DR12 RSD Measurements of the Growth of Structure Using a New Model for the Galaxy Power Spectrum

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Model

- Hand et al. (arXiv:1706.02362)
- Halo model formalism



Okumura et al. (arXiv:1506.05814)

- RSD modeling via distribution function approach
- Various observational effects modeled
- 13 free parameters, each of which physically motivated

Window Function Convolution

• Convolving the theoretical power spectrum with the survey window function

$$Q_{\ell}(s) \propto \int_{-1}^{1} d\mu RR(s,\mu) \mathcal{L}_{\ell}(\mu) \simeq \sum RR(s_i,\mu_i) \mathcal{L}_{\ell}(\mu_i)$$



Fitting



Model Performance

- 84 N-series mocks
- With comparable fitting ranges, standard deviation of $f\sigma_8$ larger by 10-20%
- Including small-scale information improves the statistical precision in $f\sigma_8$



Model Performance

- Multidark PATCHY mocks V6S
- Checked that the true cosmology is obtained by fitting the model to data



BOSS DR12 RSD Analysis

• Combined samples (LOWZ+CMASS) in 3 redshift bins



• Can accurately model P_0 , P_2 , and P_4 down to $k = 0.4 h \text{Mpc}^{-1}$

BOSS DR12 RSD Analysis



• With $k_{\text{max}} = 0.4 h \text{Mpc}^{-1}$, 4-6% constraint on $f\sigma_8$ (AP parameters fixed)

$\sigma(f\sigma_8)$	$z_{\rm eff}=0.38$	$z_{\rm eff}=0.51$	$z_{\rm eff}=0.61$
NGC	$0.460 \ ^{+0.022}_{-0.024}$	$0.482 \ ^{+0.019}_{-0.019}$	$0.444 \ ^{+0.019}_{-0.020}$
SGC	$0.466 \ ^{+0.025}_{-0.027}$	$0.481 \ ^{+0.023}_{-0.024}$	$0.448 \ ^{+0.022}_{-0.023}$

BOSS DR12 RSD Analysis



- Marginalizing over AP parameters degrades constraints by ~30%
- Small-scale information helps breaking the degeneracies between $f\sigma_8$ and AP parameters

1D + 2D posterior distribution NGC bin 1 (z = 0.38)

- Relative to k = 0.2 hMpc⁻¹, ~30% improvement achieved by extending to 0.4 hMpc⁻¹
- Including hexadecapole, $f\sigma_8$ constraints improves by ~20%
- Higher multipoles are also modeled accurately, but minimal gain in $f\sigma_8$ constraints

Conclusion

- This model accurately predicts the clustering of galaxies in redshiftspace: P_0 , P_2 , and P_4 accurately modeled down to $k = 0.4 h \text{Mpc}^{-1}$
- We get 4-6% constraint on $f\sigma_8$ with $k_{\text{max}} = 0.4 h \text{Mpc}^{-1}$
- Extending to a larger k_{max} helps (from 0.2 to 0.4 hMpc⁻¹)

Thank you!