SCIENCE NEWS

PROOF OF EINSTEIN'S THEORY FROM THE ATOM

Science Service

THE light from the interior of the atom, as well as the light from the distant stars, gives evidence in support of the Einstein theory of relativity, according to Professor A. Sommerfeld, of Munich. Following his series of lectures at the Bureau of Standards in Washington, he gave the results of his calculations of the orbits of the electrons in hydrogen and helium atoms and showed that the grouping of these lines in the spectra of these gases was in close conformity with the figures given by the Einstein formula.

According to the modern view of the internal structure of the atom there is a central nucleus of positive electricity around which revolve at high speed one or more negative electrons. These may move in circular or in elliptical orbits as do the planets around the sun. If the orbit is a circle the revolving electron moves at an even speed throughout its course. But if the orbit is an ellipse the electron must move faster when it is making the turn nearest to the central nucleus at the focus than when it is at the more distant end of the ellipse. This difference in speed would make no difference to the mass of the electron according to the old Newton theory, for this assumed that mass was unalterable. But according to the new Einstein theory a particle moving at high speed is heavier than when moving slower, so the electron would vary in mass in different parts of its elliptical orbit and therefore the energy it gave off in the form of light would depend upon the shape as well as the major diameter of the orbit.

There are only a limited number of such orbits that an electron can pursue and in slipping from one of these to another a certain quantum of light is given off which may be recognized by its position in the spectrum. The light given off from the incandescent gases, hydrogen and helium, as well as the X-ray spectrum of heavy metals like platinum, show that the corpuscles making up the atom obey Einstein's law instead of Newton's.

Astronomical evidence on the Einstein theory is expected whenever Professor W. W. Campbell, director of the Lick Observatory and president of the University of California, announces the results of his expedition to Australia last September to take photographs of the eclipse then visible. If the photographs show an outward displacement of the stars surrounding the darkened disk of the sun, it will prove that Einstein was right in predicting that a ray of star-light passing close to the sun would be drawn out of its course. For, according to Einstein, space about a heavy body like the sun is distorted so that light can not travel straight; a point that Professor Sommerfeld illustrated by putting his hand under the piano spread and puckering it up. A billiard ball, he said, would have difficulty in passing over such a hummock as light does in passing through a gravitational field. Space by itself does not exist but is produced by what is in it and the sort of space it is depends upon the amount and distribution and motion of the particles of matter.

SAMPLES OF HAFNIUM

Science Service

SAMPLES of minerals and concentrated preparations containing hafnium, the new chemical element discovered by Drs. G. Hevesy and D. Coster, of the Institute of Theoretical Physics, Copenhagen, are *en route* to this country for examination by chemists here. The samples have been dispatched by Dr. Hevesy to Dr. George F. Kunz, president of the New York Mineralogical Club, and are expected here shortly.

Hafnium is believed by Dr. Hevesy to be the hitherto missing or undiscovered element No. 72, and to be altogether a different substance from celtium, detected in 1911 by the French chemist, Urbain, who thought it was element No. 72, but classed it with the "rare earths."

In a letter to Dr. Kunz, Dr. Hevesy indicated that a new atomic weight value for zirconium, the metal with which hafnium was found, may be a by-product of the discovery. "Virtually all commercially pure preparations of zirconium contain from one to five per cent. of hafnium," said Dr. Hevesy. Since hafnium has an atomic weight greater than zirconium, it is believed that the present accepted value of zirconium is too high.

In explaining why hafnium fits into the vacant niche in the chemical table better than Urbain's celtium, Dr. Hevesy's letter explained that hafnium's chemical properties place it in the class of elements that include zirconium and thorium, and that "it has not been possible by means of highly concentrated hafnium preparations to reproduce the characteristic optical spectrum ascribed by Urbain to celtium, and which, together with an

investigation of the magnetic properties of his preparation, was the basis of the announcement of the discovery of this element.''

THE UNITED STATES PUBLIC HEALTH SERVICE AND PREVENTION OF DISEASE

United States Public Health Service

THE part played by the United States Public Health Service in the prevention of disease is not easy to evaluate, says Surgeon General H. S. Cumming. Some kinds of prevention work, such as that of barring foreign diseases out of the country, are now wholly in its hands; and for the results of such—specifically for keeping out typhus, plague and cholera while they were ravaging Europe—the service may fairly claim full credit. But most other kinds of prevention work in which it has been engaged have been carried on in greater or less part with the cooperation of state health officers.

Preventing the spread of disease from one state to another differs markedly from preventing the importation of disease from abroad; and except for the cooperation of the state health authorities, it could have been efficiently carried out only with great difficulty. The United States has authority over interstate traffic; but the several states have sole jurisdiction over traffic within their borders; and cooperation as to health regulations is essential to the adequate protection of passengers. Through such cooperation, formerly conflicting regulations have been harmonized and agreed upon by the Public Health Service and by twenty states in whole and by most of the other states in part; and this has made travel in the United States relatively safe from the standpoint of health. For instance, drinking water on trains and steamboats, which not so very long ago was obtained almost anywhere and which now and then carried typhoid fever germs, must now be taken from sources that have been examined and certified by the state authorities and the Public Health Service jointly.

Laboratory study of diseases is carried on chiefly by the service; but field work, by which data for the investigation are obtained and the results are often tested, can be carried on successfully only through the cooperation of the states.

In even more essentially cooperative work (rural hygiene, for example) it is difficult to say whether more credit for the great success of a particular work is due to the Public Health Service officer who directs, the state health officers who sustain him, or the citizens of the locality who toil so loyally to put the work across.

During the last twenty years the annual death rate in the United States has dropped for typhoid fever from 35.9 to 9.2 per hundred thousand of the population; for measles from 12.5 to 3.9; for scarlet fever from 10.2 to 2.8; for diphtheria from 43.3 to 14.7; for pneumonia from 180.5 to 123.6; and for all causes from 1,755 to 1,288.

This wonderful improvement in the health of the country is not due to the work of any one organization but to that of all of them. The Public Health Service, in common with many others in the state health services and in private life, has done its part in working out the methods by which this advance has been attained. The service, however, has, perhaps, been a little better able to render help because of its position as a central agency which collected information from everywhere; which trained its officers by sending them (with the cooperation of the state health authorities) to the battle front whenever an epidemic appeared in any state; and which sifted this and all other information that it obtained, digested it, and finally disseminated it so widely by formal printed reports, by newspaper and magazine articles and by radio broadcasts that it could not fail to come to the attention of a great number of workers who could not otherwise have learned of it, some of whom, failing to learn, might have been unable to carry to completion some task that would have fitted into the walls or might even have capped a pinnacle in the great health structure that the workers of to-day are building for the benefit of generations yet to come.

THE GIPSY MOTH THREAT

The New York State College of Forestry

CONFRONTED with the history of forest destruction by the gipsy moth, which in New England is immense in spite of the fact that twenty million dollars have been expended in attempting to control it, the authorities in New York have good reason to be alarmed. Especially is such alarm well founded because year after year the great hoards of gipsy moths of New England have been coming closer to the eastern border of New York. One year the gipsy moths of Massachusetts advanced twenty-five miles westward and in three years they have progressed from the Connecticut River valley to within sight of the Hudson River valley. In fact, they have approached so closely that the authorities in New York are uncertain as to whether or not the pests have actually crossed into the forests of the Empire State.

With much larger forested areas and consequently many times the value of the Massachusetts forests represented in the great wooded areas of New York, the advent of the gipsy moth

in this state would be a much more serious matter than in Massachusetts.

Dr. M. W. Blackman, New York State College of Forestry, Syracuse University, head of the department of forest entomology, a member of the conference on the gipsy moth situation recently held at Ithaca, states that the result of the conference was the recommendation of an appropriation of $150,000 to combat this insect. One hundred thousand dollars of this amount is for the Department of Farms and Markets, to be expended in scouting and control work. The appropriation would enable the scientists to establish a dead line from Lake Champlain south along the Hudson River valley to the beginning of the Palisade section, then southeastward into Connecticut. This dead line would traverse lightly forested areas where the progress of the gipsy moth could be fought to best advantage.

Fifty thousand dollars of the proposed appropriation would be given to the state entomologist for investigative work. Dr. Blackman states that practically all of our hardwood and softwood trees are subject to destruction by the gipsy moth. He predicted that if the dead line in New York was established and sufficient amount of continuous preventative work done each year the eastern invasion of the gipsy moth could be checked and probably would be kept from crossing the dead line.

HELIUM FOR NEW AIRSHIPS

Science Service

A change in the method of operation of the new navy airships, ZR-1 and ZR-3, now approaching completion, is announced by aeronautical experts of the National Advisory Committee and of the Navy Department. Helium will be used instead of hydrogen to hold aloft the big dirigibles which are the first of the rigid type to be used by the United States government. The original plans called for the use of hydrogen gas.

No change in the construction plans of the dirigibles will be made as none will be needed. The lifting power of helium is nine tenths that of hydrogen and the difference may be overcome by the carrying of lighter loads. Helium gas has also two great advantages. It is non-inflammable, reducing to a minimum the danger from fire, and its lifting power does not change with the altitude to the same extent that that of hydrogen does.

Flights to the ends of the earth, the north and the south poles, are declared by aeronautic experts to be perfectly practicable in the near future. Bases may be established in Alaska and Southern Patagonia, from which points the distance to the nearest pole is declared to be well within the cruising radius of the air ships. Even if the gasoline supplying the power were to run low the ship could still be navigated so long as it maintained its buoyancy by making use of the winds. German Zeppelin pilots during the war were adept at such methods.

One of the big dirigibles is being built in Germany as part of German payment of claims of this government growing out of the war, and will be navigated to this country with a German crew. The first landing is expected to be Chicago. The other "ship" is being constructed at Lakehurst, New Jersey.

A SEA-GOING LABORATORY TO REDUCE OCEAN ACCIDENTS

Science Service

AN experimental ship specially fitted for research in marine physics is proposed by Dr. L. V. King, of the National Research Council's Committee on Acoustics, as an important step toward the reduction of the yearly toll of lives and property resulting from preventable accidents at sea. The improvement in the design of aerial and submarine sound generators offers a large field for scientific effort, he said, and the first cost of equipment to make such study would be more than repaid by the lives and property saved.

The installation at the Fire Island Light near New York Harbor of synchronous signaling by radio-telegraph and by submarine sound, he cited as an example of the kind of things which could be done. This apparatus sends out a series of dots automatically through the ether and through the water, the intervals between them corresponding to the time taken for sound to travel, say, one thousand feet. The ship operator has his telephone connected to the aerial and to a hydrophone. If he counts the number of dots reaching the apparatus before the first of those traveling by water reaches his hydrophone, he evidently obtains at once the distance from the source, reckoning one thousand feet per dot. If his ship is also equipped with a wireless direction finder, he knows his exact location and can thus steer a safe course in fog.

THE SPIRAL NEBULAE

Science Service

MISS ISABEL BEVIER, of the U. S. Naval Observatory, writes that spiral nebulæ, those mysterious objects in the sky about which astronomers have engaged in excited controversy for many years, are gigantic "pin wheels" according to the recent researches of Dr. Adrian Van Maanen at the Mt. Wilson Observatory of the Carnegie Institution. He has

observed motion in them similar to that of the familiar decoration of Fourth of July nights, a throwing off of incandescent material from the center outwards in long spirals at a velocity of several hundred miles per second.

As a result of the measurements of the speed at which this material is thrown off, Dr. Van Maanen has derived some conclusions as to the size and distance of these glowing clouds of the starry sky. Some astronomers think that they are complete universes at such a vast distance from ours as to appear to the unaided eye merely as points of light. Dr. Van Maanen believes that he has disproved this theory and shown that the nebulæ are not so far away nor so large as many have supposed.

They are probably only from 3,000 to 30,000 "light years" distant and from 10 to 300 "light years" in diameter, he asserts. To astronomers these are moderate dimensions, as the diameter of our whole universe has been placed at from 30,000 to 300,000 of these units. But to a layman the distances are incomprehensible. A "light year" is the distance light, which travels 186,000 miles in a second, will traverse in a year and amounts to a little less than six million million miles. And at the nearest, these nebulæ are 3,000 light years distant.

The method Dr. Van Maanen used was to compare accurate photographs recently taken of the nebulæ with those taken a decade or more ago and then to measure the distance certain bright spots had moved. Evidence for the "pin wheel" type of motion was clearly shown. Measurements of distance were then made, and as a result the observer concludes that these objects, which are chemically composed of gaseous material heated to incandescence interspersed with stars, are not distant views of independent "island universes" in the abyss of space.

According to the island universe theory the spiral nebulæ are enormous systems of stars and nebulosity intermingled, similar in size and form to our own milky way, but at distances of hundreds of thousands or even millions of light years from it and from our solar system which lies in the Milky Way. At a most conservative estimate the diameter of the Milky Way is approximately thirty thousand light years—according to some astronomers it is ten times as great—so it is evident that the distances and dimensions for the spiral nebulæ required by the island universe theory can not be reconciled with the results of Dr. Van Maanen's investigations.

That no spirals are known to exist in or near the milky way, that they tend to gather in greatest numbers near its poles and also that they are in general receding from the Milky Way at high velocities, are some of the points that have been quoted in favor of the island universe theory. They do not furnish any insurmountable objections to the belief that the spirals are nearer, smaller objects which at most can be only the progenitors of local groups or clusters of stars such as the Hyades or Ursa Major cluster, instead of far distant galaxies. The peculiarities of the spirals, however, that led to the belief that they were island universes still make the origin and nature of these objects an unsolved mystery.

ITEMS

Science Service

By feeding Brown Leghorn chickens dried thyroid glands, Professor Harry Beal Torrey, of the University of Oregon, reports that he has delayed the appearance of normal plumage in the chicks and raised fowls with feathers of different form and color from those fed on ordinary diet. The general color of the poultry which dined on these ductless glands is darker and they did not moult like others of their kind, but the second set of tail feathers grew continuously with the first, apparently pushing out the latter which broke off after a few days. Normally, the first and second set are quite distinct.

To save the little land birds which live only on Laysan Island, a scientific expedition from the Bureau of the U. S. Biological Survey will soon leave for the Hawaiian Archipelago especially equipped to fight rabbits. The multiplication of the prolific bunnies introduced on this once celebrated bird breeding place by a German some years ago threatens to destroy the scanty vegetation of the island. If the vegetation disappears, the rare birds found on this part of the Hawaiian Islands National Bird Reservation will perish. To break this vicious circle, government experts plan to kill off the rabbits. Cooperating in this expedition, which will include other scientific investigations of bird life on the reservation, made up of a dozen or more islands, reefs and shoals which stretch for fifteen hundred miles west of the Hawaiian Archipelago toward Japan, are the Bishop Museum of Honolulu and the American Museum of Natural History of New York. The Navy will furnish a one thousand ton vessel to conduct the scientists to the different islands.

The director of public health of Peru has announced that that country is now free from yellow fever for the first time in its history.

A railroad tunnel 15,700 yards long, which will take about five years to construct, is to be run through Mont Blanc in the Alps.