

PHYSICS

New Heavy Charged Particle Fits Into Present Theories

Leading Physicists Meet to Discuss Theories of Nature of Universe; Composition of Stars Described

THE recent discovery of the now-famous X particles in cosmic radiation has done much to clear up existing theories on the nature of the rays, said Dr. Carl D. Anderson, Nobel Prize winning physicist from the California Institute of Technology, before Notre Dame's symposium on the universe and primordial particles.

The symposium brought together some of the most famous men of science to discuss basic questions on the nature of the universe and what is in it. Besides Dr. Anderson, the program included such men as Profs. M. S. Vallarta, J. F. Carlson, Arthur H. Compton, Harlow Shapley, Gregory Breit, Canon Georges Lemaitre, William D. Harkins, Eugene Guth and Arthur E. Haas.

Recent studies, said Dr. Anderson, have shown that a great majority of the effects of cosmic radiation which are observed in the earth's atmosphere, can be explained by assuming that they are caused by electrified particles; either units of positive charge (the protons) or smaller particles (the electrons) having either positive or negative charge.

Until the discovery of the X particle which has a mass intermediate between protons and electrons, said Dr. Anderson, there were difficulties in explaining all cosmic ray observations by assuming positive charged particles as the entire causative agent. These difficulties may be resolved, however, by postulating the existence of new particles (the X particles) which have unit positive or negative charge and an intermediate mass.

Dr. Anderson traced the discovery of this important particle which fits, admirably, into the present picture of cosmic rays and the structure of matter.

Theory Still Good

No present astronomical observations really justify the abandonment of the "expanding universe" theory of cosmology, said Canon Georges Lemaitre in defending his hypothesis on the structure of the universe.

Canon Lemaitre, distinguished astrophysicist from the University of Lou-

vain, Belgium, who is now visiting professor at Notre Dame, said that the observations of such astronomers as Prof. Edwin C. Hubble at Mt. Wilson Observatory contain experimental errors which are sufficiently great to rule out—as yet—any implications that some new hypothesis of universe structure must be found to replace that of the expanding universe.

Magnetic Field a Barrier

The magnetic field surrounding the earth acts as a great barrier wall to many cosmic rays seeking to pierce the atmosphere to the surface, said Prof. Manuel S. Vallarta of Massachusetts Institute of Technology.

At any given point on the earth, a particle of a given energy may only arrive from certain regions of the sky, Prof. Vallarta declared, due to the twisting effect of the earth's magnetic field on charged particles. By mathematics it is possible to work out, for any given point on the earth, a complicated cone through which particles of a given energy can pass; and also another cone in which similar particles cannot enter.

These mathematical determinations can be checked by experiments tracing the paths of primary cosmic rays. So complex are the mathematics of the equations of motion that human minds cannot integrate the differential equations employed. The giant robot calculating machine, developed by Prof. Vannevar Bush at M. I. T., was set to work on the problem and did the job. The differential analyzer, as it is called, "has played a very important role in these investigations," said Prof. Vallarta in describing the work.

Conclusions deduced from the theory indicate that apparently most of the primary cosmic rays are electrically charged particles and that at least three out of four of them possess a positive electrical charge.

Matter and Radiation Interchange

The swift and multiple changing of matter into radiation and back again

was also described at the symposium by Prof. J. F. Carlson of Purdue University.

If it is assumed that cosmic rays consist of a mixture of electrons, positrons and gamma-rays with large energies, said Prof. Carlson, it follows from theory that the electrons and positrons, in their passage through matter, will produce high energy gamma rays by radiation when they pass nuclei of atoms. Thus material particles create radiation.

In contrast the gamma rays will lose energy in the nuclear fields of atoms and create pairs of electrons—positive and negatively charged. Here is the creation of material matter out of radiation.

If the original primary cosmic ray particle has sufficient energy this interchange of matter into radiation, and back again, may be repeated many times until several hundred particles appear finally.

The new-found X particle, or heavy electron which weighs a hundred or more times as much as an ordinary electron, is necessary in the theory, said Prof. Carlson, to explain some of the observations in cosmic rays made at the earth's surface. These heavier particles have greater penetrating power than other cosmic ray particles.

Even Solid Is Empty

An electron would have to pass through a block of solid beryllium 20 miles thick before it would—by chance—strike an atom. This new picture of the emptiness of solid matter was presented in calculations reported by Prof. Eugene Guth of the University of Notre Dame.

On the same program Prof. Arthur Haas, Viennese theoretical physicist now on the Notre Dame faculty, said that the entire universe was built up out of only three kinds of matter. Two of these three primordial particles are heavy (neutrons and protons) in comparison with the third type (the electrons).

Prof. William D. Harkins, University of Chicago, reported that "the composition of the stars is about what it should be if they began their existence a hundred billion years ago as bodies of hydrogen alone, provided there has been some process which has been able to produce the great amount of neutronic matter essential for the building of heavier atoms."

Of the six different possible kinds of matter which may exist in distant galactic space, modern astronomy has positive knowledge of the existence of only two kinds, (*Turn to Page 320*)

spectral lines found in the light of the sun's corona.

None of the sought-for lines appeared, said the Princeton physicist, but—as so often happens in research—a new discovery was made. Prof. Shenstone passed an electric current through a chamber of helium gas and excited it until it gave off its characteristic pale blue-violet rays. Near the two electrodes of his discharge tube the usual and long-known line and band spectrums of helium were obtained.

However, his studies also disclosed the new continuous radiation almost on the surface of the positive electrode and also at a point about midway between the electrodes. By analyzing the radiation, Prof. Shenstone has shown that it extends continuously from the red colors into the ultraviolet region.

The new continuous spectrum has apparently no relation with the usual line, or band, spectrum of helium, says Prof. Shenstone. No accepted cause, which might explain its presence, has yet been worked out.

However, Prof. Shenstone suggests that the new radiation might be caused by the slowing down of the electrons, of the gas, as they approach the positive, or anode terminal. This is only a hypothesis, he added, however, which will require further study before acceptance.

Nitrogen Isotope "Plant"

A rare kind of sulfur, the isotope whose atoms are mass 34 instead of ordinary mass 32, has been concentrated by Dr. Harold C. Urey, Nobel chemist of Columbia University, in the latest of his separations of the different varieties of matter. H. G. Thode, John E. Gorman and Dr. Urey presented a joint paper announcing this latest achievement disentangling the isotopes.

Sulfur mass 34 has been concentrated threefold to 6.8 per cent. compared with 2.3 per cent. which is its frequency in natural sulfur.

In giant towers of glass at Columbia University, scientists are also tediously concentrating the rare isotope of nitrogen, having mass 15. Each day the large apparatus produces only a tiny drop of the rare nitrogen isotope, containing only 0.15 grams of material. Yet this rate is 100 times that of any other method.

Two columns of glass are used. One is 40 feet high and the other 25 feet high. A 46-fold increase in concentration of nitrogen 15 has been effected with the apparatus and a still greater

tenfold increase is expected as soon as a third tower 50 feet tall is added to the other two units.

Streamlined Golf Club

Something new for golfer, a streamlined golf club, was described at the meeting by Dr. S. J. Crooker, consulting physicist. Dr. Crooker exhibited a "tear drop-shaped" club which has only one-fifteenth the air resistance of a club head of the orthodox shape.

Streamlining is vital in a golf club, Dr. Crooker indicated, because at impact the club head meets the ball with speeds of something like 125 miles an hour. At these airplane speeds the application of aerodynamics to the shape of the club head has the same merits as it does to the shape of a modern transport airplane.

In windtunnel tests the superiority of the new club to the older kind was strikingly apparent. A long-hitting pro golfer, like Jimmy Thomson, should be able to strike a ball and have it carry 275 yards before hitting the ground, said Dr. Crooker. To which golfing "duffers" in the audience of physicists at the meeting added, "Woe is me!"

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said Prof. Harlow Shapley, director of Harvard College Observatory.

The two kinds of matter positively identified are galaxies and radiation, said Dr. Shapley. A third kind, star clusters, is indicated by preliminary observations still in progress.

"Of isolated stars, meteoroids and gas, we have no evidence," he declared, "and can make only rather insecure inferences."

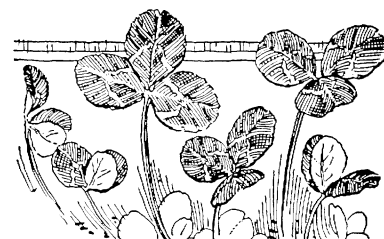
Metagalaxies are the most extreme galaxies known to astronomers. Metagalactic space is the most distant observable region of space which can be photographed on the largest astronomical telescopic camera.

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Piano wire is used in a soap factory to cut slabs of soap into small bars.

To relieve traffic congestion in Paris, a vehicular tunnel 2,700 feet long is being constructed.

Planting shrubs two or three feet away from a house allows space for painting or other work on the building when necessary.



New Kinds of Silage

GRASS, and legumes like alfalfa, soy beans, and cowpeas, go into silos on farms in the Northeastern states nowadays, where only chopped-up cornstalks went before. This one change in farm practice will be of incalculable help in the national campaign to check ruinous soil erosion.

For grass and the legumes are reckoned as soil-conserving crops, whereas corn, green goldmine though it is, must be counted as a soil-destroying crop because the clean cultivation it requires exposes loose soil to the action of running water.

Silos are indispensable in dairy farming, and highly desirable in the feeding of other kinds of livestock, because the slightly fermented, sauerkraut-like green fodder stored in them is not only highly nutritious but rich in vitamins. The fermentation keeps out undesirable kinds of microorganisms in much the same manner that sour-milk bacilli keep out putrefactive bacteria in the making of acidophilous milk and similar fermented health drinks.

Hitherto, corn and a few similar plants have been the only practicable materials for ensilage, because grasses and legumes do not contain enough

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