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SPIRAL-GEOMETRIC DISTRIBUTION OF COSMIC HIGH-ENERGY GAMMA RAYS

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ԲԱՐՁՐ ԷՆԵՐԳԻԱՆԵՐԻ ՏԻԵԶԵՐԱԿԱՆ ԳԱՄՄԱ ՔՎԱՆՏՆԵՐԻ ՊԱՐՈՒՐԱԵՐԿՐԱՉԱՓԱԿԱՆ ԲԱՇԽՈՒՄԸ

Աշխատանքում ներկայացված են կենտրոնակիր պարուրաերկրաչափական տարածաժամանակային գերտարածքներին հատուկ ճառագայթման տարածման և բաշխման մի քանի խնդիրներ։ Ըստ ներսի և դրսի դիտողների դիտարկված են ճառագայթման գրանցման և բաշխման մեկնաբանման որոշ հարցեր՝ կախված գերտարածությունում ճառագայթող մարմնի գրաված տեղից, դիրքից, ժամանակից, ինչպես նաև՝ կենտրոնակիր և ոչ կենտրոնակիր լինելուց։ Համեմատվել են տիեզերական ճառագայթման բարձր էներգիաների գամմա քվանտների երկայնակի անկյունային բաշխման փորձառական արդյունքները, և ցույց է տրվել դրանց համահնչունությունը առաջարկված մոդելին։

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СПИРАЛЬНО-ГЕОМЕТРИЧЕСКОЕ РАСПРЕДЕЛЕНИЕ КОСМИЧЕСКИХ ГАММА-КВАНТОВ ВЫСОКИХ ЭНЕРГИЙ

В работе представлены некоторые задачи распространения и распределения излучения, свойственные мегапространствам с центросодержащим спирально-геометрическим пространство-временем. С точки зрения внешнего и внутреннего наблюдателей рассмотрены вопросы регистрации излучения и трактовки распределения, зависящего от занимаемого места, положения, времени источника излучения в мегапространстве, а также от его центросодержащего или нецентрсодержащего характера. Было проведено сравнение экспериментальных результатов долготного профиля распределения высокоэнергетического гамма-излучения с предложенной моделью.

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S.R. SHAHAZIZIAN

SPIRAL-GEOMETRIC DISTRIBUTION OF COSMIC HIGH-ENERGY GAMMA RAYS

Some problems on the distribution and propagation of radiation characteristic of centre-containing spiral-geometric superspaces are presented. According to an inner observer's viewpoint the problems of detection of radiation and interpretation of distribution depending on the place, location, time of the source in the superspace as well as on its being a centre-containing or not a centre-containing one, are considered. The experimental data on the longitudinal cross section of distribution of the high-energy cosmic gamma rays is compared with the model proposed.

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From the point of view of a model of a centre-containing spiral-geometric structure of the physical space-time, consider some aspects of angular distribution of high-energy gamma quanta stemming from the location of the source as well as from its being a centre-containing or not-a-centre-containing one. In the meanwhile we shall work in the framework of a single-centre spiral geometry [1], [2] .

Choosing for the Galaxy a single-centre spiral geometry as the structural geometry of the physical space-time, also adopt that its centre coincides with the Galactic Centre. Consider how the inner observer will perceive his surroundings depending on the choice of the inner geometry of the Galactic space-time. The same aspects will also be considered from the point of view of an outer (absolute) observer, who being in a Newtonian absolute space-time will use Euclidean geometry.

The Mechanism of Distribution of Radiation from Not-a-Centre-Containing Source

As in a spiral geometry the centre (condensation point) of geometry belongs at the same time to all the straight lines and planes (axiom 1_1 [1]), then any straight line crossing an arbitrary point out of the centre will tend to the centre, yet having a finite length, i.e. the distance between the centre and any point out of it is finite.

According to the axiom 1_2 [1] , through an arbitrary point M out of the centre, there pass the continuum's power lines which, according to the outer observer's system (OOS), in particular, for an Euclidean plane, are expressed as:

$$\rho = \rho_0 e^{K\varphi}. \qquad (1)$$

(Fig.1), where k=ctg α , K takes the values ($-\infty$ — $+\infty$), is the angle between the helix tangent and the radius vector in the point of their tangency. From here on, the angle will be called the observation angle α .

If in an arbitrary point a point source of light is situated which emits uniform light in all directions, then in case of a Euclidean-geometric structure of space the light propagates by rays from the point M (by Euclidean straight lines), as shown in Fig.1a. While in a space with an inner single-centre spiral-geometric structure the light from an arbitrary point M out of the centre, will propagate by all the straight lines (helixes) passing through this point, as shown in Fig.1b, where M is the light source, O is the centre of geometry, α is the angle of observation.

In a Euclidean geometry, through the arbitrary points A and M passes only one straight line (Fig.2a), while in a spiral geometry, according to the axiom 1_3 [1] , through two arbitrary points pass an infinite number of straight lines l_1, l_2, l_3... (Fig.2b). These staright lines, according to OOS, are determined by the central angle $\angle AOM = \Psi$ of all the helixes passing through the points A and M

$$\Psi = \varphi_A - \varphi_M = \Psi_0 + 2\pi n \qquad (2)$$

where n is the number of full 2π turns of helixes connecting the points A and M, n taking the values of n=(0;1;2;3...), i.e. to each value of n corresponds a quite certain helix passing through A and M and having a definite coefficient k . The countable set of lines is limitted from one side by the shortest straight line connecting A and M (the case of n=0). As it is shown in Fig.2b, the length l_1 belongs to the line with k_1 and passes through A and M at n_1=0. And l_2 is a line passing through A and M with k_2 at n_2=1, which connects the same A and M points making, besides the angle Ψ_0 , one more turn around the centre of geometry. The coefficient k_n as well as the observation angle α_n for all the straight lines corresponding to n , will be defined by [2] :

$$K_n = ctg\alpha_n = \frac{\ln(R_A/R_M)}{\Psi + 2\pi n} , \qquad (3)$$

where to each n=(0;1;2;3...) corresponds its own α_n angle of observation. Here R_A and R_M, according to OOS, are the radial distances from the centre of geometry to the points A and M, respectively; Ψ is the central angle between these straight lines.

According to OOS, the length l_n between A and M for each straight line from the countable infinite set, is defined as [2] :

$$l_n = (R_A - R_M)/\cos\alpha_n \qquad (4)$$

As it is seen from (3) and (4), with the number of turns n increasing infinitely, the angle α_n discretely, step by step tends to 90° and l_n tends to infinity.

Thus, if in an M point of the space a point source of light is situated and in the other one, A, the observer is, and if the axiom according to which the light propagates by the straight lines of the inner geometry of the given space is not denied, then, naturally, in a space with Euclidean geometry the light will propagate by Euclidean straight lines, so the inner observer will see only one source of light (Fig. 2a). But if the physical space-time is a spiral-geometric one, the inner observer being in the point A will see the point source of light in the point M as an n number of sources at different l_n distances at different α_n angles of observation (Fig.2b) (if, as an ideal case, the light absorption in the space and the dependence of the light intensity on the distance are not taken into account).

As mentioned above, with the increasing number of turns n the observation angles α_n rapidly tend to 90°, i.e. the staright line (helix) of propagation, according to OOS, tends to a circle. Consequently, the observation angles of the third and the fourth images of the light source(a star or another object) will become very close to each other, tending to 90°. As to their subsequent distances, they rapidly grow to such degree, that even at exclusion of the absorption they become practically impossible to observe. For example, if we assume a single-centre spiral-geometric structure for galaxies and if a point source of radiation is, e.g., 6 kpc distant from the centre, and we, the inner observers, are 10 kpc distant and the central angle $\Psi=5^\circ$, then the first image of the source will be observed at an angle of $\alpha_1=9.69^\circ$ and

$l_1=4.085$ kpc, the second one will be observed at $\alpha_2=85.416^\circ$ and $l_2=50.044$ kpc, the third one will be observed at $\alpha_3=87.688^\circ$ and $l_3=99.165$ kpc. If $\Psi=45^\circ$, for the same R_A and R_M $\alpha_1=56.96^\circ$, $l_1=7.336$ kpc; $\alpha_2=85.867^\circ$, $l_2=55.495$ kpc; $\alpha_3=87.808^\circ$, $l_3=104.627$ kpc, and so on.

Now let us see how the inner observer would detect the radiation from the source M in the time. Suppose the radiation starts at t=0. In a certain τ_1 time, needed for the light to pass from M along l_1 to A, at t_1 the inner observer will detect the radiation of M at a certain angle α_1 - the first image. And in a certain τ_2 time, at a certain observation angle α_2 he will detect the second image of the same source M, and so on. Thus, If the radiation is a continuous one, it will take quite a time till he sees all n images of M .

Now consider the case when the source M is characterized by a short burst lasting $\Delta\tau$, detected by the inner observer at certain times t_n and at certain observation angles α_n . So, if one knows the place and position of the burst in the Galaxy as well as the time of the flash of the first image, he will easily predict the place, position and time of the second flash. And if one has the time interval between these two flashes and their coordinates, i.e. the corresponding observation angles, then one can estimate the real place of M in the Galaxy, i.e. the distance to the Centre.

By the way, the aforesaid also concerns the non-point sources. For instance, there is a light source B (Fig.2a) seen to the observer in the point A at an observation angle β , in an aperture angle $\Delta\beta$. S_1 and S_2 are the embracing helixes.

The images of this source at distances S_n and with angular sizes β_n will be also seen at the corresponding observation angle ρ_n for each n. It is easily seen, that the $\Delta\beta_n$ size of the source tends to zero with increasing n . For instance, if β_1=30°, β_2=36° , resulting in that β =33°, and the distances of the source and the observer to the Galactic Centre correspondingly are ρ_1=10 and ρ_2=20, then $\Delta\beta_1$ =5.12°, $\Delta\beta_2$=5'15'', $\Delta\beta_3$=1'26,44'', and so on. That is to say, the source, seen as a rather big object at the first observation angle, will tend to a point source in its subsequent images.

As it is seen, already the second image and the more so, the third one are so far from us that with account of the absorption in the medium, they cannot practically be observed. But there arises a question deserving further discussion: aren't some quite distant small sources observed at angles 90° and 270° in reality the second images of large sources which are at other observation angles now?. The now available experimental technique permits one to carry out such quite actual investigations requiring, of course, large-scale high-accuracy measurements.

According to the aforesaid, the Euclidean-geometrical pattern of distribution of stars and other distant objects constructed by us, inner observers, will not coincide with that proposed by the outer observer, just as well the general pattern, constructed by us as outer observers, will not coincide with the Euclidean-geometrical one constructed by the inner observers of the galaxies we observe.

It is appropriate to mention here, that the fact the light in the Galaxy propagates in helix trajectories was practically shown in ref.[1] by observing the light deflection in the field of the Sun. As to manifestation of the spiral-geometric characteristics of time, indicating, by the way, to the centre-containing spiral-geometric nature of the Galactic space-time, in ref.[3] it is shown through the experimental data on the variation in the length of the Earth's day.

Distribution of the Radiation of a Centre-Containing Body in a Single-Centre Spiral-Geometric Space

Now consider the problem of distribution of the radiation of a centre-containing (containing the centre of geometry) body.

Assume a circle L of radius ρ_0 (according to OOS) to be the radiator, the centre of which coincides with that of the geometry.(Fig.3). Let the inner observer be R distant, on the point A. Adopt that the radiation from any point M on the source L is uniform and is uniformly distributed in γ and β angular sectors. If the geometry is a Euclidean one, then the light from any point M belonging to L, through the sectors γ and β will propagate by Euclidean straight lines passing through that point, hence the observer in A will see L R distant, at a certain angle ω (Figs.3,4a). But one cannot say the same thing about a single-centre spiral-geometric space. Here, as mentioned above, according to spiral geometry, through any point M belonging to L can pass a countable infinite number of straight lines connecting the points A and M. These lines (helixes) with certain distribution will depict the circle L at the observation point A in an angular sector of 180°. That is to say, the source L will be seen at the point A not at ω, but at 180°, as shown in Fig.4b . Here L is the source of light (a circle with radius ρ_o, according to OOS), O is the centre of geometry, A is the inner observer R distant from the centre, O, I_o, I_1, I_2, ..., I_n are rays (staright lines) correspondingly emitted from the points M_o, M_1, M_2, ..., M_n at certain angles γ° or β°, and $\varphi(\varphi_o = M_o O M_1)$ are the central angles subtended by M_oM_1; M_1M_2; M_3M_4; ..., $M_{n-1}M_1$ segments of L . By the way, from the point A these points are observed at a certain observation angle α_n and distance l_n, and are determined by eqs. (3) and (4), respectively. It is obvious that the rays emitted by any M point of L and coming out through the sector γ will be detected by the observer A in the angular arnge of $0^\circ < \alpha < 90^\circ$ and those coming out through the sector β will be detected in the angular range of $270^\circ < \alpha < 360^\circ$ (Fig.3).

Thus, if a notion of angular density is introduced for the flux of particles emitted by L, then the number of particles coming out of the aperture angle $d\varphi_o$ is:

$$d_n = n_o d\varphi_o. \qquad (5)$$

Ignoring for the present the dependence of the light absorption on the distance l_n, using eq.(3), we obtain the following expression for the distribution of radiation of L at the

point A in dependence with α :

$$d_n = n_o \frac{\ln(R/\rho_o)}{\cos^2\alpha} d\alpha, \qquad (6)$$

where R is the distance from O to A (according to OOS), ρ_o is the radius of L, α is the observation angle from A, n_o is the number of particles emitted in unit time by the segment of L against the central angle φ_o .

As it is seen from eq.(6), the observer A will perceive the radiation of L as a uniform background one at a rather wide aperture angle in the direction to the centre of geometry. But at the angles around 90° and 270° there pronounced maxima will be registered. In the general case, with regard to the absorption of radiation as a function of l_n, the distribution of the radiation reaching A at α is expressed by

$$d_n = n_o e^{-\lambda l_n} d\varphi_o = n_o e^{-\lambda l_n} \left|\frac{d\varphi_o}{d\alpha}\right| d\alpha, \qquad (7)$$

where λ is the factor of absorption by the medium. Using eqs.(3) and (4), for the distribution of the radiation of L we obtain:

$$d_n = n_o e^{-\lambda \frac{R-\rho_o}{\cos\alpha}} \cdot \frac{\ln(R/\rho_o)}{\cos^2\alpha} d\alpha. \qquad (8)$$

It is natural to assume that in the general case, both n_o and λ cannot be constant for galaxies. They must depend on ρ (owing to the physical structure of the radiating segment, its dynamic state and different media through which the radiation propagates). That is to say, n and λ must be chosen in dependence with ρ, as they are not the same for different coordinates of the Galactic plane:

$$n_o \sim F(\rho), \quad \lambda \sim f(\rho). \qquad (9)$$

So far we were considering the case with the inner observer A being farther from the centre of geometry than the source L was. And now let the observer be between the source and the centre of geometry, as shown in Fig.5 . If the space is a Euclidean one, the observer A will see the source L' from all sides (Fig.5a) . But, if the space is a spiral-geometric one, the total radiation of L' he will detect within the angular range (90-180-270^o) as shown in Fig.5b, where L' is the source (according to OOS - a circle with radius ρ_o'), A is the inner observer R' distant from the centre O; I_o, I_1, I_2, ..., I_n are straight lines passing through the point A and the corresponding M_o, M_1, M_2, ..., M_n points, i.e. the paths of light. As to the distribution of radiation of L', it can be easily seen to have the form of eq.(8), where ρ_o' and R' have only changed their places, $\rho_o' \rightarrow R$ and $R' \rightarrow \rho_o'$.

Let us on some examples see how the inner observer at the point A would register the distribution of radiation of L at different α , ρ and n .

i) Fig.6 shows the distribution curves corresponding to one and the same n_o for differnt L with ρ_o=0.1, ρ_1=1, ρ_2=3, ρ_3=6 when λ =0.01 and R=10 .

ii) In Fig.7 λ =0.1, R=10; ρ_o=0.1; ρ_1=1, ρ_2=2, ρ_3=3, ρ_4=5, ρ_5=6 .

iii) Fig.8: for one and the same n_o, when R=10 and λ =0.4, the following cases are presented:

ρ_o=0.001, ρ_1=0.01, ρ_2=0.1, ρ_3=1, ρ_4=3, ρ_5=5 .

iiii) Fig.9: R=10, λ =0.6; ρ_o=0.001, ρ_1=0.01, ρ_2=0.1, ρ_3=1, ρ_4=2, ρ_5=4 .

As it is seen from the figures, for arbitrary λ and ρ at one and the same R the radiation distribution profile is rather sensitive to the choice of λ and ρ . In one case, in a quite wide angular range (about 120^o), the radiation is distributed as a uniform background with pronounced maxima near 90^o and 270^o, and in the other one it is just on the contrary, the distribution has a ring-shaped maximum near 140^o and inessential tails directed to the centre.

Now consider the case what distribution the observer will register at the point A when simultaneously radiate different sources L with different ρ and their corresponding n and λ . For example, when for L_1 n_1=10^5, λ_1=0.8, ρ_1= =0.01 and R=10; for L_2 n_2=10^4, λ_2=0.6, ρ_2=0.1; for L_3 n_3=10^3, λ_3=0.4, ρ_3=1; for L_4 n_4=2, λ_4=0.01, ρ_4=2 , then the distribution of the radiation of the group of sources L_1, L_2, L_3, L_4 , according to (8), will look like that shown in Fig.10a . The distribution of another group of sources L_1 (n_1= =10^5, λ_1=0.6, ρ_1=4), L_2 (n_2=10^5, λ_2=0.6, ρ_2=3), L_3 (n_3= =1, λ_3=0.01, ρ_3=5), L_4 (n_4=1, λ_4=0.01, ρ_4=6) with R=10 is shown in Fig.10b . The radiation distribution of the group L_1 (n_1=3 10^4, λ_1=0.8, ρ_1=0.01), L_2 (n_2=5 10^4, λ_2=0.8, ρ_2=0.1), L_3 (n_3=1 10^2, λ_3=0.1, ρ_3=4), L_4 (n_4=1, λ_4=0.01, ρ_4=5) has a quite different form (Fig.11), on the curve of which a step-like structure is already observed. In all the cases considered the centre-containing source was closer to the centre of geometry than the inner observer, that is why the radiation was detected within the angular range (90^o-0^o-270^o). As to the radiation detected within (90^o-180^o-270^o), the inner observer will register it as the radiation of L' (Fig. 5), the distribution of radiation of which will also be given by (8) and have a similar form. Thus, the total radiation of L and L' sources will be detected by an inner observer in the full angular range (0^o-360^o).

It should be noted that in all the cases considered the radiator (according to OOS) is taken as a circle only for simplicity. But, for an excentric circle or any such circumference, the intensity distribution curve will be just asymmetric, the place of the maxima remaining the same at the perpendicular angles of observation (90^o and 270^o). Of course, the maxima will be of different levels.

Now consider some time aspects of the radiation distribution of centre-containing sources. Suppose a centre-containing source begins to radiate at t=0. In a definite τ time, beginning from the instant t_1, the inner observer A will register radiation around 0^o within an aperture angle of $\Delta\alpha$ which during τ_n will increase with α and tend to 90^o on one side and tend to 270^o on the other side. In case of a continuous radiation, beginning from the instant t_n, the source L will be seen within the full aperture angle (180^o). And if the radiation is a pulsed one and the pulse width is much less τ_n, then the inner observer A will at first see radiation around 0^o in an aperture angle of $\Delta\alpha$ which then

is bisected ($\Delta\alpha/2$), one of the arms in the course of time tending to 90^o, and the other one tending to 270^o. It is apparent that $\Delta\alpha/2$ while tending to a perpendicular observation angle, will become zero. When considering time aspects in a spiral-geometric space-time, one must keep in mind that the process-characterizing time intervals, i.e. unit times are governed by certain laws determined by the place and position of the source and the observer in the space, which to some extent is shown in ref.[3] .

Distribution of Cosmic Gamma Radiation in Accordance with Spiral Geometry

Assuming a centre-containing spiral-geometric structure for the Galactic space-time and superposing the centres of the Galaxy and the geometry, the radiation of the nucleus, spiral sleeves and other matter-containing regions of galactic space will be registered by an inner observer according to the above considered mechanisms.

A powerful gamma radiation was detected in 1967 by the OSO-3 satellite. Then it was in details investigated by the SAS-2 and COS-B satellites. The angular distributions of the Galactic high-energy gamma radiation with an angular resolution of 3^o were obtained.

Let us consider the angular distribution of the Galactic gamma radiation observed by COS-B [4] . There were obtained distributions of gamma radiation in the energy range from 70 MeV to 5 GeV for the Galactic longitude l_o (0^o-360^o) and latitude b^{o} ($+20^{o} \div -20^{o}$) (Fig.12), and longitudinal profiles are obtained for the energy ranges 70-150 MeV, 150-300 MeV, and from 300 MeV to 5 GeV (Fig.13).

It is easy to notice that the Galactic gamma-radiation angular distribution curves are similar to the spiral-geometric distribution curves, e.g., shown in Fig.10 . A marked increase in the intensity is apparent here (Fig.12) in the direction to the Galactic Centre, within an aperture angle of 1^{o}(310^{o}-45^{o}) which is just as clearly seen in our obtained distribution curve shown in Fig.10b . As to the pronounced maxima near 80^{o} and 260^{o}, the angular distance between which makes 180^{o}, one may assume that they are the maxima of a spiral-geometric distribution near 90^{o} and 270^{o} (Fig.10b) . Hence it is logical to assume, that the present direction to the Galactic Centre has shifted by about 10^{o} relative to the direction of the spiral-geometric centre. By the way, similar shift was also noticed in ref.[3] . If assumed that gamma quanta of different energies may be produced in the matter-containing regions being at different distances from the centre, i.e. they can have different λ and different n , then, according to the aforesaid, the difference between the three curves in Fig.13 is understandable. In favour of a spiral-geometric distribution of radiation is also the fact that in all of the three curves, the angular distance between the maxima remains the same and is equal to 180^{o}. Such distributions of the Galactic radiation have been obtained for other - radio, infrared and optical regions too. One can consider, e.g., the distribution profiles shown in Fig.1 of ref.[5] or in Fig.9 of ref.[6] .

In all of these distributions the maxima clearly manifest themselves near the Galactic latitudes of 80^{o} and 260^{o}.

Still in 1959 Mills noticed a step-like structure in the distribution of the radio-frequency emission of the Galaxy [7] , which is also observed in the distribution curves of other types of emission. It is mainly explained by the existence of spiral sleeves. However, this supposition is not in conflict with our approach but complements it, as from the point of view of spiral geometry, even for a circle-shaped source with corresponding parameters, one obtains a step-like structure in the radiation distribution curves, e.g., Fig.11 . So that the existence of spiral sleeves all the more will provide for a step-like nature of the distribution curves.

The gamma-ray distribution has also a marked fine structure which mainly represents itself as superposition of the distribution of radiation of discrete not-centre-containing sources on the general profile. The COS-B group, for instance, found twenty nine discrete sources which mainly are located in the Galactic plane and are known ones. And the SAS-2 group indicated five pronounced maxima within (310^{o}-45^{o}) the nature of which still remains unknown.

Thus, the gamma-distribution curve within (0^{o}-360^{o}) represents itself as superposition of radiations of not-centre-containing discrete sources and centre-containing ones, the profile of which structurally is quite like the distribution curve of the single-centre spiral-geometric model.

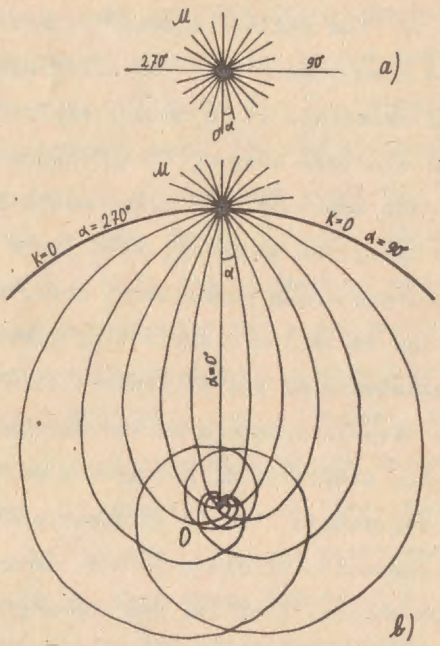

Fig.1 Propagation of the radiation of a point source:

a) in Euclidean space

b) in a centre-containing spiral-geometric space, where O is the centre of geometry, M is the radiator, α is the angle of observation.

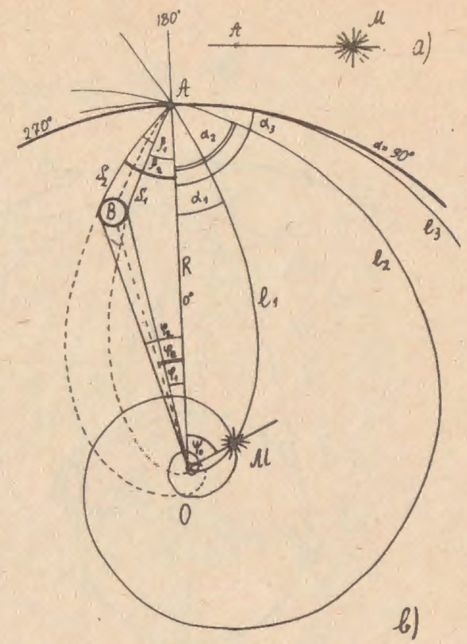

Fig.2 Detection of the radiation of a point source:

a) in Euclidean space

b) in a centre-containing spiral-geometric space, where O is the centre of geometry, A is the inner observer, R is the distance between A and O (according to OOS), M is a point source. α_1, α_2, α_3 correspondingly ar[e] the angles of observation of the 1st, 2nd and the 3rd images of the source M, and l_1, l_2, l_3 are the corresponding distances of these images from the point A; ψ_o is the central angle AOM , B is a not-centre-containing nonpoint source, S_1 and S_2 are straight lines (helixes) embracing the source, β_1 and β_2 are the corresponding angles of observation, and φ_0 is the central angle BOA .

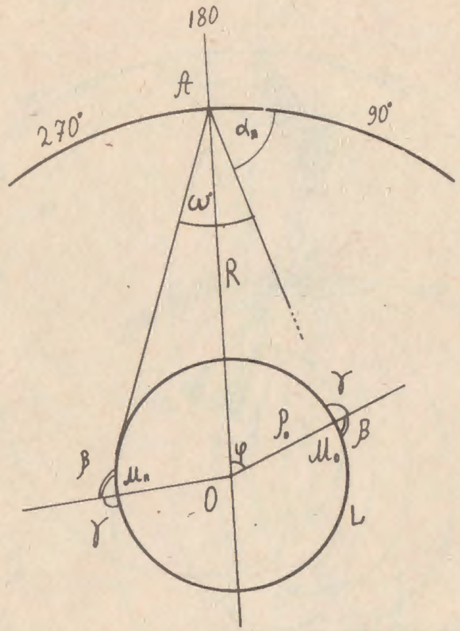

Fig.3 Observation of a centre-containing source R distant from the point A according to Euclidean geometry, where ρ_o is the radius of L (according to OOS), γ^o and β^o are the aperture angles of propagation of the radiation of the source M, ω is the angular diameter of the source L observed from A .

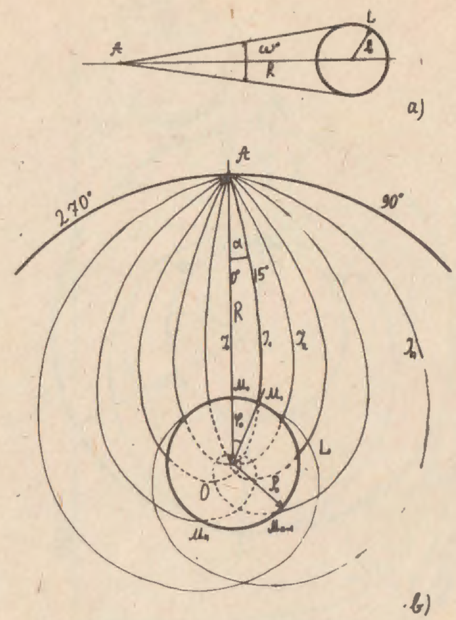

Fig.4 The source L seen by an inner observer at a distance of R :

a) in Euclidean geometry

b) in a centre-containing spiral geometry. L is the source. $I_o, I_1, I_2, \ldots, I_n$ are rays reaching A at corresponding observation angles α from the point $M_o, M_1, M_2, \ldots, M_n$, respectively. Ψ is the central angle of the corresponding points M_n of the source L.

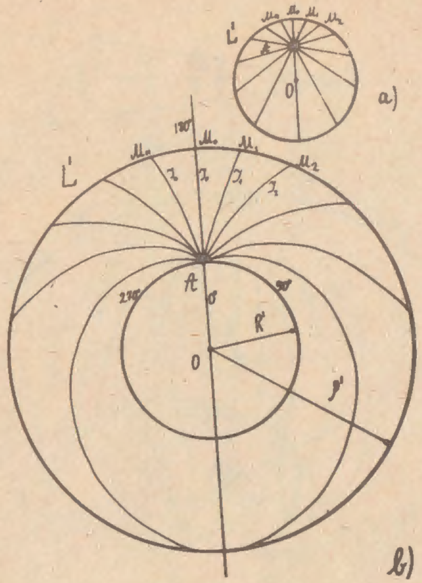

Fig.5 Detection of the radiation of a centre-containing source L' by an inner observer A, when the source is farther from the centre than the observer is:

a) in Euclidean space

b) in a spiral-geometric space.

Here R' is the distance between the points A and O. ρ' is the distance between L' and O. $I_o, I_1, I_2, \ldots l_n$ are distances connecting the corresponding $M_o, M_1, M_2, \ldots M_n$ points of L' with the point A (i.e. rays reaching A from those points).

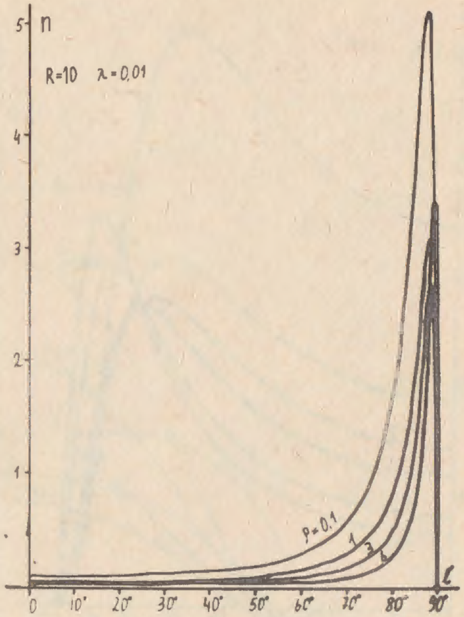

Fig.6 Angular distribution of the radiation of L according to observations from the point A, when λ =0.01, R=10, and ρ_o=0.1, ρ_1=1, ρ_2=3, ρ_3=6 .

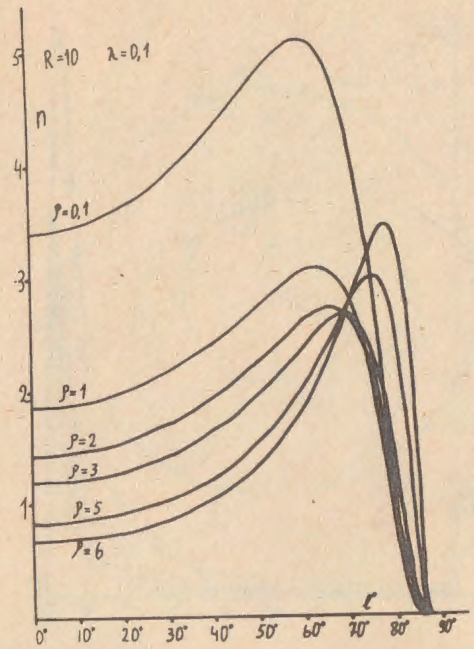

Fig.7 The profile of the angular distribution of the radiation of L according to observations from the point A, when R=10, λ =0.1, and ρ_0=0.1, ρ_1=1, ρ_2=2, ρ_3=3, ρ_4=5, ρ_5=6 .

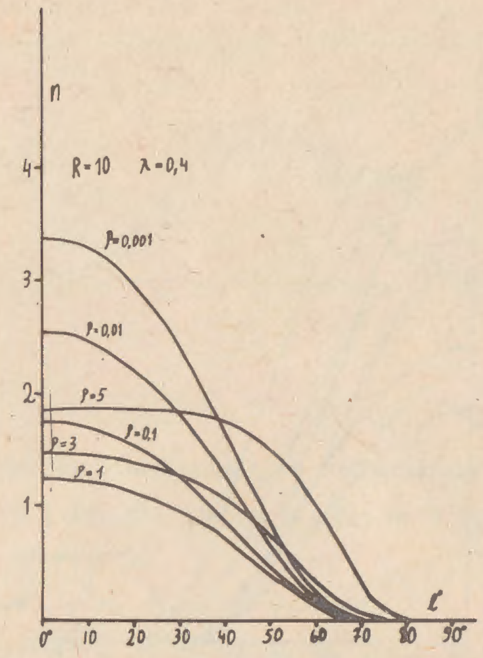

Fig.8 The profile of the angular distribution of the radiatio of L according to observations from the point A, when R=10, λ =0.4, and ρ_0=0.001, ρ_1=0.01, ρ_2=0.1, ρ_3=1, ρ_4=3, ρ_5=5 .

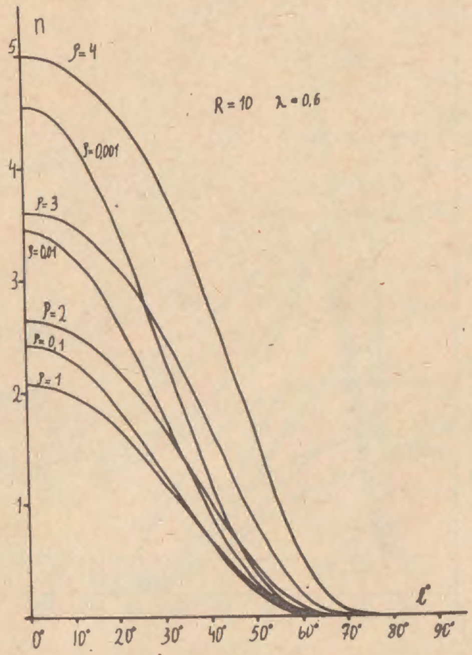

Fig.9 The profile of the angular distribution of L according to observations from the point A, when ρ_0=0.001, ρ_1=0.01, ρ_2=0.1, ρ_3=1, ρ_4=2, ρ_5=4, R=10, λ=0.6.

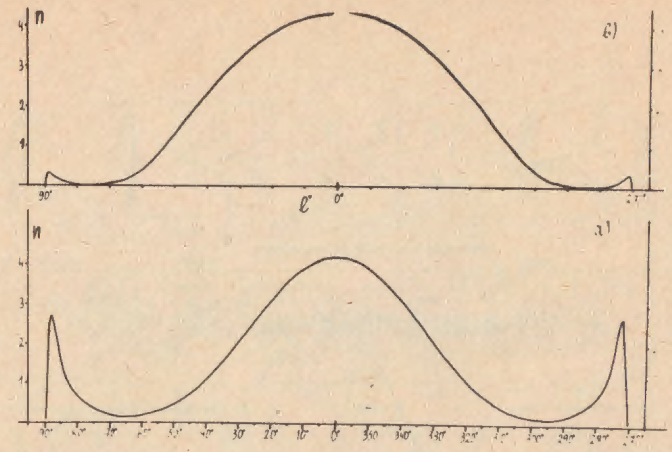

Fig.10 The angular distribution of radiation of a group of sources L for all the cases with R=10 (according to the inner observer):

a) L_1 (n_1=1 10^5; λ_1=0.8; ρ_1=0.01)
L_2 (n_2=1 10^4; λ_2=0.6; ρ_2=0.1)
L_3 (n_3=1 10^3; λ_3=0.4; ρ_3=1)
L_4 (n_4=2; λ_4=0.01; ρ_4=2).

b) L_1 (n_1=1 10^5; λ_1=0.6; ρ_1=4)
L_2 (n_2=1 10^5; λ_2=0.6; ρ_2=3)
L_3 (n_3=1; λ_3=0.01; ρ_3=5)
L_4 (n_4=1; λ_4=0.01; ρ_4=6)

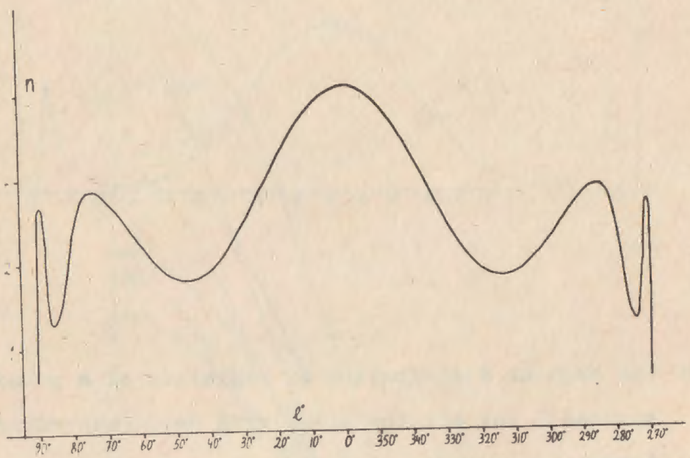

Fig.11 The angular distribution of radiation of a group of sources L, when:

L_1 (n_1=3 10^4; λ_1=0.8; ρ_1=0.01)

L_2 (n_2=5 10^4; λ_2=0.8; ρ_2=0.1)

L_3 (n_3=1 10^2; λ_3=0.1; ρ_3=4)

L_4 (n_4=1; λ_4=0.01; ρ_4=5).

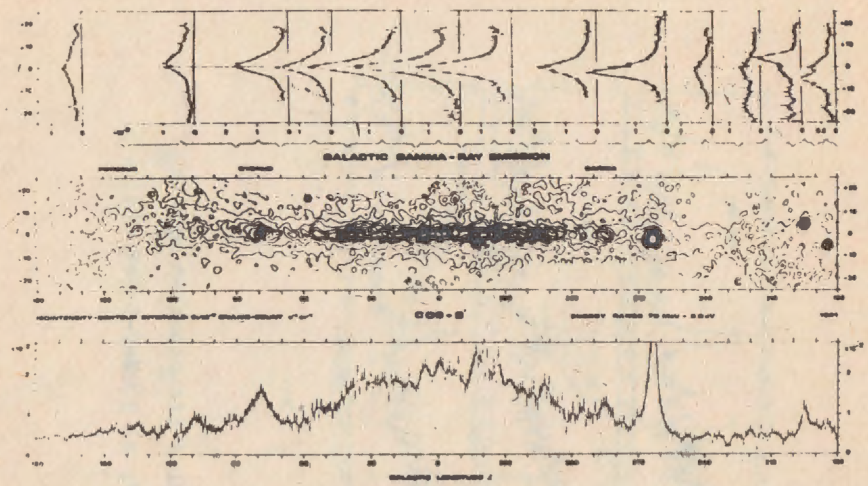

Fig.12 Propagation of the Galactic gamma radiation detected by COS-B [4] :

a) the cross section of the Galactic plane at different longitudes;

b)the contour map of the gamma radiation of the observed regions of the Galactic plane;

c) the longitudinal profile of the Galactic gamma radiation in the energy range from 70 MeV to 5 GeV.

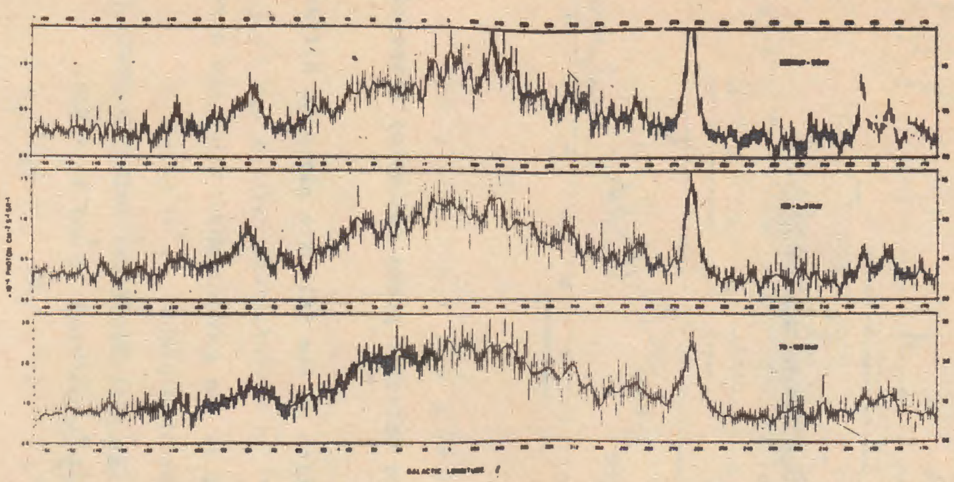

Fig.13 The Galactic gamma-ray intensity distribution within:
a) 70-150 MeV; b) 150-300 MeV; c) 300MeV-5 GeV [4] .

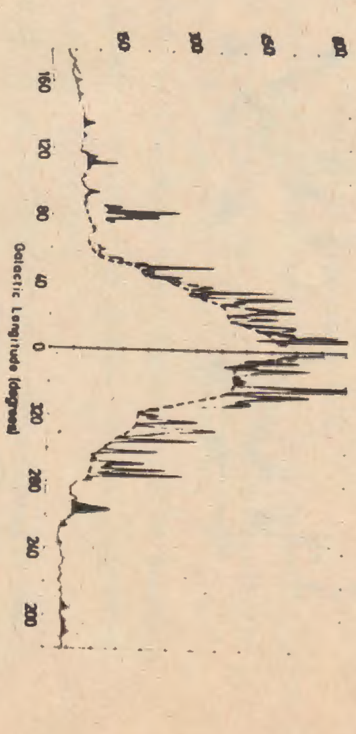

Fig.14 The longitudinal distribution of the radio-frequency (408 MHz) emission of the Galactic disk (Fig.1 in ref. [5]).

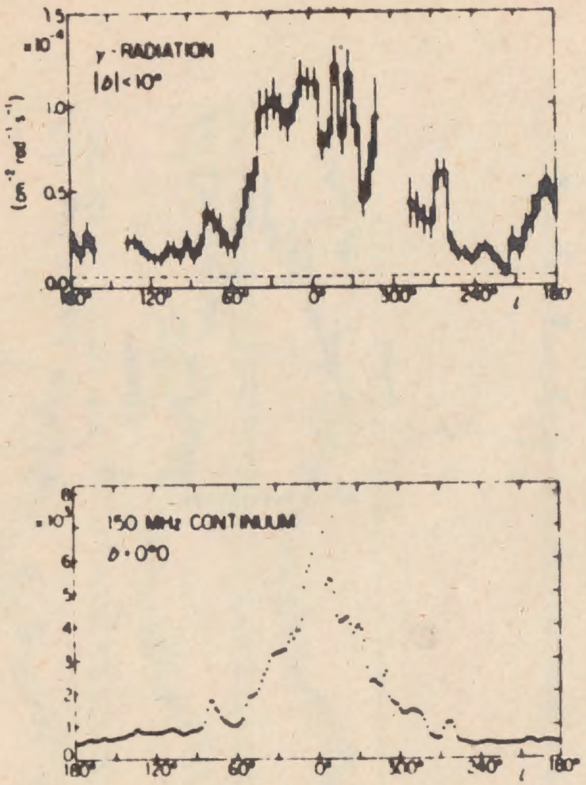

Fig.15 a) The longitudinal distribution of the Galactic gamm. radiation in the energy range of $E_\gamma > 100$ MeV (Fig.9 in ref.[6]);

b) The longitudinal distribution of the radiation at 150 MHz (Fig.9 in ref.[6]).

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