22ième Congrès Général de la Société Française de Physique

Marseille, le 04/07/2013

# Une nouvelle sonde de la cosmologie : le *galaxy clustering ratio*

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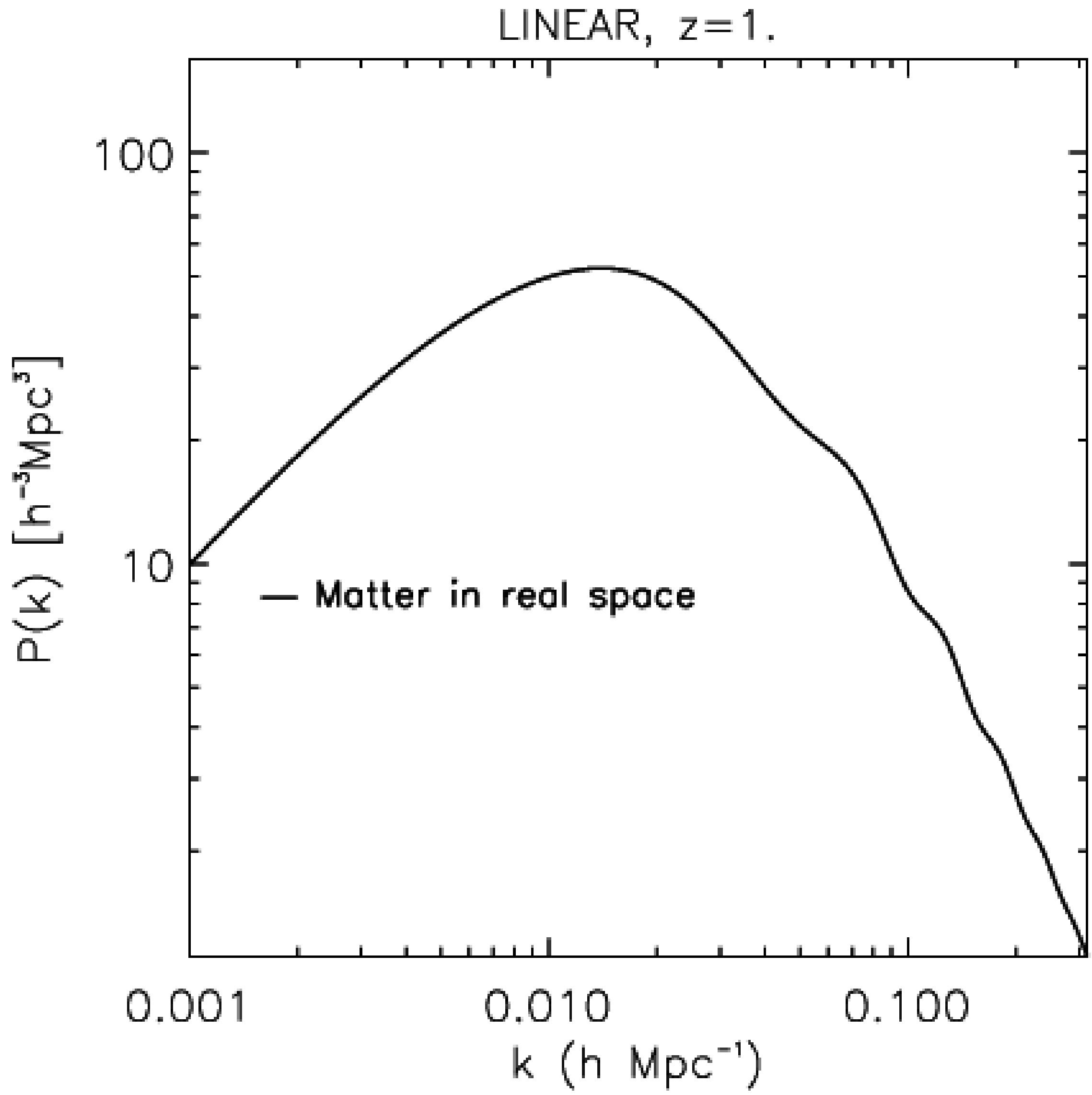
J. Bel & CM 2012 MNRAS, 424,971

J. Bel & CM 2013 A&A subm.

J. Bel, CM, L. Guzzo, J. Peacock,W. Percival et al.  (the VIPERS team) 2013 A&A subm.

# The Matter power spectrum



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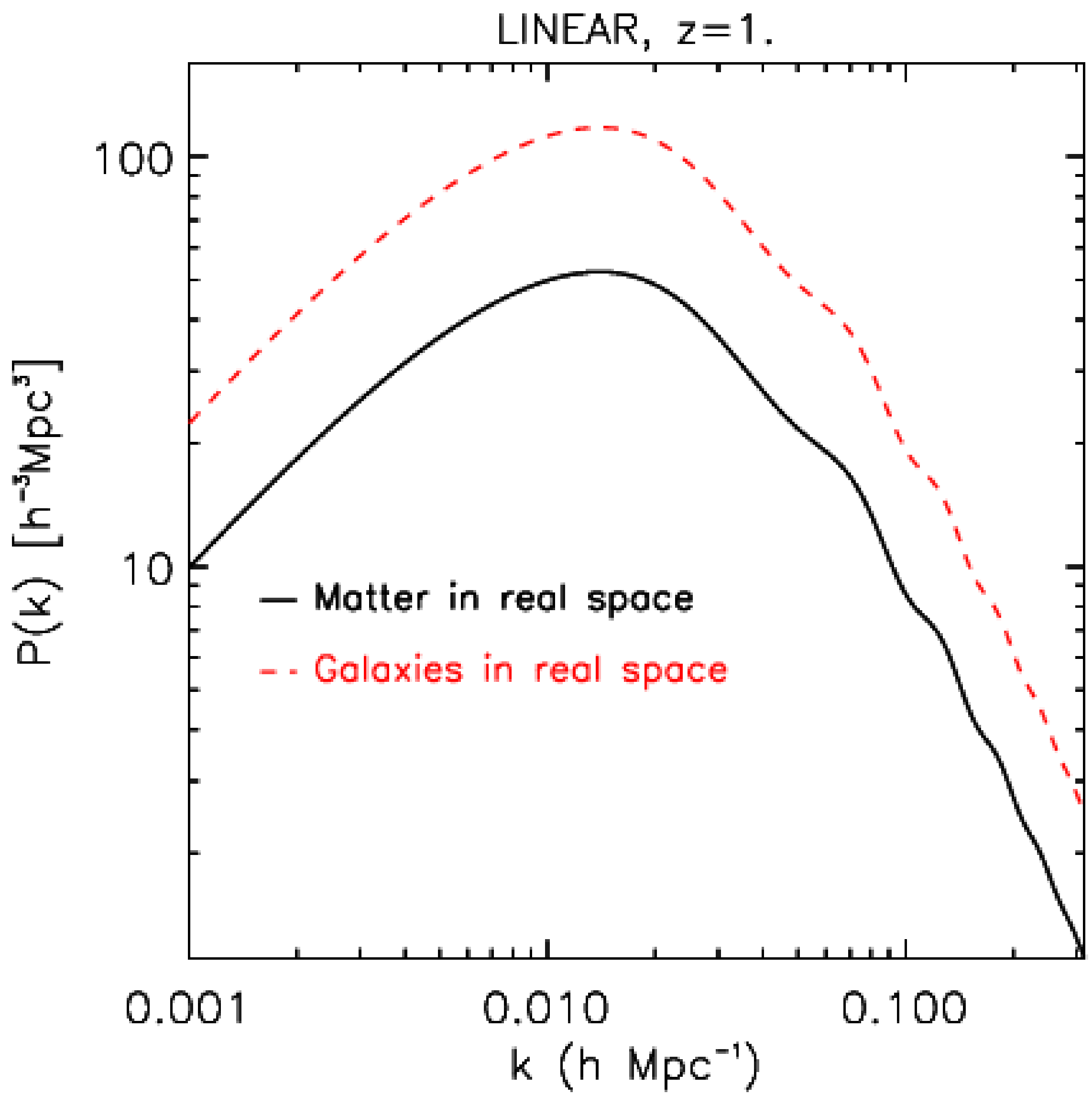


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Fry & Gaztañaga (1993)

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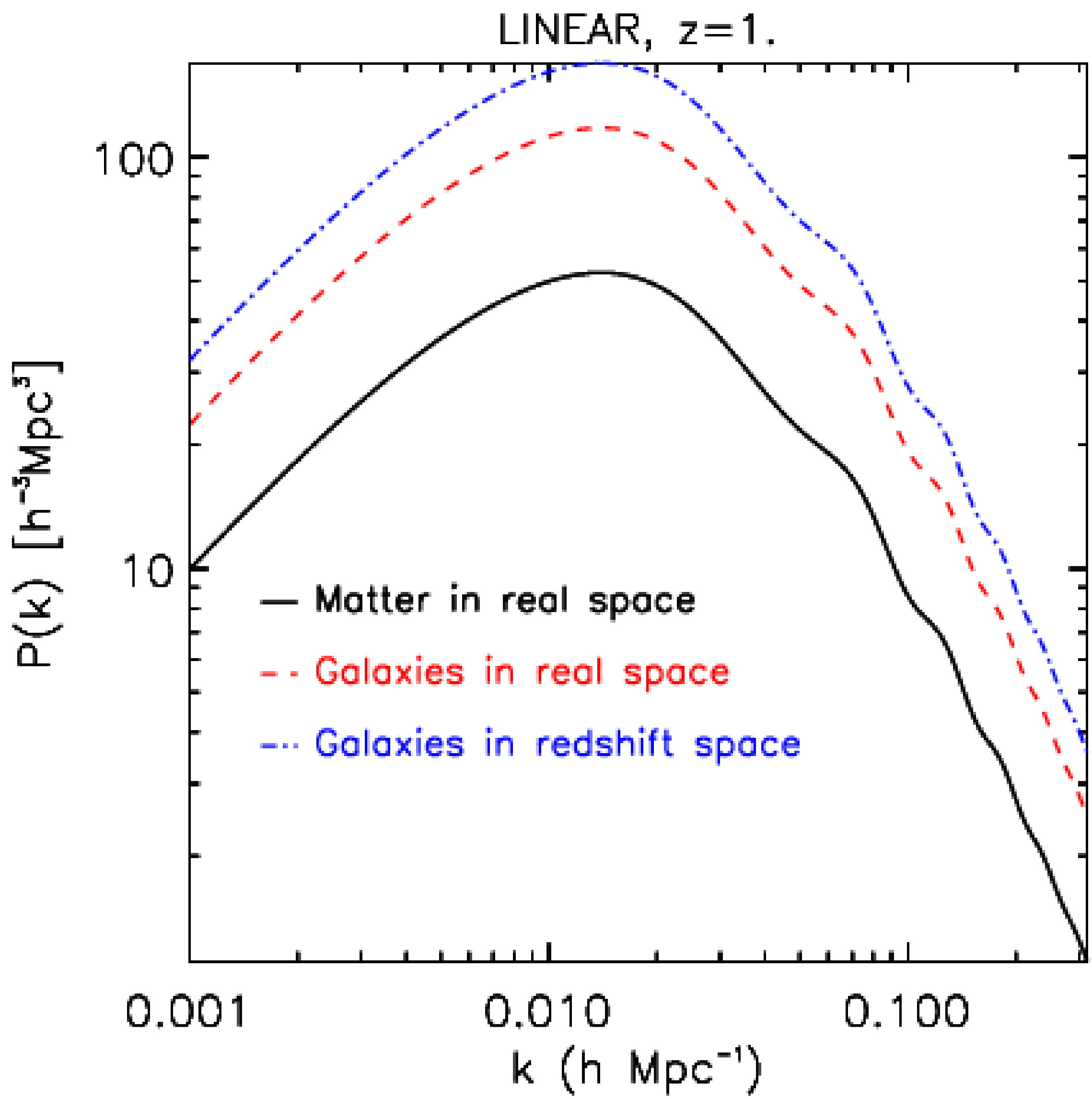


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Fry & Gaztañaga (1993)

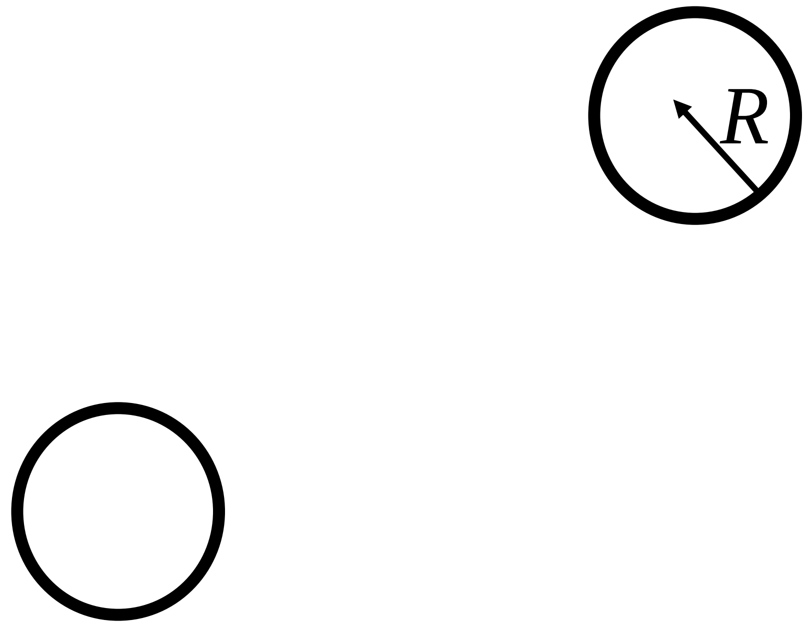
$$\delta_{g,R}{}^{z} = \delta_{g,R} + \mu_k{}^2 f^2 \delta_R$$

Kaiser (1987)

# Statistical properties of smoothed over-densities

Variance of fluctuations in spheres:

$$\sigma^2_{g,R} = \left\langle \delta_{g,R}^{\,2}(\vec{x}) \right\rangle$$



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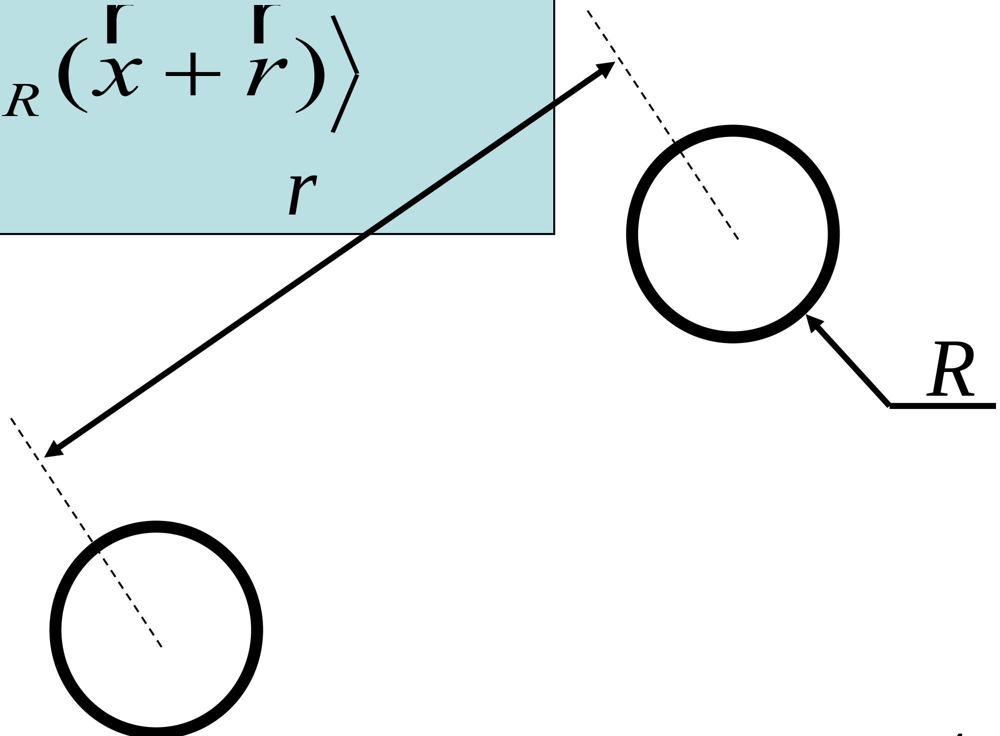
2-point correlation function of the smoothed fluctuations:

$$\xi_{g,R}(r) = \left\langle \delta_{g,R}(\vec{x})\,\delta_{g,R}(\vec{x}+\vec{r}) \right\rangle$$



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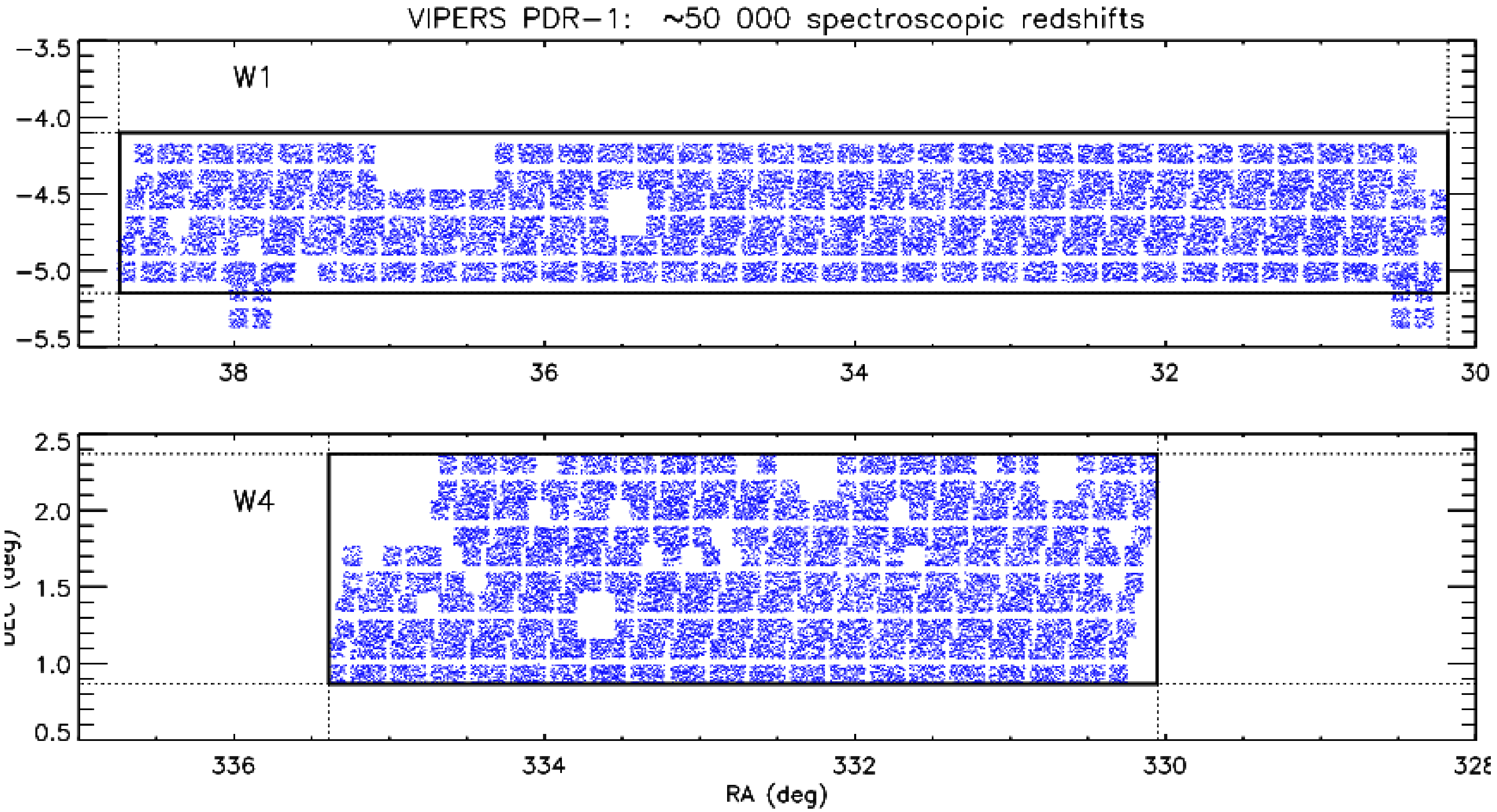

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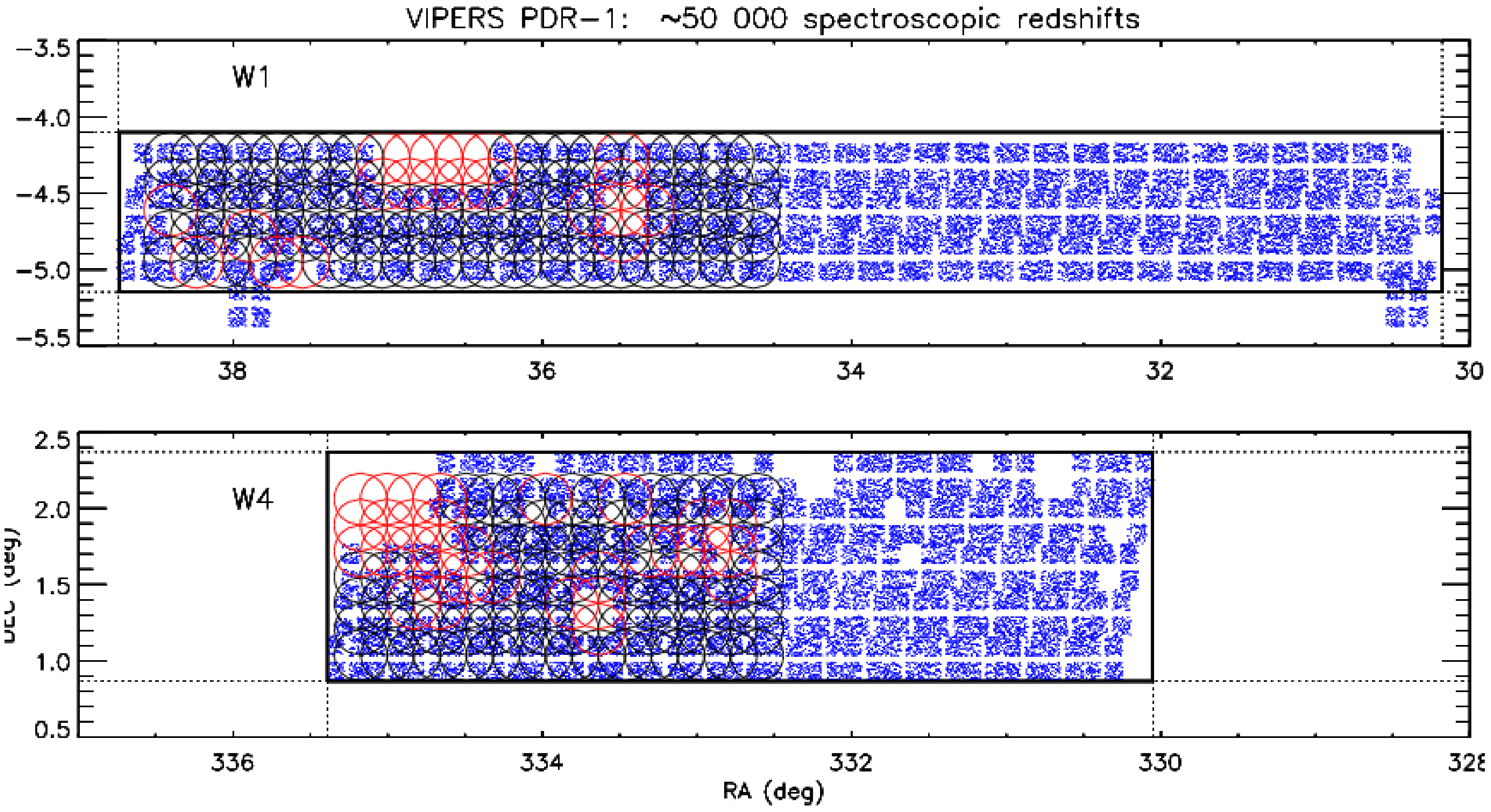

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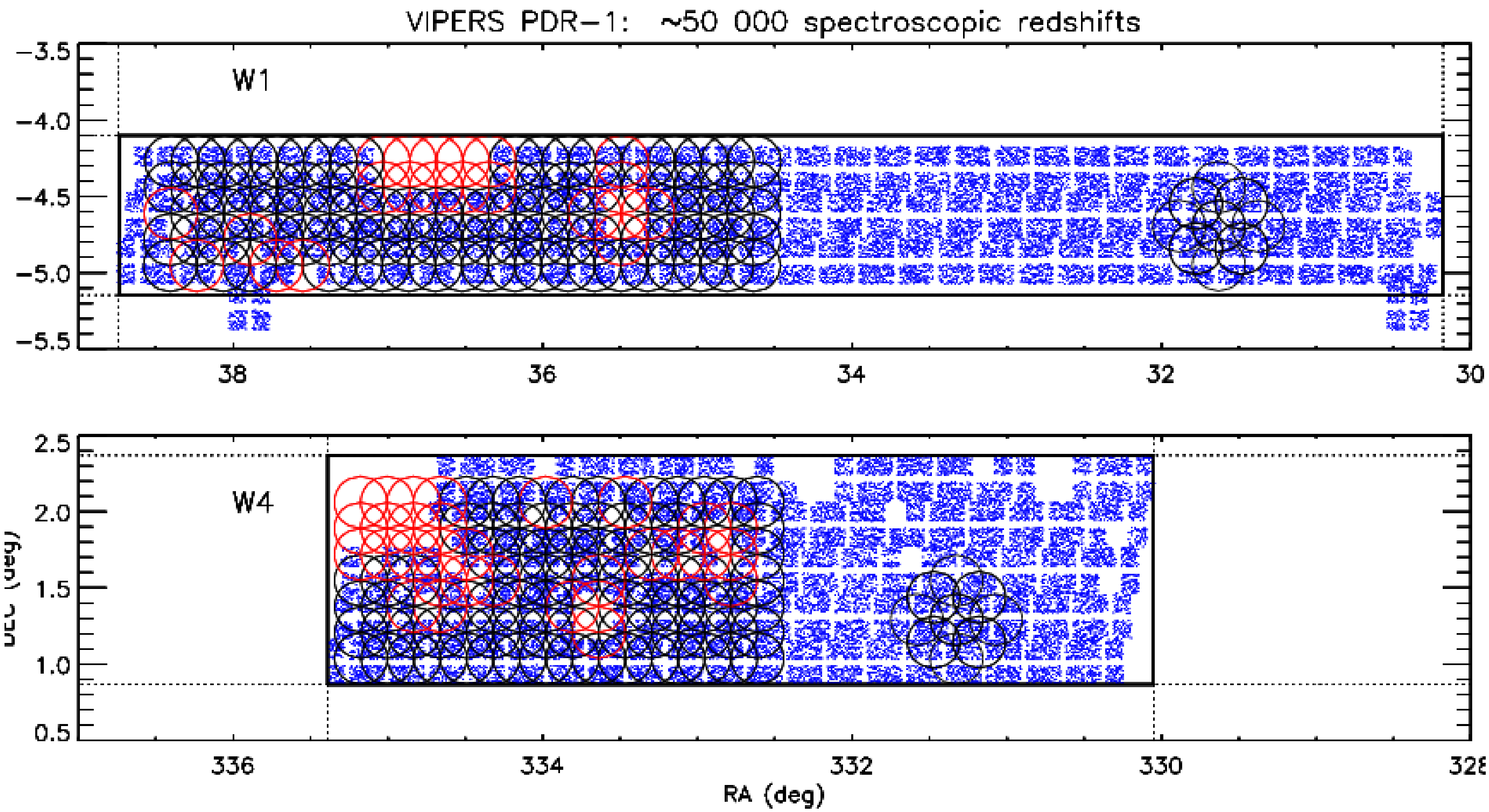

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$$F_R = \frac{\int_0^{+\infty} \Delta_k W^2_{TH}(kR)\, d\ln k}{\int_0^{+\infty} \Delta_k W^2_{TH}(kr_8)\, d\ln k}$$

and

$$G_R(r) = \frac{\int_0^{+\infty} \Delta_k(z) W^2_{TH}(kR)\, j_0(kr)\, d\ln k}{\int_0^{+\infty} \Delta_k(z) W^2_{TH}(kr_8)\, d\ln k}$$

where $\Delta_k = 4\pi\, k^3 P(k)$ is the dimensionless power spectrum

and $W_{TH}(kR) = \frac{3}{(kR)^3}\left[\sin(kR) - kR\cos(kR)\right]$

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**Amplitude independent from galaxy bias, redshift distortions, time evolution**

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Powerful Cosmic Probe

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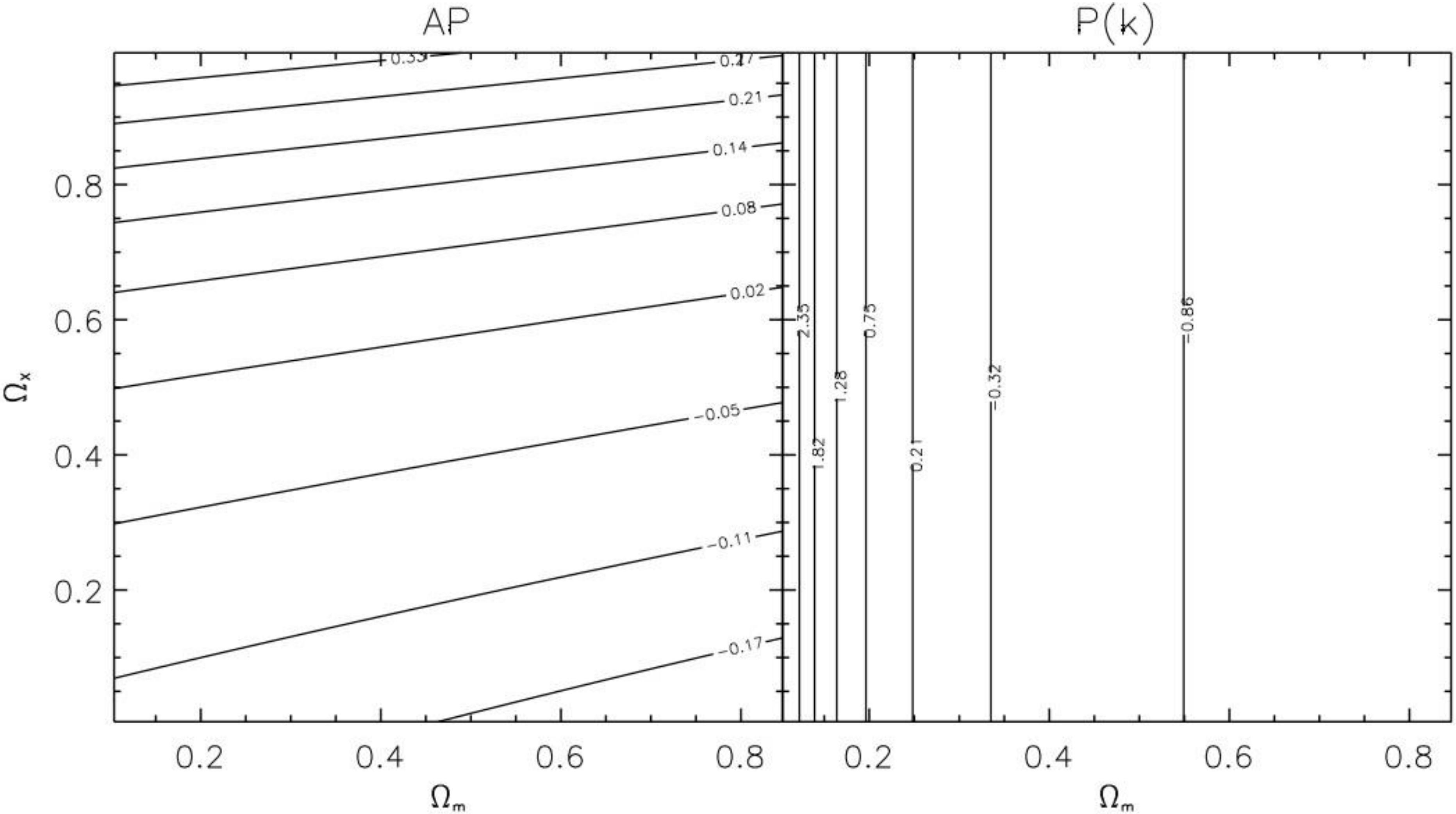
Alcock-Paczynski

Power spectrum

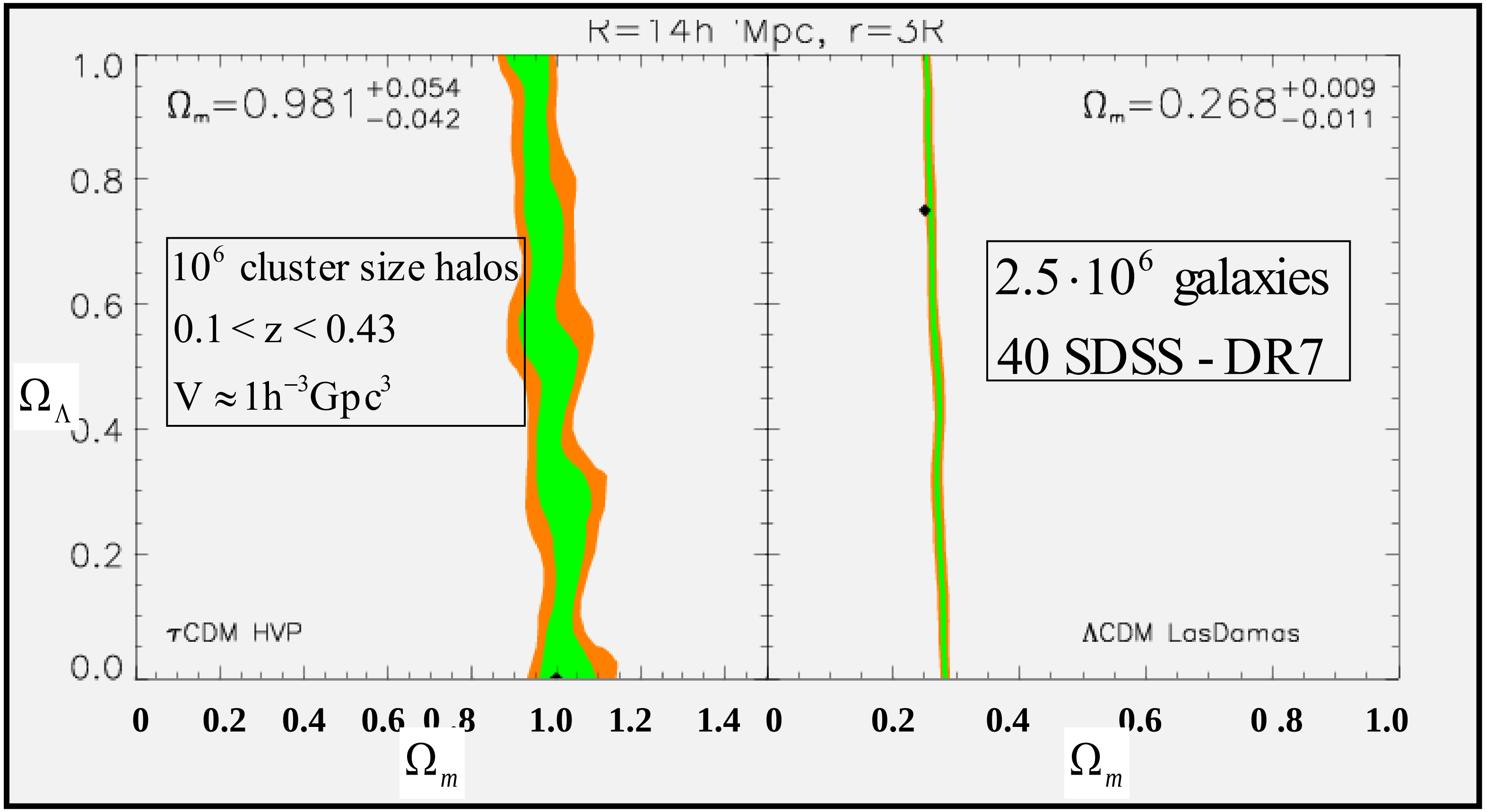
# The clustering ratio




$$\eta^z_{g,R}(r,\Omega)/\eta^z_{g,R}(r,\Omega_{true})-1$$

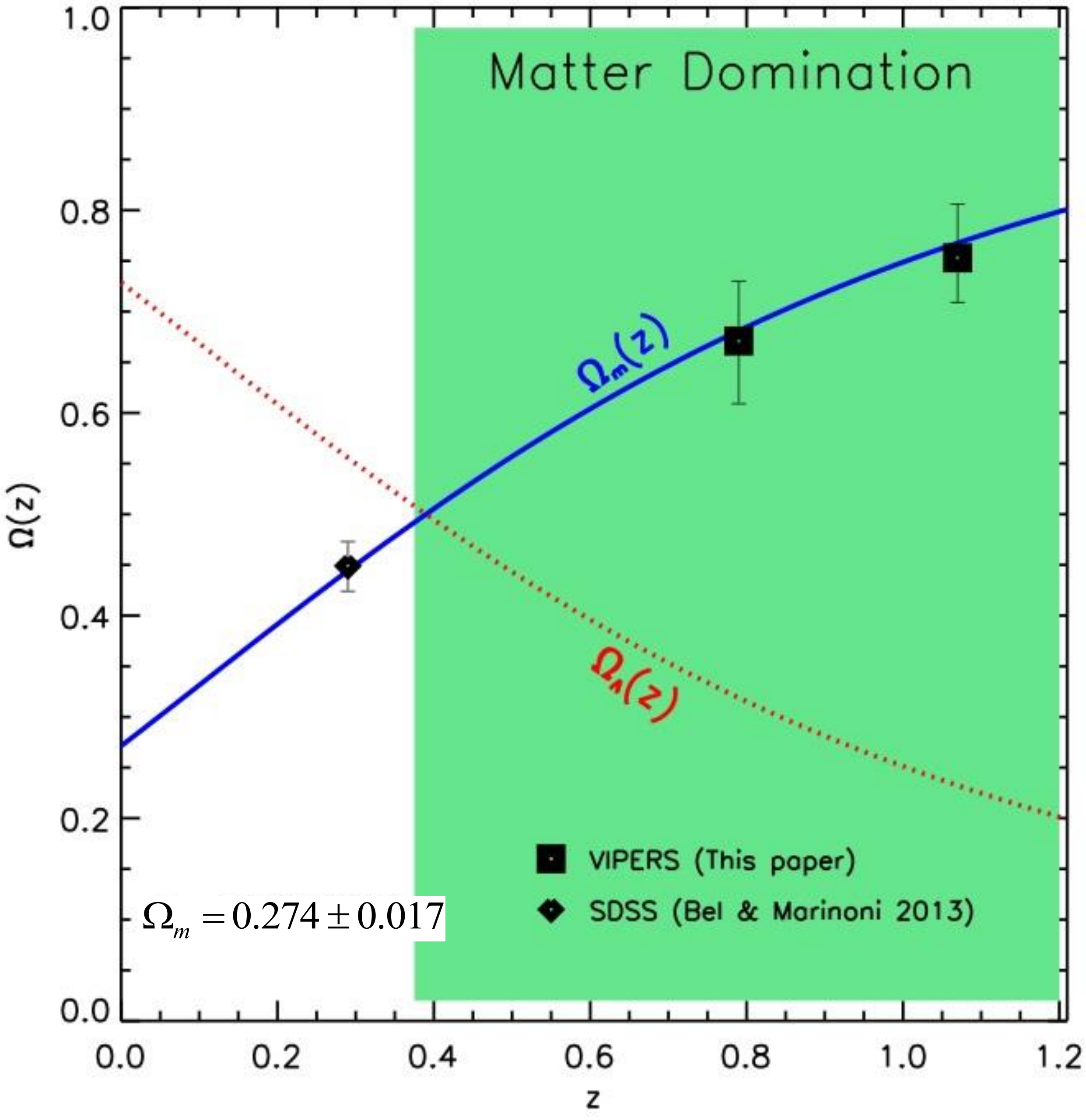
$$\eta_R(r,\Omega)/\eta_R(r,\Omega_{true})-1$$

# "Blind test" of N-body simulations: Figuring out the hidden cosmology




$$\begin{cases} h = 0.21 \\ \Omega_\Lambda = 0 \\ \Omega_m = 1 \\ \Omega_b = 0 \end{cases} \qquad \begin{cases} h = 0.70 \\ \Omega_\Lambda = 0.75 \\ \Omega_m = 0.25 \\ \Omega_b = 0.04 \end{cases}$$

# SDSS DR7 + VIPERS PDR1



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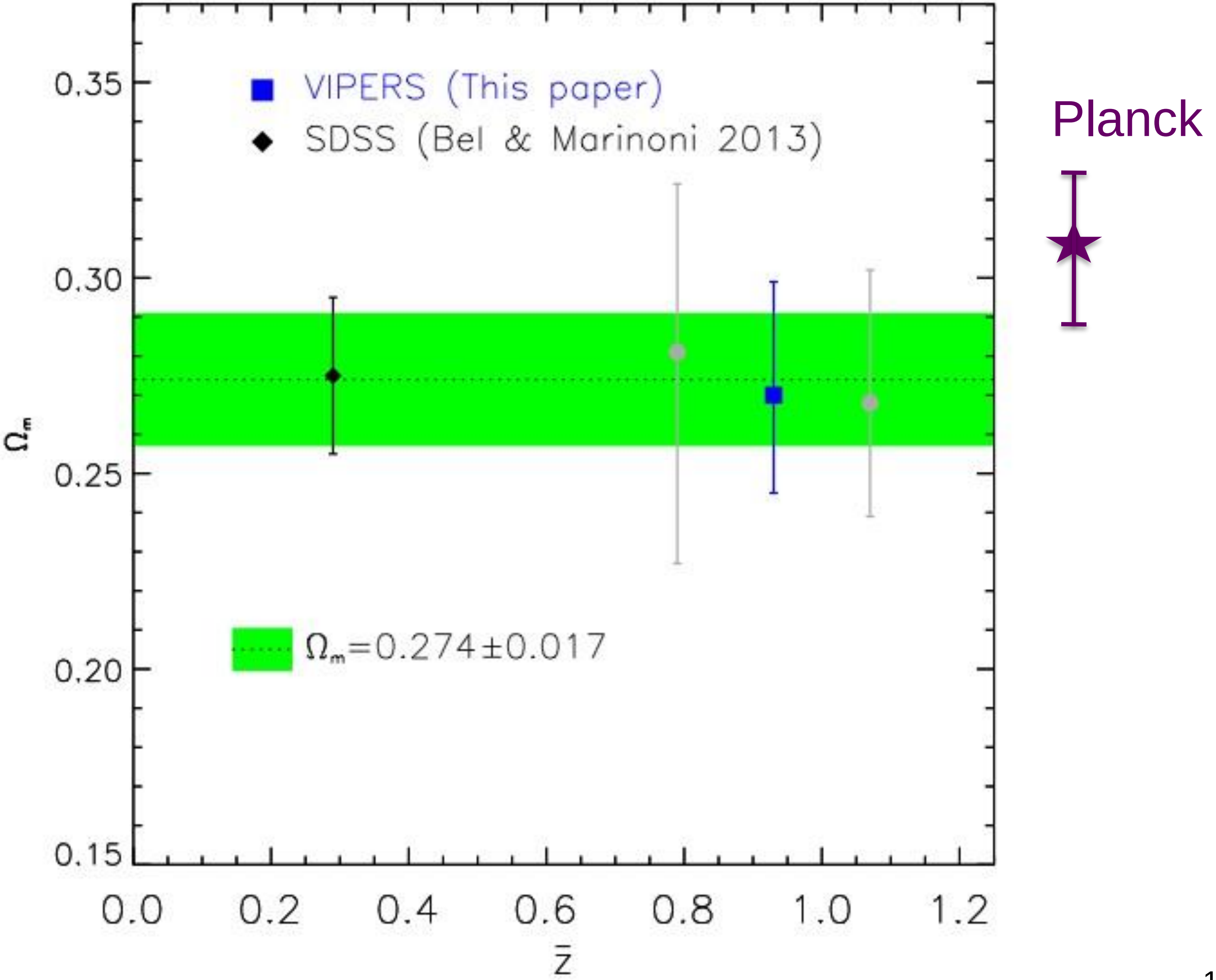


# Conclusions

• A new clustering statistic: the galaxy clustering ratio $\eta_R = \frac{\xi_R}{\sigma_R}$

- Its amplitude is the same for galaxies and matter (on linear scales)

- It is independent of linear redshift distortions

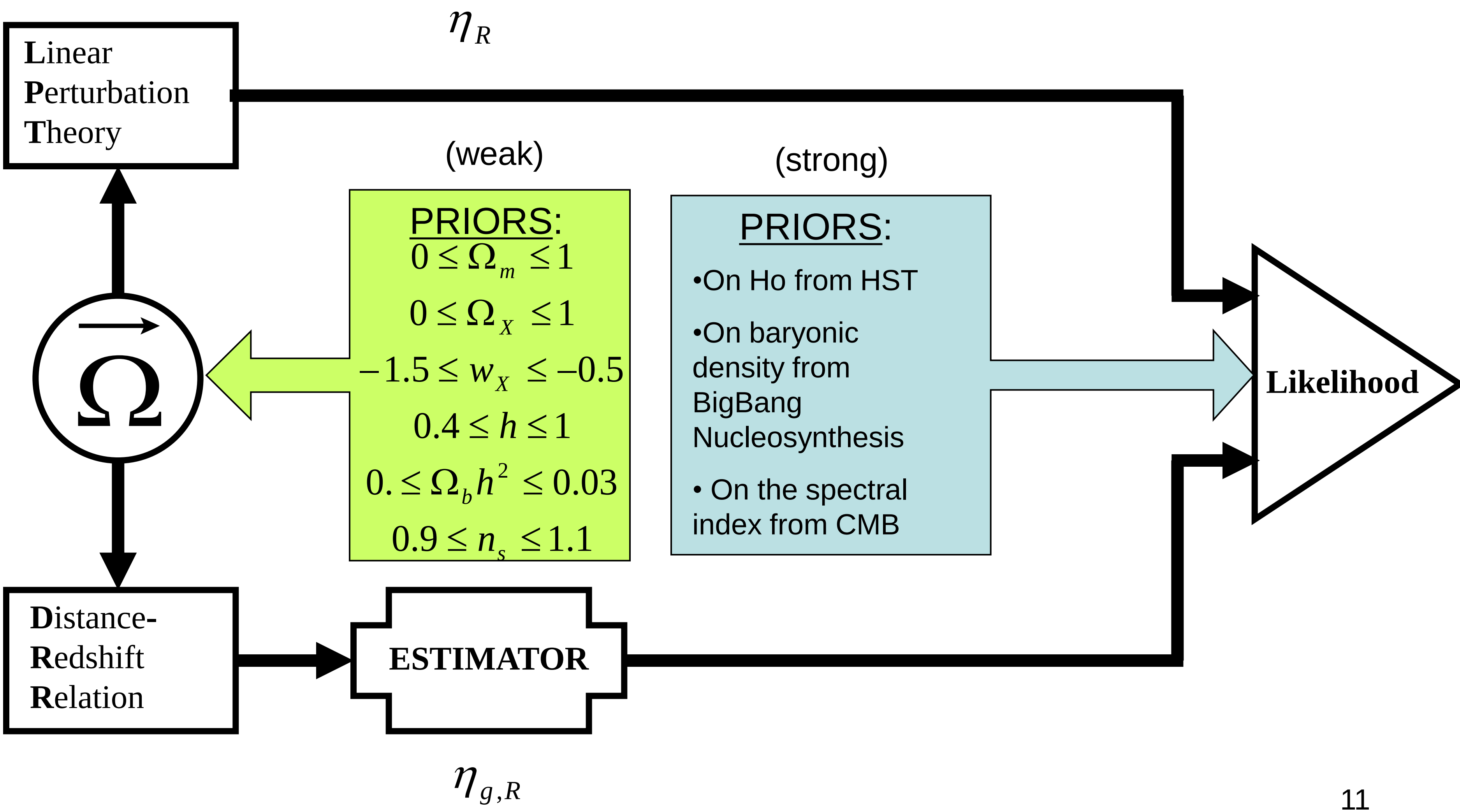
- The estimator is simple (count-in-cell) and robust (blind analysis on NON LCDM cosmology)

• Assuming a flat LambdaCDM universe and combining VIPERS and SDSS measurements

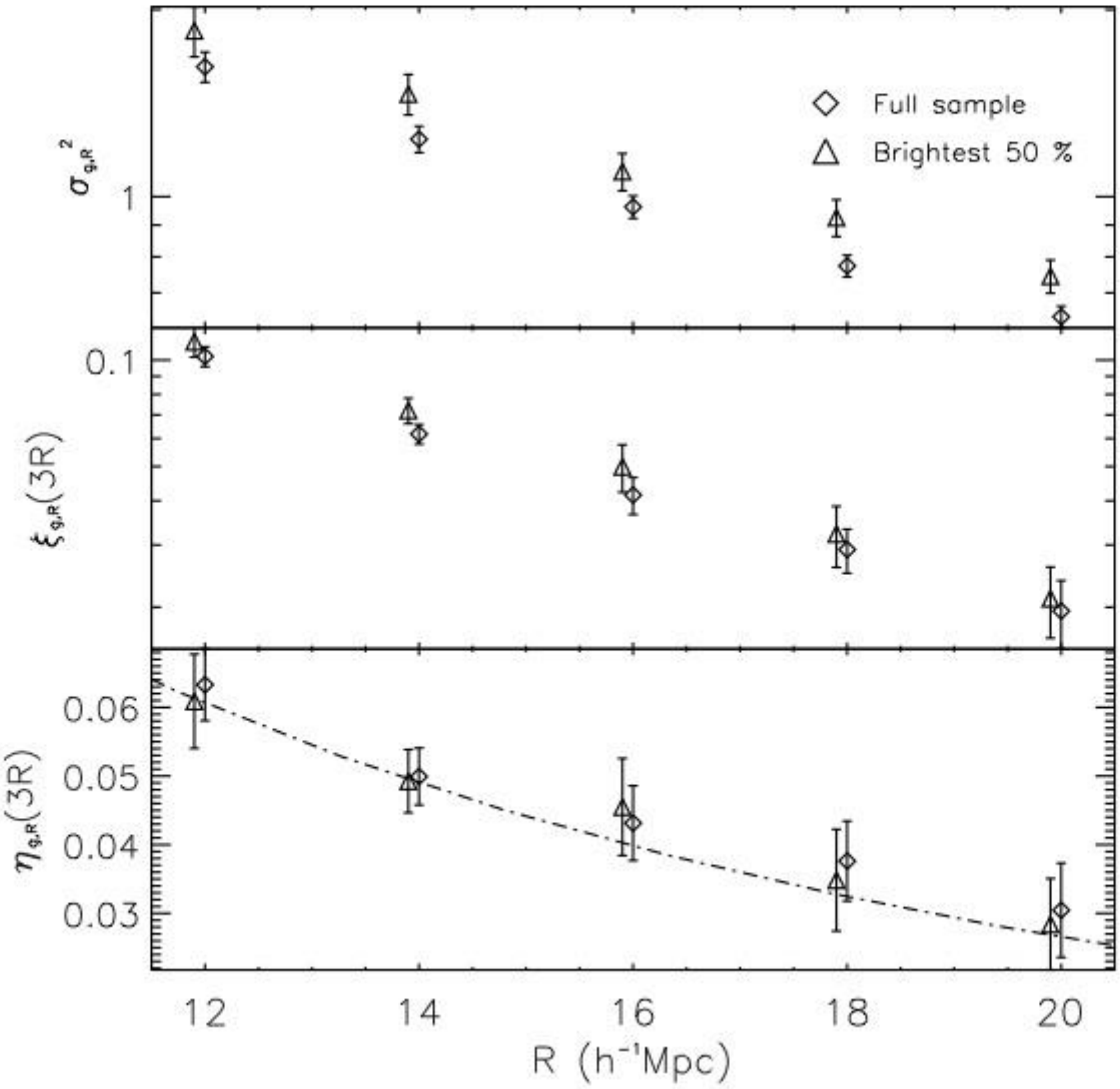
$$\Omega_m = 0.274 \pm 0.017$$

• Next: include massive neutrinos and constrain their mass

# Application of the strategy (SDSS)



# Luminosity



Full sample
Brightest 50 %
$\sigma_{g,R}^2$
1
0.1
$\xi_{g,R}(3R)$
0.06
0.05
0.04
0.03
$\eta_{g,R}(3R)$
12
14
16
18
20
R ($h^{-1}$Mpc)

# Application of the strategy (VIPERS)