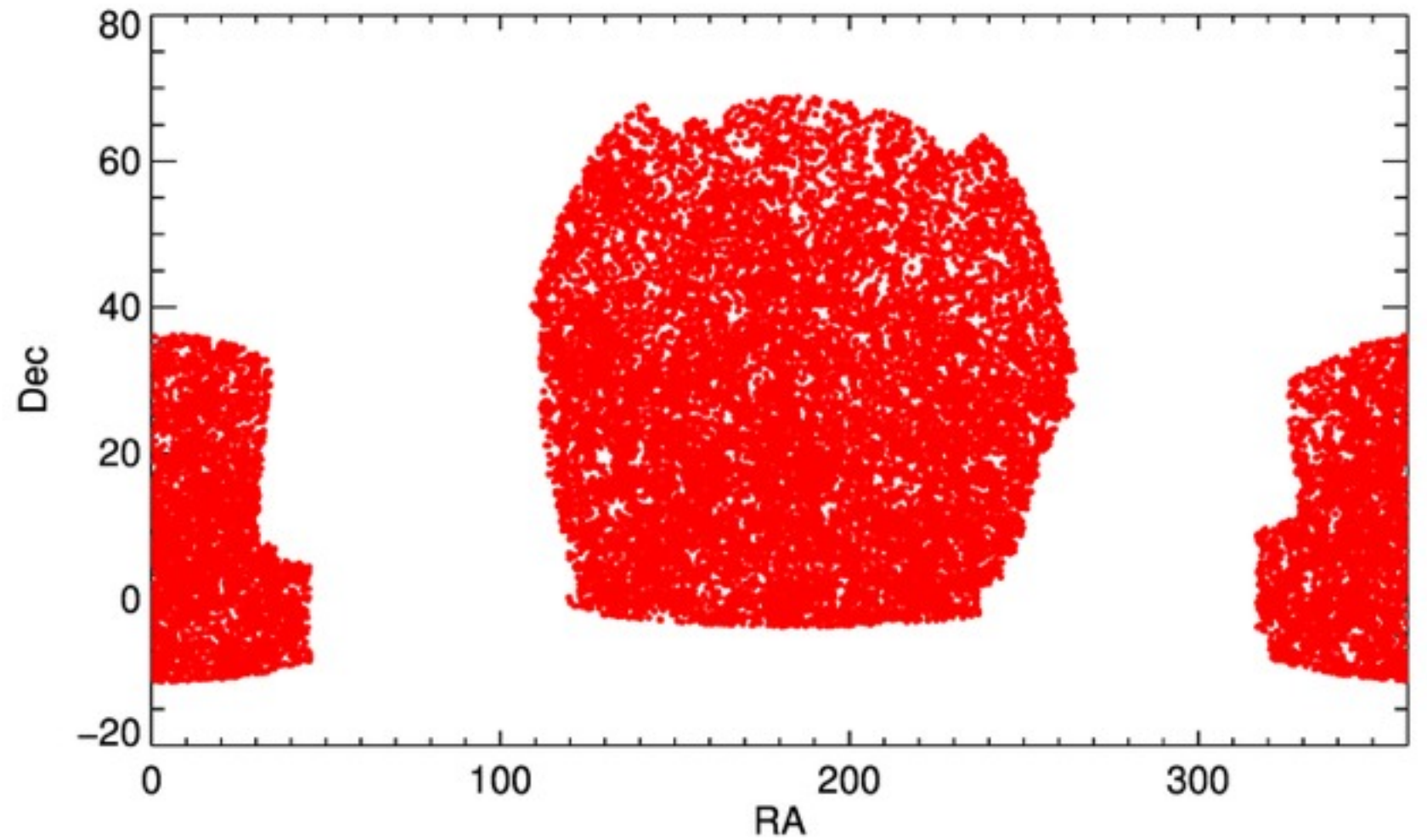
$-30.28 \leq M_i \leq -22.0$

redMaPPer

~ 25,000 clusters

$0.1 < z < 0.6$

multi-color richness



Cluster Catalog

redMaPPer catalog:

~ 25,000 clusters

$0.1 < z < 0.6$

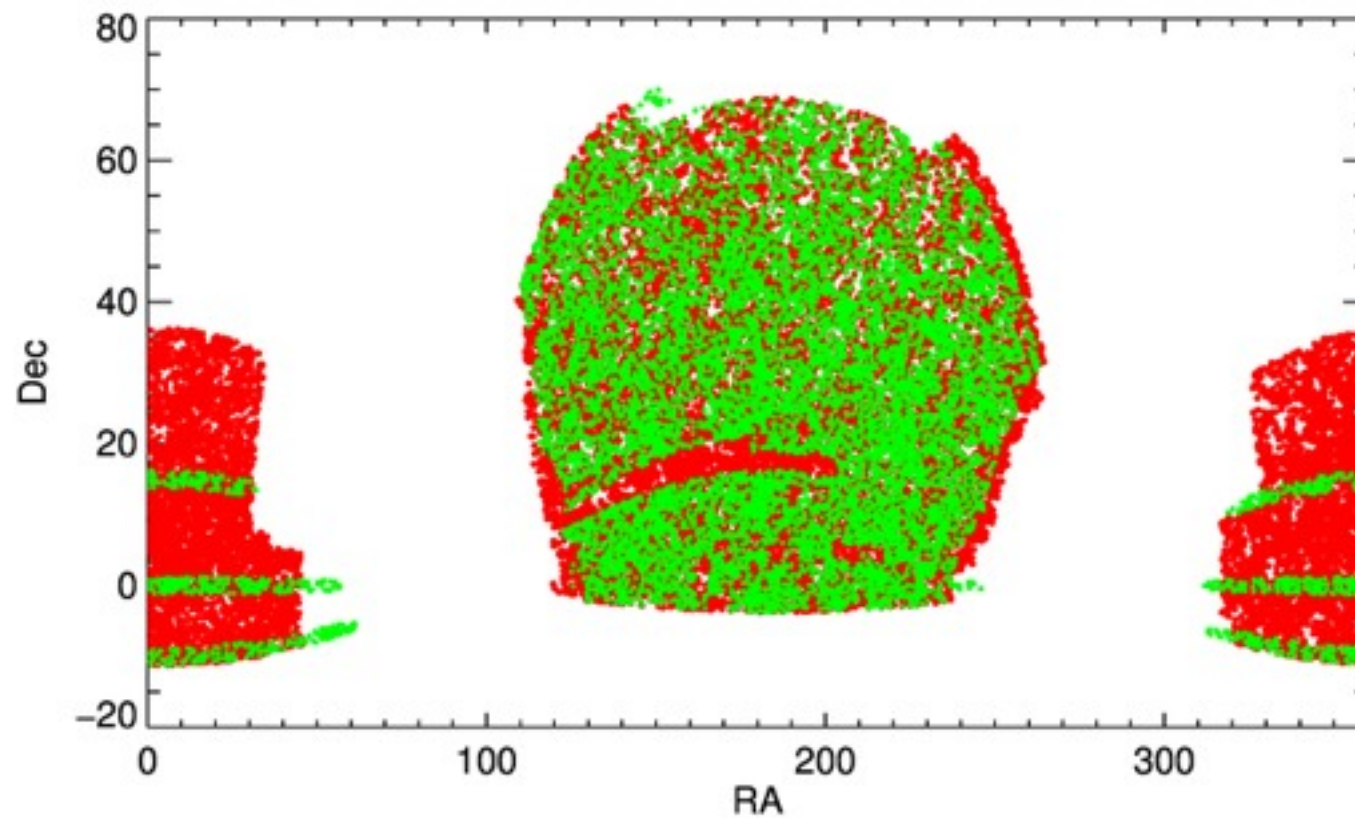
multi-color richness

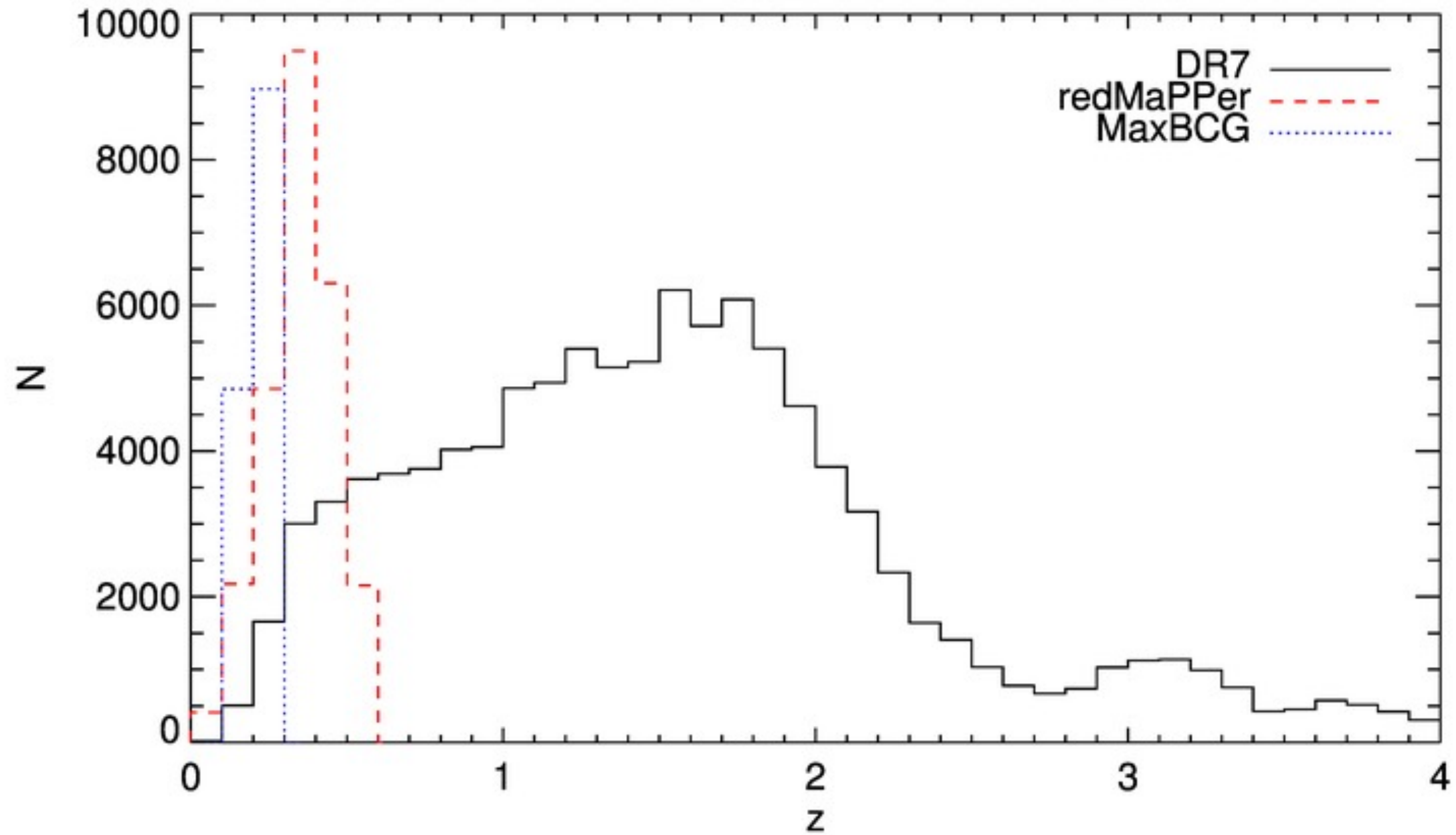
MaxBCG catalog:

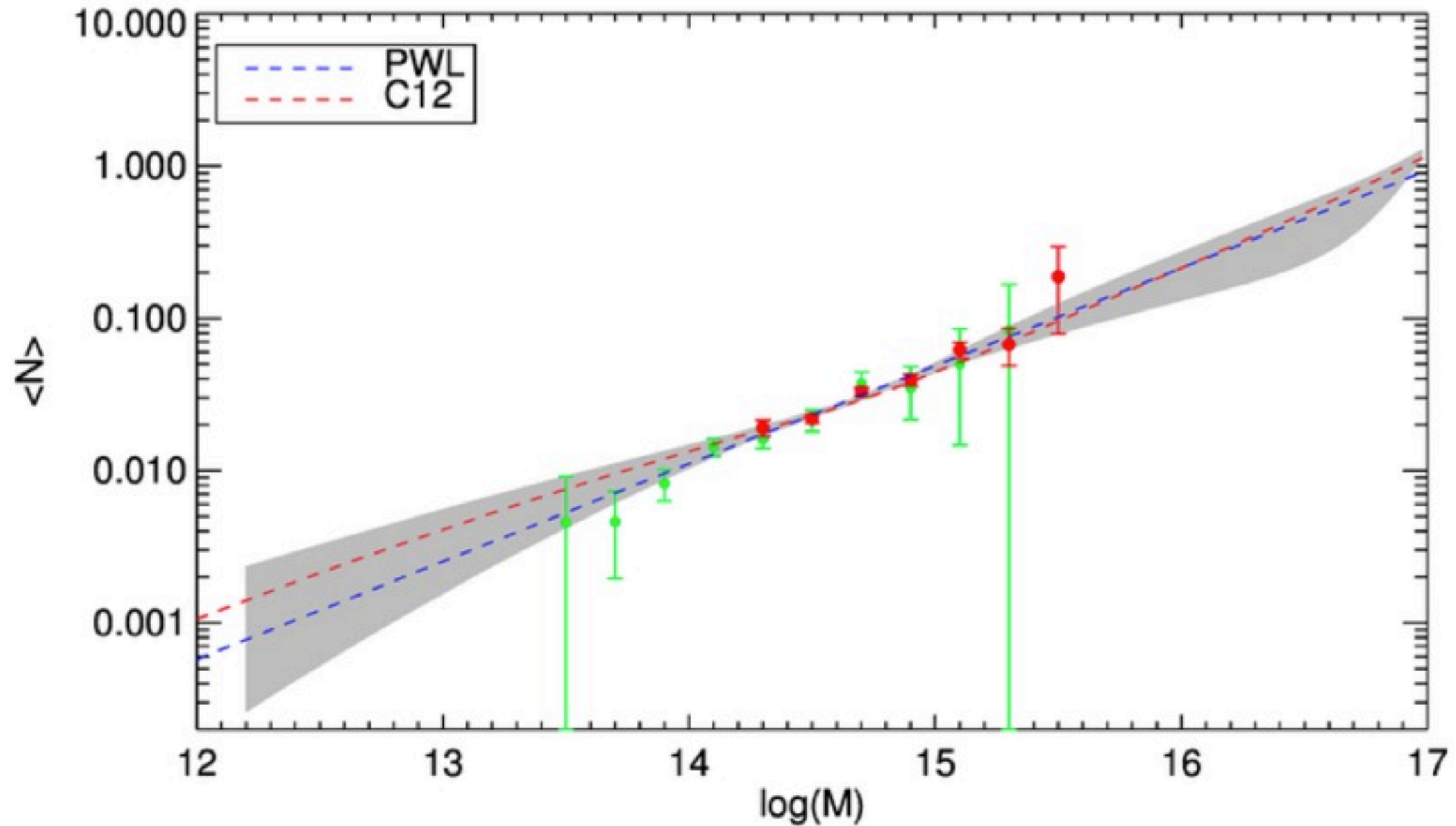
~ 13,700 clusters

$0.1 < z < 0.3$

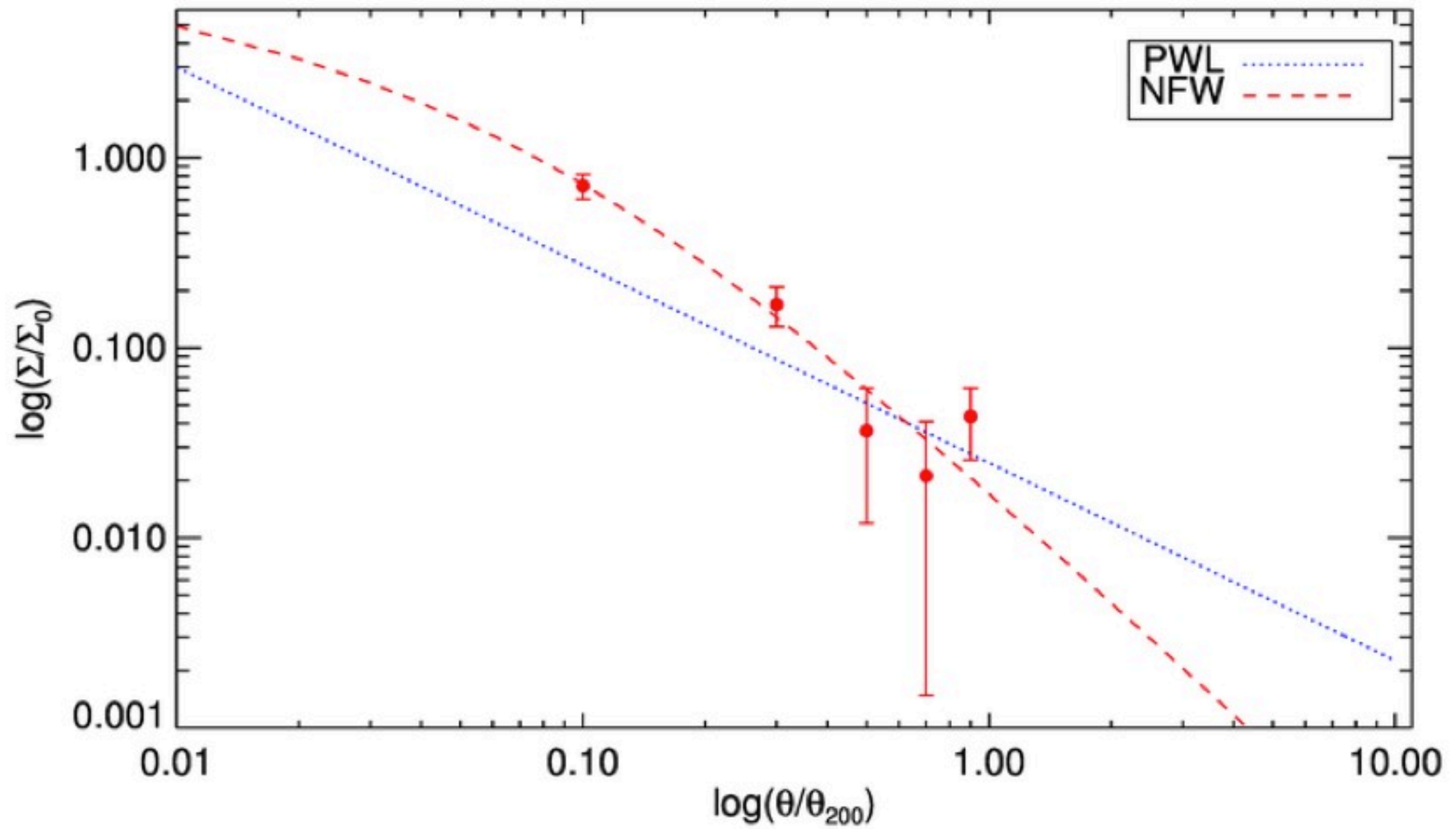
single-color richness







The MOF of quasars measured using MaxBCG catalog (green points) and using the redMaPPer catalog (red points).



- HOD is a powerful analysis to interpret the clustering of luminous objects.
- Direct measurement method is a sufficient approach to break the degeneracy between HOD models.
- Preliminary result of the MOF shows the mean number of quasars increasing monotonically as a function of halo mass.

Thank You!