changes little if $\tau_e > 0.2$ sec and amounts to ∿50 cm/sec. This contradicts the experimentally observed growth of the plasma pressure in the entire range of variation of τ_e. This discrepancy can be explained by assuming that the increased pressure is offset by the effect of the decreased inductance of the filament.

The authors thank I.N. Golovin for useful discussions and remarks, and N.N. Shvindt for performing the optical measurements.

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OBSERVATION OF EXCESS γ-RADIATION FLUXES FROM THE REGION OF THE NORTHERN GALACTIC POLE

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Submitted 17 January 1973
ZhETF Pis. Red. 17, No. 5, 254 - 258 (5 March 1973)

A γ telescope with a tracking spark chamber, registering γ quanta of energy higher than 100 MeV, was installed for the first time in January 1969 on the satellite Cosmos-264. The preliminary data were published in [1, 2]. We present here the results of a search for discrete γ-radiation sources.

The telescopes consisted of scintillation counters C_1 and C_2 and a directional Cerenkov counter $\check{C}$ with organic-glass emitter. The electronic circuit separated the events $\bar{C}_1C_2\check{C}$ produced upon conversion of the γ quanta in a lead converter one radiation length thick, and triggered the spark chamber. The upper wide gap of the chamber measured the directions of the conversion-pair components. In the succeeding four gaps, interlined with lead plates, an electronic shower developed, and its registration increased substantially the reliability of the γ-quantum event. To decrease the background produced by the charged cosmic particles on board the satellite, an additional (movable) counter was placed on the outside, and its operation was revealed by lighting of lamp L. The telescope was calibrated beforehand in beams of monochromatic electrons with energies from 100 to 1500 MeV. The effective telescope area was 90 cm^2, the average registration efficiency was ∿0.2. A detailed description is given in [2].

The satellite orbit was almost circular with altitude ∿270 km, inclination 70°, and revolution period 89.7 min [3]. The angle between the axis of the telescope and the direction to the zenith was 57°, so that γ quanta from the secondary atmospheric flux did not enter the aperture of the instrument. The γ telescope scanned the section of the sky in the region of the constallations Virgo, Canes Venatici, Bootes, and others. In two days' work there were obtained about 9000 stereo photographs, the events in most of which, as shown by the scanning, were produced by particles passing outside the solid angle of the telescope ("side background"). The particles entering the aperture of the telescope were subdivided, in accord with their manifestation in the spark chamber, into the following type: 1) single straight track (p-background) produced by protons and cosmic-ray nuclei registered as a result of missed counts of the anticoincidence counter C_1; 2) electron shower, but the lamp L is lighted (γ-background); 3) electron shower, lamp L is not lighted (γ-quanta). The events identified as

Table 1

№	Type of event	Entry in telescope solid angle	Type of event in spark chamber	Lighting of signal lamp	Relative fraction
1	p-background	yes	single track	yes, no	0.040
2	γ-background	yes	shower	yes	0.015
3	γ-quantum	yes	shower	no	0.025
4	"Extraneous background," random telesc. operation	no	single track shower empty frame	yes, no	0.920

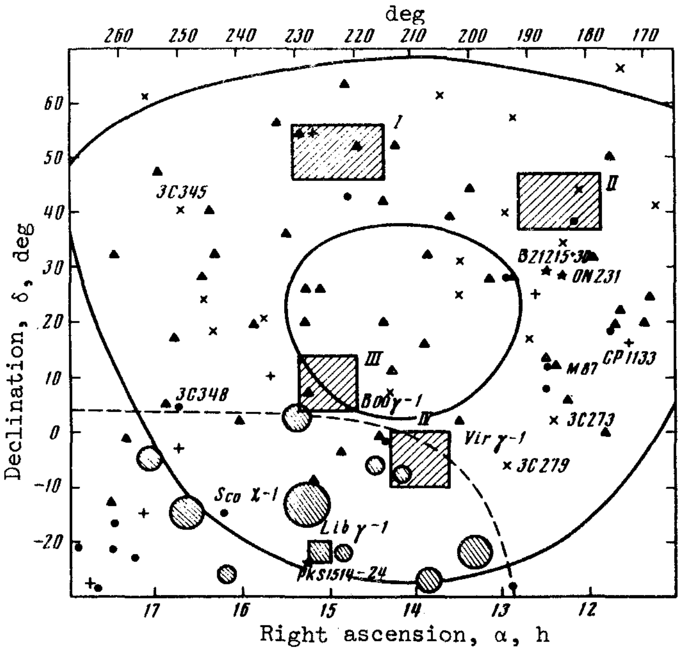
Table 2

Characteristics of γ-quantum excesses

Bin number	Position of bin		Observed number of γ quanta, N_γ	Expected number N_0	Excess, effective stand. deviat.	Number of scans, M	Poisson probability P	Flux 10^{-5}, $\mathrm{cm}^2/\mathrm{sec}^{-1}$	Coincidence
	Right ascen. α°	Declin. δ, deg							
1	223 ± 5	51 ± 5	11	3,6 ± 0,5	3.8 ± 0,5	130	0.13	~4	–
II	185 ± 5	41 ± 5	10	2,8 ± 0.5	4.3 ± 0.5	260	0,13	~4	–
III	225 ± 5	9 ± 5	8	2.4 ± 0,4	3,6 ± 0,5	260	0,52	~3	excess [5]
IV	208 ± 5	-5 ± 5	11	3.4 ± 0,5	4,1 ± 0,5	130	0,08	~5	excess [5]

γ quanta were those with a pair of tracks or a single track in the upper gap of the chamber. A summary of all the events is shown in Table 1. Since the outside counter did not cover the entire angle of view of the telescope, an appreciable fraction of the events of the third type consisted also of secondary γ quanta. This is indicated by the similarity of the geomagnetic dependences of the background and γ events.

The measured angles of the particle tracks in the spark chamber were used to calculate the celestial coordinates of the registered particles, viz., the right ascension α and the declination δ. Two maps of the scanned section of the sky were prepared: the γ map, on which the γ-quantum coordinates were plotted, and the background map, where the p- and γ-background cases were marked. For mutual comparison, the maps were broken down into $10^\circ \times 10^\circ$ square bins (the dimension of the square was determined mainly by the particle scattering in the converter), and the grid was moved over the map in steps of definite size. The comparison has shown that the maps are equally filled, with the exception of four bin sections, where the γ quanta are seen to exceed the background events. Following the shifts, the γ-quantum excesses appeared approximately in the same places, and no negative surges of equal value were observed. The final position of the excess was taken to be the bin with the largest excess of the number N_γ of the γ quanta over the expected value N_0, which was determined in turn from the background and the γ events in the neighboring bins. Table 2 gives the characteristics of the excesses. The excess value $N_\gamma - N_0$ is expressed in effective standard deviations $\sigma_{eff} - N_0$, as in [4, 5]. The probability P of the random appearance of an excess was calculated with allowance for the number M of all the scans, which is equal to the number of bins multiplied by the number



Map of scanned section of the sky: ▲ - radiogalaxies, × - quasars, * - variable radio sources with bright optically variable cores [11], ● - x-ray sources, + - pulsars; ▧ and ◍ - possible sources of γ radiation observed by Frye et al. [5, 8]; dashed line - boundary of region scanned by Frye et al [5]; ▨ - possible sources of γ radiation observed in the present work; solid line - boundary of scanned region (0.2 of maximum exposure).

of shifts. Not one excess goes beyond the 95% confidence level (the corresponding value is $P \simeq 0.01$), and this can be taken as a criterion for observing the source [6, 7]. Therefore the registered excesses can be regarded as the only possible sources of the γ quanta. The probability of random appearance of all four excesses is quite small ($\sim 10^{-3}$), from which it follows that at least some of them are due to discrete sources. The γ-quantum fluxes were calculated from the values of the excesses, the characteristics of the telescopes, and the time and angles of observation. The error in the value of each flux is ∿50%.

The figure shows a map of the scanned region of the sky, on which are marked the locations of the excesses obtained with the Cosmos-264 and those observed by Frye et al. [5] with high-altitude aerostats (surges beyond 3 - $3.5\sigma_{eff}$). Squares III and IV, which were located in the common scanning region, coincided with the locations of the excesses of [5]. Independent observation of the excesses in two different studies greatly decreases the probability of a random appearance (decreasing the number of scans by an approximate factor 30), giving grounds for regarding them as real sources of cosmic γ quanta. In accord with their locations in the constellations Bootes and Virgo, the sources should be designated Boo γ-1 and Vir γ-1. The absence of excesses in the location of other surges of [5] is due to the fact that they are located at the edge of the scanning region, where the number of observations is small. The absence of an effect from the source Lib γ-1, the upper limit of the flux from which was 1.7×10^{-5} $(\mathrm{cm}^2\mathrm{sec})^{-1}$ in this observation, agrees with the results of [8], where no source was observed in February 1969, which is practically the time when the observations were made with Cosmos-264. This indicates that the γ-radiation sources are variable, as is also pointed out in [9, 10].

The investigated region of the sky is of interest also because it is located in the region of the galactic pole, where the γ-quantum sources are most readily extragalactic objects. The map shows the possible sources of both galactic and metagalactic nature: pulsars, x-ray sources, etc. The squares of the excess γ radiation, however, are too large for a reliable identification with astrophysical objects.

The authors thank S.A. Volobuev for great help with the experiment and V.N. Semina and L.M. Vorob'eva for help with the reduction of the experimental material.

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ELECTRON-VIBRATIONAL INVERSION IN THE REACTION OF OXIDATION OF CARBON DISULFIDE

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Submitted 8 October 1972; resubmitted 7 February 1973
ZhETF Pis. Red. 17, No. 5, 259 - 262 (5 March 1973)

As is well known, chemical reactions are widely used to produce inverted population of the vibrational degrees of freedom of molecules [1]. It has been suggested many times that chemical excitation of the electronic levels would be desirable [2], since a rise in the temperature of the reacting mixture does not influence strongly the deactivation of the electronically excited molecules, so that the rate of such a chemical reaction can be made very large (e.g., limited only by the rate at which the reacting substances explode) without loss of inversion.

The appearance of essentially non-equilibrium luminescence in the course of various gas reactions (chemoluminescence) has been known for a long time [3]. The purpose of this paper is to point out the possibility of obtaining electron-vibrational inversion in the reaction of oxidation of carbon disulfide in the gas phase ($CS_2 + O_2 \rightarrow CO, SO_2$).

Let us examine the oxidation of carbon disulfide, which goes through the following stages [3]:

$$CS_2 + O \rightarrow CS + SO, \tag{I}$$

$$CS + O_2 \begin{array}{l} \nearrow CO + SO \\ \searrow COS + O \end{array}, \tag{II}$$

$$\text{(III)}$$

$$SO + O + M \begin{array}{l} \nearrow SO_2 + M \\ \searrow SO_2^* + M \end{array}. \tag{III*}$$

The third reaction produces, with appreciable probability, the electron-excited molecules SO_2 (excitation energy $\hbar\omega \approx 3.5$ eV), and this produces strong luminescence of the reacting gases. This luminescence is interpreted as triple-single transitions in the SO_2 molecule, which are allowed when it collides with paramagnetic particles (O_2, O, SO). The ratio of the recombination constant of the radicals SO and O in the triplet (III*) and singlet (III) states of SO_2 is approximately equal to the ratio of the statistical weights of these states [4],