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### Redshift Space Distortion with different galaxy colour and group mass

Qianjun Hang Supervisors: John Peacock & Shadab Alam

### Large Scale Structure of the Universe



2dF Survey Final Data Release 2003

### What is RSD?

- \* It all starts with velocities...
- \* Distances to galaxies are measured by redshifts of their spectra via Hubble's law  $D \sim v/H$
- \* Galaxies can have peculiar velocities  $D' \sim (v+u)/H$



More complicated: baryonic physics, non-linearity etc.

### 2D correlation function



- from random distribution at certain scale.

\* In simulations, we can compare both real space and redshift space.

\* Correlation function: measures the deviation of galaxy distribution

### How to model these effects?

- \* We have good theory
- \* Peculiar velocity:  $\nabla$



- \*  $\delta$  comes from displacements:  $\delta = -\nabla \cdot \mathbf{D}$
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- \*  $\delta \rightarrow (1+f\mu^2) \delta$
- \* Galaxies  $\delta_g = b(1+f\mu^2)$

y on large scales!  

$$f \cdot \mathbf{u} = -\dot{\delta} = -Hf\delta$$

$$f = \frac{d\ln\delta}{d\ln a}$$

Along line of sight,  $D \rightarrow (1+f\mu)D$ , where  $\mu = \cos\theta$ 

$$\delta = (1 + \beta \mu^2) \delta$$
, where  $\beta = f/b$ 

### How to model these effects?



 $P_{c}^{s}(k,\mu) = b_{\rm gal}b_{\rm grp}(1+\beta_{\rm gal}\mu^{2})(1+b_{12}\beta_{\rm gal}\mu^{2})P_{m}^{r}(k),$ 

Mohammad et. al. 2016

### Cross-correlation of galaxies and groups

### GAMA



Mocks

## Fitting the mocks

\* We fit the projected correlation function  $w_p$  and the multipole expansions  $\xi_l$ , l=0,2,4.



Fitting mean of the mocks: galaxy auto-correlation

Model 1







# Fitting the mocks





We fit with various minimum scale cuts  $r_{min}$  because measurements at very small scales are biased.



# Preliminary Results: mocks

Model 1



The mean gives relatively unbiased results.

Model 2

## Preliminary Results: GAMA data

Model 1



Consistent with Blake et. al. 2013, where they measured  $f\sigma_8=0.36\pm0.09$  from GAMA at *z=0.18* 

Model 2

# Thank you!

Questions?