## CONTENTS

CERTAIN RESULTS OF COSMIC-RAY INVESTIGATIONS CONDUCTED WITH SOVIET SATELLITES	
AND SPACE PROBES. L. V. Kurnosova, V. I. Logachev, L. A. Razorenov, and M. I. Fradkin	1
§ 1. Investigation of the Nuclear Component of Cosmic Rays with Soviet Satellites	
and Space Probes	3
§ 2. Certain Results Concerning the Earth's Radiation Belts	9
Literature Cited	13
EXTENSIVE AIR SHOWERS. Yu. N. Vavilov, O. I. Dovzhenko, N. M. Nesterova, S. I. Nikol'skii,	
A. A. Pomanskii, E. I. Tukish, and V. I. Yakovlev	15
Introduction	16
Chapter I. Method of Studying Extensive Air Showers	18
§ 1. Composite Studies of Extensive Air Showers	18
§ 2. Determination of the Flux Density of Shower Particles on the Plane of Observation.	
The Method of Correlated Hodoscopes	21
§ 3. Hodoscopic Detectors of $\mu$ -Mesons and Nuclear-Active Particles	24
§ 4. Ionization Chambers in EAS Studies	27
§ 5. Observations of Cerenkov Radiation Emitted by Extensive Air Showers	30
§ 6. Wilson Chambers and Scintillation Counters	31
Chapter II. Composition of Extensive Air Showers	34
§ 7. Lateral Distribution of Charged Particles	34
§ 8. Particle-Number Spectrum of Showers at High Altitudes	37
§ 9. Energy Spectra of the Electron —Photon	39
§10. Energy of the Electron—Photon Component of Air Showers	40
§11. Lateral Distribution of Nuclear-Active Particles and Their Number in Showers	
with Different Numbers of Charged Particles	44
§12. Energy and Composition of Nuclear-Active Particles in EAS	44
§13. Lateral Distribution of $\mu$ -Mesons and Their Number in EAS with Different Numbers	
of Charged Particles	47
§14. Energy Spectrum of μ-Mesons in EAS	49
§15. The Lateral Distribution of Cerenkov Radiation Emitted by EAS	5
§16. Energy Lost by EAS Particles Above the Plane of Observation	5
§17. Fluctuations in Cerenkov Flashes	58
Chapter III. The Cores of Extensive Air Showers and High-Energy Nuclear-Active Particles	6.
§18. The Structure of EAS Cores	6.
§19. High-Energy Nuclear-Active Particles and EAS	68
§20. Energy Flux Fluctuation in EAS Cores	70
§21. Primary Cosmic Rays and EAS	78
Chapter IV. Development of Nuclear Cascade Showers in the Atmosphere	78
§22. The Nuclear Cascade Process and the Method of Calculation	78

§23. Results of Calculations of EAS Parameters	80
a) The Electron—Photon Component	80
b) The Nuclear-Active Component	83
§24. High-Energy Nuclear-Active Particles Accompanied by EAS	87
Literature Cited	95
A SEARCH FOR PHOTONS WITH ENERGY ~ 10 <sup>13</sup> eV DUE TO LOCAL SOURCES OF COSMIC	
RADIO EMISSION. A E. Chudakov, V. L. Dadykin, V. I. Zatsepin, and N. M. Nesterova	99
Introduction	101
§ 1. Apparatus	103
§ 2. Principal Characteristics of the Apparatus	104
1. Energy Sensitivity	104
2. Integral Amplitude Spectrum	107
3. Shower Counting Rate as a Function of Zenith Angle	108
4. Shower Counting Rate as a Function of the Angle Between the Optical Axis	
of One of the Telescopes and the Common Direction of the Remaining Telescopes	109
5. Expected Angular Dependence of the Shower Counting Rate due to a Point Source	
of Photons on the Celestial Sphere	109
§ 3. Results of a Search for Local Photon Sources	111
§ 4. Discussion of Results	114
Conclusion	117
Literature Cited	118
EVDEDIA (ENITAL DATA ON THE DEVELODA (ENIT OF EVTENCIVE AID CHOWEDS IN THE LIDDED HALE	
EXPERIMENTAL DATA ON THE DEVELOPMENT OF EXTENSIVE AIR SHOWERS IN THE UPPER HALF OF THE ATMOSPHERE. R. A. Antonov, Yu. A. Smorodin, and Z. I. Tulinova	119
Introduction	121
Apparatus	122
Apparatus Chapter I. Altitudinal Variation of Vertical Extensive Air Showers in the Upper Part	100
of the Atmosphere	124
§ 1. Method for Detecting Vertical Showers	124
§ 2. Density Spectra of Extensive Air Showers	128
§ 3. Global Altitudinal Variation and Altitudinal Variation of Vertical Extensive Air Showers	129
§ 4. Spatial Distribution of Particles in Showers	131
§ 5. Altitudinal Variation of Vertical Showers with a Particular Quantity of Particles	132
Chapter II. Formation of γ-Quanta in Extensive Air Showers	135
§ 6. Electron—Photon Bursts in Extensive Air Showers	135
§ 7. Computation of the Total Quantity of High-Energy $\gamma$ -Quanta in Extensive Air Showers	
of a Given Intensity	136
§ 8. Experimental Results	137
§ 9. Spectra of High-Energy γ-Quanta in Extensive Air Showers of a Particular Intensity	140
Conclusions	143
Literature Cited	144
RADIATION UNITS OF LENGTH AND CRITICAL ENERGIES. O. I. Dovzhenko and A. A. Pomanskii	145
Introduction	147
§ 1. The Radiation Logarithms	149
§ 2. Bremsstrahlung and Formation of Electron—Positron Pairs in a Field of Atomic Electrons	151
§ 3. Corrections for Inexactness of the Born Approximation	153

§ 4. Range of Validity of the Bethe and Heitler Formulas	159	
§ 5. Electron Ionization Losses Over the Radiation Unit Length in Various Substances		
(Critical Energy)	162	
Summary		
Literature Cited	167	
PARTICLE-NUMBER FLUCTUATIONS IN AN ELECTRON-PHOTON SHOWER. N. M. Gerasimova	169	
Literature Cited	183	
AN ANALYSIS OF THE ANGULAR DISTRIBUTIONS OF PARTICLES CREATED IN HIGH-ENERGY		
NUCLEAR INTERACTIONS IN A PHOTOGRAPHIC EMULSION. G. B. Zhdanov		
Introduction	185 187	
§ 1. Asymmetry of Angular Distributions	187	
§ 2. Selection of Events According to Number of Slow (Nh) and Fast (ns) Particles	188	
§ 3. Inelasticity Coefficients and Types of Interactions	191	
§ 4. Role of Fluctuations. Further Consideration of Asymmetry	197	
Summary	199	
Literature Cited	200	
DASSACE OF LICH ENERGY MICHEONS TUROUGH THE ATMOSPHERE AND PROPERTION		
PASSAGE OF HIGH-ENERGY NUCLEONS THROUGH THE ATMOSPHERE AND PRODUCTION  OF MESONS I. T. Baradzai, W. I. Bubtson, Yu. A. Smaradin, M. W. Salawian		
OF MESONS. L. T. Baradzei, V. I. Rubtsov, Yu. A. Smorodin, M. V. Solov'ev, and B. V. Tolkachev	001	
§ 1. Experimental Work	201	
§ 2. Energy Spectra of Nuclear Cascades	203 207	
§ 3. Absorption of the Nuclear-Active Component in the Atmosphere	207	
§ 4. Energy Spectra of Electron—Photon Showers Created in the Atmosphere	209	
and the γ-Ray Production Spectra	212	
§ 5. Production of Pions and Their Flux in the Atmosphere	218	
Summary	222	
Literature Cited	223	
	220	
CHRONOLOGICAL BIBLIOGRAPHY OF PAPERS BY STAFF MEMBERS OF THE COSMIC-RAY		
LABORATORY OF THE P. N. LEBEDEV INSTITUTE OF PHYSICS OF THE USSR		
ACADEMY OF SCIENCES FROM 1934 TO 1962	225	