# **АСТРОФИЗИКА**

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# INTEGRAL GEOMETRIC METHOD OF MORPHOLOGICAL INVESTIGATION OF EXTRAGALACTIC SYSTEMS

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1. The dimensionless  $B_k$ -statistics [1,2] and invariant properties of Radon transformations from spherically symmetrical density profiles are used to investigate the morphological peculiarities of superclusters of galaxies and A 2151 cluster.  $B_k$  - statistics are determined by the relation

$$\underline{B}_{k} = \frac{A_{2k}}{A_{k}^{2}} - 1 \qquad A_{k} = \frac{2}{N(N-I)} \sum_{k=J} r_{ij}^{k}$$

where  $r_{i}$  is the distance between i-th and j-th clusters, N- total number of clusters in supercluster.  $A_{k}$  - statistics are related with certain aspects of integral geometry [2], particularly with Blashke problem on the characterization of convex bodies in - ndimensional Euclidean space [3].  $A_{k}$  - statistics are approximations (at  $N \rightarrow \infty$ ) of the functionals. That is they are - k-order moments of pair distribution (distance between two points) inside of body or random chord length distribution in the case of point arrangement on its surface.

Extrema of the functionals (and consequently  $A_k$ ,  $B_k$  - statistics) are necessary characteristics of bodies and may be used to determine of geometrical forms of complicated astrophysical systems. One can calculate analyticaly (at  $N \rightarrow \infty$ , see Table 1) and numerically for final N the values of  $B_k$  - statistics for a few special geometrical configurations. These values must be compared with observational ones. We studied morphology of 16 superclusters of galaxies from West list [4]. The number of clusters in selected superclusters satisfies the condition N > 4. For our purpose we used a compilation of redshifts and velocity dispersions for Abell clusters [5]

Table 1

Figure/statistics	B	B <sub>2</sub>	B <sub>3</sub> -	B <sub>4</sub>
ball sphere circle circumference	0.134 0.125 0.220 0.234	0.429 0.333 0.670 0.500	0.837 0.562 1.289 0.735	1.357 0.800 2.041 0.941
straight chain	0.500	1.400	2.571	4.000

Here we present preliminary results of statistical analysis and numerical simulations for different values of N. Superclusters seemed to have quite different morphological properties. Some of them are flattened systems (probabaly pancake or disk shaped, SC 8, N = 7) or flattened and elongated simultaneously, for example SC 12, N=4 (clusters are numerated according to West list). Having close to spherical forms the superclusters are also existed (SC 11, N=5).

2. To investigate the large scale asymmetry of any system of objects first of all it is necessary to select those signs which allows to distinguish sphericaly symmetric systems amongst the others. Such signs have to be invariant under the projective transformations of the system or under the special transformations which forms subclass in the class of projective transformations. We considered Radon transformation F(p) of space density f(r) in n - dimensional spherical volume. Function F(p)is an integral along the hyperplane, which intersects this sphere at the p - distance from the center. One can show that ortogonal projections of sphericaly symmetric distributions on the linear subspaces of Euclidean space all have the same Radon transformation which equaled to linear density. This result has a simple consequence - the mass of the sphere on the one side from hyperplane is independent of its orientation. Taking into account this property one can show the presence of eastern asymmetry of central region as well as northeast to south-west elongation in distribution of galaxies in the cluster A 2151, the structure of which was already investigated by isodensitometric method [6].

The publication of more detailed paper about discussed problems should follow.

Интегрально-геометрический метод морфологического исследования внегалактических систем. С помощью моментов парного распределения и преобразования Радона от пространственной плотности исследуются конфигурации сверхскоплений галактик, а также тонкая структура скопления Abell 2151.

# INTEGRAL-GEOMETRIC METHOD

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