

Investigation of the large voids in the spatial distribution of galaxy clusters in the Northern Galactic Hemisphere

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Изследване на големите празнини в пространственото разпределение на куповете от галактики в Северната галактична полусфера

Константин Я. Ставрев. Анотация на дисертация

The dissertation contains the results from an investigation of the large voids in the spatial distribution of galaxy clusters in the Northern Galactic Hemisphere. In comparison with previous investigations some more complete samples of objects tracing the large-scale structure of the Universe are used. A refined and automated void search and analysis procedure based on the approximation of a void by a system of crossing empty spheres is applied. The most complete so far identification of the large voids ($\geq 50 h^{-1}\text{Mpc}$ for a Hubble constant $H_0 = 100 h \text{ km s}^{-1}\text{Mpc}^{-1}$) in the spatial distribution of clusters of galaxies in the Northern Galactic Hemisphere to a limiting distance of $420 h^{-1}\text{Mpc}$ is presented. The parameters of the identified voids are determined. The void parameters total volume, equivalent diameter and sphericity are introduced and determined for the first time for voids in the spatial distribution of clusters of galaxies.

The analysis of the spatial distribution of the voids supports a model of a void-filled universe. The presence of two huge two-dimensional structures (great walls) separating the large voids at distances $200 - 250 h^{-1}\text{Mpc}$ and $\geq 400 h^{-1}\text{Mpc}$ from the galactic plane is found in support of the existence of a large-scale regularity with a period for the redshift $\Delta z \sim 0.05$. The statistical significance of the voids is verified and the hypothesis that the large voids of rich clusters are random fluctuations is rejected. The mean characteristics for the void dimensions, volumes and sphericities are determined. Mean dimensions $105.0 \pm 5.6 h^{-1}\text{Mpc}$ and $87.2 \pm 4.1 h^{-1}\text{Mpc}$ for the voids in the distribution of Abell/ACO clusters of richness class $R \geq 1$ and $R \geq 0$, respectively, are obtained. These dimensions are in agreement with the SCDM model.

The population of the voids in the spatial distribution of rich clusters composed of poor clusters, groups, and individual galaxies is identified. The analysis of the radial distribution of the void population confirms a model of a hierarchical structure of the voids.

Key words: cosmology: observations – large-scale structure of Universe – galaxies: clusters: general – methods: data analysis

References

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