fact, described for similar conditions in [4], that the generation field shifts in time from the center of the beam cross section towards the edges.

T a b l e

| Liquid (analytically pure) | $\delta n_{\parallel} \times 10^6$ | $(K_a)_{exp} \times 10^8$ | $(K_a)_{calc} \times 10^8$ | k ($cm^{-1}$) $\times 10^3$ |
|---|---|---|---|---|
| Acetone | < 1 | - | 1.03 | 3.4 |
| Benzene | < 1 | - | 5.73 | < 0.8 |
| Water | < 1 | - | - | 16 |
| Nitrobenzene | 5 | 42 | 26.4 | 2.7 |
| Toluene | 2 | 17 | 6.5 | < 0.8 |
| Ethyl alcohol | < 1 | - | 0.21 | 3.4 |

The observed changes in the refractive index can be attributed to the orientation of the anisotropically polarized molecules of the liquid in the alternating field. This process is characterized by a certain Kerr constant $K_a$, which is connected with the change in the refractive index [5] by the formula $\delta n_{\parallel} = (1/3)K_a\lambda E^2$. As seen from the table, for nitrobenzene and toluene, the calculated values taken from [5], $(K_a)_{calc}$ are in satisfactory agreement with the obtained experimental values $(K_a)_{exp}$.

In conclusion, I am grateful to M. D. Galanin and E. A. Sviridenkov for a useful discussion of the results.

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## RADIO EMISSION OF EXTENSIVE AIR SHOWERS (EAS) OF COSMIC RAYS

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Following a number of theoretical [1-3] and experimental investigations [4-8], the comprehensive experimental setup of the Nuclear Physics Institute of the Moscow State University was used to study the lateral distribution of radio emission from extensive air showers.

A block diagram of the experimental setup is shown in Fig. 1. A detailed description of the comprehensive apparatus is given in [9]. Broadband horizontal half-wave dipoles $A_1$ and $A_2$ are located at 60 and 140 m from the center of the apparatus. The axes of the dipoles

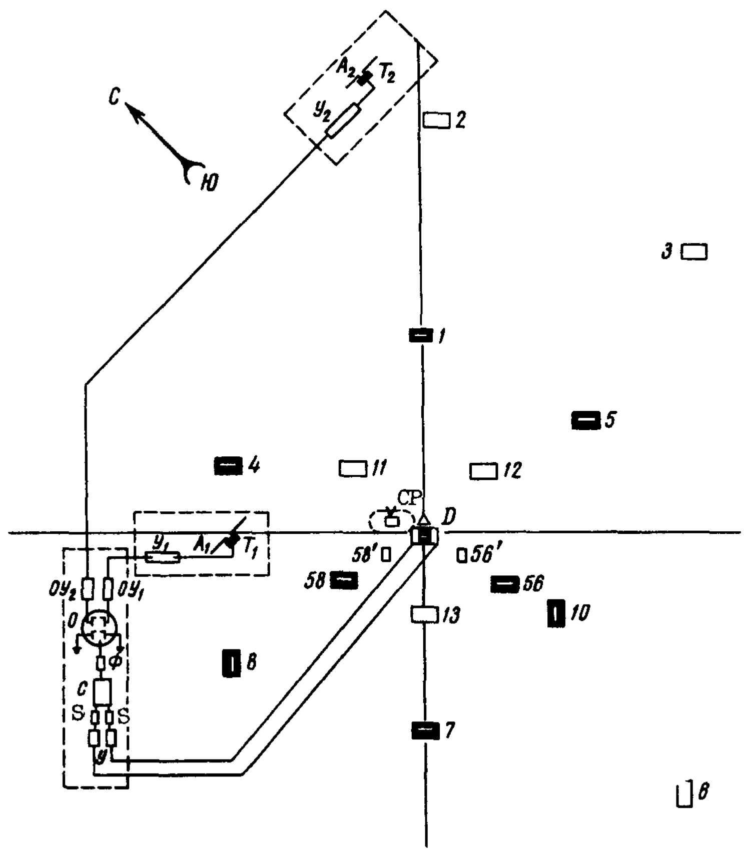

Fig. 1. Block diagram of experimental setup: $A_1, A_2$ - half-wave horizontal dipoles, $T_1, T_2$ - symmetrizing transformers, $Y_1$, $Y_2$ - preamplifiers, $OY_1$, $OY_2$ - final-stage amplifiers, S - shapers, Y - amplifiers, CP - control points; points 1,4,5,56,58,7,8,and 10 contain both hodoscopes and scintillation counters, points 2,3,6,11,12,13,$56^1$,and $48^1$ contain only hodoscopes; $\Delta$ - underground muon detector.

were oriented east and west. The dipoles were placed at a height 0.225 $\lambda$. The resonant frequency of both dipoles was 30.2 MHz, and the bandwidths at the 3 dB levels for antennas $A_1$ and $A_2$ (with the amplifiers) were 3.7 and 2.2 MHz, respectively.

The sweep ($\tau_{sw}$ = 5 $\mu$sec) of the DESO-1 oscilloscope (O) was triggered by pulses from a control system located at the center. The pulses from two triggering scintillation counters D (each ~0.5 $m^2$ in area, distance between them 3 m) were shaped and fed to a coincidence circuit C, so that the coincidence pulse served as a triggering signal for registration of the pulses from the radio channels. The resolution time of the triggering system was 200 nsec. The radio emission from the showers was registered for 1100 hours. A complete analysis of the registered radio pulses was made for the last 400 hours. Radio pulses in which the signal level exceeded the noise by a factor of 25 were analyzed for all the 1100 hrs.

In 400 hrs of operation, we registered 27 EAS accompanied by a radio-emission power flux (near $A_1$ or $A_2$) exceeding the cosmic-noise power flux by five times or more. During the remaining 700 hrs we observed 17 EAS with a radio-emission power flux exceeding the cosmic-noise flux by 25 times.

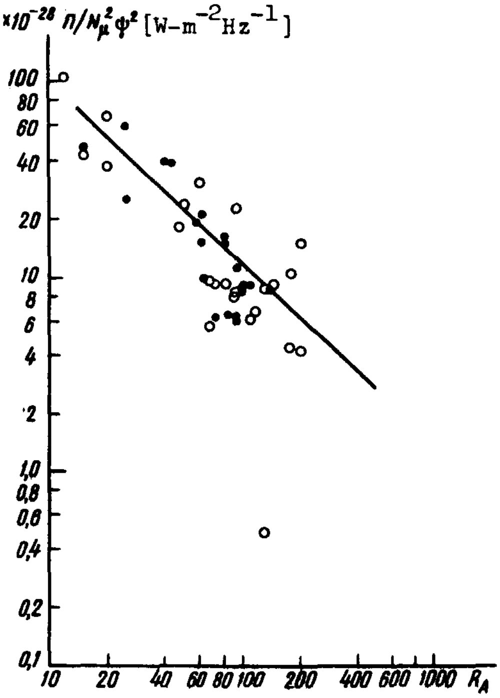


Fig. 2. Lateral distribution of radio emission from EAS with power flux normalized to $N_\mu^2$ and $\psi^2$. • - small amplitudes, o - large amplitudes ($\Pi_{rec} > \Pi_{noise}$). Solid curve - theoretical [3].

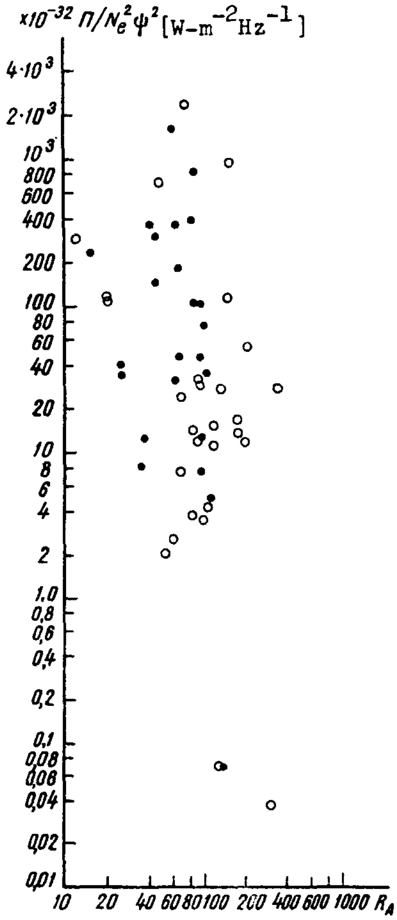


Fig. 3. Lateral distribution when the radio-emission power flux is normalized to $N_e^2$ and $\psi^2$. • - small amplitudes, o - large amplitudes.

According to predictions made by Kahn and Lerche [3], the EAS radio-emission electric field intensity is $\sim \underset{\sim}{v} \times \underset{\sim}{H}$, i.e., the radiation is linearly polarized. To plot the lateral distribution of the radio-emission flux density, the latter was normalized to the square of the total number of muons $N_\mu^2$ (Fig. 2) or electrons $N_e^2$ (Fig. 3), with account taken of the relation

$$\psi^2(\theta, \varphi) = |E(\theta, \varphi)|^2/E_{max}^2,$$

where $\psi(\theta, \varphi)$ is the degree of polarization, $E(\theta, \varphi)$ is the intensity of the electric field produced by the Cerenkov radio emission of the current [3], and $E_{max}$ is the maximum intensity of the electric field produced when the shower axis moves perpendicular to the direction of the earth's magnetic field.

The solid line in Fig. 2 corresponds to the theoretical relation calculated in the theory of Kahn and Lerche [3] for the lateral distribution of the radio emission.

An earlier analysis [10] shows that the scatter in the values of the radio-emission power, observed in Fig. 2, can be attributed, on the one hand, to the presence of correlation between the average radio-emission power at a specified distance from the shower axis and the zenith angle $\theta$ of the EAS axis, and on the other hand to errors in the determination of the following: a) the zenith and azimuthal angles of the axis $\theta$ and $\varphi$, b) the muon flux, and c) the radio-emission flux itself.*

It is seen in Fig. 3 that the scatter of the power flux of the radio emission, when normalized to $N_e^2$, is larger by several orders of magnitude than the case of normalization to $N_\mu^2$. We note also that, as shown in [10], normalization of the radio-emission flux without taking $\psi^2$ into account leads to a very large scatter of the power flux, even if the normalization is to $N_\mu^2$. We conclude therefore that the radio-emission flux is linearly polarized and is proportional to $N_\mu^2$. We note that $N_\mu^2$ is a good measure of the energy $E_0$ of the primary particle producing the EAS, and consequently we can put approximately $\Pi \sim E_0^2$.

| № | $\Pi_1$ | $\Pi_2$ | $R_{1A}$ | $R_{2A}$ | $\theta°$ | $\phi°$ | $n$ |
|---|---|---|---|---|---|---|---|
| | W/m$^2$Hz | W/m$^2$Hz | m | m | | | |
| 1 | $3.1 \cdot 10^{-19}$ | $8.9 \cdot 10^{-19}$ | 132 | 52 | 11 | 168 | 1,13 |
| 2 | $28 \cdot 10^{-19}$ | $30 \cdot 10^{-19}$ | 105 | 98 | 38 | 206 | 1,01 |
| 3 | $93 \cdot 10^{-19}$ | $48 \cdot 10^{-19}$ | 199 | 327 | 23 | 174 | 1,31 |
| 4 | $17 \cdot 10^{-18}$ | $80 \cdot 10^{-19}$ | 93 | 178 | 24 | 316 | 1,14 |
| 5 | $50 \cdot 10^{-19}$ | $32 \cdot 10^{-19}$ | 68 | 115 | 39 | 49 | 0,85 |
| 6 | $40 \cdot 10^{-18}$ | $41 \cdot 10^{-19}$ | 20 | 117 | 36 | 46 | 1,29 |
| 7 | $87 \cdot 10^{-19}$ | $48 \cdot 10^{-19}$ | 90 | 173 | 36 | 350 | 0.92 |

The table lists the calculated values of the exponent n of the power-flux lateral-distribution function $\Pi \approx aR^{-n}$ (where R is the distance from the shower axis), using flux data obtained from two simultaneously operating antennas ($A_1$ and $A_2$). It is natural to assume here that the factor $\psi^2$ no longer need to be taken into account. Notice should be taken of the agreement between the exponent obtained for the lateral-distribution function from the data of the table ($\bar{n} = 1.09 \pm 0.06$) with the lateral-distribution exponent corresponding to the theory of Kahn and Lerche ($n \approx 1.0$).

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* The error does not exceed 3 - 4° in the zenith angle and 6 - 10° in the azimuthal angle; the error in the determination of the total number of mesons in the shower is not more than 35% of $N_\mu$ [11]; the relative error in the power flux of the radio signal from the EAS does not exceed 15% [10].

## TRANSVERSE MOMENTA OF LEADING PARTICLES IN NUCLEON-NUCLEON INTERACTIONS WITH ENERGIES $10^{12}$ - $10^{14}$ eV

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The leading particle in a high-energy collision is defined as the particle that carries away the maximum energy. In this paper we discuss briefly results concerning leading particles in nucleon-nucleon interactions at energies in the range $10^{12}$ - $10^{14}$ eV.* These interactions were obtained in two large emulsion blocks in ICEF and in Brawley, in which a complete analysis of the "jets" was possible. We chose 24 events with $N_h \leq 5$ and $n_s \leq 20$, which apparently are for the most part nucleon-nucleon interactions.

To facilitate the scanning and to ensure a greater measurement accuracy, we considered