with serum from patients recovered from yellow fever. The two together give protection against the disease. The six members of Dr. Sawyer's staff who had contracted yellow fever in the course of their work furnished the serum for the first immunization, but Dr. Sawyer finds that it is possible to use serum from the immunized persons also.

It is now ten months since the first human beings were immunized in this way. By tests of their serum on mice, Dr. Sawyer finds that they still are immune. He has been able to test the serum of one of the original Walter Reed volunteers, and finds him also still immune, after thirty years.

The Rockefeller research team hopes that the immunity they are now giving will be equally lasting. It takes about seven to twenty-one days for the immunization to become effective, they find. At the end of a year, they plan to re-test the sixteen persons immunized in their laboratories to see how much protection they will still have against the disease.

Sealed in glass tubes and frozen, some of the immunizing material was sent to Nigeria, in Africa, and to Brazil, where it was used successfully to immunize three other men. As yet not enough material has been produced to immunize large groups of population, but some is already available for scientists, explorers, educators, missionaries, etc., going to yellow fever countries.

Science News Letter, May 7, 1932

ASTROPHYSICS

Cosmic Rays Detected Having Highest Energy Ever Observed

RADIATION from the depths of the cosmos with the greatest enrgy ever observed by man has been detected at the California Institute of Technology, Pasadena, by experiments performed by Dr. Carl D. Anderson under the direction of Dr. Robert A. Millikan, Nobel prize physicist.

With energies four hundred times that of the most intense gamma rays from radium and four thousand times that of the most penetrating X-rays used in cancer treatment, these cosmic rays of terrific smashing power are shown to rate a thousand million volts. There are no energies from processes taking place on earth that are more than eight million volts and no higher measurements had heretofore been made. These are from radioactive disintegration.

So large are these energies shown by about ten per cent. of the cosmic rays caught photographically in a new giant ray track chamber, that Dr. Millikan has added two possible hypotheses to his previous suggestions as to the cause of some cosmic rays. The apparent energies in a few of these rays are such as would be expected from the entire annihilation of a proton, the positive unit of matter, in the outer parts of the universe. Or equally well they may be signals of the synthesis of heavy elements of over atomic weight 100 out of hydrogen in distant cosmic spaces. If the latter idea proves correct, it means that silver, gold and other heavy elements are much more plentiful in the rest of the universe than they happen to be here on earth. A thousand million volts is just about the energy that would be given off if silver were synthesized out of hydrogen.

In making the first direct measurements of energies of cosmic rays Drs. Millikan and Anderson were searching for evidence of the nature of this penetrating radiation that has puzzled scientists for the last seven years.

The question was: Are cosmic rays electro-magnetic waves, photons, or ether vibrations like light, X-rays and gamma rays, or are they neutron particles of high speed and energy, such as were suggested as a possibility in Europe recently?

By building a large "cloud chamber" in which cosmic rays rushing through moisture-charged air or gas leave a visible track of tiny water droplets and by subjecting the chamber to an immense magnetic field that bends the cosmic rays, Drs. Millikan and Anderson have obtained evidence that the photon hypothesis best explains the cosmic rays and that they are probably of the same family as light and X-rays. No evidence for the neutron hypothesis was found.

A thousand photographs made with the apparatus secured the portraits of 34 cosmic ray tracks, with curvatures under the influence of the magnetic field that are less as the energy increases.

In his report to the National Academy of Sciences, Dr. Millikan said that the facts indicate that the cosmic rays are absorbed principally by the heart or nucleus of the atoms they hit rather than by the electrons that circle about the heart of the atom. His photographs show cosmic rays that hit an atom releasing two other tracks, one negative and the other positive, indicating both positive and negative particles are sometimes thrown out of the nucleus when it is disintegrated. The photon hypothesis is upheld by the fact that the cosmic rays also hit electrons and act in the same manner as gamma rays, producing the well-known Compton effect, and give more energy than a neutron can.

Nine out of ten of the cosmic rays entering the detecting apparatus have energy values corresponding to those to be expected from the hypothesis advanced by Dr. Millikan several years ago that they originate in the building of the more abundant elements in the depths of the universe. The cosmic birth cries of helium-atom building would be only 27 million volts and would therefore be absorbed by the atmosphere of the earth and not reach the cosmic ray detector at Pasadena. But 116 million volt rays corresponding to oxygen-building, 216 million volt rays corresponding to silicon-building, and 500 million volts corresponding to iron-building are detected.

These researches by Drs. Millikan and Anderson were carried on under the support of the Carnegie Corporation.

Science News Letter, May 7, 1932

GEOLOGY

Low-Lying Bahama Islands Were Once Mountainous

THE NOW low-lying Bahamas have a lost history of mountainous existence, Prof. Richard M. Field of Princeton University told the National Academy of Sciences.

Data indicating this ancient story of the British islands off the Florida coast resulted from the submarine researches conducted in West Indian waters last winter, in which a major role was played by a delicate pendulum which "feels" out the differences in the rocks due to their varying gravitational attraction. The islands were apparently once a large, continuous land mass.

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