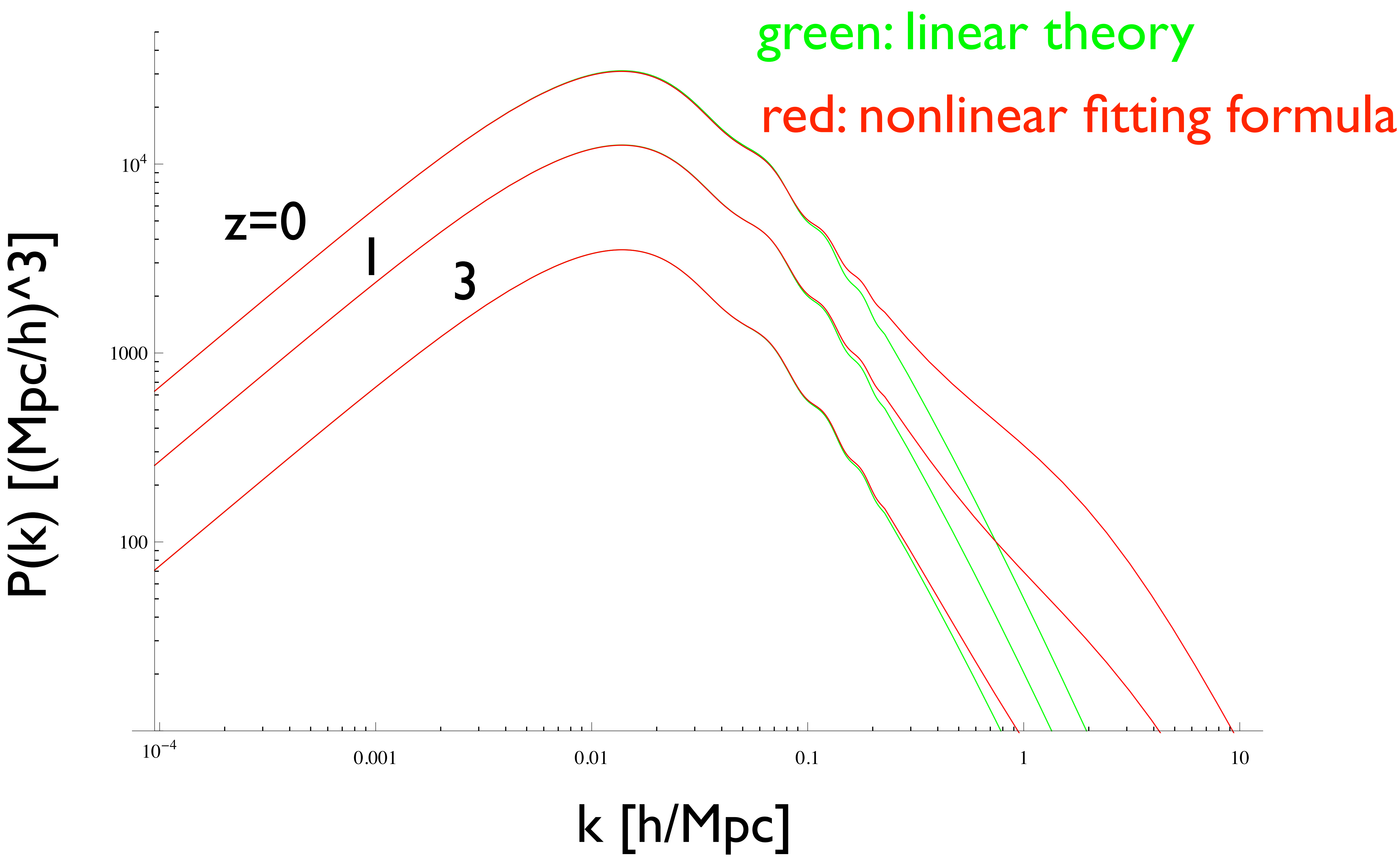
Correlation function & power spectrum

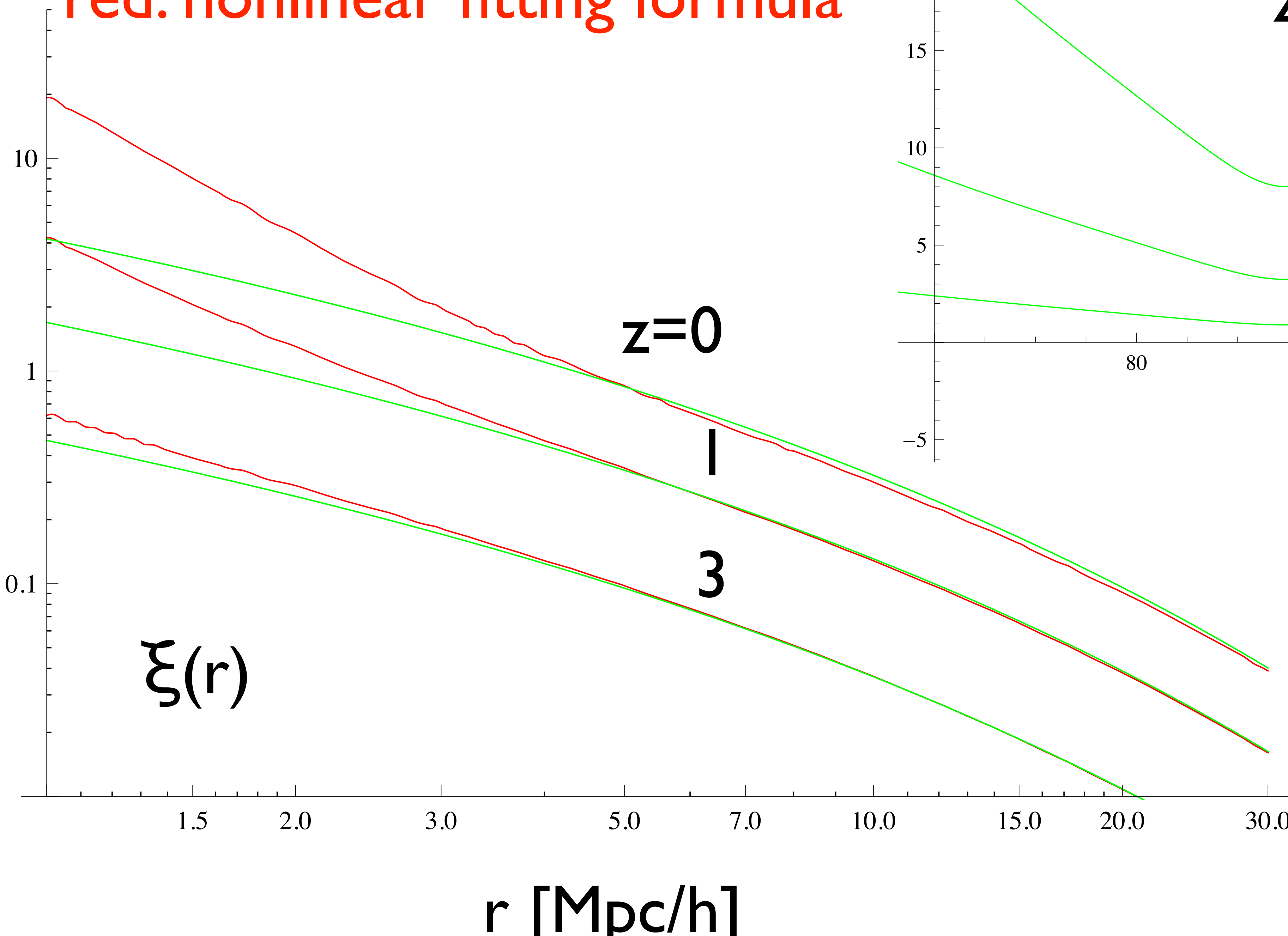
(3D) power spectrum

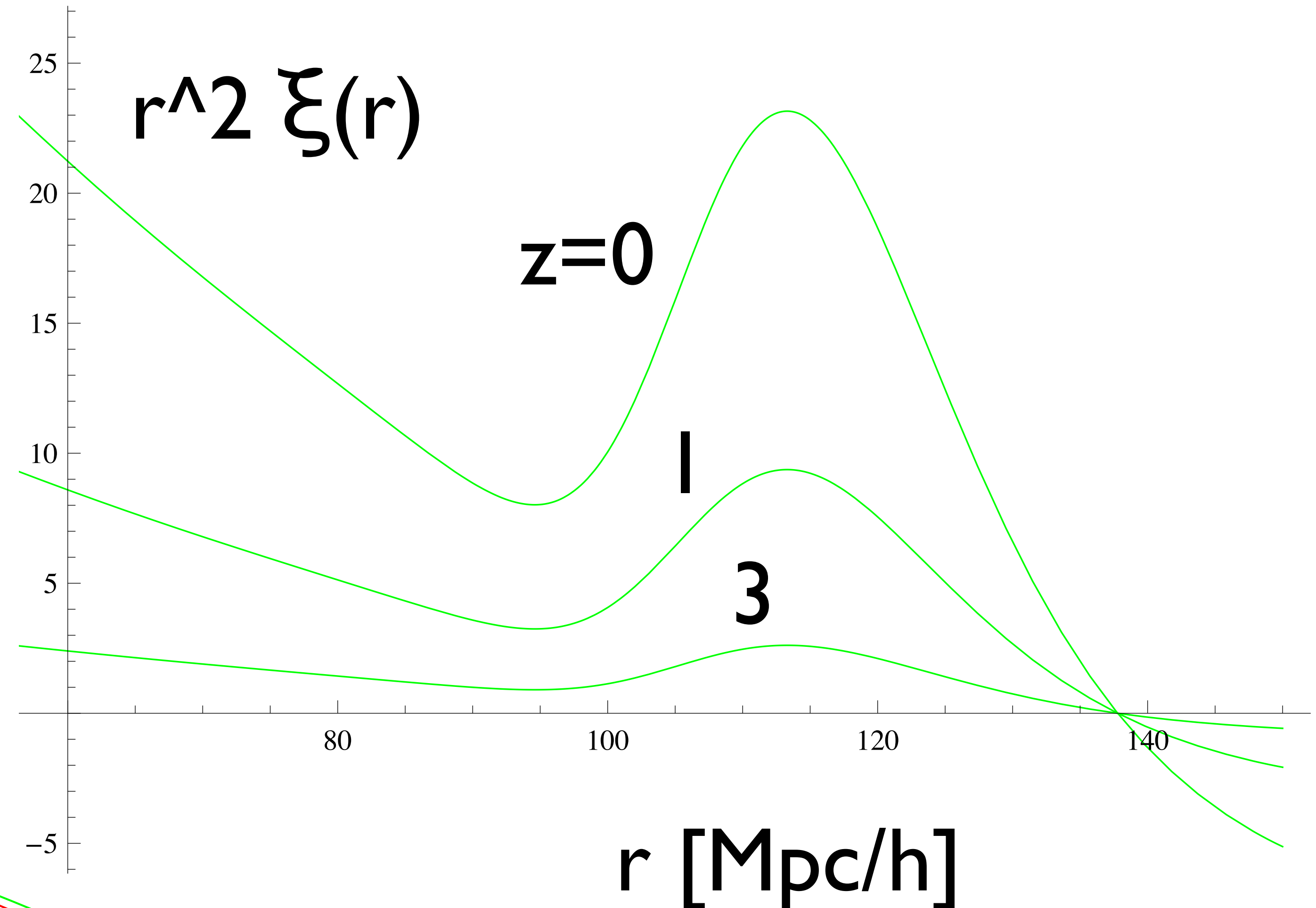


(3D) correlation function

green: linear theory

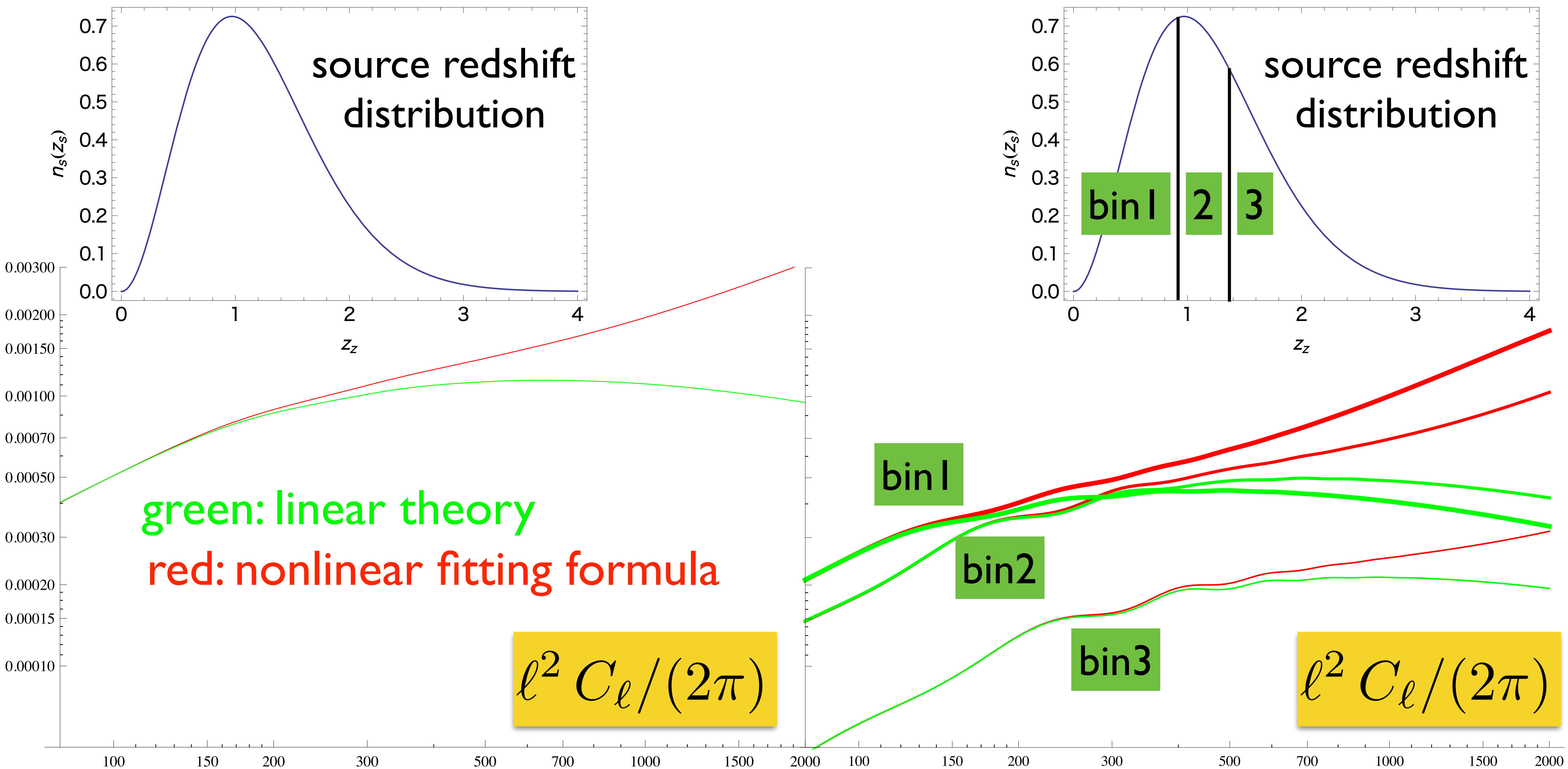
red: nonlinear fitting formula





Angular power spectrum

$$C_\ell = \int_0^{\chi_\infty} d\chi \left\{ \frac{w_g(\chi)}{f_K(\chi)} \right\}^2 P_{\delta\delta}\left(k = \frac{\ell}{f_K(\chi)}; z(\chi) \right)$$



Exact vs Limber approx

Limber approx. (flat)

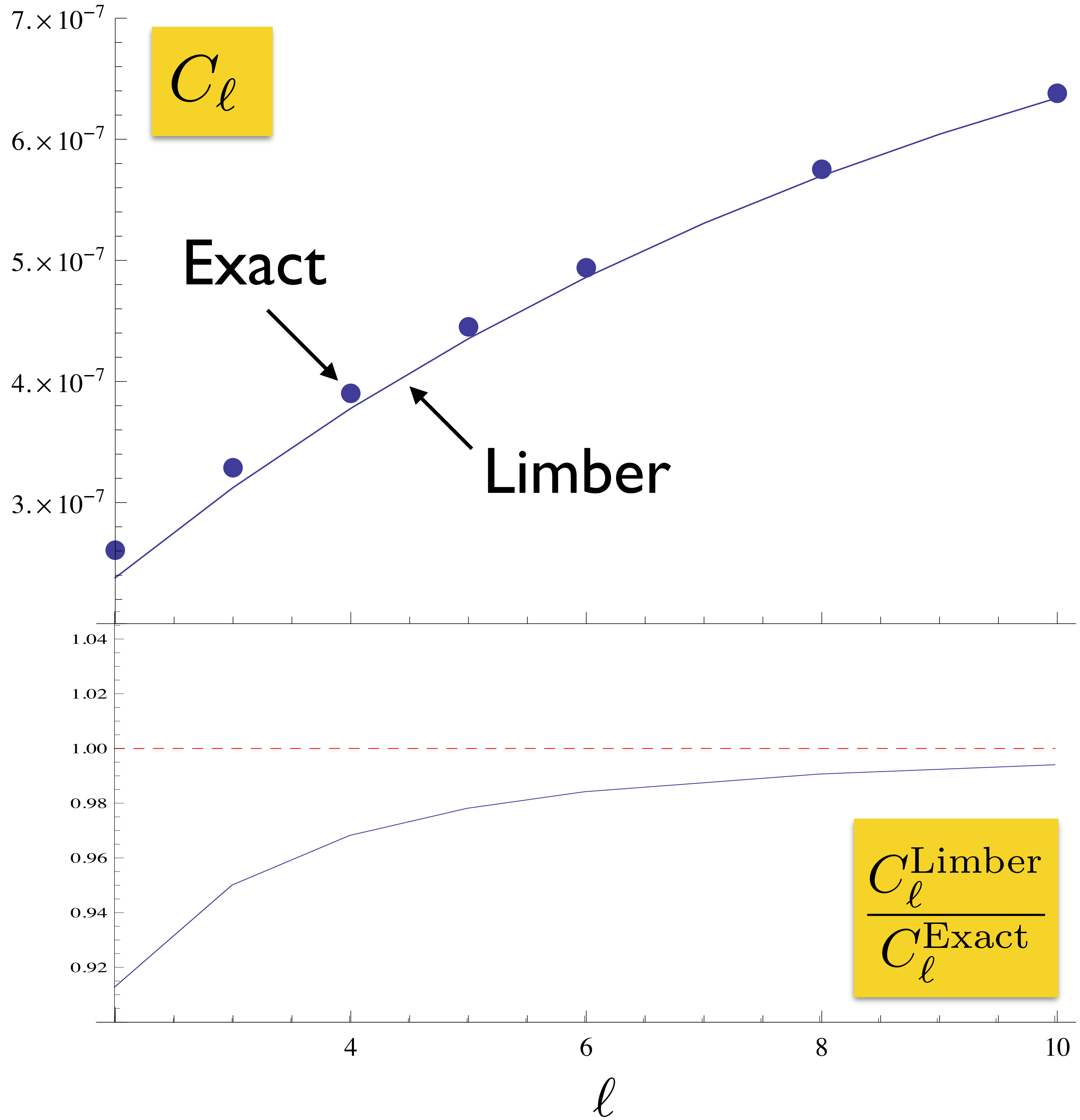
$$C_\ell = \int_0^{\chi_\infty} d\chi \left\{ \frac{w_g(\chi)}{\chi} \right\}^2 P_{\delta\delta} \left(k = \frac{\ell}{\chi}; z(\chi) \right)$$

Exact formula (flat)

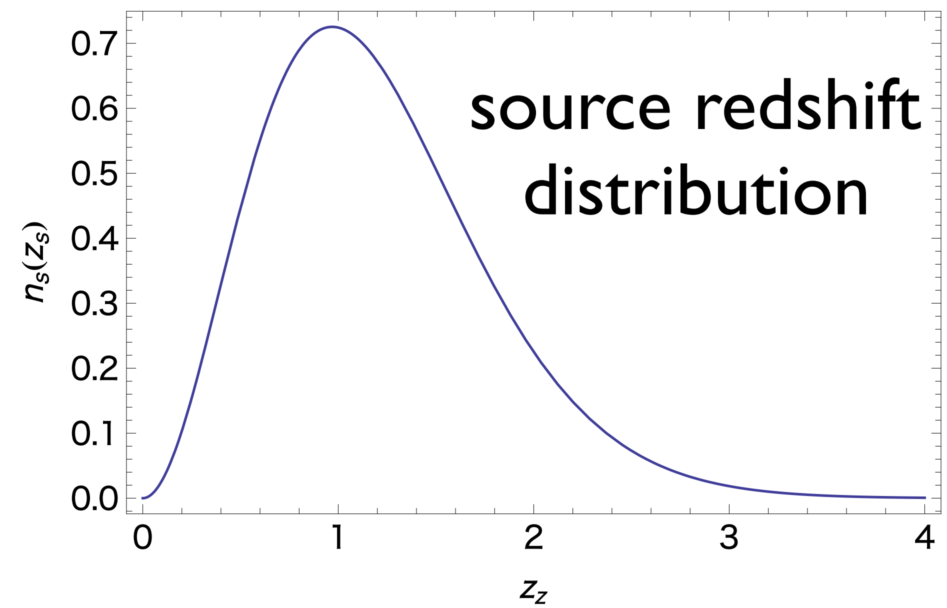
$$C_\ell = \frac{2}{\pi} \int dk\, k^2 \int d\chi_1 \int d\chi_2$$

$$\times\, w_g(\chi_1) w_g(\chi_2)\, j_\ell(k\chi_1) j_\ell(k\chi_2)\, P_{\delta\delta}\left(k; z(\chi_1), z(\chi_2)\right)$$

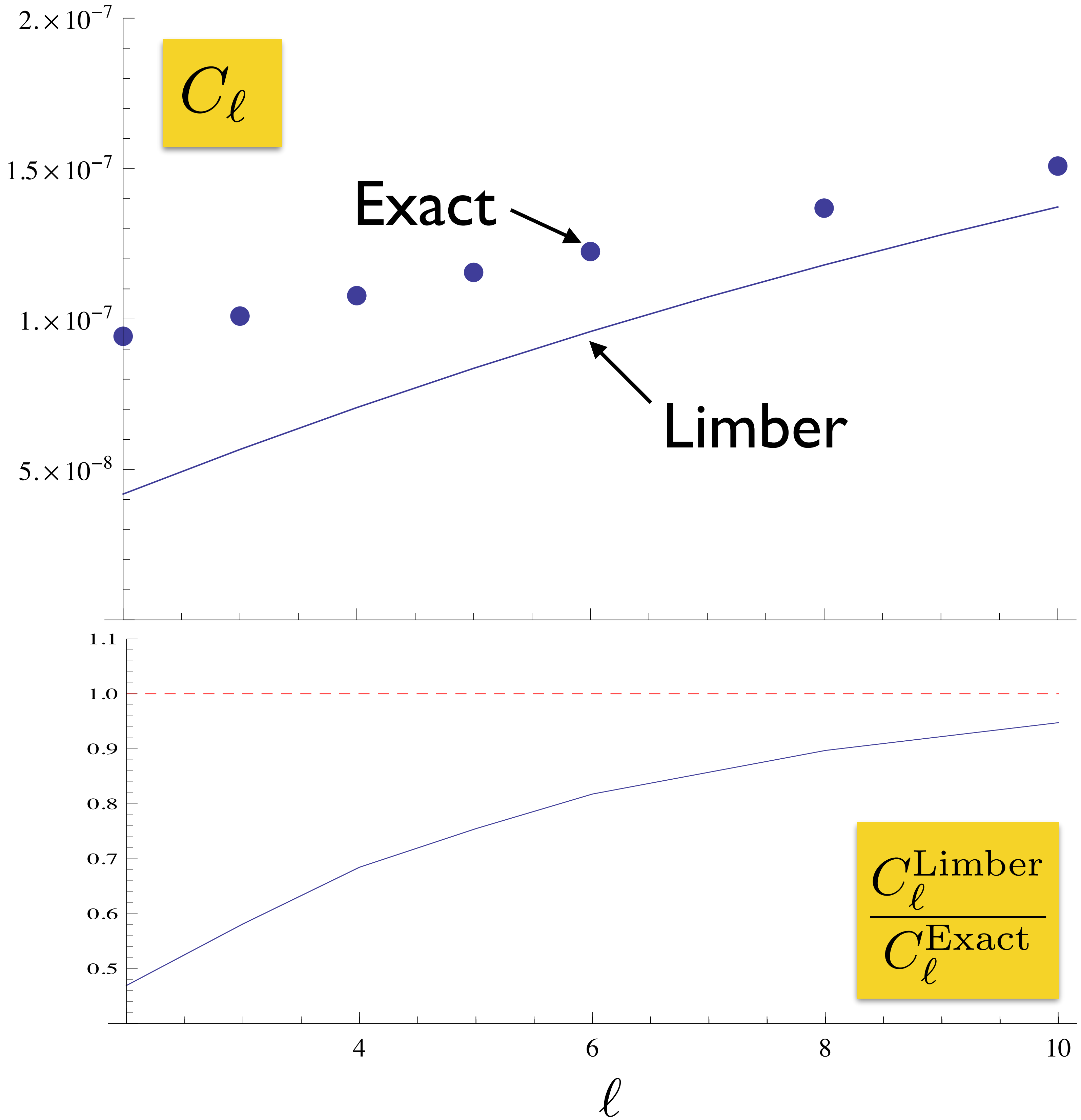
Result (1)



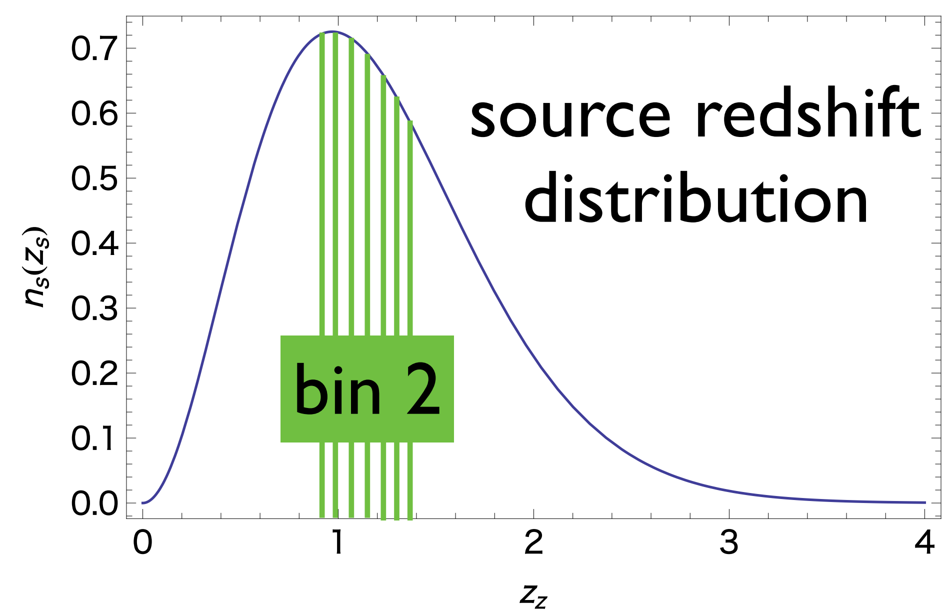
Assuming linear theory



Result (2)



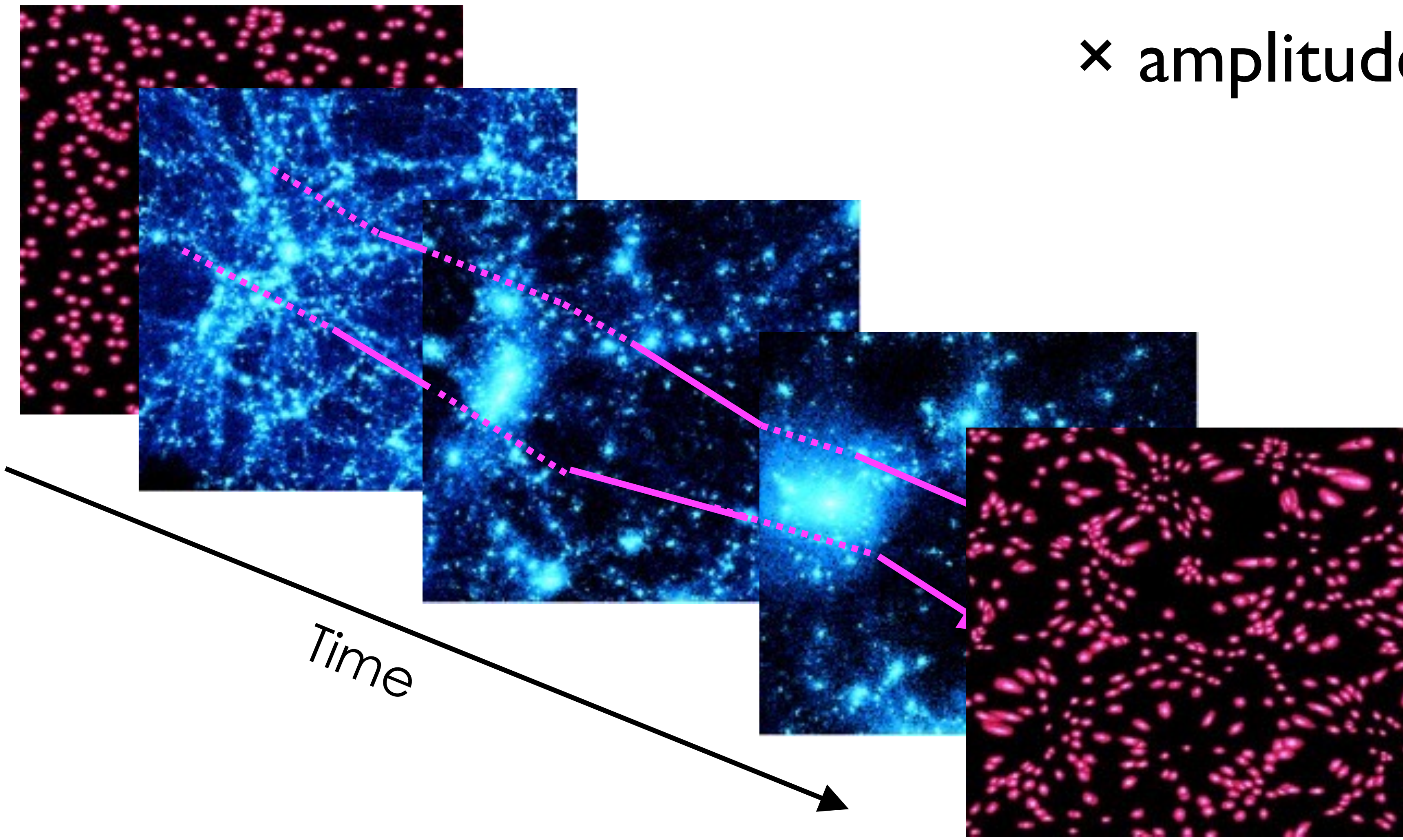
Assuming linear theory

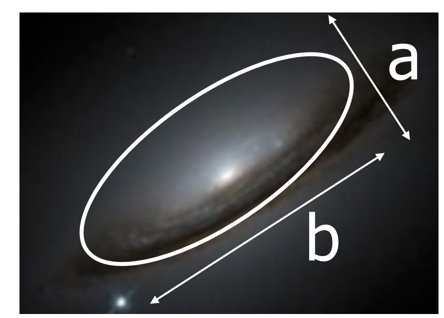


Cosmic shear

Ellipticity ∝ weighted mean of geometric distance

× amplitude of density field





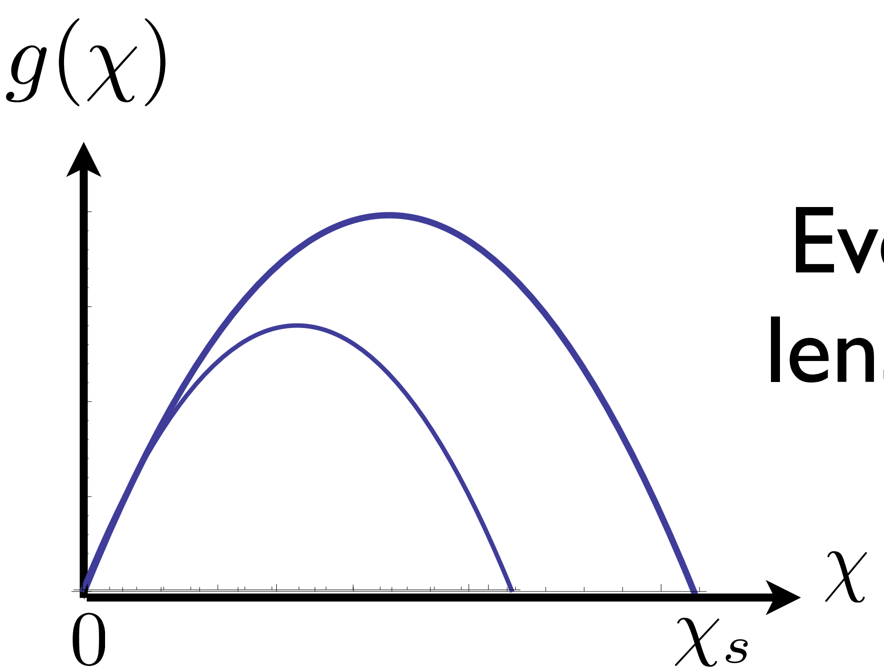
$$\gamma = \frac{a-b}{a+b}$$

Angular power spectrum

$$C_\ell^{\kappa\kappa} = \int_0^{\chi_\infty} \frac{d\chi}{\chi^2} \{g(\chi)\}^2 P_{\delta\delta}\left(k = \frac{\ell+1/2}{\chi}; z(\chi)\right) \; ;$$

Lensing kernel

$$g(\chi) = \frac{3}{2}\frac{\Omega_{\rm m} H_0^2}{a(\chi)} \int_\chi^\infty d\chi_s \frac{(\chi_s - \chi)\chi}{\chi_s} n(\chi_s)$$



Even if source distribution is delta function, lensing signals from multiple source redshifts are statistically correlated

Angular power spectrum

Convergence field (κ)