PHYSICS

Cosmic Rays Are Declared Principally Particles

Over Nine-Tenths of Energy Detected by Research Instruments is Thus Accounted For, It is Found

THE GREATEST piece of scientific detective work of modern times—the research to learn the nature of the baffling cosmic rays—is almost completed. Over nine-tenths of all the cosmic rays which scientists measure on stratosphere flights and in their world-wide surveys consist of positive particles streaming to earth from interstellar space.

This is the report which Dr. Thomas H. Johnson, assistant director of the Bartol Research Foundation at Swarthmore, Pa., presented to the American Association for the Advancement of Science.

"It is now possible to say with considerable certainty," declared the cosmic ray researcher, "that the particle part of the cosmic rays accounts for from 90 to 98 per cent. of the total intensity at the top of the atmosphere. It is highly probable therefore that by far the greater part of the cosmic radiation consists of positive particles and there is at the most but a few per cent. to be accounted for in some other way, possibly as a gamma radiation."

Dr. Johnson bases his contention that cosmic rays are really positively charged particles on the clearing up of the three major objections to the corpuscular theory of the radiation's nature. The former objections, he indicated, were:

First, that the particles did not have great enough energies to account for their often remarkable penetration through lead and other dense materials. Theory demanded that the rays (if they were particles) should have energies equal to 10,000 million volts. Most of the cosmic rays observed had only 600 million volts energy.

Second, the stopping of the rays as they came through the atmosphere of the earth was much too great. The absorption of cosmic rays, providing they were corpuscular in nature, was 25 times what it ought to be on theory.

Third, the amount of absorption as indicated by the range of the atom debris, which the rays knocked out of atoms inside cosmic ray instruments, did not vary with the energy of the incoming radiation. If the theory were correct, the absorption coefficient ought to change with energy. Observations have proved that for great differences of cosmic ray energy the absorption is either independent of the energy, or not related to it.

The first and second objections, said Dr. Johnson, have been advanced by Prof. Robert A. Millikan and his colleagues at the California Institute of Technology. The third is a new mystery advanced by himself, he added.

All three objections to the particle nature of cosmic rays may be solved, the Bartol scientist declared, if one realizes that the incoming corpuscular rays make direct hits on the nuclei of atoms in the air. These direct impacts cause the "showers" or "bursts" of cosmic rays detected by many observers.

It is probable, said Dr. Johnson, that every time one of the high-energy primary particle rays hits an atom nucleus it creates 25 secondary rays of the lower energy. The collision would account for the seemingly 25 times too great absorption of the rays and indicate that scientists have only a twenty-five to one chance of detecting the incoming high-speed particle. The secondary rays produced would be the "soft" 600-million-volt rays observed by Carl Anderson and others in the Wilson cloud chamber apparatus.

The nucleus impact phenomenon, Dr. Johnson added, is a chance occurrence. For still more penetrating rays with energies of 100,000 volts, a direct hit would produce about 1,700 secondary rays with energies commonly observed —the 600-million-volt rays.

With all this mixture of secondary radiation present in the instruments it would be a rare, lucky chance indeed which would demonstrate the existence of a really high-energy particle even though a large fraction of incoming radiation is of the positive particle type, he added.

"Shower production seems to be able," Dr. Johnson concluded, "to explain away the principal difficulties which have been raised with the corpuscular hypothesis and it is extremely unlikely that any other hypothesis would be able, in such a simple manner, to correlate so many cosmic ray effects. In fact, I think we may say that this hypothesis is now substantially proven, as an explanation of the principal part of cosmic radiation."

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ARCHAEOLOGY

World's Oldest Peace Treaty Carried a Curse

INTERNATIONAL worries over treaties have not changed much in 4800 years, judging by a look at the world's oldest peace treaty, which is now in the possession of Yale University.

The world's oldest known treaty of peace was made between two rival Sumerian cities, after bloody wars over a boundary line. The city of Lagash finally conquered the city of Umma about 2900 B. C., and the treaty drawn up between the two called for repara-

OLDEST PEACE TREATY

Peace between two cities was guaranteed by the words of this treaty. The conquering city had the clay treaty drawn up on a piece of clay shaped like a hunter's net. That was a sinister bit of diplomacy, meaning that the god Ningirsu would capture in his great net the vanquished people, if they dared break the terms. Curse or no curse, the treaty failed.

tions by the conquered city.

In the hope of scaring the city of Umma into keeping the terms of the treaty the inscription called on the god Ningirsu to capture the people in his great net and punish them if they should ever dare to cross the boundary contrary to the treaty terms. To emphasize the curse, the treaty was written on a clay cylinder shaped like a net such as hunters used to bag game.

Curse or no curse, the people of Umma rose in rebellion in a few years, and the peace treaty so cunningly drawn was discarded as a scrap of clay.

A document from a "New Deal" given to a country about 2650 B. C. is another exhibit selected from the Yale Babylonian Collection by Dr. F. J. Stephens, acting curator, to show the progress of Babylonian history from 3500 B. C. to about 150 B. C.

The New Deal was given to the city of Lagash by King Urukagina, who rose as champion of the people in a time of great unrest and corruption. He brought about changes in government which greatly improved the lot of the common people, says Dr. Stephens.

Science News Letter, June 30, 1934

MEDICINE

Arteriosclerotic Heart Disease Is On the Increase

PEOPLE today are unquestionably wearing out sooner because of the faster pace at which they are living.

So declared Dr. Fred M. Smith of Iowa City during the meeting of the American Medical Association in Cleveland. A leading cause of death today is arteriosclerotic heart disease, which is essentially a wearing out process.

He and his associates, Drs. W. D. Paul of Iowa City and H. W. Rathe of Waverly, Iowa, told the story of this disease in an exhibit at the meeting and in a report of four hundred cases to the American Heart Association, which also met in Cleveland.

The number of deaths from heart disease is much greater today and has increased much faster in the last twelve years than the numbers from either cancer, pneumonia or tuberculosis. The latter disease, in fact, has shown a decrease.

Fully half of the heart deaths are due to arteriosclerotic heart disease. In this condition the space inside the arteries of the heart itself is gradually encroached upon till it becomes so small the blood can hardly get through, or it may be entirely stopped by what physicians call an occlusion. As a result, the part of the heart muscle supplied by the diseased or occluded arteries does not get enough blood to perform its share of the heart's work.

Fortunately, the heart has a remarkable capacity to compensate for this condition, the unaffected part taking over the entire job of pumping blood out into the body. Fortunately, also, physicians have found certain drugs which actually dilate arteries that are being closed up. Rest is also very helpful in this condition, because it reduces the amount of work the heart must do and the quantity of blood it needs.

Pain in the chest, often severe and lasting anywhere from several hours to several weeks, is the chief symptom of this heart ailment. Shortness of breath is another symptom. Angina pectoris may also be present.

The pain in arteriosclerotic heart disease is different from the pain in angina both as to location, duration and type. An important difference is that the pain in angina comes on during exercise, excitement or exertion of some kind, while the pain of arteriosclerotic heart disease frequently occurs while the patient is resting, or wakes him out of his sleep at night.

Physicians do not know how to prevent this type of heart disease, though more moderate living habits may help.

Science News Letter, June 30, 1934

ASTRONOMY

Electrical "Tides" Suggested As Cause of Sunspots

THE FAMOUS eleven-year sunspot cycle which astronomers have been observing for decades may be caused by the electrical interaction of the sun and its neighboring planets, Venus, the earth, and Mercury.

The suggestion that sunspots result from electrical "tides"—to use a moon and earth analogy—was advanced by Fernando Sanford, emeritus professor of physics at Stanford University before the Astronomical Society of the Pacific at its meeting. The Society met in conjunction with the American Association for the Advancement of Science at the University of California.

All the planets have strong negative electric charges upon them with respect to the sun. Since the planets move in orbits which take them alternately near and away from the sun Prof. Sanford suggests that at the nearest position the increase in electric field between various solar bodies might produce the sunspots. If this situation is true, a check of sunspot activity and the proximity of the planets to the sun should show some correlation.

Studies of sunspot cycles from 1750 to 1928 show, the veteran scientist declared, the sought-after correlation between sunspots and the periods of conjunction of Venus and the earth on one hand; and Venus, Mercury and the earth on the other.

Prof. Sanford maintains that Venus and the earth are responsible for the eight-year sunspot cycle while Venus, Mercury and the earth cause the more easily recognized eleven-year cycle.

Science News Letter, June 30, 1934

ASTRONOMY

Age of Meteorites Points To Origin in Solar System

METEORITES, the bits of cosmic matter which stream about through space and sometimes fall flaming to earth, are members of the solar system which holds the sun and the earth.

Experiments using a radium time-clock to estimate the age of meteorites were reported to the American Association for the Advancement of Science by Dr. Robley D. Evans of the University of California which prove the origin of the shooting stars.

The clock used by the California scientist is the radioactive disintegration of the element uranium into lighter elements, including radium. In the process, atoms of the light gas helium are given off. When a sample of meteoric material is "new" it has little helium in it; when old it may be saturated with the gas. Determining the ratio of helium to radium in a rock sample is a check on its antiquity.

Scientists all over the world, declared Dr. Evans, have now checked the age