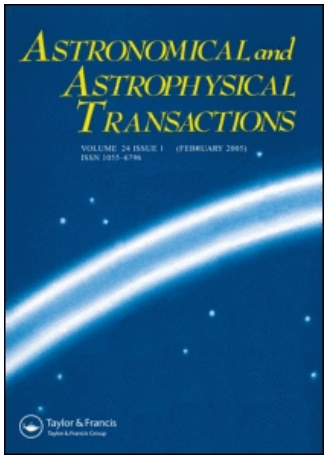


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# TOPOGRAPHY OF THE HUBBLE DIAGRAM INCLINATION AROUND THE CELESTIAL SPHERE: A SPIRAL SINKING TO THE SUPERATTRACTOR PLACED IN THE CENTER OF A GIANT ZELDOVICH PANCAKE?

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The Hubble diagrams are constructed for the galaxies in different solid angles on the sky. The topography of inclinations of the fitting straight lines on the diagrams is shown around the celestial sphere. Four extremal regions on this topography may be interpreted as evidence of a spiral infall of the galaxies to the Superattractor placed in the center of a flattened structure—the Zeldovich pancake.

KEY WORDS Galaxies, Hubble diagram, large-scale motions, cosmology.

## 1. INTRODUCTION

Rauzy *et al.* (1991) revealed the Great Attractor ($l = 280°$, $b = +10°$) structure extended along the line of sight, as well as the second flow of galaxies which does not converge within a volume of a catalogue used. Mathewson *et al.* (1992) have not found any infall of the more distant galaxies to the Great Attractor. They emphasized that just a flow of galaxies is firmly established and the existence of the Great Attractor is ambiguous.

The aim of this work is to reveal an arrangement of the attracting center (centers) on large scales. We used a topography of the Hubble diagram fitting straight line inclination (hereafter IT). This topography is constructed using the data on magnitudes and radial velocities of galaxies (Paturel *et al.* 1989). A similar method was applied (Litvin *et al.* 1993a) to the field of QSO redshifts (up to $z = 3$). An anisotropy of the inclinations of the straight lines fitting the QSO Hubble diagrams was discovered on the sky. This anisotropy was interpreted as evidence of existence of the Superattractor, a giant attracting center. Its action sphere could have radius $z$ exceeding unity, that is larger than the Great Attractor scale ($z$ about 0.1) by a factor of ten. A few independent tests confirmed this hypothesis (Litvin *et al.* 1993a, b, c).

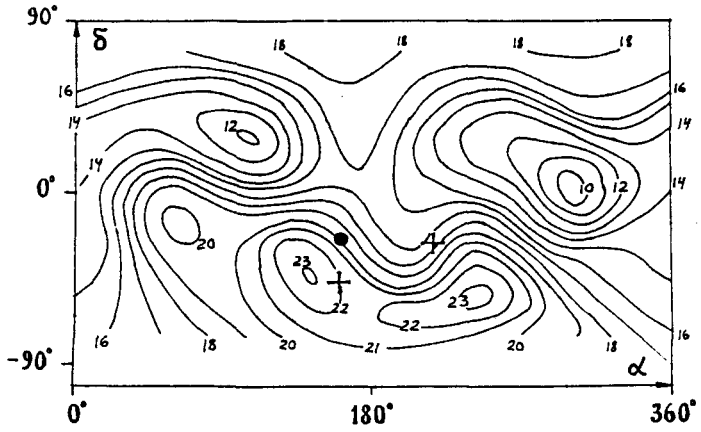


**Figure 1** Topography of the inclination tangent of a straight line fitting the points on the Hubble diagram in the coordinates ($m$, $z$) with respect to the $m$ axis. The Mercator projection in equatorial coordinates is used. The isolines of the tangent in relative units are shown. The crosses indicate the galaxy flows according to Rauzy *et al.* (1991). The solid circle corresponds to the axis of the MBR dipole according to Mathewson *et al.* (1992).

In this paper we find in the IT two directions of the maximum galaxy recession and two directions of the minimum one. Two of these directions are close to the above flows. However, the hypothesis of two streams is not able to explain the data on the two orthogonal quasi-periodical structures (Tully *et al.* 1992). We propose a qualitative scenario to be synthesized from the Zeldovich idea on pancakes (see, e.g., Zeldovich and Novikov 1975) and Anselm's hypothesis on arion Bose condensation (Anselm 1990). We add the assumption of a spiral sinking of the galaxies to the attracting center (see Discussion).

## 2. METHOD OF ANALYSIS AND RESULTS

The Extragalactic Data Base (Paturel *et al.* 1989) is considered. This Catalogue consists of about $3 \cdot 10^4$ galaxies with measured $z$.

Our analysis is made using the code KASTAR described by Litvin *et al.* (1990). The celestial sphere is covered by a grid of equidistant points in equatorial coordinates. Each $i$th point is a center of a circle with radius $R = 30°$. The galaxy population inside the $i$th circle is used to construct the $i$th Hubble diagram ($z$, $m$). The smoothed IT based on the inclinations of such 162 diagrams is given in Figure 1.

## 3. DISCUSSION

Four clear features of the IT can be seen in Figure 1 (two peaks and two hollows) are placed approximately along a large circle on the celestial sphere. The coordinates of one pole of this circle are $\alpha = 28° \pm 3°$, $\delta = -20° \pm 5°$. In order to

explain this picture, as well as the existence of two orthogonal quasi-periodical structures (Litvin *et al.* 1989, Broadhurst *et al.* 1990, Tully *et al.* 1992), the following scenario is proposed:

(1) The galaxy population under study is a small part of an axisymmetric Zeldovich pancake.

(2) A giant mass, the Superattractor, discovered using the quasar population (Litvin *et al.* 1993a, b, c) is in the center of this pancake at the redshift $z$ exceeding unity.

(3) The objects within the pancake are falling to the center along spirals, i.e., a superposition of infall to the center and rotation around it is assumed.

(4) Our Galaxy is positioned with respect to the pancake center just like the Sun in the Milky Way: near the equatorial plane in an outer area. The Galaxy takes part, together with the Virgo cluster and other neighbours, in the general sinking.

(5) One may roughly consider the motion in the pancake to be superimposed to the general Fridmann expansion of the isotropic and homogeneous Universe.

The following interpretation of the empirical data is possible:

(a) The two peaks in the IT are as a result of larger infall velocities at smaller distances to the Superattractor. Therefore, the galaxies in the directions to the center and anticenter are seen to move away from the observer.

(b) Two hollows in about tangent direction are due to the fact that the spirals have non-zero pitch-angles, therefore the galaxies come nearer to the observer when seen in the direction of rotation, as well as in the opposite one. Indeed, in the direction of rotation, the projection of a distant galaxy velocity on the line of sight is smaller than that of the observer. In the opposite direction, the corresponding projection for some distance could be equal to the modulus of the galaxy velocity.

(c) If one assumes, according to Anselm (1990), that the Bose condensation of arions generates a slice quasi-periodical structure within the pancake, then one observes only two nearly orthogonal directions in which the slice structure is visible. These directions are the ones to the center of the pancake and along the axis of symmetry. The first direction roughly corresponds to the Supergalactic SGZ axis. The corresponding quasi-periodical slice structure was found by Tully *et al.* (1992) and Litvin *et al.* (1993d). The second structure whose normal is close to the SGY axis was found by Litvin *et al.* (1989) and Broadhurst *et al.* (1990).

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