

Census of the Universe – Logical Map

H_0 – measured by HST key project etc. $\rightarrow 72 \pm 8 \text{ km s}^{-1} \text{Mpc}^{-1}$ WMAP3 (i.e. 3 year) $\rightarrow 73 \pm 3 \text{ km s}^{-1} \text{Mpc}^{-1}$ Critical density is $\rho_c = 9.2 \times 10^{-27} h_{70}^2 \text{ kg m}^{-3}$	Dynamics & critical density
$\Omega_b = 0.044 \pm 0.002 h_{70}^{-2}$ from CMB and large scale structure $\Omega_b = 0.032 - 0.048 h_{70}^{-2}$ from cosmic nucleosynthesis $\Omega_* \approx 2 - 4 \times 10^{-3} h_{70}^{-1}$ observed (2dF) $\Omega(\text{Ly } \alpha \text{ clouds}) \approx \Omega_b$ at $z \sim 2-3$ Cosmological simulations and observational constraints \rightarrow most baryons are probably in a hot phase at $z=0$	Baryons
$M/L \sim 100-300$ solar units in most galaxies & clusters \rightarrow dark matter M/L vs system scale \rightarrow biasing of galaxy formation $\Omega_m \approx 0.3$ from baryon fraction in clusters and spatial clustering of galaxies. $\Omega_m = 0.24 \pm 0.02$ from WMAP3. Optical lum. density in Universe $j_B = 1.7 \pm 0.2 \times 10^8 h_{70} L_{\odot} \text{ Mpc}^{-3}$ from 2dF $+ M/L \rightarrow \Omega_m \approx 0.3$	Dark matter
$\Omega_r = 5.0 \times 10^{-5} h_{70}^{-2}$ at $z=0$, from the CMB Neutrino contribution depends on unknown m_ν , but observations of large scale structure (2dF, WMAP etc.) suggest $\Omega_\nu < 0.01 h_{70}^{-2}$	Radiation & neutrinos
Flux from high z SNIa gives $\Omega_\Lambda \approx \Omega_m + 0.4$ First peak of CMB angular power spectrum $\rightarrow \Omega = 1.02 \pm 0.02$	Ω and Λ
$H_0 \approx 70$, $\Omega = 1$, $\Omega_m \approx 0.3$ (of which $\Omega_b = 0.044$), $\Omega_\Lambda \approx 0.7$ Age of Universe $\approx 13.5 \text{ Gyr}$	Concordance cosmology