How Michelson Supports Einstein

Physics

When Prof. A. A. Michelson, of the University of Chicago, announced at the recent meeting of the American Optical Society the latest results of his work on ether drift, he returned to one of his first and most famous researches. He also wrote the latest chapter in a history which he began, and in which the theory of relativity, that made famous the name of Einstein, plays an important part.

It was in 1887 that Prof. Michelson, then at the Case School of Applied Science in Cleveland, collaborated with his colleague, Prof. E. W. Morley, in performing the now classical Michelson - Morley experiment. Up to that time scientists were generally agreed in supposing that light waves travelled through a queer medium which pervaded all space, and which was called the ether. If the ether was in all space, then it should be possible to detect the earth's motion through it. The earth travels around in its orbit at a speed of about 20 miles per second. If a beam of light is divided into two parts, then sent in directions at right angles to each other, reflected from two mirrors back and recombined, light and dark bands may appear. These are due to the light waves getting tangled up, and interfering, and so are called interference bands.

If one beam of light has to travel a little farther than the other, the bands are moved and so the method affords a very delicate means of measuring minute displacements. In one form this interferometer has proved a valuable scientific measuring instru-over the center of the instrument.

Motion through an ether would produce the same effect as a lengthening of one of the beams, and so would theoretically cause a shift in the fringes, depending on the direction of the light paths with respect to the earth's motion. Prof. Michelson and Prof. Morley tried the experiment, but found an effect far less than that expected. So small was it that they attributed it to unavoidable errors.

Then physicists began to search around for some explanation of why this effect did not occur. The Dutchman, Prof. H. A. Lorentz, proposed what is now termed the Lorentz-Fitzgerald contraction. This was that motion through space produces an actual shrinkage of physical objects, which would just balance the effect sought for. As all measuring sticks would be similarly affected, it would be impossible to detect this contraction. Finally, as a further development of these ideas, Einstein proposed his preliminary theory of relativity in 1905, followed by his general theory in 1915.

In the ten years after the publication of Einstein's paper, the three "proofs" of the theory that he suggested were all successful. One was the explanation of the strange behavior of the orbit of the planet Mercury. Another was the bending of light waves as they passed near the sun, shown by observations made during solar eclipses. The third was the shift in the lines of the sun's spectrum when compared with spectra of light from terrestrial sources. Accordingly, the relativity theory was placed on just about as firm a foundation as a theory could be.

But a difficulty appeared in 1925. Dr. Dayton C. Miller, professor of physics at the Case School of Applied Science, where Michelson had first performed his experiment, tried it again. Miller obtained small effects, less than had originally been expected, but apparently definite and consistent. They seemed to show a motion of the earth towards part of the sky near the constellation of Lyra. As astronomers actually recognize the existence of such a motion, the results seemed rather convincing.

Though efforts were made at the time to get Prof. Michelson to comment on this result, surprising to science because it did show an effect, he said nothing. However, he was not satisfied with the situation so he set out to repeat the experiment himself.

No one questioned the accuracy of the original Michelson-Morley experiment. Prof. Miller pointed out that Michelson had obtained a slight effect, attributed to experimental errors, and that it was genuine. Still Prof. Michelson said nothing, but continued his preparations to repeat the experiment on a far more accurate scale than ever before. If he still obtained the small effect, it would be obvious that it was real, but if it were eliminated or greatly reduced, then it would be apparent that in originally attributing it to (*Turn to next page*)

Appalachian Quakes

Seismology

The earthquakes of eastern Tennessee and western North and South Carolina which occurred recently belong to a family of quakes that are well known to seismologists. Though some of these quakes have been severe and felt over wide areas, on the whole they are not especially dangerous, said Commander N. H. Heck, of the Division of Terrestrial Magnetism and Seismology of the U. S. Coast and Geodetic Survey.

"In this respect they differ from the California quakes," he said. "On the Pacific coast the quakes are centered near the surface of the ground, where the damage may be severe, though the shock is not always felt over a very wide area. In the case of the quakes of Tennessee and North and South Carolina, they seem to be very deep. They may be very severe at their centers, and so are felt over a large area, but they are so far from the earth's surface that the damage is ordinarily rather slight.

"These quakes are associated with the Appalachian Mountains, and seem to show that these mountains, from Virginia to Alabama, are still in the process of adjustment. They are quite different in character from the quakes that sometimes occur along the Atlantic Coast, like the famous Charleston quake of 1886. This was a real major earthquake. A different type of earthquake also occurs sometimes in western Tennessee, characteristic of the Mississippi Valley. In the middle of Tennessee, earthquakes are uncommon."

One of the first quakes recorded in this series was in 1874. It was centered in MacDowell County, North Carolina, near Stone Mountain, but was quite local in character. On January 1, 1913, there was one centered in Union County, South Carolina, which was felt over an area of 40,000 square miles. Later in the same year, on March 28, and on April 17, Knoxville experienced shocks, but neither of these was severe.

The most important of the series was on February 21, 1916, and was centered near Skyland, North Carolina. This was felt over an area of 200,000 square miles. Like the others, there was no very severe damage. At Sevierville, Tenn., for instance, some bricks were knocked from chimneys. This seems to have been typical of the damage.

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