PHYSICS

Experiments Favor Einstein

Midnight balloon ascensions a mile and a half high made recently in Belgium may prove to be strong evidence in favor of Einstein's theory of relativity, and contrary to the results obtained by Dr. Dayton C. Miller, of the Case School of Applied Science at Cleveland, working at the Mt. Wilson Observatory in California, which were supposed by some authorities to be fatal to the German's theory. These balloon experiments, just published, were made by Prof. A. Piccard and Dr. E. Stahel, of the University of Brussels.

They were a repetition of the Michelson-Morley experiment, named after the physicists who first performed it many years ago. This was intended to show whether or not the earth, on account of its motion, was drifting through the ether, which was supposed to permeate all space, and to be the medium in which light waves vibrate. When first performed, an almost negligible result was obtained. It was partly in an effort to explain this unexpected result that the theory of relativity was formulated. When repeated last year by Dr. Dayton C. Miller, of the Case School of Applied Science, Cleveland, working at the Mt. Wilson Observatory in California, a mile above sea level, an apparent effect was found. While this was not as great as had been originally expected, Dr. Miller said that it could be explained by a motion of the sun, and the earth with it, towards the constellation of the Dragon, at a speed of over a hundred miles a second. This was antagonistic to the relativity theory.

In the new work, the Michelson-Morley experiment was repeated at sea level and from a balloon. A somewhat modified form of apparatus was used, in which the records were made on a photographic film, instead of by the eye, as in Miller's apparatus. As it is necessary to turn the apparatus while the experiment is in progress, so that it successively points in different directions, this was accomplished by providing the balloon with two small electrically operated propellors, turning the entire balloon about two or three times a minute. The illumination of the apparatus, which must be furnished by light of a single color, was obtained from the blue radiation of a mercury vapor lamp.

From measurements of the photographic records, it was found that there was an apparent ether drift of about four and a third miles a second. However, as the thermostat controls of the apparatus, intended to keep it at a constant temperature were designed to work with the thermometer below freezing, and since unexpectedly higher temperatures were found the night of the ascent, the results may be in error by an amount as great as the value found. However, it was stated, they show that the value of the ether drift does not increase, the higher above the earth the observations are made, which was the chief point of antagonism with the relativity theory.

What is said to be another new point in favor of the validity of Einstein's theory of relativity is contained in a series of experiments recently completed by Dr. Roy J. Kennedy, of the California Institute of Technology, at Pasadena, and which have just been reported to the National Academy of Sciences.

Dr. Kennedy has also repeated the Michelson-Morley experiment with an improved form of apparatus, in which the beam of light, which is divided into two parts and then recombined, causing alternate light and dark "interference" bands, travels only about 13 feet, instead of more than 200 feet as in Miller's apparatus. The effect sought for is measured by means of a shift in these interference bands as the apparatus is pointed in different directions. With the instrument used by Dr. Miller, says Dr. Kennedy, a difference in pressure of a twenty-five thousandth of a pound per square inch in the air through which the two parts of the divided beam pass, would produce an effect as great as that observed. A temperature difference of a five-hundredth of a degree Fahrenheit would produce the same effect, he stated.

As Dr. Kennedy's light path was so much shorter, there was much less chance of such error, and the entire apparatus was small enough to be completely enclosed in a sealed metal case containing helium gas, which was at atmospheric pressure. This prevented circulation of the air, and any difference in pressure or temperature in different parts of the apparatus. By means of an improvement in the way of observing the interference bands, the instrument is as sensitive as Dr. Miller's despite the shorter light path. However, though "a shift as small as one-fourth that corresponding to Miller's would be perceived," said Dr. Kennedy, "the result was perfectly definite. There was no sign of a shift depending on the orientation. Because an ether drift might conceivably depend on altitude, the experiment was repeated at the Mt. Wilson Observatory, in the 100-inch telescope building. Here again the effect was null."

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GENERAL SCIENCE

The Importance of Research

Extract from a speech delivered by Secretary of Commerce Herbert Hoover at a banquet to celebrate the 25th anniversary of the founding of the U. S. Bureau of Standards, December 4, 1926.

I am impressed with the fact that we are a people of 110,000,000 on a continent where we have already developed the large proportion of our national resources, a population growing at a rate that we must face in the next fifty years, doubling up to perhaps two hundred million people. We must face the solemn economic fact that unless we develop through science the greater utility of our resources, expand by discovery their usefulness, we can not maintain the standards of living of that vast increment of population to those standards that we now enjoy.

Dr. Malthus a century ago brought forth a theory, with which you are all familiar, that an increase of population would be met with pressure on subsistence which would defeat its own purpose. The Malthusian doctrine has not proved true. It has not proved true due solely to the development of science and the discovery of its applications, and today we are just in that same race of population and science. It is only through the support of agencies of this character, and hundreds of other institutions engaged in scientific research, that we may expect with confidence that as our population grows we can still add this increment of comfort and luxury which we have enjoyed in the last century.

But science has more to it. It stands for far greater things than purely material benefits. Research, development and engagement in science is an engagement in the elaboration of truth, the discovery of truth. It is a process of improvement in the veracity of man and precision of thought, and those indeed are spiritual benefits for from the truth, the development and science of truth in our people, must come an appreciation of those things that lie in the realms of the imponderable and that lie out of the range of the material in life.

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A battery of three-inch anti-aircraft guns can fire 60 shells a mniute.

Goats, cattle, and horses are known to eat poison ivy without ill effects.