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

COSMIC 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

DR. 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

COSMIC 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 experimenters 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 electroscope 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 electroscope, 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)

ECOLOGY

NATURE RAMBLINGS
by Frank Thone

When Woods are Deserts

CLASSIC MYTH had the Greek sun-god Phoebus turn himself into a shower of gold, to visit one of the numerous lovely ladies of whom he was enamored, when she was locked up in an inaccessible tower. So today the sun is able to visit the hosts of delicate woodland flowers that live only through his favors, by showering himself through the interlaced bars of the as yet sparsely leaved tree branches.

It seems a trifle paradoxical, that the flowers of the early spring woods should be so much like the flowers one finds in the semi-arid lands of the Southwest and the Rocky Mountains, yet such is the case. Some of them are of the same genera: violets, trout-lillies, buttercups, anemones, spring beauties, and many others. And even where they are not fairly close relatives, there are astonishing resemblances in general habit of growth.

The solution to the paradox is to be found in the fact that before the leaves are on the trees, the ground under them is not properly speaking in the woods. It is at least halfway in the windy, sunny open, subject to much the same illumination and the same evaporation rates as the prairie alongside or the chaparral a thousand miles away. Only when the leafy canopy has closed itself, excluding the warming sun and materially cutting down the force of the drying breeze, does the forest become properly a forest to the trees that grow underneath. Then it is that the spring flora—geraniums, phloxes, bellworts, hepaticas, and all the rest—gives way to the much reduced number of flowers that will consent to blossom in the deep shade of the summer woods.

This characterization of the spring woods as really touched with the tang of the desert is no mere impression. The difference between the woods of May and the woods of July has been scientifically measured. Several years ago sets of instruments for measuring the evaporation rate of water were placed in a typical strip of midwestern woodland along the bluffs of the Illinois river, and kept in operation from the first of May until nearly the end of September. The evaporation rate in July was high, as might have ben expected. But a result that was not expected at all was that in the first week in May, when the leaves had not yet covered the oak trees, the evaporation rate was still higher!

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Gladiolus flowers in gardens are generally considered to be without scent, but some of the wild species of Africa are strongly fragrant.

The principle of the thermometer was discovered by Galileo 87 years after Columbus discovered America.

PHOTOGRAPHY

Slenderizing of Movie Stars Achieved in Projection

MOVIE STARS owe some of their sylph-like slenderness to the engineer. By placing the projection booth high above the screen, he can reduce even the dainty, slight figures of ingenues as much as five or six pounds, apparently, and becomes a rival of dieting. This service of the engineer as a beautifier was disclosed to the Society of Motion Picture Engineers in a report of Clifton M. Tuttle, of the Eastman Kodak Company's research laboratories.

Placing the projection booth out of line with the screen produces a distortion of the figures of which the audience may not be conscious.

If the projector points down toward the screen at an angle of 17 degrees, the height of figures on the screen in relation to their width is increased as much as five per cent., Mr. Tuttle said, and suggested that this artificial elongation or slenderizing of forms may have set the style for the boyish figure with no curves.

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planes were used in experiments 17 degrees below the equator in Peru.

The results of these airplane tests bring to light the fact that cosmic rays grow rapidly softer or less penetrating as altitude increases. This softening is so marked that more than 75 per cent. of the rays existing at altitudes of 25,000 feet have insufficient energy to penetrate four inches of lead. As Dr. Carl D. Anderson in Dr. Millikan's laboratory has measured the loss of energy of cosmic rays passing through lead, Dr. Millikan can conclude that more than three-fourths of the cosmic rays at 25,000 foot altitudes have energies of less than 350,000,000 volts. But particles of this voltage cannot penetrate more than half of the depth of the atmosphere, and Dr. Millikan concludes that the experiments furnish convincing proof that the cosmic rays found at low altitudes are certainly secondaries which are formed in the earth's atmosphere by collision with air atoms. Photographs taken by Dr. Anderson have caught the cosmic rays, which are nonionizing and can not be photographed themselves, in the act of smashing atomic hearts and letting loose pos- (*Turn page*)

itively and negatively charged particles.

Dr. Millikan concludes that his researches present strong evidence that all but a small fraction of the cosmic rays observed at sea level by cosmic ray counters and other devices used by other investigators are secondary rays produced within the earth's atmosphere.

Most of the cosmic rays, then, according to his interpretation, enter the atmosphere as photons or radiation like light, X-rays or radium's gamma rays, not as charged particles, like electrons or positrons. The new airplane experiments also lend support to Dr. Millikan's theory that the total cosmic ray curve is to be explained by not less than three and probably four or five cosmic ray bands, corresponding to different colors of light in the visible spectrum. Those rays that reach only the upper part of the atmosphere are, he finds, with energies less than 75,000,000 volts.

Dr. Millikan's experiments were supported by funds of the Carnegie Corporation administered by the Carnegie Institution of Washington. In the sounding balloon experiments he had the full and effective cooperation of the U. S. Weather Bureau, and in the airplane test the equally effective cooperation of the U. S. Army Air Force and the Royal Canadian Air Force.

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PHYSICS

Liquid Helium Makes Lead Superconducting

LIQUID helium and superconducting lead were produced at the new cryogenic laboratory of the California Institute of Technology at Pasadena, just six months after the beginning of construction and a year after the project was started.

Prof. A. Goetz found that a thirty-foot coil of fine lead wire suddenly lost all trace of electrical resistance because of its immersion in liquid helium. It remained in this superconducting state for twenty minutes while he and Dr. Alfred B. Focke, research fellow, congratulated each other that the apparatus functioned perfectly as designed and needs no modification.

The new low-temperature laboratory is considered a triumph of thermodynamic reasoning and skilful construction. The method used is a series of adiabatic expansions and this method permits the use of small quantities of helium.

Science News Letter, May 6, 1933

PHOTOGRAPHY

World's Fastest Camera Lens Made For Movies of X-Rays

A CAMERA lens having seventeen times the speed of the fast lens usually used on home movie cameras, or fifty-five times that of the ordinary kodak lens, has just been announced by the Carl Zeiss works, of Jena.

The speed of such lenses is called "relative aperture" which is obtained by dividing the diameter of the lens by the distance to the plate or film when it is focussed on a distant object. The smaller this ratio, the more light is admitted through the lens, and the faster the exposure that can be given. With the same exposure, a picture can be taken in correspondingly poorer light.

Good hand film cameras are frequently equipped with a lens of F. 6.3 relative aperture, while F. 3.5 lenses are used on movie cameras. The new Zeiss lens, which is called the R-Biotar, has a relative aperture of F. 0.85, which means that its diameter is larger than its focal length. It is made of five pieces of glass, and has a focal length (the distance from the center of the lens to the film when focussed at infinity) of 45 millimeters. This is intended for the amateur size, 16 millimeter motion picture film, but it is announced that the same lens will soon be available in a longer focal length for the standard 35 millimeter film.

Deep Focusing Not Needed

The larger a lens is, the less is it able to focus near and distant objects sharply at the same time. This is inherent in any lens, and so the new lens has very little depth of focus, as this quality is called. However, this is not objectionable for the purpose for which it was designed, that is, for X-ray motion pictures. In taking such films, the subject is placed between an X-ray tube and a fluorescent screen, on which his insides are visible as a shadow picture.

A fast lens must be used to photograph the image from the screen, because at best its light is relatively feeble. However, the entire picture being photographed is the same distance from the camera, so great depth of focus is not needed. In ordinary still X-ray photography no camera is used at all. The X-rays, after passing through the subject's body, fall directly on the photographic film, which must be as large as the part of the body being photographed.

Probably the new lens will be found useful in other fields of scientific photography, where great light gathering power is more necessary than great depth of focus.

Science News Letter, May 6, 1933

GENERAL-SCIENCE

Students Predict Decline Of Western Civilization

IS WESTERN civilization doomed? A future decline of the culture of the Western world is predicted as probable by two-thirds of the research students of the University of Maine, Orono, Me., who were questioned on the subject by Dr. Nathan Israeli, of the psychological laboratories. The results were reported to the *Journal of Social Psychology.*

Interested in the subject by Oswald Spengler's book, "The Decline of the West," 151 research students in the fields of psychology, history and sociology reported their attitudes toward the likelihood of the collapse of Western culture. Two-thirds are in agreement that the decline of Western civilization is probable.

The debacle will be caused by the following factors, listed in the order of the importance assigned: (1) overpopulation; (2) war; (3) political corruption; (4) moral decadence and irreligion; and (5) overmechanization. Other contributing causes listed include: economic problems; unemployment; luxury; exhaustion of natural resources; inadequate adjustment to an increasingly complex civilization; divorce and family breakdown; urbanization, etc., etc.

The average of the years set for the decline by those students who deem it inevitable is 2160.7, and by those who deem it quite improbable, the year 2312.5. Students who deem collapse in the West least probable defer the average date of decadence to the year 13,634.6.

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