



From First Light to the Milky Way, Zurich 2003

The Clustering of SDSS Galaxies vs Color (using Photometric Redshifts)

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**T. Budavari, A. Connolly, I. Csabai, I. Szapudi
and the SDSS Collaboration**

$w(\theta)$ with Photo-z

Advantages

- Sample selection based on rest-frame quantities
- Strictly volume limited samples
- Current sample chosen to overlap with spectroscopic sample for comparisons
- Largest angular correlation study to date

Photometric Redshifts

Physical inversion of photometric measurements!

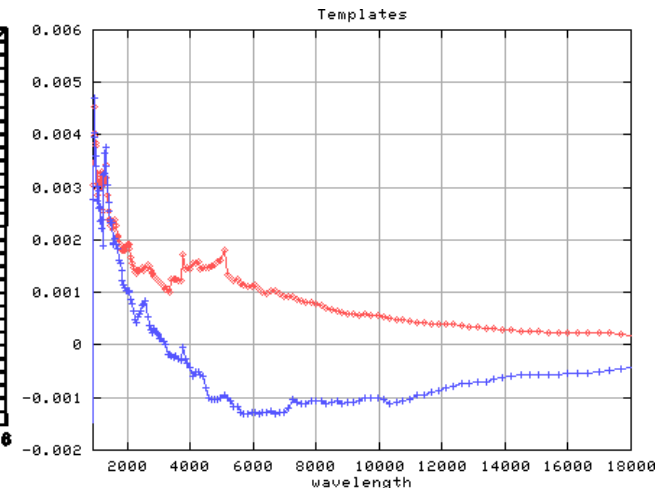
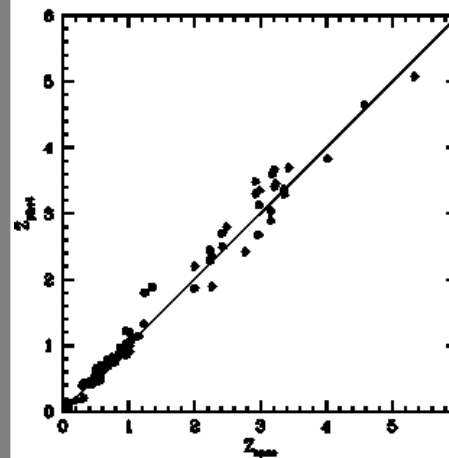
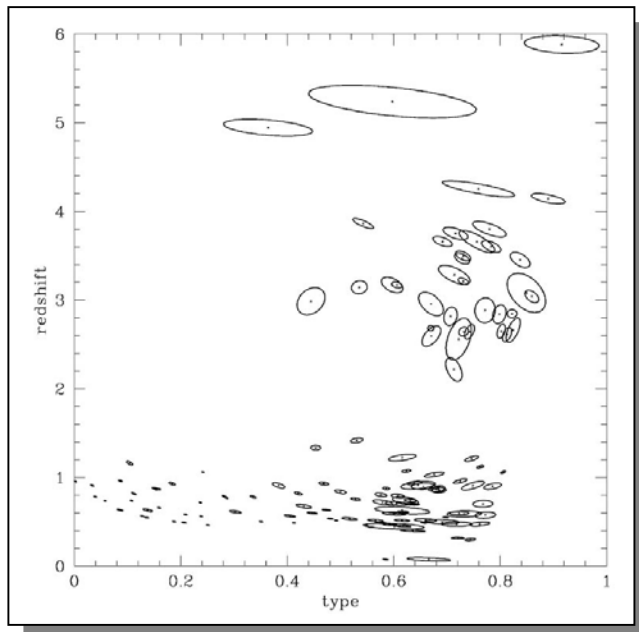
Adaptive template method (Csabai et al 2001, Budavari et al 2001, Csabai et al 2002)

Covariance of parameters

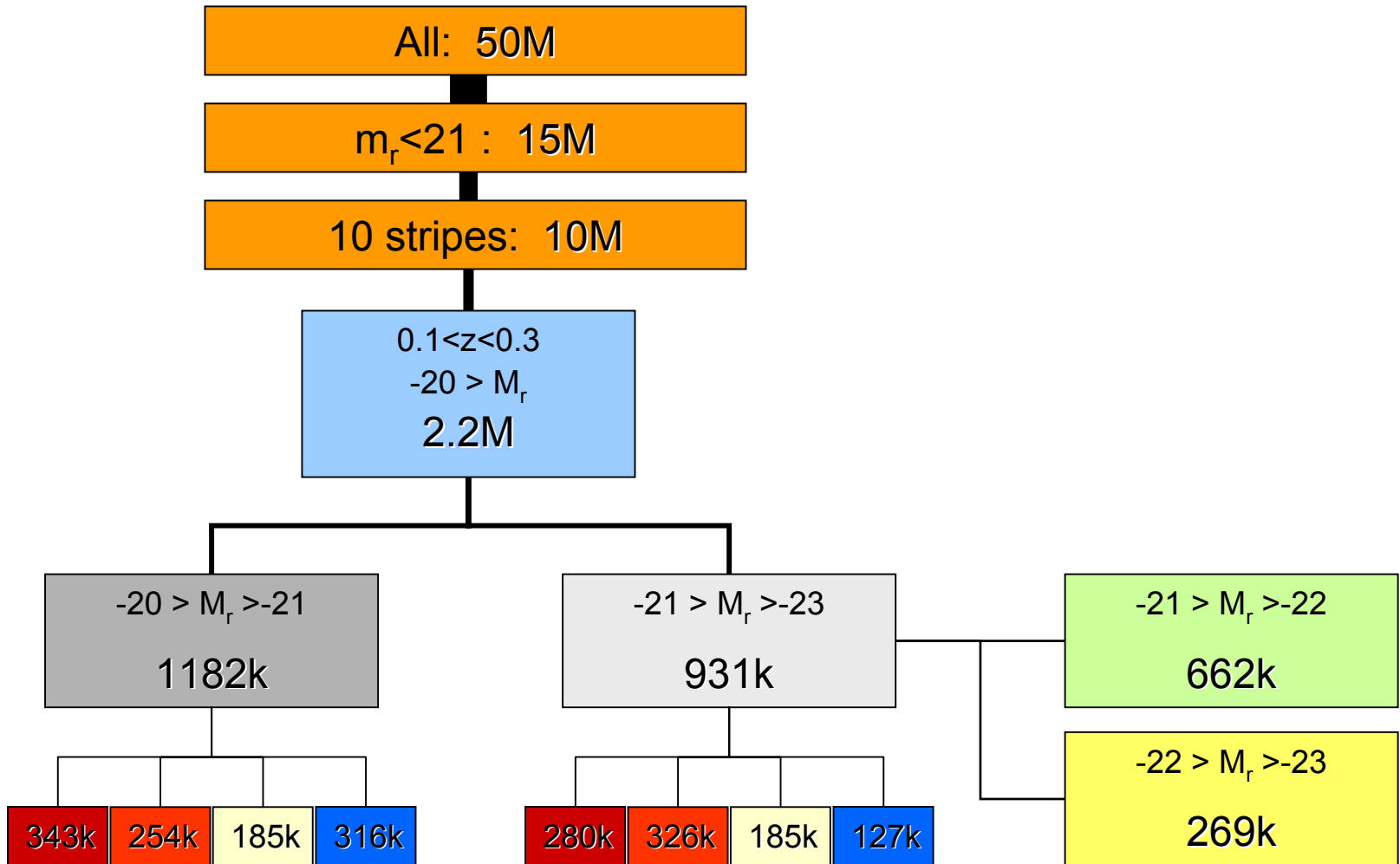
u
g
r
i
z



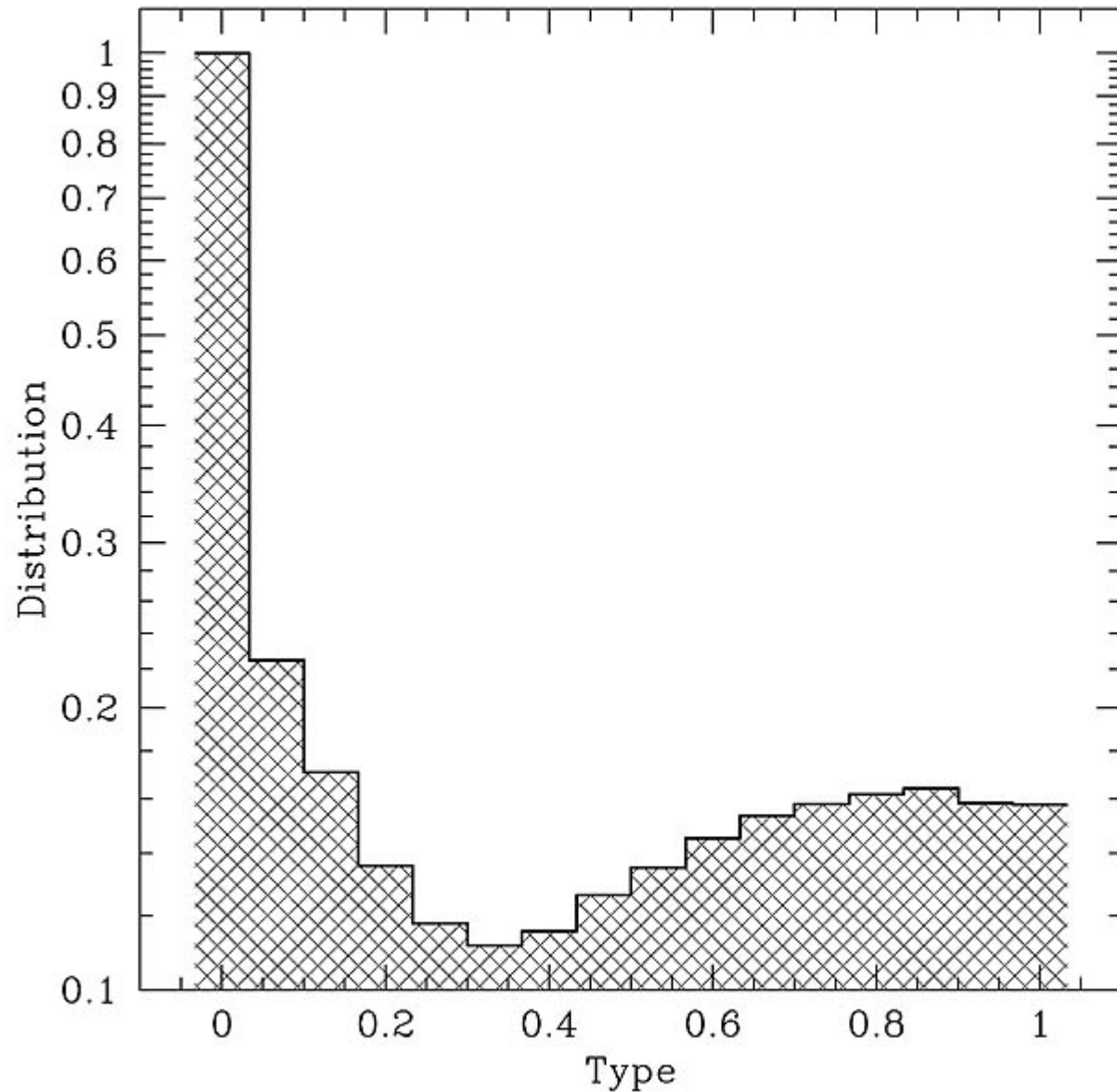
L
Type
z



The Sample

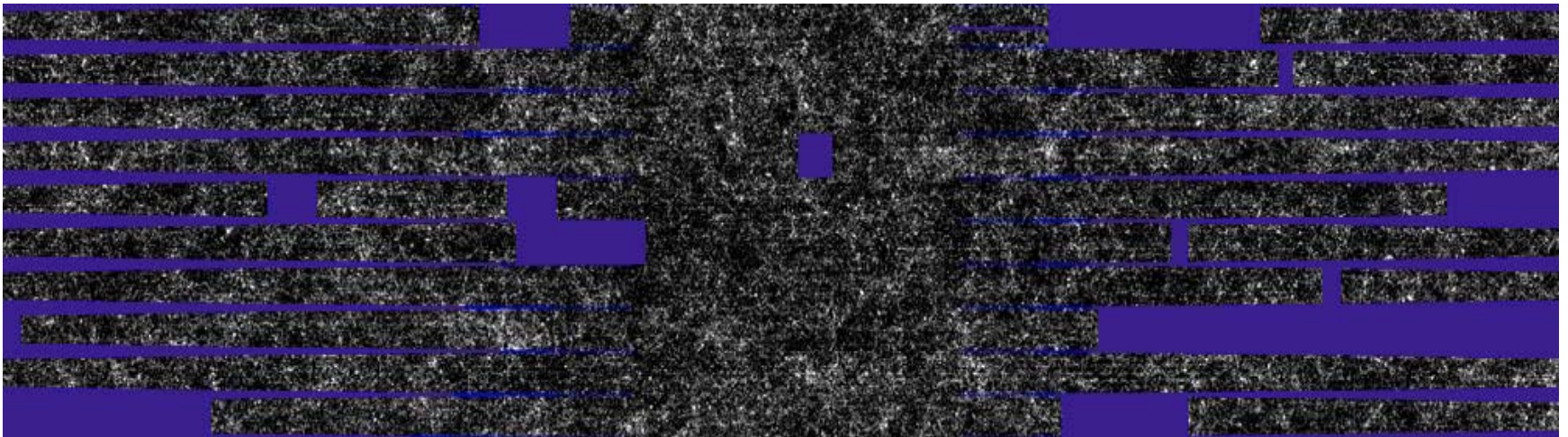


Distribution of SED Type



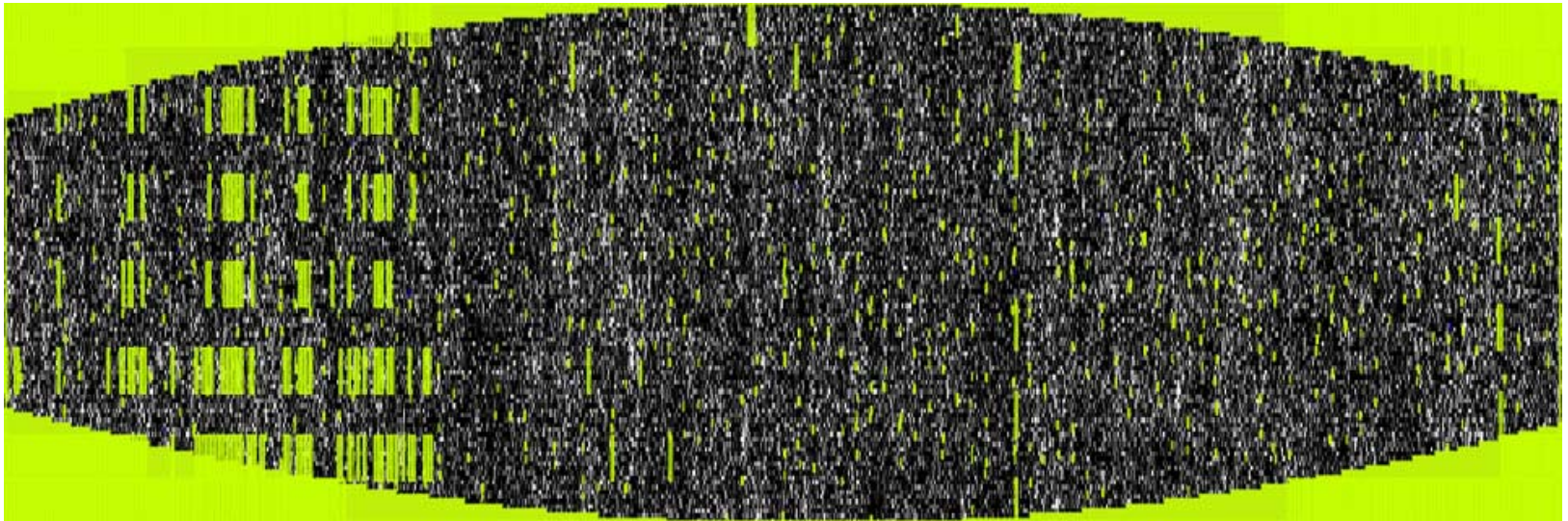
The Stripes

- 10 stripes over the SDSS area, covering about 2800 square degrees
- About 20% lost due to bad seeing
- Masks: seeing, bright stars



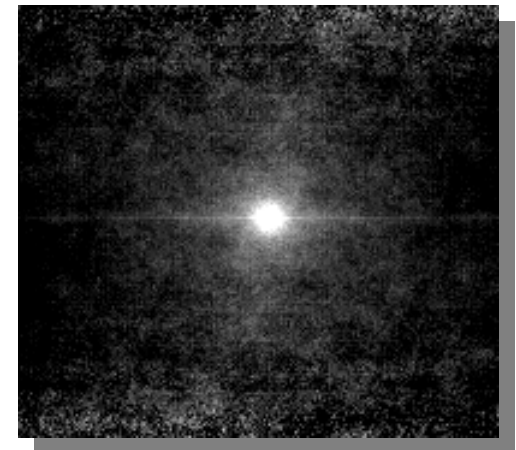
The Masks

- Stripe 11 + masks
- Masks are derived from the database
 - bad seeing, bright stars, satellites, etc



The Analysis

- eSpICE : I.Szapudi, S.Colombi and S.Prunet
- Integrated with the database by T. Budavari
- Extremely fast processing:
 - 1 stripe with about 1 million galaxies is processed in 3 mins
 - Usual figure was 10 min for 10,000 galaxies => 70 days
- Each stripe processed separately for each cut
- 2D angular correlation function computed
- $w(\theta)$: average with rejection of pixels along the scan
 - Correlations due to flat field vector
 - Unavoidable for drift scan



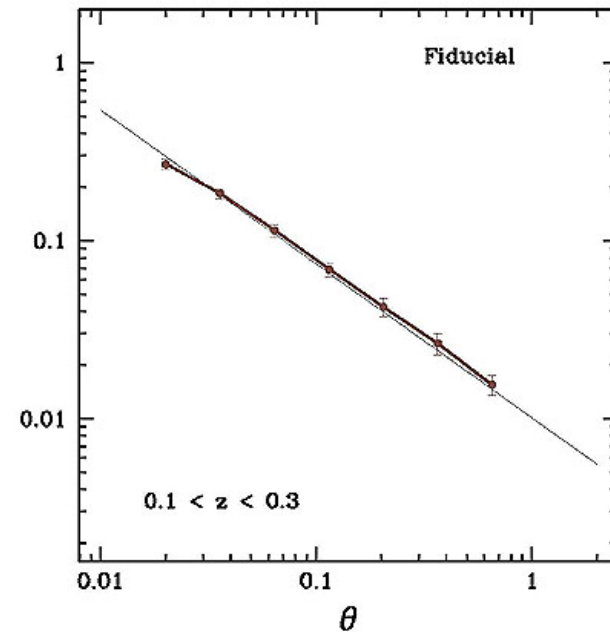
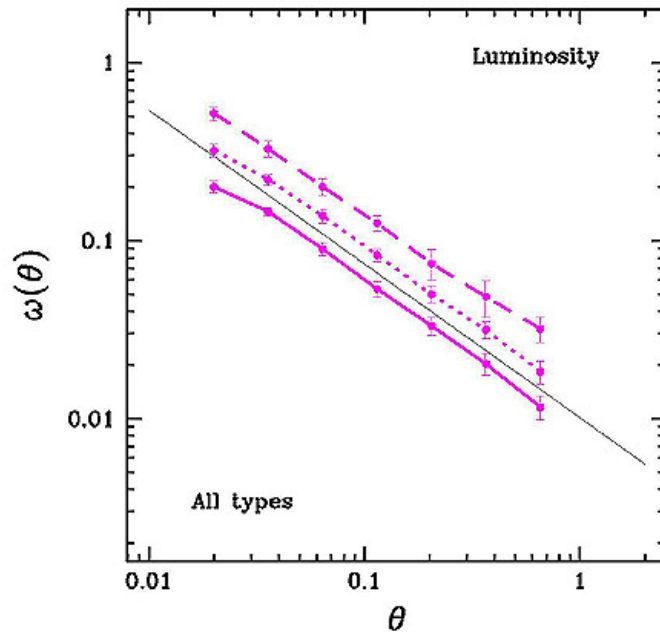
Angular Correlations I.

● Luminosity dependence: 3 cuts

-20 > M > -21

-21 > M > -22

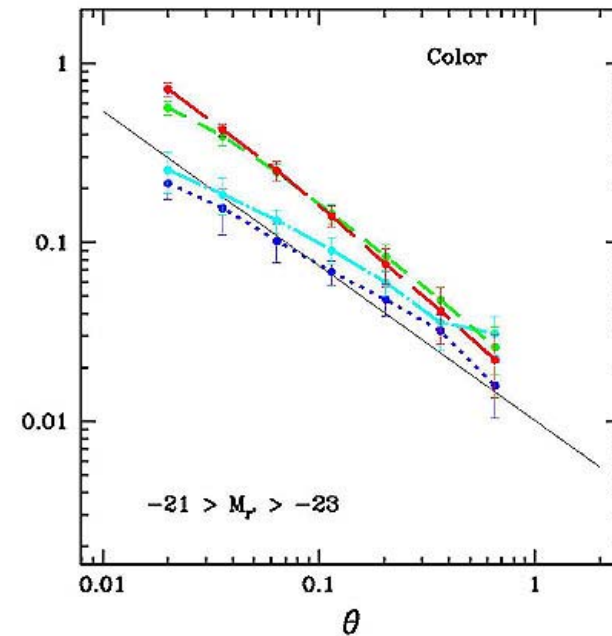
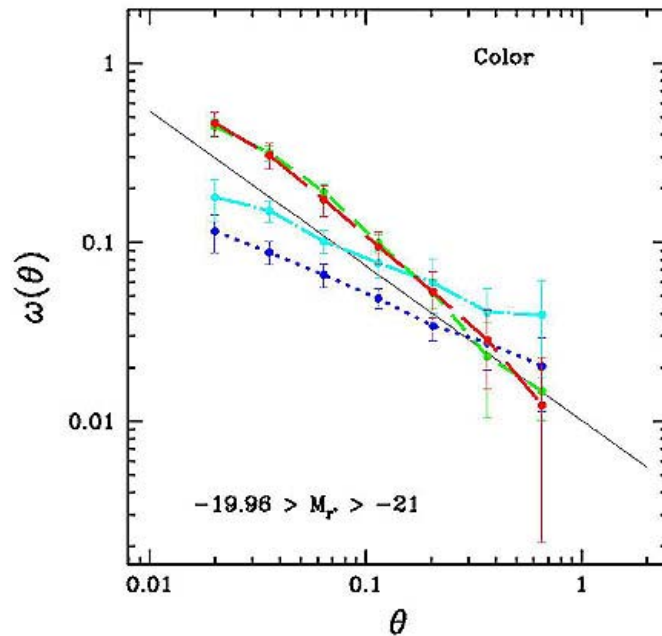
-22 > M > -23



Angular Correlations II.

Color Dependence

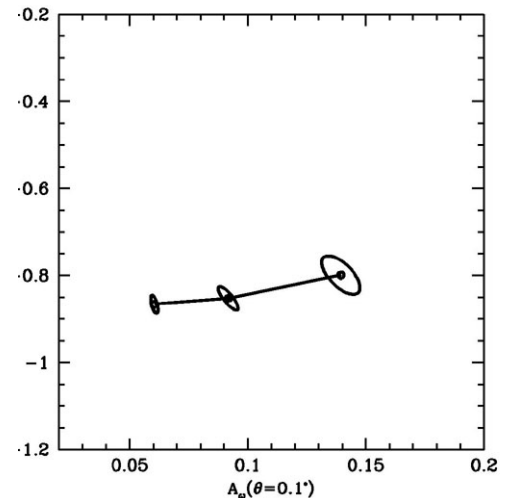
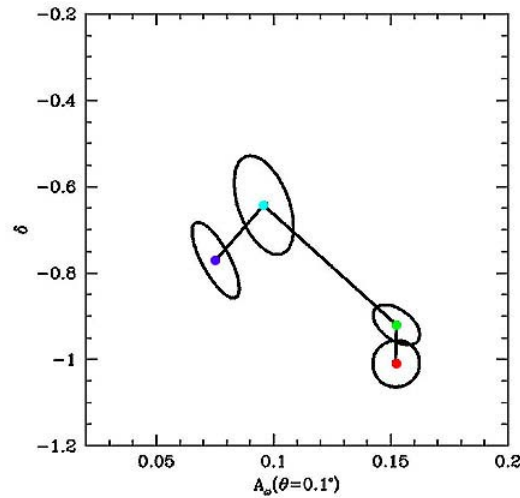
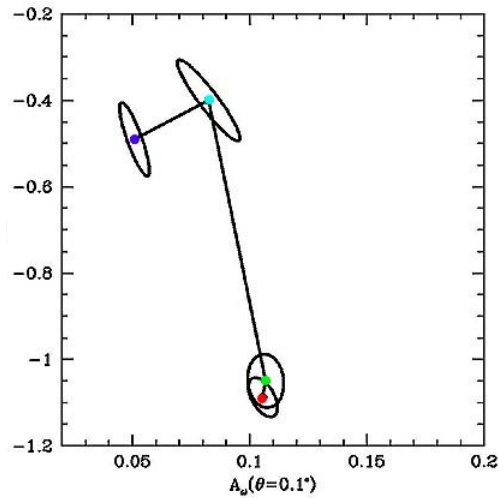
4 bins by rest-frame SED type



Power-law Fits

✪ Fitting

$$w(\theta) = A_\omega (\theta / 0.1^\circ)^\delta$$



Redshift distribution

- The distribution of the true redshift (z), given the photoz (s)

- Bayes' theorem

$$P(z | s) = \frac{P(s | z)P(z)}{P(s)}$$

- Given a selection window $W(s)$

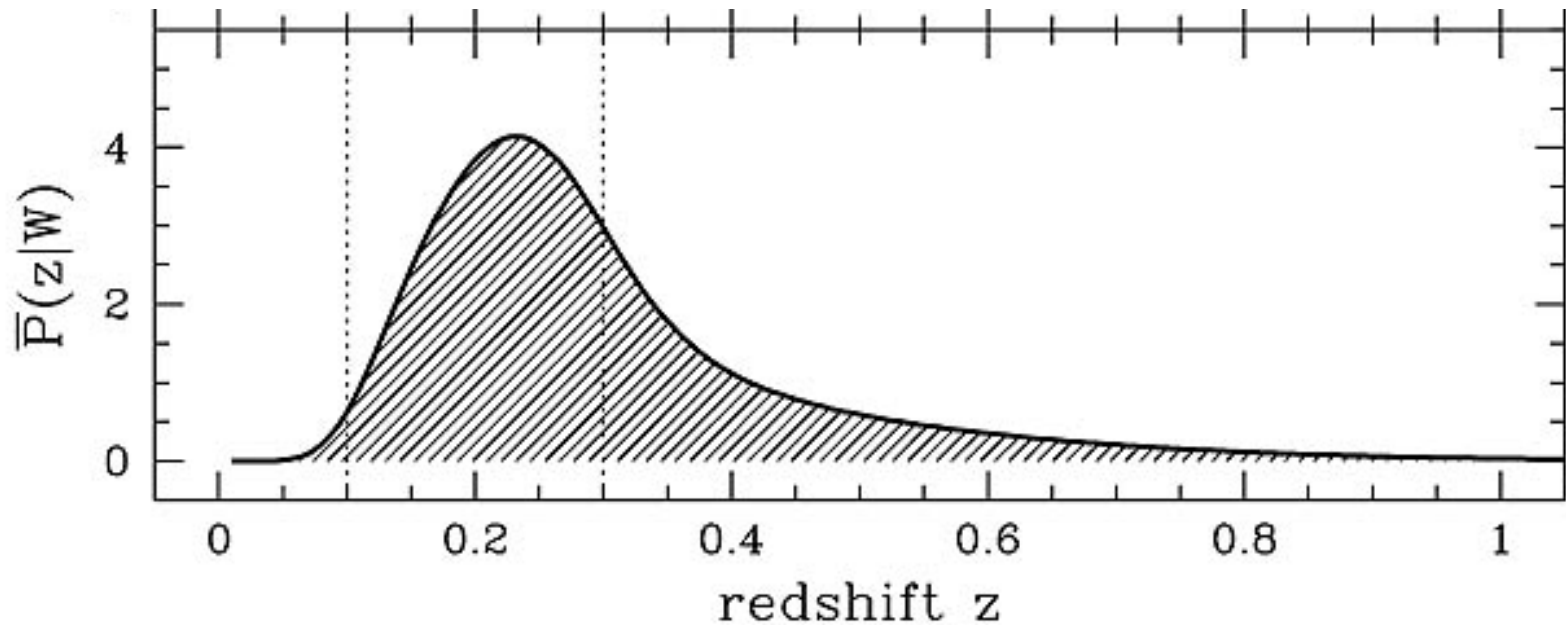
$$P_w(z) = \int ds P(s) W(s) \frac{P(s | z)P(z)}{P(s)}$$

- A convolution with the selection window

$$P_w(z) = P(z) \int ds W(s) P(s | z)$$

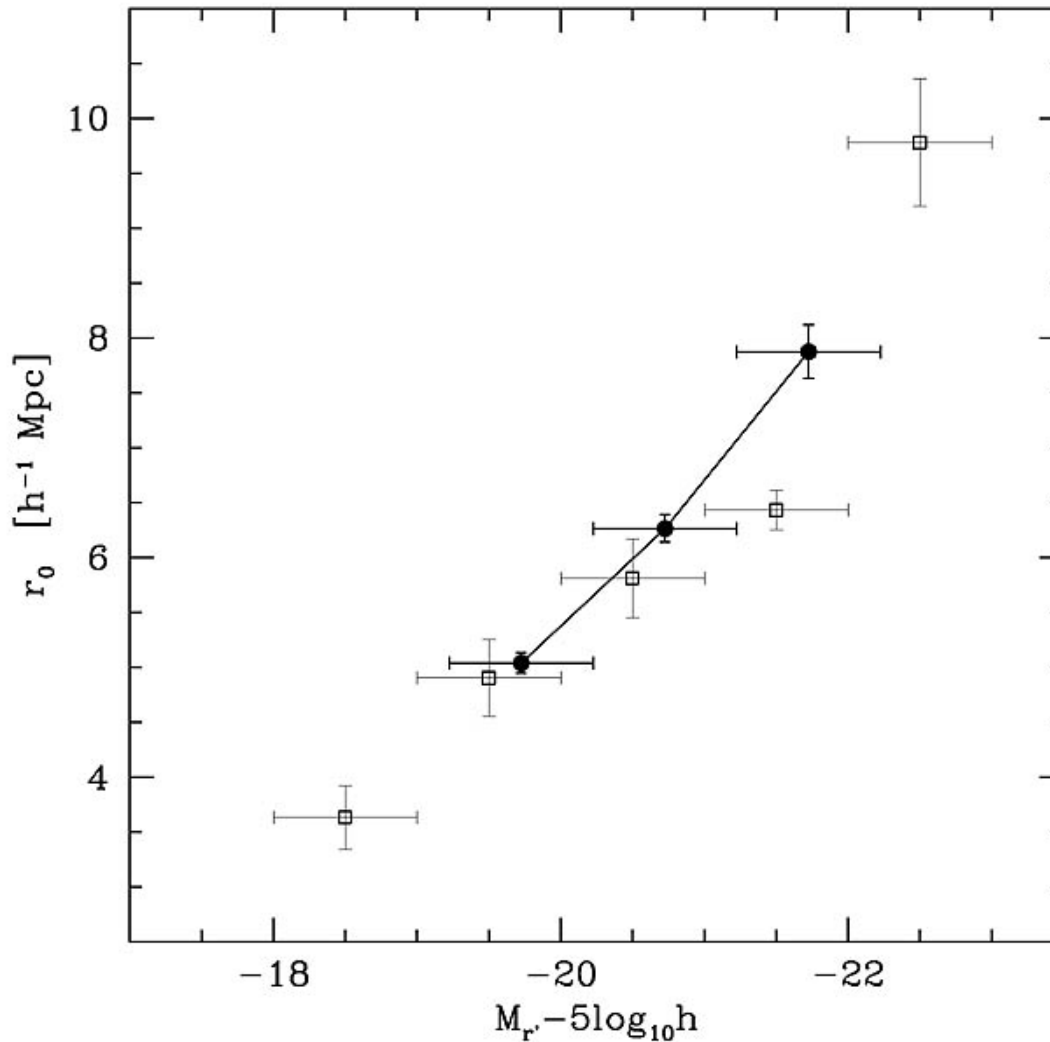
Detailed modeling

- Errors depend on S/N
- Final dn/dz summed over bins of m_r



Inversion to r_0

From $(dn/dz) +$ Limber's equation $\rightarrow r_0$

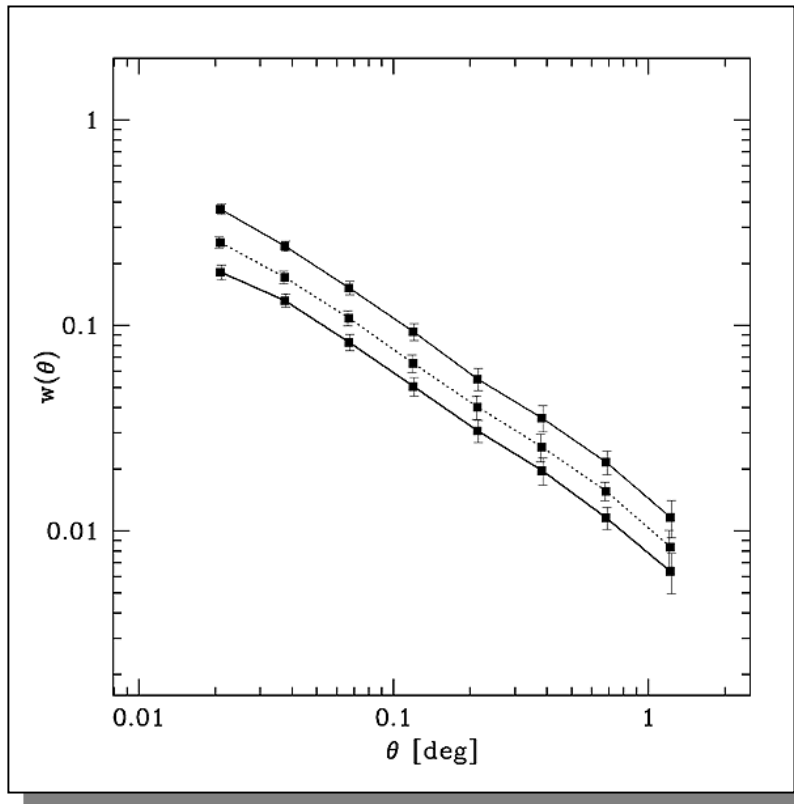


Bimodal $w(\theta)$

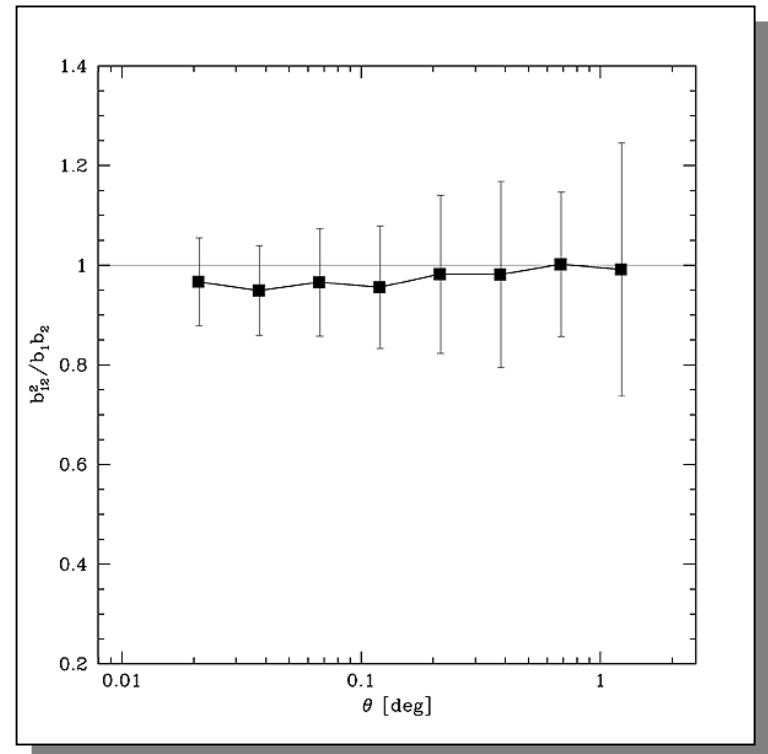
- No change in slope with L-only cuts
- Bimodal behavior with color cuts
- Slight change in slope with color/L cuts
- Can be explained, if galaxy distribution is bimodal (early vs late)
 - Correlation functions different
 - Bright end ($-20 >$) luminosity functions similar
 - Also seen in spectro sample (Baldry, Glazebrook et al 03)
- In this case L cuts do not change the mix
 - Correlations similar
 - Prediction: change in slope around -18
 - Color cuts would change mix => changing slope

Cross-Correlations I.

☉ Luminosity split (20-21 vs 21-23)



w

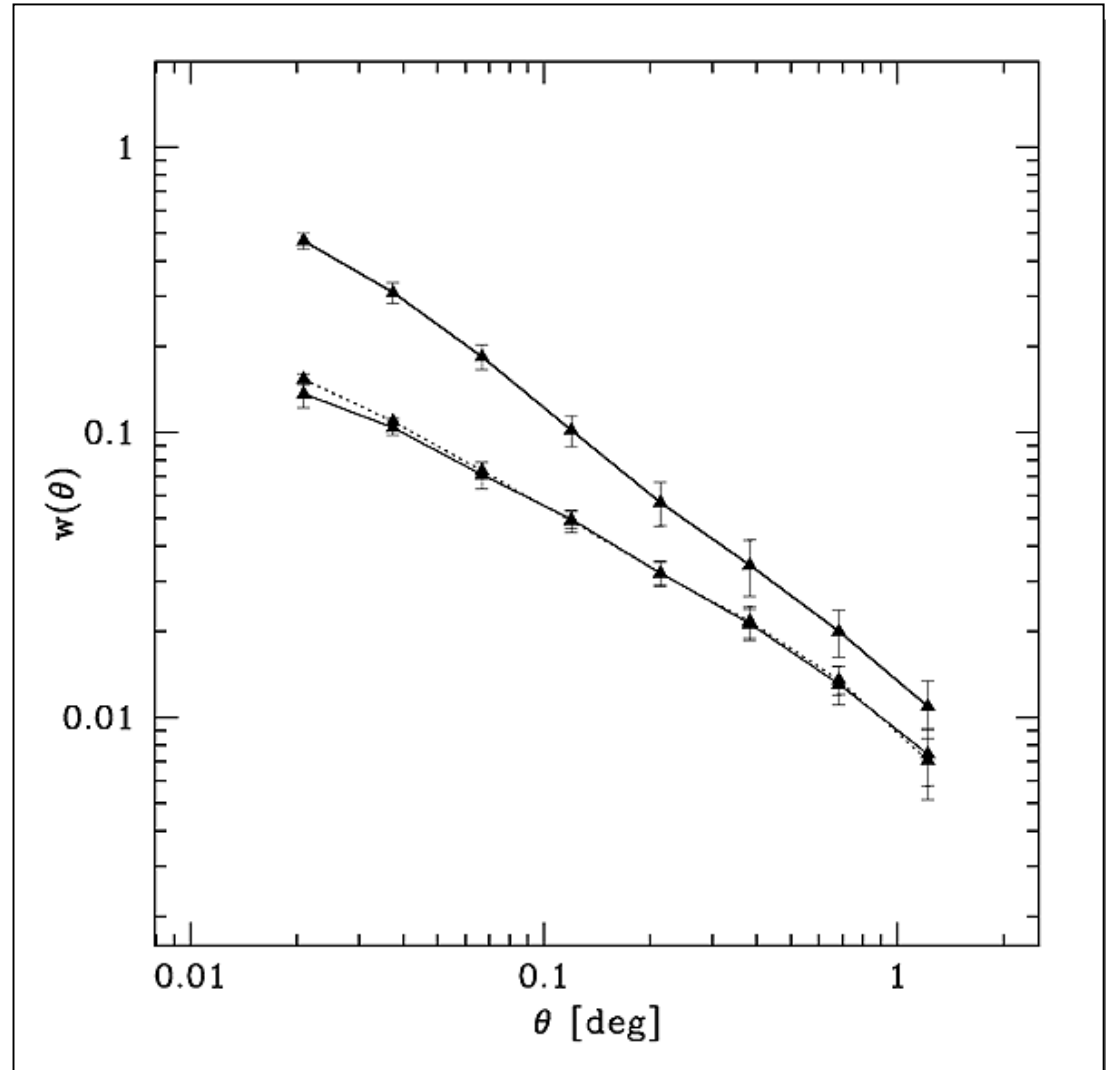


$$\frac{w_{12}}{\sqrt{w_{11} w_{22}}} = \frac{b_{12}^2}{b_1 b_2}$$

Linear bias!

Cross-Correlations II.

- Color split:
red vs blue half
- Xcorr:
identical to BB!
- Multi-halo
model?



Conclusions

- Rest-frame sample selection
- Approximately volume limited samples
- Largest angular correlation study to date
- Results consistent with 3D clustering
- Clear detection of L and color dependence
- L dependence points to linear bias
- Color dependence strongly bimodal!
- Puzzling cross-correlation properties
- Challenge for semi-analytic scenarios