Economic Importance to Man," Dr. Elmer D. Merrill, director-in-chief; October 29, "Our Native Ferns," Mr. Albert C. Smith, associate curator; November 5, "Australia, Past and Present," Dr. Arthur Hollick, research associate in paleobotany and Dr. Forman T. McLean, supervisor of public education; November 12, "Crocuses and How to Use Them," Mrs. Wheeler H. Peckham, honorary curator of Iris and Narcissus collections; November 19, "Planting the Bulbs," Mr. Kenneth R. Boynton, head gardener; November 26, "A Winter in Bermuda," Dr. Fred J. Seaver, curator.

APPORTIONMENT of $5,000,000 emergency forest highway funds to be expended in thirty-four states and territories in the fiscal year 1933 has been approved by Secretary Hyde. Building of new highways in the national forests will be begun at once to give employment and open up the national forests to greater use and protect them from fire. The $5,000,000 is part of the 322,000,000 voted by Congress for public works as an emergency measure. Vermont and Mississippi share in national forest highway apportionment this year for the first time.

MORE than 100,000,000 trees were distributed by State forestry departments for forest planting in 1931, says the Forest Service on the basis of reports from the States. These were grown in State nurseries. The figure does not include any privately grown trees. Of the total number, 25,500,000 were sent out for farm planting, 38 States and 2 Territories cooperating with the Forest Service in this activity. In addition, 52,500,000 were planted on State lands and 24,800,000 were distributed for planting on private lands other than farms. Total plantings of all these three classes were nearly 30 per cent. over 1930. In total trees distributed for planting on all classes of lands other than national forests, New York led, Michigan was second, and Pennsylvania third. In farm plantings Pennsylvania led, followed by New York, Ohio, Puerto Rico, and Michigan. Pines and spruces were far in the lead among the species sent out for farm planting. Under the Clarke-McNary Act the Forest Service cooperates with the States in growing forest trees for planting on farms. Distribution is made through the State forestry agencies direct to farmers and usually at cost. The Federal Government does not distribute any stock for State or private planting.

DISCUSSION

THE FUNDAMENTAL PARTICLES

THE experiments of Millikan and Anderson on the tracks due to cosmic radiation in an expansion chamber offer very convincing evidence for a positive particle whose mass is small compared with the mass of the proton. This extremely important observation indicates that it may be profitable to examine more seriously the suggestions from the theoretical side that there are different possible aspects of the electron. The fact that the theory has resisted so stubbornly the efforts to dispose of the negative energy electron or to distort the positive electron into a proton causes us to regard it now with increased respect.

The present theory of the electron seems to lead inevitably to an electron with negative energy and—with the help of the assumption due to Dirac that the negative energy states are almost all filled—to a positive electron of the same mass. Furthermore, as Dirac has shown, the theory provides for a magnetic pole with its corresponding negative energy states and pole of opposite sign. The existence of any one of these particles seems practically to imply all the others. We may therefore regard any one of them, *e.g.*, the electron, as the fundamenal particle. Or perhaps we could say more conservatively that the electron and the Dirac magnetic pole are the fundamental particles.

The problem then arises of constructing with these constituents alone all the observed physical entities. In other words, we require models of the proton, the neutron and possibly the photon. The last could be constructed of a positive and negative electron so close that the potential energy almost compensates the rest mass. The separation would be of the order of 10^{-13} cm. The system would have higher levels and the low level would not be reached in one transition. The jumps on the way down would result in radiation of half the frequency of the exactly analogous hydrogen frequency. Unfortunately, if these were emitted in the sun, they would not be easily visible, as Lyman $_\alpha$ would occur at 2430 Å and the limit of the Balmer series would be above 7200 Å, so that no lines would appear in the visible region.

There is, however, another possibility, much more interesting to the present writer, which depicts the photon as a combination of an ordinary and a negative energy electron. Under suitable conditions the Dirac equation for such a system reduces to one close to that customarily used for the photon. The mass term vanishes and the system moves with the velocity of light.

The most interesting new feature of the program is the picture of the neutron. This is built of a positive and negative magnetic pole. The argument by which the existence of the Dirac pole is inferred suggests that not only is the ratio of pole strength of the magnetic to the electric particle equal to $\frac{1}{2\alpha}$

(where $\alpha = \frac{2\pi e^2}{hc} \sim \frac{1}{137}$), but their potentials are everywhere in that ratio. This leads to a mass for the magnetic pole of $\frac{m}{4\alpha^2}$ where m is the mass of the electron. If now the Dirac equation for the combination of two poles is examined the normal level turns out to have an energy corresponding to a mass approximately (within a factor 2) equal to that of the proton. Moreover, the energy differences between adjacent levels are of the order of 10^9 volts. This is therefore by far the simplest system so far considered which could explain the emission of cosmic radiation.

The proton is of course a combination of a neutron and a positive electron. These then suffice for the building of nuclei. The process of β emission is obvious, even though there are no electrons in the nucleus.

Unfortunately, the considerations mentioned here suffer because the relativistic two body problem has not yet been solved. It can only be hoped that the reduction to a one body problem, which was resorted to in all the examples given, will prove a working approximation in these cases as it has in other cases, where, however, relativistic effects were less important.

I am indebted to Drs. Millikan and Anderson for their kindness in making me acquainted with their experimental results.

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SEPTEMBER 10, 1932

LIGHT A FACTOR IN RANCIDITY

IN the June 3 (1932) issue of SCIENCE is published a brief résumé of the work carried on by the Food Research Division of the Bureau of Chemistry on the subject indicated. The conclusions confirm in general the results which had been obtained in these laboratories and which were made public at the spring meeting of the American Chemical Society, held at Columbus, Ohio, from April 29 to May 3, 1929. Our study of the catalytic activity of various wave-lengths of light upon the oxidation of fats and oils has shown that light transmitted by blue glass is the least effective in this respect, while that transmitted by amber glass is the most effective.

The results will shortly be published in one of the scientific journals.

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AN UNUSUAL COTTON PLANT

ON June 8, 1932, the writer, accompanied by Mr. Philip Beltrán, was studying the Tangüis cotton in the Pisco Valley. On Hacienda "San Jacinto," a most interesting plant was found. The fibers produced by this plant were uniformly $1\frac{3}{8}$ inches long, with the exception of from 15 to 20 per each seed which measured $1\frac{3}{4}$ inches. These extra long fibers had the same general characteristics as the others, but were very prominent because of the extra length. All the cotton of the plant was picked, and each seed has been carefully examined. The long fibers were found on every one. In every instance, these long fibers were attached at about the middle of the seed and the number per seed varied only slightly. The writer has examined hundreds of plants of Tangüis and other varieties of cotton, but never before had seen such a variation in the length of the fiber.

The Tangüis cotton originated from a single plant found by Señor Fermín Tangüis, Hacienda "Urrutia," Pisco. A careful study of this variety has given sufficient evidence to state that the first plant was undoubtedly a field hybrid between one of the native Peruvian cottons and an unknown variety of American Upland cotton grown in Peru under the name of "Suave" or "Egipto."

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A METEOR IN WISCONSIN

AT 8:25 P. M., on August 22, a meteor of great brilliancy and of unusual size passed over central Wisconsin. The light was so brilliant that the landscape was lighted up as by a powerful searchlight and sharp shadows of trees were cast on the street in front of my house. We first saw it in the S-W quadrant at an apparent elevation of approximately forty-five degrees. Before it disappeared it had crossed the east-west line, with which its path made an angle of about twenty degrees. That is, the direction of its flight was west, twenty degrees north.

Its apparent angle of fall was about forty degrees. The real angle of its path with the horizon must have been considerably less or else its height was very much greater than we estimated (one mile). Its apparent size was about that of the full moon, it was dazzlingly white with a greenish blue blaze of color close to its surface.

Both my son, Dr. H. E. Culver, and his wife, as well as myself distinctly saw what appeared to be melted globules rolling back and disappearing in the fiery train which streamed out behind the meteor. Nothing was observed by us to fall toward the earth and we heard no sound as the meteor passed, but some two