PHYSICS

Harvard Scientist Measures Speed of Light Automatically

New Light Speedometer Can Measure Velocity With Error of Less Than Two and Half Miles a Second

A HARVARD physicist has solved a three-century-old problem of science, how to measure automatically the fastest thing in the universe—the speed of light.

The ultimate velocity of about 186,000 miles per second has been measured by Dr. Wilmer C. Anderson, research fellow, by crimping the light beam with "permanent waves," 19,200,000 of them per second.

This new light-speedometer is the first which has not required visual observation by the human eye, and which has eliminated friction as a possible source of error. It can measure light-velocity with an error of less than two and a half miles per second. It is believed the apparatus will give the most accurate measurements of light-speed ever made.

The equipment has been put to work on one of the basic problems of modern physics and astronomy — whether the speed of light is actually constant under all conditions, or whether it varies. Although many important theories are based on the assumption of a constant velocity of light, past measurements have been inconclusive on this point.

In contrast with the large scale of some types of light-speedometers, which have utilized long outdoor tubes, Dr. Anderson's apparatus is contained in a small laboratory room and hallway. Four separate readings of light-speed can be made per minute.

Beam Modulated

The beam of a 1,000-watt projection lamp is passed through a tube which modulates the beam at a frequency of 19.2 megacycles — or in other words makes the beam fluctuate between bright and dim intensity 19,200,000 times a second. Accuracy of the fluctuations is controlled by a standard frequency generator developed by Prof. G. W. Pierce, of Harvard.

With the light issuing from the modulator in waves of known frequency, the main problem is to determine the exact length of the manufactured waves. Velocity is equal to the frequency multiplied by the wavelength.

The fluctuating beam splits at a small sheet of glass held across the path. One side goes up and down a hallway system of mirrors a distance of about 185 yards. This long path is fixed, and its length is known to fifteen thousandths of an inch. The other half of the beam is sent over a shorter path, about two yards long, whose length is slowly varied during the velocity measurement. Each half of the beam has the same waveform, or light to dark fluctuations, as the original.

After traveling their different paths, the two halves of the light beam are recombined and focussed on a special photoelectric cell, a five-stage electron multiplier tube, which translates the light force into electric impulses whose intensity can be easily measured and recorded.

Intensity The Clue

The basic clue to the wavelengths comes from the intensity of the reunited light beam. The intensity depends entirely on the relation between the fluctuations of the two half-beams as they reunite. If the fluctuations coincide—that is, if the bright parts of one beam enter the photocell with the bright parts of the other beam, then the fluctuations of light intensity will be at their greatest. Conversely, if the two beams "cancel" one another—if the bright spots of one enter the cell with the dark spots of the other—then there will be a minimum fluctuation of the light intensity.

By altering the length of the short path slowly and constantly during the recording, by means of a moving mirror, Dr. Anderson is able to determine the exact point at which the light beams cancel one another. At that point it is known that the long-path beam is entering the photocell exactly 23 half-wave lengths behind the short-path beam, or, in other words, that the long light-path is 23 half-wavelengths longer than the short path. Since the lengths of the two paths in meters is very accurately known, determination of the wavelength of the light waves becomes a matter of simple mathematics. Dr. Anderson has spent three years perfecting the equipment, financed in part by the Carnegie Institution of Washington.

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ANTHROPOLOGY

New Guinea Natives To Be Eased Into Civilization

NATIVES of the Dutch portion of New Guinea may not know it, but they are likely to be eased into civilization.

The mountainous interior of their island home has of late become attractive to mineral prospectors. Airplanes have been called into service to get over the coastal jungle. To the Dutch government, it seemed that the head-hunting natives of the coast, and more especially the gentler, farming groups of the interior, needed protection against too sharp contact with all this machine culture.

So, the Netherlands Committee for International Nature Protection appointed a sub-committee to plan for these Papuan natives. Their report is now ready.

Two ways of safeguarding the natives seemed possible. One was to herd them apart on a reservation like curious permanent exhibits. The other was to prepare them gradually for the changed world which their island will inevitably become. The latter course, being chosen, now awaits approval of Dutch colonial officials.

The plan calls for three stages of transition. It will use missions and mission schools to teach the natives. It will introduce economic improvements. Ultimately, the natives are expected to cooperate with the Dutch government like other colonials.

Efforts to avoid well-known problems that arise in such situations can be seen in the recommendations. Suggestions include: Sufficient farm land should be reserved for the natives. Medical safeguards should keep out diseases. Eastern immigrants should be barred from native reserves. Importation of drugs and alcohol should be forbidden. Natives employed by companies should be protected by regulations. And, more important than it looks—importation and sale of yard goods to natives should be prohibited, lest they be tempted away from their suitable native clothing. This is a health measure, based on Australian experience.

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