# SCIENCE NEWS

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## THE WASHINGTON MEETINGS OF PHYSICISTS

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### AN ULTRAMICROMETER

SCIENCE'S first chance to make measurements directly of individual atoms promises to come from a new ultra-precise measuring instrument.

An electric ultramicrometer capable of detecting displacements of less than a billionth of an inch with an accuracy to a few per cent. was described at the American Physical Society meeting at Washington by Professor J. C. Hubbard, of the Johns Hopkins University. It is believed the apparatus will be applicable to studies of atoms by direct observation.

The detecting apparatus is an electrical circuit containing a quartz plate resonator roughly similar to those used in broadcast transmitters for controlling the frequency of radio signals. The quartz plate, in the fashion used by Professor Hubbard, is extremely sensitive to small frequency changes. "A number of applications of this sensitivity to frequency variation suggest themselves, perhaps the most interesting applying to measurement of small displacements of an ultramicrometer plate in the exciting circuit."

Displacements of $10^{-9}$ cms (less than a billionth of an inch) have been measured to a few per cent., the accuracy depending upon the absence of mechanical disturbances. By suitable mechanical insulation it is expected that displacements less than one ten-billionth of an inch may be measured. "Such distances," Professor Hubbard explained, "being much smaller than the dimensions of individual atoms, it is believed that a number of problems of great interest in atomic and molecular physics will now be open to study by direct observation."

### A NEW TYPE AIRPLANE VIBRATION

A severe type of vibration, of a kind hitherto unknown in airplanes, has been discovered in a fast, high-performance combat plane of the Nation's air forces. The cure for the vibrations—which "rattle the pilot's teeth"—has already been found and should result in improved pilot operation of the aerial fighting forces of the United States.

Dr. L. B. Tuckerman and Dr. Walter Ramberg, of the National Bureau of Standards in Washington, discovered the cause and cured the fault.

The two-blade propeller of the fighting plane, they indicated, sets up air impulses with a frequency of 3,200 per second. The winds of the airplane take up a vibration, due to air impulses, of just half as much—1,600 vibrations a second. The wings, in turn, set up vibrations in the airplane tail structure of 800 vibrations per second. Vibrations between wing and tail, in the ratio of two to one, would be dangerous if they stayed exactly that. Actually the ratio is not quite two to one steadily, so that beat frequencies occur which sometimes cancel and at other times augment each other. It is the addition of the wing and tail vibrations which "rattle the pilot's teeth."

Two things cured the plane of its vibrations. The wing and tail surfaces were slightly altered so that the vibrations were less near the critical two to one ratio, and further, a three-blade instead of a two-blade propeller was installed. The vibration discovery, according to Dr. Tuckerman, probably is not a serious problem in a large airplane of the commercial transport type, but seems to appear only in the tiny, powerful combat planes.

Solving the problem was of tangible importance, however, not because there was any particular danger of the airplane shaking itself apart, but rather that the removal of the annoying vibration brought greater comfort to the pilot. And increased comfort means that the pilot can fly better, shoot bettter and do all his other flight tasks in an improved fashion.

### PHOTOGRAPHING LIGHTNING

Like a nail gradually piercing a wooden board step by step under the impact of a carpenter's hammer, lightning strokes start from the clouds and finally reach the earth. This "blow by blow" description of a lightning bolt coming to the earth was secured from a motion picture study made at the University of New Mexico and the University of Virginia. Professor J. W. Beans and Drs. L. B. Snoddy and E. J. Workman described studies of lightning strokes near Albuquerque, N. M. Using cameras they found that the first flash extended half way from the cloud to the earth. A second one followed the path of the first but went six tenths of the way, while a third traveled seven tenths of the distance between cloud and ground. The fourth flash reached all the way and struck the earth. Four other flashes from the cloud to earth followed at short intervals. Successive flashes occurred one hundredth of a second apart.

### SENSITIVENESS TO TEMPERATURE OF THE SKIN

The human skin of the face is more sensitive to small temperature differences than are the most sensitive thermometers, according to a report presented by Dr. J. D. Hardy and T. W. Oppel, of the Russell Sage Institute of Pathology and the New York Hospital.

The minimum amount of radiation required to stimulate the heat sensation in the skin of the face causes a temperature rise of only five ten-thousandths of a degree Centigrade per second.

Boeckman type differential thermometers, among the most sensitive instruments available, will only record temperature differences of one thousandth of a degree Centigrade, according to the thermometer calibration division of the National Bureau of Standards in Washington.

The white skin of the face was radiated with various wave-lengths of both visible and infra-red light. It was found that the sensitivity of the skin to heat varied with

the area exposed up to 200 square centimeters, or about 30 square inches. After this area was attained there was little increase in absolute sensitivity.

### A New Form of Wave Propagation

A brief but amazing glance at scientific experiments which foreshadow what communication of the future may be like with radio waves only six inches long was presented before radio engineers and physicists by Dr. G. C. Southworth, Bell Telephone Laboratories, New York City.

Speaking, by invitation, before a joint meeting of the American Physical Society and the Institute of Radio Engineers, Dr. Southworth described his studies of a new form of wave propagation along guide lines. The electric waves used were of extremely high frequency and, indeed, beyond any wave frequencies now used for communication. The fundamental nature of Dr. Southworth's waves makes them akin, in one sense, to radio waves, but instead of being broadcast in all directions through space they travel along specially constructed guides from point to point. But before jumping to the assumption that the guiding system is like a telephone or telegraph wire it should be realized that the wave guides are like nothing so far used for the purpose in communication. Instead of consisting of electrically-conducting wires, the wave guides are composed of hollow metal tubes. The waves travel along inside nine tenths as fast as light on insulating material which will not conduct an ordinary electrical current.

The waves, being inside what is essentially a metal shield, have little external effect on near-by instruments and in turn are almost completely free from static and other noise troubles caused by outside interference. These two points alone indicate the difference between the present system and ordinary radio where interference between stations and annoyance from static are a major problem.

In his lecture, Dr. Southworth abstained from too-enthusiastic predictions about the immediate practical importance of the new system as a means of communication. The following possibilities, however, even though in the future perhaps, can not be overlooked: (1) The electric waves used are in the range of frequencies which television will use. (2) With a decrease in the size of the guiding tubes the system should be practical for long distance transmission of the waves (communication). (3) A communication electric wave system free from static and outside interference, which conceivably could be "piped" from place to place and interlace in a fashion not much different from the network of telephone wires now in use.

"The situation at present," according to Dr. Southworth, "is that the art at these extreme frequencies is not yet at a point which permits a satisfactory evaluation of practical use. However, for short distance transmission or for use as antennas or projectors of radio waves or for selective elements analogous in nature to the tuning elements so commonly used in radio, there are not the same economic conditions limiting the size of the structure. For such uses, then, structures of this type (wave guide tubes) deserves serious consideration."

The electric waves used in the Bell Laboratory experiments were 15 cms in length, or about six inches. Special types of radio oscillators, known as Barkhausen tubes, are used to generate the short waves.

For detecting elements at the other end of the experimental guide tracks, Dr. Southworth used a trap-like chamber in which was inserted a variation of the old-fashioned crystal and "cat's whisker" detector. The tiny current picked up by this detector was led to a sensitive galvanometer which measured the intensity of the current. Dr. Southworth stated that "there is no return current path, at least of the kind that is commonly assumed in ordinary transmission."

### The Wilson Cloud Chamber Apparatus

The Wilson cloud chamber apparatus, which is one of the most potent tools of science for taking actual photographs of the break-up of atoms, has been redesigned into an instrument which weighs only 76 pounds, by Dr. Gordon L. Locher, of the Bartol Research Foundation of the Franklin Institute. Hitherto, cloud chamber apparatus have been unwieldy, heavy instruments weighing hundreds and even thousands of pounds. It was in such an instrument that Dr. Carl Anderson first discovered the new atomic particle, the positron.

Dr. Locher's variation of the famous instrument was designed for the stratosphere flight of Dr. and Mrs. Jean Piccard. He constructed a similar one for the last stratosphere flight of the *Explorer II* of the National Geographic Society and Army Air Corps. It is semi-automatic in operation and is made of light-weight Dowmetal.

The new light-weight instrument should find wide use in studies of nuclear disintegration and cosmic radiation, especially in balloon flights and for observations on high mountain peaks where it is with only the greatest of difficulty that the ordinary, heavy type of equipment can be set up.

Dr. Locher expressed the belief that one of the greatest benefits to be derived from cosmic-ray studies will be the eventual correlation of cosmic-ray nuclear disintegrations with those produced by laboratory means. He showed cloud chamber photographs of some of the 185 cosmic-ray disintegrations he has obtained in paraffin, boron and lead. Those from paraffin show paths of massive nuclear particles that do not resemble anything produced by radioactivity or by laboratory disintegrations. An explanation of their origin awaits further investigation.

### Cavitation

Intense audible sounds have been found, by Dr. L. A. Chambers, of the University of Pennsylvania Medical School, to produce visible light in fourteen different liquids in the spots where cavitation occurs.

Cavitation is the phenomenon occurring in water, for example, at the blades of swift-moving ship's propellers. Holes or empty spaces are created in tiny spots within the fluid. These evacuated spaces collapse suddenly and the liquid comes together with an impact which causes a high, momentary increase in pressure. The resulting effect in the case of propellers is a pitting and erosion

of the metal surfaces. Steam turbine blades face the same difficulty.

Dr. Chambers creates the cavitation holes in his experimental liquids by the intense audible sounds with frequency ranging from 1,000 to 9,000 cycles per second. In the regions where the cavitation was occurring he found that visible light is emitted by the liquid. An adequate explanation is still lacking but it seems probable that the atoms of the fluid are sufficiently excited in the process to emit light.

### LONG LIFE RADIOACTIVITY

While it is commonly thought that artificial radioactivity is a transitory, soon-passed happening that is entirely over in a few hours or days at the most, Dr. Edwin McMillan, of the University of California, stated that a beryllium-aluminum alloy target from the famous cyclotron apparatus in Professor E. O. Lawrence's laboratory shows a radioactivity which has a minimum half life of ten years.

Last June the beryllium-aluminum alloy target of the equipment was removed after having been in use for a year. It had been used so much that even long-period artificial radioactivity had been built up. For the last four months the radioactive decay of this target has been studied and it now seems to be disintegrating at a fairly constant rate which indicates a period of half life lasting at least a decade of time.

Another part of the apparatus, composed of molybdenum and brass, was also removed and examined. It, too, had been in such a position that it had been struck by the piercing deuteron particles generated by the apparatus. From this piece another long-period radioactivity of half life of three months was found.

### ERUPTIONS IN ATOMS

A phenomenon corresponding to microscopic volcanic eruptions in bits of tungsten ribbon covered with thorium, and used in vacuum tubes, has been discovered at the Bell Telephone Laboratories, New York City. A. J. Ahearn and J. A. Becker described their studies of these thorium eruptions with an electron microscope.

On heating the thoriated tungsten filaments to temperatures as high as 4,000 degrees Fahrenheit, the Bell Laboratory scientists found that the filament surface was covered with little "active" areas which erupted and migrated over the surface of the pockets of thorium. From measurements of the currents in their equipment they estimate that about 50 billion thorium atoms are involved in such eruptions. Each little pocket of thorium, they estimate from calculations, contains from 10 billion to two trillion thorium atoms.

The studies were made to determine, if possible, the process whereby the thorium atoms are distributed over the tungsten surface of the filament. This knowledge is basic in the field of filament emission in radio and other vacuum tubes.

### PROTECTION FROM RAYS

The vast drive of physicists in the last few years to learn more about the secrets held within the cores of atoms has resulted in a new influx of radiation burns caused by x-rays and the radioactive substances, either natural or artificial, with which these explorers of the atom must work. This knowledge and a suggestion of ways in which investigators can guard against such piercing radiation was presented by Dr. G. Failla, chief physicist of Memorial Hospital, New York City, where—for years—radium and x-rays have been used for the treatment of cancer and its allied diseases.

In its way the new increase in radiation burns is similar to the havoc wrought in the early days at the start of the century when x-rays and radium rays were first being used for experiment and therapy, except that the latest increase comes when the scientists supposedly have full knowledge of the dangers they face in such atomic research.

### TELEVISION TESTS

Radio waves of the kind to be used in television have been flying over New York City in recent months between two of the metropolis' greatest skyscrapers, the Empire State Building and the RCA Building.

These waves, completely out of all range of ordinary broadcast receivers, have a frequency of 177,000,000 cycles a second. They are in the range used for experimental television broadcasts, according to P. S. Carter and G. S. Wickizer, of RCA Communications, Inc., before the joint meeting of the Institute of Radio Engineers and the International Scientific Radio Union. The high-frequency signals received came by several paths besides the direction one between the two skyscrapers. Some of the signals arrived after reflection off the ground and after reflections from other near-by buildings. This reflection characteristic of the high-frequency waves is typical, for it is known that they can be propagated in straight lines; have difficulty in bending around intervening obstacles; in fact, have a transmission distance limited quite largely by the curvature of the earth.

### RADIO RECEPTION

Owners of the new high-powered radio receivers may get their thrills from "picking up" distant stations throughout the United States and foreign lands, but scientific men use these distant signals to study the tides created by the moon in the ionized layers miles above the earth which make such transmission possible. Dr. Harlan T. Stetson, of Harvard University, presented new facts about the moon tides in the radio reflecting layers before the joint meeting of the Institute of Radio Engineers and International Scientific Radio Union.

Dr. Stetson studied the changing intensity of radio signals between KFI, Los Angeles, and WBBM, Chicago and Delaware, Ohio, as the moon moved across the sky at night. Correlating his findings with observations made at Harvard University by Professor H. R. Mimno, Dr. Stetson concludes that "these results may be interpreted as indicating that when the moon is opposite the sun there is a tendency for an increase in the ionic density on the night half of the earth's atmosphere thus favoring increased number of reflections (better reception) from the E layer." The E layer refers to one of the zones of ionized particles which reflect radio waves.