

ing some fifteen million years early in the Age of Mammals. These animals have been studied in great detail by Dr. Henry Fairfield Osborn, honorary president of the American Museum of Natural History. They started with skulls less than a foot long, and before they became extinct they had skulls about a yard in length. According to Dr. Laughlin's charting, they could have become even bigger-headed, if other conditions had not cut them off before the tendency of their skulls to grow had worked itself completely out.

Dr. Laughlin has been working on his mathematical method for applying the data of genetics to the problems of evolution for a good many years. His full technical discussion will appear as a special publication of the Carnegie Institution of Washington.

*Science News Letter, May 6, 1933*

## PHYSICS

## Tests Indicate Cosmic Rays Are Particles

**C**OSMIC RAYS smash into the atmosphere of Mexico City with more intensity from the west than from the east, Dr. Thomas H. Johnson of the Bartol Research Foundation has found in the course of an expedition arranged with the cooperation of the Carnegie Institution of Washington.

His experimental results presented to the American Physical Society on Dr. Johnson's behalf by Dr. W. F. G. Swann, director of the Bartol Research Foundation, uphold the idea that cosmic rays are composed principally of positively charged corpuscles or particles.

With three cosmic ray counters arranged in line so that a record was made only when all three were coincidentally discharged by cosmic radiation, Dr. Johnson pointed his instrument at various elevations.

Comparing the intensities of cosmic radiation on the east and west sides of the magnetic meridian of Mexico City, Dr. Johnson found percentage differences between east and west ranging from 1 per cent. at 25 degrees distance from the zenith to 25 per cent. at 65 degrees to the zenith.

"These results are just those to be expected on the basis of the theory of the latitude variations of Lemaitre and Vallarta," Dr. Swann explained, "and they show that the principal corpuscular component of the primary cosmic radiation is positively charged."

*Science News Letter, May 6, 1933*

## PHYSICS

# Drs. Compton and Millikan Agree On Experiments

## Both Scientists Approve Statement Presenting Similarity; Both Particles and Photons In Incoming Beam

**D**R. ROBERT A. MILLIKAN and Dr. A. H. Compton, two of the leading experimenters upon cosmic rays, have announced agreement in experimental data gathered by different methods upon separate expeditions.

To the National Academy of Sciences meeting in Washington, Dr. Millikan told how delicate instruments borne aloft by airplanes showed that cosmic rays diminish in hardness or penetrating power at the same rate whether the locality is near the equator or in high latitudes such as in the United States. Dr. Compton reported that his experiments on high mountain peaks in this country and in South America in the tropics showed the same effect.

In other words both Dr. Millikan's and Dr. Compton's experiments can be interpreted by assuming that both photons and particle rays, some of them perhaps the new positron particle discovered last year in Dr. Millikan's Pasadena laboratory, are present in the incoming beam.

This article is, in effect, a joint statement by Drs. Millikan and Compton who are often pictured as holding opposite views upon cosmic rays. Both scientists approved the article.

*Science News Letter, May 6, 1933*

## PHYSICS

## Most of Universe's Radiant Energy in Cosmic Rays

**C**OSMIC RAYS, totally unknown a few decades ago, are now recognized to comprise the greater portion of the radiant energy of the universe, Dr. Robert A. Millikan, of the California Institute of Technology, Pasadena, told the National Academy of Sciences at its meeting in Washington.

As the result of new researches with sounding balloons and airplanes this past year, Dr. Millikan and his associates have determined with great accuracy the way in which cosmic rays vary downward from nearly the top of the earth's atmosphere. The recent experimental results, combined with the findings of Dr. Millikan and other experi-

menters in past years, allow Dr. Millikan to conclude that the total radiant energy in our galaxy in the form of cosmic rays is nearly the same as that in all the other forms of radiation, such as light and heat emitted by stars.

In the immense spaces between the galaxies of stars the starlight and heat must diminish to a small amount of that found in our own Milky Way galaxy, but the cosmic radiation coming to the earth from far beyond our neighbor stars, from the depths of the universe, must be even greater in intensity in intergalactic space. In this way Dr. Millikan concludes that cosmic radiation forms the greater part of the radiant energy of the universe.

### 20 Miles Up

One of the sounding balloons launched by Dr. Millikan and Dr. I. S. Bowen reached a height at which only a half of one per cent. of the atmosphere's weight remained above it, equivalent to about 20 miles altitude (16 millimeters of mercury pressure). The cosmic ray electroscop record obtained was reliable up to nearly that height, to within about 92 per cent. of the top of the atmosphere. One other balloon flight, carrying the remarkably light, automatic instruments to great heights in the stratosphere, agreed closely with the record flight, and the two checked closely the results of a similar sounding balloon ascension made at the same time by the German physicist, Regener.

With a cosmic ray electroscop, devised by Dr. H. Victor Neher, that records accurately and automatically under the strenuous conditions of rushing auto, railroad train or airplane, measurements of cosmic ray intensity have been made at altitudes up to 29,000 feet, nearly six miles. U. S. Army bombers and pursuit planes carried the instruments aloft first without screening and second screened by a shield of lead of 10 centimeters thickness at several localities in the United States and at Panama, while commercial (*Turn to Page 286*)