Linear Fluctuations & the Power Spectrum
\( \Omega_m = 0.3 \quad \Omega_\Lambda = 0.7 \)

\( \Omega_m = 0.3, \quad \Omega_\Lambda = 0 \)

\( \Omega_m = 1 \)

\[ D(z) \]

\[ a_{\text{exp}} \equiv 1/(1+z) \]
“LIFO” diagram: last in, first out

\[
\ln R \text{ (physical)} \quad \ln a/a_i
\]

\[
\text{Hubble radius } cH^{-1}
\]

\[
\text{3000 } h^{-1} \text{ Mpc } (cH_0^{-1})
\]

\[
1 \ h^{-1} \text{ Mpc}
\]

\[
10^7 \ h^{-1} \text{ Mpc}
\]
\[ P(k) \sim k^1 \]

\[ P(k) \sim k^0 \]

\[ P(k) \sim k^{-1} \]

\[ P(k) \sim k^{-2} \]
7.3. Comparison to other results

Figure 35 compares our results from Table 3 (modeling approach) with other measurements from galaxy surveys, but must be interpreted with care. The UZC points may contain excess large-scale power due to selection function effects (Padmanabhan et al. 2000; THX02), and the angular SDSS points measured from the early data release sample are difficult to interpret because of their extremely broad window functions. Only the SDSS, APM and angular SDSS points can be interpreted as measuring the large-scale matter power spectrum with constant bias, since the others have not been corrected for the red-tilting effect of luminosity-dependent bias. The Percival et al. (2001) 2dFGRS analysis unfortunately cannot be directly plotted in the figure because of its complicated window functions.

Figure 36 is the same as Figure 35, but restricted to a comparison of decorrelated power spectra, those for SDSS, 2dFGRS and PSCz. Because the power spectra are decorrelated, it is fair to do "chi-by-eye" when examining this Figure. The similarity in the bumps and wiggles between Fig. 35.—Comparison with other galaxy power spectrum measurements. Numerous caveats must be borne in mind when interpreting this figure. Our SDSS power spectrum measurements are those from Figure 22, corrected for the red-tilting effect of luminosity dependence. The purely angular analyses of the APM survey (Efstathiou & Moody 2001) and the SDSS (the points are from Tegmark et al. 2002 for galaxies in the magnitude range $21^m < r^* < 22^m$ — see also Dodelson et al. 2002) should also be free of this effect, but represent different mixtures of luminosities. The 2dFGRS points are from the analysis of HTX02, and like the PSCz points (HTP00) and the UZC points (THX02) have not been corrected for this effect, whereas the Percival et al. 2dFGRS analysis should be unaffected by such red-tilting. The influential PD94 points (Table 1 from Peacock & Dodds 1994), summarizing the state-of-the-art a decade ago, are shown assuming IRAS bias of unity and the then fashionable density parameter $\Omega_m = 1$.

Fig. 37.—Comparison of our results with other P($k$) constraints. The location of CMB, cluster, lensing and Ly$\alpha$ forest points in this plane depends on the cosmic matter budget (and, for the CMB, on the reionization optical depth $\tau$), so requiring consistency with SDSS constrains these cosmological parameters without assumptions about the primordial power spectrum. This figure is for the case of a "vanilla" flat scalar scale-invariant model with $\Omega_m = 0.28$, $h = 0.72$, and $\Omega_b/\Omega_m = 0.16$, $\tau = 0.17$ (Spergel et al. 2003; Verde et al. 2003, Tegmark et al. 2003b), assuming $b^* = 0.92$ for the SDSS galaxies.

Tegmark et al 2004
State-of-the-art software: CAMB

Code for Anisotropies in the Microwave Background

by Antony Lewis and Anthony Challinor

Features:
- Support for closed, open and flat models
- Scalar, vector and tensor modes including polarization
- Output $C_l$, matter transfer functions, matter power spectrum and $\sigma_8$
- Fast computation to ~0.3-0.1% accuracy, with controllable accuracy level
- Relatively structured and easily extendable Fortran 90 code
\( \Omega_m = 1 \)
$\Omega_m = 0.1$
\( \Omega_m = 1 \)  \hspace{1cm}  \( \Omega_m = 0.1 \)