

PHYSICS

Variations in Light Speed Not Accepted by Scientists

Dr. Adams Holds Variation Conceivable Only as Last Resort And Not Established by Results of Recent Experiments

Variations in the speed of light are not accepted by Carnegie Institution scientists, on the basis of recently announced results. The discrepancies in the instrumental readings must find their explanations elsewhere. Dr. Walter S. Adams, director of the Mount Wilson Observatory, where the late Prof. A. A. Michelson prepared the latest light-velocity experiments, indicated this in an exclusive statement to Science Service.

"The last hypothesis to be adopted is that the velocity of light varies," said Dr. Adams. "If a man knows accurately when the sun should set but observes that according to his watch it sets five minutes ahead of time, a logical person does not assume that the motion of the sun varies but that his watch is wrong."

By DR. WALTER S. ADAMS, Director, Mount Wilson Observatory

THE LATEST average value of the velocity of light, which will doubtless be accepted as the world standard, is announced by the scientists of the Mount Wilson Observatory of the Carnegie Institution of Washington as 299,774 kilometers (186,276 miles) per second. Further analysis of the observations may change the last figure by one or two units. This value compares with the Michelson 1926 result of 299,796 kilometers per second obtained as the result of observing the passage of light between two mountain peaks in California. The new value is 22 kilometers per second (or seven thousandths of one per cent.) lower than the old value.

Certain unexplained variations which exceed considerably the experimental error of measurement have been found in the course of the observations. One of these had for a time a period of $14\frac{3}{4}$ days and another a long period of about one year, but neither period persisted throughout the entire series. The range of variation in each case was about 20 kilometers (12 miles) per second.

The cause of such apparent variations is first of all to be sought in instrumental sources, in possible changes in the

apparatus, the length of the light-path, ground disturbances, errors in the timing mechanism or a possible effect of refractive index in the path of light. The precision required in this difficult experiment is extraordinarily high. It is only as a last resort that we should have recourse to the hypothesis that the velocity of light actually varies. We have long believed this to be a fundamental constant of nature and although a variation is conceivable it is not established by these results.

The present investigation was carried on by Dr. Francis G. Pease of the Mount Wilson Observatory and Fred Pearson of the University of Chicago, working with the mile-long vacuum pipe line at the Irvine Ranch, Santa Ana, California. The apparatus was designed and first used by the late Prof. A. A. Michelson. Although yielding a value for the velocity of light of extraordinarily high accuracy it can hardly settle questions involving quantities of such a minute order as those here considered. For such an investigation it would be desirable to have quartz mirrors, a much more stable pipe-line and



MEASURED LIGHT

The mile-long vacuum tube used in the Michelson velocity of light experiment at Santa Ana, Calif., is shown above. The inset pictures the 32-sided rotating mirror which flashed light into the tube.

elaborate timing devices.

Recent determinations of the velocity of light have shown a tendency toward slightly smaller values. It does not seem necessary, however, to ascribe this to other than coincidence, especially since many of the individual values in the different series of observations frequently overlap another widely.

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SOCIOLOGY

More War in World As Civilization Advances

WAR HAS been growing more and more common, not less, as the world has grown older and civilization has (presumably) advanced.

This discouraging but fact-facing conclusion was laid before the meeting of the American Association for the Advancement of Science, by Prof. Pitirim A. Sorokin and Lieut.-Gen. N. N. Golovin of the Harvard University department of sociology.

The two men tried to get a quantitative expression of the warlikeness of the world in each century from the twelfth

onward, for Central Europe, England, France and Russia; and from the sixteenth century onward they added the Netherlands, Spain, Italy and Germany. Admitting from the outset that their results could be only rough preliminary approximations, they assigned numerical values to such factors as size of armies, proportion of losses, numbers of nations involved and duration of the conflicts. Statistically manipulated, these figures yielded "index numbers" for the many wars the world has seen through the centuries. (Turn Page)

The grand total of these index numbers, for all eight nations studied, shows a progressive increase from the twelfth century, when the number was 2.7, doubling or more than doubling for each century until the seventeenth, when it had risen to 519.4. The eighteenth century, with an index number of 567.5, showed little increase, and during the nineteenth century the number actually fell to 318.9. But the twentieth century, with the World War and its smaller forerunners involving scores of nations, tens of millions of soldiers and millions of deaths, raised the index number to the appalling level of 13,736.0.

Dr. Sorokin and Gen. Golovin regard all wars before the seventeenth century as "comparatively insignificant"; but since that time things have become progressively worse. Even the nineteenth century, with its recession

from the preceding high points of the seventeenth and eighteenth centuries, was more than a hundred times worse than the "barbarous" Middle Ages so far as war was concerned.

"This refutes the theories," they commented, "that war tends to disappear with the progress of civilization. It means also that the commendable hopes that war will disappear in the near future are based on nothing more than wishes and a belief in miracles."

The two investigators could find no marked trend, cycle or periodicity in the occurrence of European wars, though there was some indication of such periodicity in three countries: Germany, Italy, and Russia. In all probability, they suggested, this "trendless" or erratic oscillation in the occurrence and intensity of war will continue indefinitely.

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ARCHAEOLOGY

95-Room House Unearthed In Lost City by CCC Workers

By M. R. HARRINGTON, of the Southwest Museum, in charge of the Lost City Project

CIVILIAN Conservation Corps boys, excavating ruins of the Lost City of the Moapa Valley which will soon be flooded by waters of Boulder Dam, have uncovered an ancient ruined building containing 95 rooms. It seems to have been the largest building in the Lost City, and is probably the largest structure of the Early Pueblo Period known. Its age is estimated at 1,200 to 1,500 years.

Most of the 95 rooms were small, some too small for a human being to live in. These latter were doubtless for storage. The larger rooms, many provided with fireplaces, were living rooms.

Strangely enough, the rambling, one-story structure had been three times destroyed and twice rebuilt. This is shown by three layers of ruined rooms, piled one above the other. Some time after the final rebuilding the occupants left for good. The roofs fell in and the adobe walls crumbled. Desert winds piled drift sand into a large sand dune over the spot.

To uncover the ruins, the CCC boys had to remove not only six feet or so of sand but thick growth of thorny mes-

quite bushes. (A worker is pictured on the opposite page.) None of the walls stands higher than three or four feet. They are of adobe clay or adobe with layers of stone between.

Finger marks which have remained in the adobe more than a thousand years were found. These were inprinted when some builder who must have been in a hurry laid on a course before the last one was dry. The adobe was squeezed out of shape by the weight above, and had to be pushed back with the fingers.

The excavators have found many articles, lost or abandoned when the inhabitants left their homes for the last time. Largest of these are metates, or grinding slabs for corn, and manos or hand-stones used with them. The smallest articles are grains of charred corn and tiny beads of shell. There are bushels of broken pottery, some with painted designs in black and white or black and red. An occasional jar or bowl is whole or restorable.

Among the most curious things found were a number of crude clay dolls, all broken. Most of them were in one place, in the main patio. Is it a question whether these were children's toys or were used in some ceremony.

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PHYSIOLOGY

New Protein-Digesting Enzyme Found in Pancreas

DISCOVERY of a powerful protein-digesting enzyme in the pancreas has just been announced by Drs. M. Kunitz and John H. Northrop of the Rockefeller Institute Laboratories in a report to *Science*.

The new enzyme, for which the name chymo-trypsin is suggested, was obtained by the action of minute amounts of the well-known pancreatic enzyme, trypsin, on crystals of a protein substance which Drs. Kunitz and Northrop obtained from fresh pancreas tissues. The newly-found protein they call chymo-trypsinogen.

The new enzyme, chymo-trypsin, is quite distinct from trypsin and except in its power to clot milk, its digestive activity is much less than that of trypsin.

The significance of the discovery lies in the fact that it gives new knowledge of how pancreatic enzymes or ferments become active, a matter that has never been agreed upon by scientists. It has long been known that these enzymes are not active in fresh pancreas or in freshly secreted pancreatic juice. They are activated by the action of a ferment from another part of the digestive tract. Since the new enzyme was obtained from apparently pure protein material, it seems to Drs. Kunitz and Northrop that the protein-digesting action of this and perhaps also of the other pancreatic enzymes is a property of the protein molecule.

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ENGINEERING

Unemployed Engineers Begin Aerial Mapping

PUTTING a large number of unemployed engineers and assistants quickly to work on an aerial mapping project that promises to be highly valuable to many Governmental agencies—this is the goal of a new Civil Works Administration Program.

Airplanes will soon be flying over selected agricultural agencies in ten southern states, while cameras take overhead views of farms and fields. On the ground below, groups of workers will chain off individual properties and plot to scale the results shown on the air pictures. Fitted together, the air photographs will then form a great mosaic picture map of the land.