COSMOLOGICAL PARAMETERS DETERMINATIONS FROM DEEP SKY REDSHIFT SURVEYS

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1. Observations

A new cosmological method and new calculations are presented in order to derive the cosmological fundamental parameters $(H_0, \Omega_0, \Lambda_0)$ using the *observed correlation function*.

The form of the *correlation function*:

$$\xi(r) = \left\{ \begin{array}{lll} (r/r_0)^\gamma & \begin{array}{c}\gamma = -1.77, \\ r_0 = 19 - 21h^{-1}\mathrm{Mpc}\end{array} & \text{for } r \leq r_a = 10h^{-1}\mathrm{Mpc} \\ f_P(r) & \text{(periodic function)} & \text{for } r_a \leq r \leq r_b = 1000h^{-1}\mathrm{Mpc} \\ f_G(r) & \text{(Gaussian fluctuations)} & \text{for } r \geq r_b. \end{array} \right\}$$

is derived from different 3D catalogs (Suran 1993):galaxies ($r \leq 750h^{-1}\mathrm{Mp} \leq c$)-YALE catalog; clusters ($r \leq 500h^{-1}\mathrm{Mpc}$) - North Galactic Cone Catalog; superclusters ($r \leq 500h^{-1}\mathrm{Mpc}$) .

2. Equations

For our model and calculations we used the following *input parameters:*

$(H_0, \Omega_0, \Lambda_0)$, (a_0) , $\xi^{obs}(r)$ where a_0 - the scale parameter and $\xi^{obs}(r)$ the *observed* correlation function (see last section).

Using these parameters we could determine:

for z$\simeq 0$

o the power spectrum: $P(k) = \frac{1}{2\pi^2} \int\limits_0^\infty \xi(r) \frac{\sin(kr)}{kr} r^2 dr$, $k = \frac{2\pi}{\lambda} = \frac{2\pi}{a_0 r} \Longrightarrow$

M. Kafatos and Y. Kondo (eds.), Examining the Big Bang and Diffuse Background Radiations, 505–507.

$$P(k) = \left\{ \begin{array}{ll} Ak^n = F_G(k) & k \leq k_b \\ A\frac{(k/k_t)^{n_s}}{1+(k/k_l)^{n_s-n_l}} = F_P(k) & k_b \leq k \leq k_a \\ F_L(k) & k \geq k_a \end{array} \right\}$$

which match with COBE spectrum at $F_P \rightarrow F_H$ (horizont limit).

o density perturbations: $|\delta_k|^2 = 8\pi^3 |P(k)|$;

o the transfer function: $T_f^2(k) = \frac{|\delta_k|^2}{Ak}$;

o *peculiar* velocity field: $\mathrm{v}^2(r_b) = \left[\frac{a_0\Omega^{1.2}}{\pi^3}\right] H_0^2 \sum_k k^2 |P(k)| \, dr V_s(k, r_b)$;

where $V_s(k, r_b) = \frac{\sin(kr_b)}{kr_b}$ or $e^{-k^2 r_b^2}$;

o *biasing* parameters (second determination): $\sigma^2(r_c) = 2a_0 \sum_k k^4 |P(k)| \, dr W_s^2(k, r_c)$

where $W_s^2(k, r_c) = \left[\frac{3\sin(kr_c) - 3kr_c\cos(kr_c)}{(kr_c)^3}\right]$, $b = \frac{1}{\sigma}$, $\xi_g = b^2\xi_m$, $b_m = \frac{1}{\sigma_{8,m}}$;

o mass fluctuations: $[(\delta M/M)(r_c)]^2 = \int_0^\infty k^2\delta^2(k) W_s^2(k, r_c)$;

o the *local* topology (3D) of the Universe:

$C_\nu = \frac{1}{\pi}\left[\frac{\sigma_1}{\sqrt{3}\sigma_0}\right]^3 (1-\nu^2)e^{-\nu^2/2}$, where $\sigma_1 = \frac{1}{2\pi^2}\int_0^\infty P(k)k^4 dk$ and $\sigma_0 = \frac{1}{2\pi^2}\int_0^\infty P(k)k^2 dk$

for $\mathbf{z = z_H}$

o temperature fluctuations:

▹ total: $(\delta T/T)^2_{rms} = \frac{1}{4\pi}\sum_{l=2}^{l\,\max}(2l+1)C_l e^{-\frac{l^2\theta_c^2}{2}}$; quadrupole: $(\delta T/T)^2_Q = \frac{5}{4\pi}C_2 e^{-2\theta_c^2}$

where $C_l^2 = 32\pi a_0 \Omega_0^{1.54}\left[\frac{H_0}{2c}\right]^4 \sum_k |P(k)| \, dr J_l^2(k, r_m)$;

o the topology (2D) of the Universe: $C_\nu = -\frac{1}{\pi}\left[-\frac{C"(0)}{C(0)}\right]^{3/2}(1-\nu^2)e^{-\nu^2/2}$.

3. Results

We made the cosmological calculations using the following set of input parameters:

$n_s = -1.6, n_l = 2.4, \lambda_t = 175, \lambda_l = 10$ (power spectrum form);

$A = 24^4, \epsilon_0 = 3.10^{-5}, \theta_c = 0.051299$ (transfer function normalisation, COBE);

$a_0 = 1, b = 1. - 1.5$ (biasing parameters);

$r_a = 25, r_b = 50, r_c = 8$ (different scales); $l_{\max} = 20$ (nr.of harmonics).

The obtained results are presented in Table 1., where we denoted T≡topology, Sigma≡ σ.

Table 1: Results of cosmological calculations

H0	Omega	(DT/T)Q	(DT/T)rms	V(50)	Sigma	ampl(T)
100	0.1	8.37e-7	1.9e-6	74.	2.36	1.21
	0.2	1.42e-6	3.3e-6	112.	1.91	2.42
	0.5	2.88e-6	6.71e-6	194.	1.45	6.05
	0.7	3.37e-6	8.69e-6	237.	1.31	8.47
	1.0	4.91e-6	1.14e-5	294.	1.40	12.11
50	0.1	8.35e-7	1.94e-6	93.	2.36	0.94
	0.2	1.42e-6	3.31e-6	141.	1.91	1.89
	0.5	2.88e-6	6.71e-6	244.	1.45	4.73
	0.7	3.73e-6	8.69e-6	299.	1.31	6.63
	1.0	4.91e-6	1.14e-5	371.	1.18	9.46
50;b=1.5	0.1	6.82e-7	1.58e-6	76.	1.92	0.95
	0.2	1.16e-6	2.70e-6	115.	1.56	1.80
	0.5	2.35e-6	5.48e-6	199.	1.19	4.73
	0.7	3.05e-6	7.10e-6	244.	1.07	6.62
	1.0	4.01e-6	9.34e-6	392.	0.97	9.46

References

[1] Suran,M.D.,Popescu,N.A. (1992),in Symp. Observ. Cosmology, ed.G. Chincarini,pg.154;

[2] Suran,M.D.,Popescu,N.A. (1993),Romanian Astron.J.,**3**,1,pg.1;

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