DETERMINATION OF THE LARGE-SCALE AND SUPER-LARGE-SCALE STRUCTURE BY MEANS OF THE SPACE DISTRIBUTION OF QUASARS

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It is very important to study the large-scale structure by means of the space distribution of quasars. Using this method, one may search for the more distant superclusters and explore the super-large-scale structure, i.e., the existence of super-superclusters. The answer to the problem would be of great interest. It is related to the question about the transition of the clustering of galaxies on about 100 Mpc to the uniformity of the universe. Recently Oort et al and de Ruiter et al suggested that the quasars are located in superclusters. So we soppose that analysing the space distribution of quasars might give us some information about the super-large-scale structure of the universe. But up to the present the study of the clustering of quasars has not obtained universally accepted conclusions; in fact, some of them, including grouping and clustering (Arp; Chu and Zhu), no clustering (Chu and Zhu; Osmer; Webster), clustering for $z < 2$ and no clustering for $z > 2$ (Fang et al) and stringing (Deng et al), are contradictory.

In order to obtain more reliable conclusions we should improve the statistics on the clustering of quasars.

Firstly, we choose five independent samples for testing. They are two samples in 25 deg^2 field (Savage and Bolton 1979), one sample of quasar candidates in 25 deg^2 field with redshift value determined by using the slitless spectrum (Savage et al 1984), and two samples of candidates without redshift value in 64 deg^2 field with sampling identifications rates 80% and 83% respectively.

Secondly we tested the five samples with various statistical methods, including the two-point correlation function $\xi(r)$, the cluster analysis, percolation parameter B_c calculation, multiplicity function $F(x)$ analysis and others. Among them the cluster analysis is very effective for determining the essential geometrical structure of the agglomeration region of quasars. Besides the size $L_m(r)$ of the maximum connectea region we use the number $N_m(r)$ of quasars in the maximum connected region to derive the geometrical structure.

Thirdly, we consider the influence of the redshift distribution of the quasars on the clustering of quasars. As is well known, some peaks and dips appear in the redshift distribution. Thus when comparing the considered sample with the uniform Monte Carlo samples, we may get some

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false clustering or cancel some true clustering owing to the peaks and dips.So we adopt the quasars around the peak z~2 as our sample in order to reduce the statistical fluctuations and increase the number density in the space.

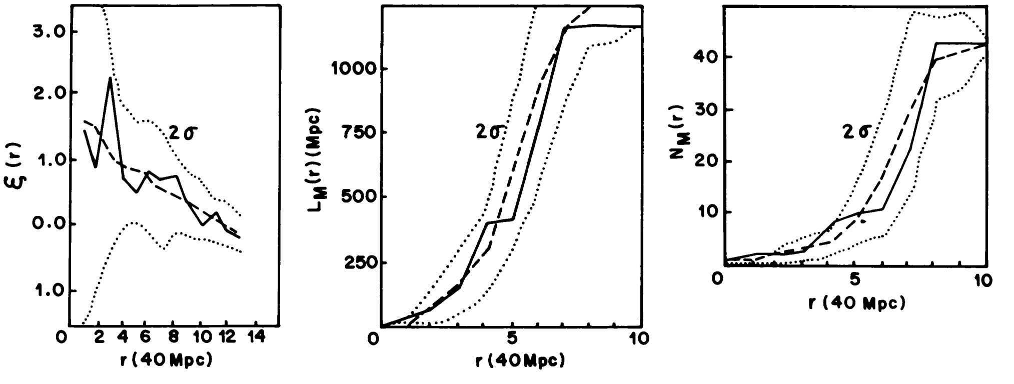
We have computed the two-point correlation $\xi(r)$, the size function $L_m(r)$ and quasar number function $N_m(r)$ of the maximum connected region, percolation parameters $B_{c\alpha}$, $B_{c\delta}$, B_{cz} in the right ascension direction, declination direction, the line of sight, multiplicity function $F(x)$ etc, and compared them with the corresponding function or quantities of the Monte Carlo sampling. We obtain the following results and conclusions.

1. For all five samples either two-point correlation function $\xi(r)$ or $L_m(r)$ and $N_m(r)$ curves are near to the corresponding average curves of the Monte Carlo sampling. The differences between them are within the 2σ range. That means that the clustering and the stringing of the samples are not obvious But some excess of $\xi(r)$ and $N_m(r)$ has been found between σ and 2σ curves (see Figs), i.e., there is possibly some very weak clustering, when the distance between quasars is about 100 Mpc.It is compatible with the view that the quasars exist in supercluster.

2. From $\xi(r)$, $L_m(r)$ and $N_m(r)$, the distribution of quasars is near to the random one up to 400 - 1000 Mpc. It indicates that the universe above the superclusters is uniform and structureless.

3. The computational percolation parameters $B_{c\alpha}$, $B_{c\delta}$, B_{cz} have $|B_c - B_c^{(R)}| < \sigma^{(R)}$. It supports the above mentioned conclusion.

4. The multiplicity function $F(x)$ of the five samples are similar to those of the corresponding Monte Carlo samples, but there is some excess of groups at 160 Mpc.



Figs. $\xi(r)$, $L_m(r)$, $N_m(r)$ curves of sample A;
——— sample; ---- Monte Carlo