

mouth and Galesburg, Ill.; and Conway and Mullins, S. C.

The method reported by Dr. Dean takes into account two factors. One is a common water supply which has not been changed in either its source or physical set-up during the life of the group of children examined. The other

is examination of a group of at least 25 children all nine years old or more who have used the water supply continuously since birth for both drinking and cooking. From these two factors may be determined the "mottled enamel index" of a community.

Science News Letter, November 2, 1935

PHYSICS

New Theory of Cosmic Rays Advanced by Dr. Swann

A NEW theory of the nature of cosmic radiation, rays constantly bombarding the earth and its inhabitants, is suggested by Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute.

Dr. Swann's hypothesis, explaining cosmic rays as electrically charged particles, welds together some eleven known experimental findings which have puzzled scientists for years. His report appears in the *Physical Review* (Oct. 21).

Science Service has asked Dr. Swann's colleague, Dr. W. E. Danforth, to interpret the new hypothesis in simple language.

Dr. Danforth's statement follows:

Explanation of The Swann Theory of Cosmic Rays

By DR. W. E. DANFORTH, Bartol Research Foundation

ARE cosmic rays a sort of super X-ray, i. e. very high-powered "bullets of light," or are they particles or matter bearing electrical charges?

Until recent years the former possibility was almost universally favored. The recent journeys of scientists, bearing cosmic ray detectors to various parts of the world and to mountain tops, however, have proved that these projectiles, which pelt down upon us from interstellar space, are affected by the earth's magnetic field. Therefore they must consist, at least in part, of electrically charged particles such as electrons or protons.

A complete theory of cosmic rays, however, has a host of facts to explain. A theory must, for instance, result in a mathematical formula from which the number of cosmic rays at any altitude can be calculated. The appeal to physicists of the "super X-ray" or "photon" theory lay in its success in giving the

correct altitude formula. But now that a large part of the cosmic radiation is known to be of electrically charged nature, this success of the photon theory appears illusory.

A new form of charged particle theory, which enables one to explain all of the major known facts about cosmic rays, including the precise way in which their intensity varies with altitude, is propounded in the current issue of the *Physical Review* by Dr. W. F. G. Swann of the Bartol Research Foundation at Swarthmore, Pa.

Perhaps the boldest aspect of this theory is the supposition that the original (or "primary") rays continue right through our atmosphere in undiminished numbers until they bury themselves in the earth. But what, the reader may ask, about the fact that on a mountain top there are many times as many rays as at sea level? To this question Dr. Swann replies that nearly all of the rays which affect cosmic ray detectors are not the original primary cosmic rays, but are other electrically charged particles knocked out of atoms by the primary rays as the latter traverse the atmosphere. These secondary rays fly forward with practically the same direction as the primary which produces them. Some energy is lost by the primary every time it produces a secondary.

One of the cornerstones of the theory is the supposition that the number of secondaries produced in a given distance, is in direct proportion to the energy of the primary ray. Strangely enough, the theory permits a primary charged particle to be changed into something else, e. g. a bullet of light, once it is within the atmosphere.

Science News Letter, November 2, 1935

Whalers in the southern seas used to get 60 to 70 barrels of oil from a whale; now the industry manages to extract almost twice that much.

ARCHAEOLOGY

Finds of Cave Man Art Made in Interior Spain

NEW finds of the art of the Crô-Magnon cave men have been made in two caverns in the province of Guadalajara, Spain, by a father-and-daughter team of archaeologists, Juan Cabré and Maria de la Encarnacion Cabré. The style of the drawings identifies them as belonging to the Aurignacian period of Old Stone Age culture; they include as subjects plants as well as animals, and men or at least man-like figures—for the human representations are far less realistic than those of animals.

The man-like drawings are shown in both hunting and fishing scenes, and at least one of the figures is shown swimming.

Many of the animals represented are extinct, or at least are no longer found wild in Europe. These include bison, aurochs, rhinoceros, wild horse and wolverine. Among animals still existing in the wild state are deer and goats, together with the representation of one bird.

As in many other cave-studios of Old Stone Age art, the walls were used several times over, so that now the outlines of several animals may be seen cutting through each other.

The figure of the rhinoceros is of especial interest. It is shown covered with wavy lines, which probably indicate that it was the extinct woolly species, adapted to the Ice Age climate.

Science News Letter, November 2, 1935



BY AN OLD SPANISH MASTER

Newly found cave drawings of the Old Stone Age. The animals represented in this sketch are deer, wild horse, wild cattle and (upper left) rhinoceros.