SCIENCE NEWS

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SOME ADVANCES IN THE SCIENCES DURING 1934

Physics

RADIOACTIVITY was created by an external cause for the first time when Professor F. Joliot and Mme. Irene Curie-Joliot, Institute of Radium, Paris, bombarded boron, magnesium and aluminum with alpha-particles with the result that positrons were given off after the bombardment was stopped. Chemical proof was obtained of artificial transmutation as a result of their production of artificial radioactivity. Artificial production of radioactive elements useful in medicine and superior in intensity to the rays of radium was predicted by them at the International Conference on Physics.

Carbon is made artificially radioactive and delayed production of positrons is produced by bombardment with deutons accelerated with a million-volt tube, was demonstrated by Professor C. C. Lauritsen, R. Crane and W. Harper of the California Institute of Technology.

Artificial radioactivity was produced in graphite (carbon) by bombardment with 600,000-volt protons with the production of positrons by Drs. J. D. Cockcroft, C. W. Gilbert and E. T. S. Walton, Cambridge, England.

Alpha-particles are ejected from lithium at speeds greater than the swiftest radioactively-produced alpha-particles when lithium is bombarded with deutons, Cavendish Laboratory experiments showed.

A way to make common element sodium radioactive by artificial means and yield gamma radiation over twice as penetrating as those from natural sources was discovered by Professor Ernest Lawrence, Drs. Edwin McMillan and Malcolm C. Henderson at the University of California.

On basis of experiments on bombarding heavy uranium with neutrons Professor Enrico Fermi, Italian physicist, predicted the early discovery of a whole series of radioactive elements lying between thorium and actinium in the periodic table.

Artificially produced gamma radiation having penetrating power equal to 3,500,000 electron-volts of energy was reported by Drs. C. C. Lauritsen and R. Crane, of the University of California.

A theory of the origin of the mysterious cosmic rays was advanced by Professor F. Zwicky, of the California Institute of Technology, and Dr. W. Baade, of the Mount Wilson Observatory, which holds that the rays are caused by the sudden flare-up, or bursts of energy, from the type of star known as super-novae.

Cosmic rays were deflected by strong fields for the first time in the laboratories of the University of Stuttgart by Ernst Lenz, pupil of Professor Erich Regener, the cosmic ray authority, indicating that much of the radiation is corpuscular in nature.

For the first time the intensity of cosmic rays has been found to vary with different times of the day, the maximum occurring at noon and the minimum between 9 P. M. and 3 A. M., by Dr. Victor F. Hess, of the University of Innsbruck, working in the Tyrol Mountains, 7,600 feet above sea-level.

Partial annihilation of matter, the building up process whereby heavier elements could be formed from atoms of hydrogen, is responsible for the formation of cosmic rays, according to Dr. R. A. Millikan.

While cosmic rays are now known to consist of a mixture of corpuscular particles and photons of light the particle part of the rays accounts for from 90 to 98 per cent. of the total intensity at the top of the atmosphere, according to the estimate of Dr. T. H. Johnson, of the Bartol Research Foundation.

Plans were announced by Dr. A. H. Compton for extended cosmic ray research with small unmanned free-flight balloons which would transmit by radio the data being obtained in automatic instruments miles above the earth.

Cosmic ray measurements 820 feet below the surface of the Red Sea indicate that a large share of cosmic radiation consists of electrical particles, according to Professor W. F. G. Swann of the Bartol Research Foundation.

Radiation resembling cosmic rays but less penetrating is thrown out by the tops of thunderstorm clouds was reported by Dr. B. F. G. Schonland, South African physicist.

Hardest cosmic rays so far discovered (penetrating more than 800 meters or 2,620 feet of water) were discovered by Dr. Axel Corlin of the University of Lund, Sweden, through experiments in an iron mine.

The formation of positrons from cosmic or gamma rays received support from calculations by Drs. W. Heitler and F. Sauter, of Bristol and Berlin.

Cosmic rays are charged particles, not radiation, Drs. A. H. Compton and R. J. Stephenson, University of Chicago, concluded on the basis of cosmic ray meter records of the Settle-Fordney stratosphere 11-mile high flight.

Evidence accumulated that a trinity of particles, neutron, positron and electron, compose all the matter of the universe.

Following Dr. R. M. Langer's and Dr. Carl Anderson's early prediction, renewed suggestions that there exists a new atomic particle—the negative proton—were advanced by Dr. S. Tolansky of the Imperial College of Science, London, and Professor G. Gamow of the Polytechnical Institute, Leningrad, U. S. S. R.

A new atomic particle—a double weight neutron—was suggested by Dr. M. A. Tuve of the Carnegie Institution in Washington.

Experimental proof of conversion of radiation (cosmic or gamma rays) into matter (electrons or positrons) was questioned by Dr. Carl D. Anderson, California Institute of Technology, who holds that when lead or aluminum is bombarded, rays merely knock out particles already existing in atomic nuclei.

A new source of protons for atomic bombardments, consisting of an electric arc operating in hydrogen at low pressure between an incandescent filament and a metal electrode, was devised by Drs. Edward S. Lamar

and Overton Luhr, Massachusetts Institute of Technology.

Fast electrons, as well as cosmic and gamma rays, may give rise to pairs of negative and positive particles when they hit nuclei of atoms, Dr. D. Skobeltzyn, Leningrad, found.

Professor Enrico Fermi of Italy discovered the type of artificial radioactivity in which a negative electron or beta-particle is liberated—as contrasted with the liberation of the positron in the Joliot experiments—by bombarding elements with neutrons.

That the half-life or rate of decay of artificial radioactive materials is different for the same substance when produced in different ways was shown by the experiments of Drs. C. C. Lauritsen, R. Crane and W. Harper, California Institute of Technology, who found that, when they turned carbon into nitrogen by bombarding it with deutons, the half-life of the material was different from the nitrogen made by the Joliots in Paris by bombarding carbon with alpha-particles.

The positron is the shortest lived thing in the universe and dies when absorbed by matter as predicted by the Dirac theory, Professor F. Joliot and Professor Jean Thibaud, French scientists, determined independently.

Using instruments counting individual photons of light, Swiss scientists, Edgar Meyer, M. Schein and B. Stoll, have been able to detect a new band of invisible light in the ultra-violet in the region from 2,400 to 1,900 Ångstrom units.

By free-flight balloon ascensions Professor Erich Regener of the Physical Institute of Stuttgart, Germany, indicated that 70 per cent. of the ozone is below 19.5 miles altitude, much lower than the height previously supposed.

Invention by Professor G. R. Harrison, of Massachusetts Institute of Technology, of two devices for measuring and analyzing complicated spectra are: (1) a wavelength computing machine which automatically prints wave-lengths and intensities with all correction factors directly on a photographic plate, and (2) an interval sorter which performs and sorts 50,000 subtractions of wave numbers per minute.

Analysis of the observations made by American investigators during the Polar Year indicates that the temperature of the region from 62 to 124 miles above the earth is probably in the neighborhood of 80 degrees Fahrenheit.

Small periodic variations in the measurements of the velocity of light were found in the course of extensions of Michelson's experiments at Mount Wilson Observatory, which gave a new average value, 299,774 kilometers per second, but these were attributed not to a real variation in light's speed but to other undiscovered causes.

A new theory of relativity developed by Sir Shah Sulaiman, distinguished mathematician and justice at Allahabad, India, links the classical mechanics of Sir Isaac Newton with the results predicted by Einstein's relativity.

"Photographs" of atoms magnified, in effect, 200,000,000 times obtained by the use of x-rays were exhibited by Professor A. H. Compton and Dr. E. O. Wollan of the University of Chicago.

X-ray studies of the structure of wood fibers reveal that even, soft tone accompanies the non-orientation of the wood fibers in the maple back of a violin, Dr. K. Lark-Horovitz and W. I. Caldwell of Purdue University have discovered.

Heat-absorbing glass which removes 52 per cent. of the "hot" but invisible infra-red rays and which is expected to prove useful for skylights in southern factories during hot summer months, was reported by Dr. Roger S. Estey, physicist of the Electrical Testing Laboratories, New York City, to the Optical Society of America.

Sextants and binoculars can be improved for use under certain light conditions by attaching polarizing prisms, Dr. E. O. Hulbert, Naval Research Laboratory, found.

A precise value for the velocity of sound, 1087.13 feet per second at zero degrees Centigrade was announced by Dr. Dayton C. Miller, Case School of Applied Science, who computed data from big gun firing just after the close of the World War.

By firing a gun into the barrel of a similar gun, Dr. C. Ramsauer, German physicist, developed a method of producing high pressures and high temperatures simultaneously.

The Raman effect of heavy water (containing hydrogen isotope mass two) is different from that of ordinary water, Dr. R. W. Wood, Johns Hopkins University, found.

Production of clear crystals of lithium fluoride transparent to 900 Ångstrom units in the ultra-violet and with practically no variation in dispersion over visible spectrum, have been developed as a practical optical material in large sizes by Professor D. C. Stockbarger of Massachusetts Institute of Technology.

Chemistry

Triple-weight hydrogen, three times as heavy per atom as the ordinary kind, was discovered at the Cavendish Laboratory of Cambridge by Lord Rutherford and Drs. M. L. Oliphant and P. Harteck; at the Department of Terrestrial Magnetism of the Carnegie Institution by Dr. M. A. Tuve, L. R. Hafstad and Odd Dahl; at Princeton University by Drs. Gaylord P. Harnwell, Henry D. Smyth, Walker Bleakney and Philip T. Smith.

Existence of helium of atomic mass three instead of four was reported by Dr. P. I. Dee of Cavendish Laboratory of the University of Cambridge.

Age-long impact of cosmic rays on the earth's surface caused the formation of the rock-like material of the crust out of the nickel-iron core, is the suggestion of Professor Gilbert N. Lewis of the University of California.

A new chemical indicator called "nitrazine yellow" for telling the difference between acid and base solutions at very low concentrations was developed by Dr. Henry Wenker.

Protactinium, after uranium the heaviest of all elements in atomic weight, was successfully isolated independently in the United States by Dr. Aristid Von Grosse, University of Chicago, and in Berlin by Drs. Georg Graue and Hans Kading, Kaiser Wilhelm Institute.

The atomic weight of protactinium, next to the heaviest element known to science after uranium, was measured

as 231 times that of hydrogen by Dr. Aristid Von Grosse and M. S. Arguss, of the University of Chicago.

Professor Enrico Fermi, Italian physicist, reported the production of new material by bombarding uranium, present heavy-weight champion, with neutrons, but later found that what he had mistaken for element number 93 was really a new form of actinium of atomic number 91.

Propane, a normal constituent of liquefied natural gas, can extract a considerable portion of the so-called Pennsylvania type of ingredient of lubricating oil, making a superior oil out of supposedly inferior western oils, according to work carried out by Dr. Ulric B. Bray, of Los Angeles.

Specially prepared calcium sulfate or gypsum, called soluble anhydrite, was developed as a drying agent by Professor W. A. Hammond, of Antioch College, and Professor J. R. Winthrow, of the Ohio State University, useful in dehydrating alcohol and other chemicals.

Isolation in pure crystalline form of a new, very reactive substance, gamma methyl fructoside, from fructose, the sugar of fruits, by Dr. Claude S. Hudson, U. S. National Institute of Health, called in question current chemical views as to the composition of sucrose, the common sugar of commerce.

Citric acid, which makes lemons sour, was extracted commercially from the cheapest kinds of Russian tobacco by Soviet chemists.

A rival for transparent cellulose wrapping material called Pliofilm was made synthetically from rubber which is moisture-proof, elastic and easily sealed by slight heat and pressure.

A new antiseptic, azochloramid, soluble in water and not easily destroyed by heat was reported to the American Chemical Society by Dr. Franz C. Schmelkes and Henry C. Marks.

Commercial extraction of bromine from sea water was achieved at the Wilmington, N. C., plant of the Dow Chemical Company by a method which may have also, as a by-product, the extraction of gold from the water.

Various chemicals which stepped out of the "rarity" class into commercial production by carload lots during 1934 include: (1) Acetamide, valuable chemical solvent; (2) diphenyl oxide, a fluid with high boiling point and chemical stability useful as a heat transfer agent between boiler furnace and high pressure steam in high temperature boilers, which allows cheaper boiler construction; (3) boron carbide, industrial abrasive approaching the diamond in hardness which is made from coke and born in electric furnaces.

A new method of chemical separation of artificial radioactive isotopes from the parent substance was developed by Drs. Leo Szilard and T. A. Chalmers, of St. Bartholomew's Hospital, London, which, for the case of iodine, involves the use of pure iodine vapor to prevent radioactive iodine atoms, formed by the bombardment of ethyl iodide, from returning to the target. The method appears useful for the concentration of man-made radioactive products of atomic number higher than thirty.

Astronomy

Previously accepted dimensions of the Large Magellanic Cloud, nearest of external galaxies, were doubled (not less than 20,000 light years diameter) by studies under Dr. Harlow Shapley of the Harvard College Observatory.

The Milky Way galaxy in which we dwell (about 30,000 light years to its center) is no larger than other galaxies seen as spiral nebulae, Dr. J. S. Plaskett and Dr. J. A. Pearce, Dominion Astrophysical Observatory, Victoria, concluded from a study of the gravitational behavior of the so-called Class B stars.

The Milky Way galaxy was found to be only half as large as heretofore supposed through photoelectric measurements by Drs. Joel K. Stebbins and C. M. Huffer of the University of Wisconsin which verified the existence of dust particles in our galaxy that cause astronomers to misjudge true star distances.

The Milky Way galaxy in which the sun and earth are located may be nearly spherical instead of being watch-shaped as previously supposed, Dr. Harlow Shapley of the Harvard College Observatory reported as the result of Harvard measurements of the cluster type Cepheid variables at large angular distances from the Milky Way.

A photoelectric cell device attached to the 100-inch Mount Wilson Observatory telescope by Drs. Joel Stebbins and Albert E. Whitford showed the Andromeda nebula to be double its hitherto recognized size due to material on its edges detected by the photoelectric cell but "dark" to human eyes; photographs made with Harvard's Oak Ridge patrol telescope extend the bounds of the nebula still further, and bring out evidence that the system is nearly spherical rather than highly flattened.

A vast super-galaxy in the constellation of Hercules was discovered by Dr. E. F. Carpenter of Steward Observatory of the University of Arizona, this "galactic archipelago" being perhaps 1,500,000 light years in diameter.

Great winds (4 to 40 miles per second) blow in the atmospheres of stars, Dr. Otto Struve and Dr. C. T. Elvey, of the Yerkes Observatory, determined from the evidence of spectroscopic phenomena which have puzzled astronomers for years.

Aluminum-coated glass reflecting mirrors were used by Professor S. L. Boothroyd and associates of Cornell, working at Lowell Observatory, to photograph starlight in the extreme ultra-violet, with the object of obtaining information about temperatures and classifications of stars.

Argon was discovered in the atmosphere of distant stars by Dr. W. W. Morgan of Yerkes Observatory.

Zeta Aurigae, a naked eye visible star consisting of a very hot blue star that three times each eight years is eclipsed for a month by a cooler, gigantic reddish companion, was observed intensively in October because of the possibility of determining the composition, pressure and distribution of the outer atmosphere of the red star by the changes in the blue star's light shining through it.

Some wholly unexplained absorption lines, probably of interstellar origin, in the spectra of stars were found by Dr. Paul W. Merrill, of Mount Wilson Observatory.

(To be concluded)