METACATALOGUE OF GALAXIES AND LARGE SCALE STRUCTURES IN THE UNIVERSE

Kalinkov M.
Department of Astronomy
Bulgarian Academy of Sciences, Sofia

The present state of the compilation of the Metacatalogue of galaxies is described by Kalinkov et al. (1981). The preparation of the catalogue originated from the necessity to put on magnetic tape Zwicky's catalogue in order to study the distribution of galaxies and clusters of galaxies. Enlarging the Metacatalogue by joining to it other catalogues, some interesting results for the large scale structure in the Universe have been obtained. New methods for efficient data processing have been developed for smoothing and filtering of discrete fields, for computing the two-cell correlation function and its matrix representation to test homogeneity and isotropy, and so on (Kalinkov, 1974, 1976, 1977).

It is found that independently of which clusters are used, be it Abell or Zwicky's, the large scale distribution is almost the same. The largest condensations of matter which confidently can be traced have a size of 300 h^{-1} Mpc (H = 100 h km s^{-1} Mpc^{-1}) for the Abell and Zwicky catalogues. Moreover the characteristic size of second-order clusters of galaxies is (50 ± 4) h^{-1} Mpc for both Abell and Zwicky clusters, a result which is confirmed by four independent statistical tests (Kalinkov and Kuneva, 1980) and is supported by the analysis of the distribution of Zwicky galaxies. Smoothing and filtering of the Lick counts of galaxies with different functions allows to search aggregates with large density contrast. Most of them have a characteristic size of 50 ÷ 60 h^{-1} Mpc.

Adopting a m_{10} - z relation for Abell clusters (Kalinkov et al, 1975) it is possible to compute the two point correlation function according to Peebles (1973, 1980) which is $u = (22.74/R)^{2.10}$. This is the first space correlation function, derived directly without using the angular correlation function.

However, the most interesting result is connected with the hierarchy in the Universe. According to de Vaucouleurs (1970, 1971) there is a density-radius relation for galaxies, (cgs units)

C. Jaschek and W. Heintz (eds.), Automated Data Retrieval in Astronomy, 259–260.

https://doi.org/10.1017/S0252921100083056 Published online by Cambridge University Press

$$\log \rho = 15.19 - 1.7 \log . r$$

and there is no indication for an approach to $\log \rho \simeq$ const out to $\log r \simeq 27$. Data processing of the Metacatalogue shows that this should be the case but for a smaller range. Applying a modification of the nearest neighbour method to the Abell clusters, the relation is

$$\log \rho = 11.98 - 1.617 \log . r.$$

Assuming that a calibration is made for $R = 10\ h^{-1}$ Mpc, requiring that the mean mass of one Abell cluster is $12.43 . 10^{15}\ M_\odot$ (one order of magnitude higher than the usual estimate) this relation is just the de Vaucouleurs relation, but for $5 < R < 30$. For $R \simeq 100\ h^{-1}$ Mpc which is nearly the limit for the nearest neighbour method, there is a strong approach to $\log \rho \simeq -29.2$. Our results show that both models of hierarchical clustering of de Vaucouleurs namely that clustering occurs on all scales i) with relative maxima near a series of preferred characteristic sizes (galaxies, clusters, ...) and ii) with no preferred sizes, are not consistent with observations. Another model is more reliable - it is the same as i), but with the addition, that with increasing order of clustering, the density contrast tends to unity.

REFERENCES

De Vaucouleurs, G. : Science, 167, 1203 (1970)

De Vaucouleurs, G. : Publ. Astron. Soc. Pac. 83, 113 (1971)

Kalinkov, M. : Proc. First Europ. Astron. Meet. 3, 142 (Springer Verlag) (1974)

Kalinkov, M. : Mem. Soc. Astron. Ital. 45, 637 (1976)

Kalinkov, M. : Highlights of Astronomy, 4, part I, 279 (1977)

Kalinkov, M., Kuneva, I. : C.r. Acad. Bulg. Sci. 33, 1305 (1980)

Kalinkov, M., Kuneva, I., Stavrev, K. : this Volume (1982), p. 261.

Kalinkov, M., Stavrev, K., Kuneva, I. : Sov. Astron. J. (Lett.) 1, N° 2, 7 (1975)

Peebles, P.J.E. : Astrophys. J. 185, 413 (1973)

Peebles, P.J.E. : The Large-Scale Structure of the Universe (Princeton University Press) (1980)