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EINSTEIN'S NEW THEORY

(By Cable to *Science Service*)

DR. ALBERT EINSTEIN'S new theory, which is about to be published by the Prussian Academy of Sciences, is said to be as exclusively mathematical as was his original theory of relativity and therefore will be comprehensible only to leading experts. But from what little has been given out, the nature of the paper may be inferred.

According to the relativity theory the gravitational effect of a body exercised by its mass is confined to the gravitational field which surrounds it and within which space the body is consecutively affected. Space, consequently, is no absolute independent entity, but exists only in relation to the influencing body. The motion of bodies is not determined by any general force of gravitation drawing them together, but by the properties of gravitational fields, from which their motions can be determined.

Similarly, every electrically charged body is surrounded by an electrical field, the charges and properties of which determine the electrodynamics of the body. These could be derived from the known characteristics of the electrical field.

The older theories used to derive the laws of electrodynamics from hypothetical motions of the smallest particles of mass, thus regarding electrodynamics as a special part of mechanics. Modern physics tried to solve the difficulty by the reverse process, that is, by reducing mechanical changes to electrodynamical causes, regarding the motions of material masses as electrical processes. From this point of view mechanics became a special part of electrodynamics in general.

By the application of the mathematical laws of the gravitational field as developed by the relativity theory, Einstein is said to have settled the above question by applying them to the electrodynamical field, thus uniting both fields under identical laws.

Dr. Edwin E. Slosson, director of *Science Service*, author of "Easy Lessons in Einstein," writes that according to the advance information Einstein has succeeded in devising mathematical formulas which bring under a single set of laws the phenomena of electricity and magnetism with those of gravitation. If so, it will be a great triumph of mathematical genius, for hitherto no scientist has been able to demonstrate such a relationship, although many have attempted to solve this perplexing problem.

The laws of the motion of bodies in the two fields are much alike in form. For instance, Newton's law of gravitation states that two bodies attract one another with a force proportional to their mass and inversely proportional to the square of the distance between them. Two bodies charged with opposite electricities behave in the same way, that is, they attract one another with a force proportional to their charge and inversely proportional to the square of the distance between them.

But there is this important difference between the two cases. It is possible to interpose a screen between two electrified or magnetized bodies that will cut off the force while nothing will interfere with the effect of gravitation. Every radio fan realizes the effect of interposing sheets of metal or grids. But the pull of the sun on the earth acts through 93,000,000 miles of empty space and would act the same if this space were filled with iron or anything else.

Because gravitation acts the same between all bodies regardless of their composition or what is between them, Einstein did away with the idea of a hypothetical pulling "force" of gravitation and simply said that bodies came together because of the peculiar state of the space between them due to their presence and distance. His brief paper of 1915 generalized his theory of relativity of 1905 to include gravitation as well as mechanics and now it appears he has in another five-page paper extended the general theory to cover electricity and magnetism.

VOLCANO ERUPTIONS IN HAWAII

HAWAII may expect an eruption of either Kilauea or Mauna Loa, its two largest volcanoes, in 1929.

This is the prediction made by Dr. Thomas A. Jaggar, director of the Hawaiian Volcano Observatory, maintained by the U. S. Department of the Interior. For many years Dr. Jaggar has kept careful watch on these volcanoes. Upon this study, and the records of volcanic eruptions during the nineteenth century, he bases his prediction.

His past success at predicting these eruptions augurs well for his latest one. "In 1912," he said, "I wrote that Mauna Loa should become active before 1915; it broke out in 1914. In 1917 I wrote that a great crisis in Hawaiian volcanism should come around 1920; both Kilauea and Mauna Loa had flank outflows within the twelve month preceding July 1, 1920, and a great explosive crisis came in 1924. In 1923 I wrote that the nine-year cycle following 1913 would probably be unusually long and representative of the long term intervals such as 1868 and 1790 had illustrated; the 1924 engulfment accompanied by shore collapse at Kapoho was a close parallel to 1868."

Japanese, Italian, Hawaiian and Caribbean volcanoes show that 130 years approximately is a common interval between big eruptions or earthquakes near eruptive centers, or both, he pointed out. However, Vesuvius and Kilauea both show a minor interval of nine or ten years between eruptions, and the larger volcanoes, Etna and Mauna Loa, average their outbreaks at four- or five-year periods.

"It is not permissible to say that Kilauea and Vesuvius will break out every nine years, or Mauna Loa and Etna every four and a half years," Dr. Jaggar stated. "A volcano is not a clock. The interval theory is based on averages, and the averages are based on certain laws of

nature such as those that determine the space intervals of ripple marks in the sands of the sea or the time intervals of waves when they break rhythmically on the beach.

"The lava under a volcano has been pressing upward for ages through a crack of a certain size. It has blocked or impeded that crack with its own heap of lava and so has forced itself to adopt a rhythm or interval like the puffs from a steam engine. If it has several vents, these divide responsibility for the interval, and if one vent is low and close to the water-table, while the other is high and far above the ground-water of the island, the probability of explosion is greater for the lower vent. This is because a sudden drop in the lower vent may place the lava column below the water-table and so develop a steam-chamber. This is the situation of Kilauea as compared with Mauna Loa."

THE EROSION OF SOILS

MILLIONS of acres of good farm land have already been laid waste, and many other millions severely impoverished, by steadily increasing soil erosion in this country, of which we have taken little or no heed.

Testifying before the House Appropriations Committee, H. H. Bennett, of the U. S. Bureau of Chemistry and Soils, made a strong plea for increases in appropriations for this work, stating that though the Budget Bureau had been asked to allot $40,000 to the Bureau of Chemistry and $40,000 to the Bureau of Public Roads, as increases, there had been no increases, excepting a little over $2,000 for the Bureau of Public Roads.

The Appropriations Committee, however, did not allow any further increases, and the bill as passed by the House recently carried the usual $10,085 for soil erosion work by the Bureau of Chemistry, and $9,000 for such work by the Bureau of Public Roads. The bill is now before the Senate. Mr. Bennett said that in the Piedmont region, extending from New York to Central Alabama, which has been in cultivation a long time, fully 65 per cent. of the 47,000,000 acres comprising this area had lost its top soil.

"This means that farmers are now operating on subsoil, which requires much heavier fertilization, about 400 to 800 pounds per acre for cotton, whereas about 200 pounds formerly produced the same amount of cotton."

About 10 to 12 per cent. of this land has also lost its subsoil, he said. "In South Carolina, in Fairfield County, 93,000 acres of land formerly cultivated, and considered as good soil, have been mapped as rough gullied land permanently destroyed. The gullies ramify the countryside in all directions. In thousands of places rock is exposed." Between Baton Rouge, La., and extending up the Missouri River to South Dakota, and up the Mississippi River to central Wisconsin, there are ten to forty thousand acres which have been permanently destroyed. "In several counties in northwestern Mississippi and western Tennessee," he said, "agriculture has been almost driven out of the uplands. These counties have suffered so from erosion the farmers have been driven into the stream bottoms to cultivate soil.

"In northeastern Kansas, the Missouri River loessial belt, where lies some of our finest farm land, along with large similar areas in southeastern Nebraska, western Iowa, and in northwestern Missouri, we found last year, as a result of a single rainy period, that 40 tons of soil had been removed per acre from numerous fields in that region.

"The grain was washed out also. The soil went down the slopes, making little gullies in each depression made by the drill. Some of these washes were 2 or 3 feet in places. Absolutely nothing is being done in that region to stop this, while much is being done to accentuate it.

"Gully erosion has destroyed large areas in this country, more than 10,000,000 acres, and this is but an insignificant part of the damage that is being done. The really serious damage is the slow erosion that we have termed sheet erosion, because it slowly takes off part of the topsoil, the most fertile soil, during every rain that is heavy enough to cause water to run downhill.

"The farmer never notices it until clay and rock begin to appear through his fields. His acreage yield begins to fail, and he ascribes it to exhaustion of plant food in the crops taken off."

It is difficult to find places where there is no erosion. Dr. Bennett went through Iowa and others of the central states last year and found on many slopes that have not even been cultivated for a generation that the soil has been greatly thinned down and in many places the subsoil is exposed. The subsoil once exposed goes faster than the soil went. When the subsoil is removed, the land is down to bed-rock.

There is a small state experimental station at Spur, Texas, which is dealing with methods of combatting soil erosion. They are studying cropping systems in relation to erosion, and the effectiveness of terracing, and are doing much good work. "This little station is the first comprehensive soil erosion station in the history of the world. Yet some nations have disappeared from the earth as a result of soil erosion." Results of terracing at this station, Mr. Bennett said, had prevented 24 to 42 tons of soil per acre per year from being washed off, and the conservation of the rainfall and the prevention of the run-off, had increased the yield of cotton and alfalfa by 14 to 42 per cent.

If farmers were taught to prevent run-off, Bennett believes, it would be a big step in flood control, as the soil added to swollen streams increases the volume. As things are going now, "in a little while the bulk of our rolling lands will have been ruined or so severely impoverished that they can maintain only a peasant type of farming."

SWEETENING FROM CORN-COBS

A COMPOUND about 300 times as sweet as sugar has been evolved from corn-cobs by Dr. Henry Gilman and A. P. Hewlett, organic chemists at Iowa State College. Should this new compound prove to be harmless to the body it may become valuable as a sweetening for food for diabetic patients who can not use sugar. The work is in a preliminary stage and the value of the new compound is undetermined, according to Dr. Gilman.

Perhaps perfume bottles and household extract bottles in the future will be filled with compounds derived from corn-cobs. During the past year Dr. Gilman and George

Wright have produced from the corn-cob many new compounds which may prove valuable as perfumes and food flavors. Although physiological reactions of the new compounds have not been thoroughly determined early tests have been promising. Most of these compounds possess fruity, pleasant odors, while one especially promising compound may possibly be used for maple or walnut flavoring or as an added flavoring for coffee. Raisin, caraway and apple flavors also have been produced. One compound, a perfume possibility, has an odor resembling champaca, a heavy, fragrant perfume made from the flowers of an East Indian tree, while another compound has the fragrance of roses.

The work with corn-cobs is a part of the work with agricultural wastes being done at Iowa State College. At a recent exposition in New York a local anesthetic, the hydrochloride of diethylaminoethyl-beta-furylacrylate, developed by Dr. Gilman and associates, was shown. This anesthetic, prepared from corn-cob material, is approximately as effective as novocaine.

AMERICAN PLANTS IN THE SOUTH SEA ISLANDS

SEEDS of American plants, or parts of plants with the seeds still clinging to them, probably made a long emigrant voyage southward by water millions of years ago, and their descendants are still growing in the islands of the South Seas.

This is the picture presented by Dr. Forest B. H. Brown, botanist of the Bernice P. Bishop Museum of Honolulu, as a result of his studies on plants of the dogwood family growing in the Marquesas and neighboring islands. The route would be impossible to-day, for ocean currents do not set southward from the Gulf of Mexico, and Central America and the Isthmus of Panama bar the way into the Pacific. But during Cretaceous times, when dinosaurs still walked the earth, there was open sea where the land link now binds the continents together, and Dr. Brown is of the opinion that much seed-bearing plant material then drifted down the Mississippi, across the Gulf, through this strait and so into their great adventure southward.

Such a voyage route would account, in the opinion of Dr. Brown, for the presence on the island of Rapa of the plant known as Lautea, which is a primitive relative of the American dogwoods and the only representative of its family ever found in the South Pacific islands. The American members of the family that stayed at home have evolved into more advanced forms, but fossils have been found in New Jersey that prove the presence of Lautea-like forms here some forty millions of years ago.

Associated with this far-from-home dogwood are other primitive plants, including a creeping fern, which are abundantly represented in American fossil beds of Cretaceous age, distributed all the way from Greenland to the Gulf of Mexico.

ROUTES OF MIGRATING BIRDS

BIRDS flying north in spring, after sojourning in their favorite winter resorts, are as much given to travel over habitual "trunk lines" as human tourists are. And when they arrive at customary junction points they will take branch lines for the last stages of their journey. So J. T. Nichols, of the American Museum of Natural History, stated before the meeting of the Linnean Society of New York.

An excellent example of this trunk line travel can be found along the Atlantic coastal plain. Birds bound southward for the winter fly down this level stretch as far as Georgia or Florida before branching off for South America or the West Indies, just as many tourists travel by rail to Jacksonville or Key West before boarding their steamers. And when the birds return in spring they fly straight to the New York region, where one stream detaches itself and follows the shoreline of Long Island Sound, just as some railway tracks do.

Why birds migrate has been a matter of discussion and debate ever since there has been such a thing as natural history, but, Mr. Nichols said, the underlying reasons are still very little understood. It seems clear that the impulse to move is active in each bird individually, and that it is not merely a matter of following the movements of a flock leader. The nature of this internal impulse, however, is still a mystery. It may have something to do with a long-period change in glandular activity, or quite possibly it may be the result of a change in the length of the days at the turn of the season.

What advantage there may be for migrating species in the long, laborious yearly flights is also more or less a matter of debate. The explanation may be sought in the great fluctuation in the supply of food, from a very low point in the snowy season to a high one in summer, combined with the longer working day in northern latitudes, enabling the parent birds to forage for their offspring several hours longer than they could in the tropics.

INSECTS AS LEPROSY CARRIERS

ANOTHER grave charge may be laid at the door of the mosquito, already held responsible for the transmission of yellow fever and malaria. This pest, and its brothers in iniquity, flies, fleas, bedbugs and lice, are being considered as possible carriers of leprosy. If this theory proves to be true, it may mean that leprosy, which has plagued man since Biblical times, can be wiped out completely. Studies are now being carried on at Manila by the U. S. Army Medical Department Research Board on the rôle of the mosquito in leprosy transmission.

In these experiments an attempt is made to transmit leprosy by mosquitoes. Medical journals carry the records of several previous experiments in which attempts to transmit leprosy to animals or men were unsuccessful. In only one instance was leprosy transmitted to man. For the present studies, volunteers, prisoners serving long terms, were selected with the permission of the late Governor-General Wood. Mosquitoes were allowed to feed on lesions of leprosy patients and then to bite the healthy volunteers who were free from leprosy. Sixteen months later, the volunteers were still free from leprosy. This not long enough to rule out the possibility of leprosy developing. However, the volunteers may not be

susceptible to the disease. The studies, begun under the direction of Lieutenant-Colonel Edward B. Vedder, Medical Corps, U. S. A., are being continued by his successor at Manila.

The theory of insect transmission seems the only one that satisfactorily explains how men become infected with the disease. Contact is not a satisfactory explanation, as very many instances are reported of married couples one of whom had leprosy living together for years without the other one acquiring the disease. Climate and density of population have been thought to have some connection, but they alone can not be the reason for the spread of leprosy, Lieutenant-Colonel Vedder showed by a comparative study of these factors with the incidence of leprosy in the Philippines.

The fact that insects do not always acquire *lepra bacilli* from feeding on leprosy patients, and that in the rare instances when they do get these organisms they do not always immediately bite a well person may explain why leprosy is not universal even in countries where it is always prevalent.

THE HOOF-AND-MOUTH DISEASE IN CALIFORNIA

THE recent threatened outbreak of hoof-and-mouth disease at Whittier, Calif., which necessitated the destruction of a drove of swine, has put officials of the U. S. Department of Agriculture on the alert, and any sign of a new outbreak will be followed instantly by rigorous suppressive measures. The slaughter of whole herds of animals may seem a stiff price to pay for American freedom from this terrible Old-World plague, but it is the only means so far known to stop its spread. The disease is so freely and rapidly contagious that usually a whole herd will be infected before any cases are brought to the attention of the authorities, and then nothing but wholesale shooting and burning or burial will stop the epidemic.

In Europe, where the disease is long-established and pandemic, the radical treatment employed in this country would be of no use; they simply have to stand their losses as best they can, and take remedial measures even though these have comparatively small success. Several serum treatments have been devised, but so far none has shown definite curative value, and the immunity conferred by preventive serums is only partial and does not last long. It is because of this apparent incurability that American authorities are willing to resort to what looks like sheer massacre whenever farm animals begin to show the telltale lameness and sore mouths. Better that a few beasts should die than that all the cattle perish.

The last outbreak of hoof-and-mouth disease in California, three years ago, had a sequel that at first looked exceedingly alarming. Deer in the Stanislaus National Forest contracted the infection, and the proposal to use the same methods there that were employed on farms and ranches met with loud opposition from sportsmen and from some conservationists. But the agricultural authorities insisted and in the end had their way. It cost the lives of between 22,000 and 23,000 deer, but in the end the epidemic was stamped out.

ITEMS

DISCOVERY that the Schwassman-Wachmann comet, located by German astronomers, is not a new visitor but a periodic one, that returns to the region of the earth and sun once every six years and ten months, is announced at the Yerkes Observatory of the University of Chicago. From the study of photographic plates of the comet made with one of the observatory's large telescopes, Dr. George Van Biesbroeck and C. Y. Chang have computed its orbit. The comet is still visible through large telescopes, but it is receding from the earth. Though it came near the sun in 1922, and doubtless on earlier occasions as well, it appears that it has never been observed before.

THE molar teeth of a mastodon, together with fragments of a tusk and pieces of ribs and other bones, have been found 22 feet beneath the ground level, near Menlo Park, California, about 28 miles southeast of San Francisco. Dr. Eliot Blackwelder, geologist of Stanford University, has reported the find to the *Journal* of the Washington Academy of Sciences. With the exception of one of the teeth, the bones have all been placed in the university museum. Because a human skull was found buried under the Stanford campus some years ago, at about the same depth, Dr. Blackwelder hints at a possible great age for this relic, saying, "The suggestion of contemporaneity is not to be lightly dismissed." However, Dr. J. W. Gidley, of the U. S. National Museum, is inclined to look somewhat askance on a human skull claiming to be so old. "If this mastodon is of late Miocene or early Pliocene age, as Dr. Blackwelder says it is, that sets it back some two or three million years. And we have as yet no evidence that man has been on earth that long."

A LOCALITY is wanted that has not been touched by the influenza epidemic, where absolutely no cases of flu have occurred. If such a place can be found, it could be used by the U. S. Public Health Service for studies on the disease. A serious difficulty encountered in previous influenza research has been the impossibility of securing absolute control conditions. Only where there are persons who have not had or been exposed to influenza is it possible to judge accurately the results of experiments on transmission of the disease, immunity, etc. Meanwhile, preparations are under way at the Hygienic Laboratory for other studies of the disease. Statistical studies will also begin soon. As soon as the epidemic is over, house-to-house canvasses will be made in various cities to determine the proportion of people affected.

A NATIVE source for camphor, important in both medicine and manufacturing, has been discovered in a species of wormwood that grows on the sandy steppes of the Government of Astrakhan. An oil extracted from this plant has been subjected to experiments at the Saratow experiment station, and was found to yield a good quality of camphor. The crystals differ in their physical properties from those of camphor obtained from camphor trees, but chemically they are identical with it.