SCIENCE NEWS

Science Service, Washington, D. C.

EXACTNESS OF SPECTROSCOPIC MEASUREMENTS

ACCURACY comparable to that required to measure the distance from New York to Chicago with an error of at most about three inches was ascribed to the spectroscope at the second annual International Spectroscopy Conference meeting on July 21 at the Massachusetts Institute of Technology.

Dr. Ralph A. Sawyer, of the University of Michigan, and Dr. William F. Meggers, of the National Bureau of Standards, told the 150 scientists assembled that the spectroscope is undoubtedly the most accurate instrument of its kind known to science. The super-sensitivity of the instrument is better appreciated when it is realized that instead of measuring a distance of 1,000 miles, the distance from New York to Chicago, the spectroscope measures distances of approximately one eight-thousandths of an inch.

In measuring wave-lengths the ångstrom, defined as one one-hundred-millionth of a centimeter (there being roughly two and one half centimeters in an inch), is used as a unit. Dr. Sawyer said that with the spectroscope in measuring wave-lengths of approximately 5,000 units, accuracy to one part in twenty million had been attained. Scientists have measured wave-lengths to eight significant figures, measuring with accuracy one ten-thousandth of these tiny ångstrom units.

Scientists, however, are not yet satisfied and feel that there is a need of even a higher degree of accuracy. Dr. Sawyer expressed the opinion that with improved equipment and the finer technique that is being steadily developed, this need will be fulfilled within a relatively short time.

This need is particularly felt at present in measuring ultra-violet and infra-red wave-lengths. In visible light, fairly satisfactory standards of measurement have been established. Discussing this point, Dr. Sawyer said he believed that increased dispersion in the use of the spectroscope would aid in eliminating the various types of interference which now hinder the establishment of satisfactory standards.

Dr. Meggers described his work with the so-called noble gases, argon, neon, xenon and krypton. He illustrated his lecture with lantern slides of the spectra of these gases which he has photographed. He explained their remarkable clarity as compared with other spectra shown, as due to the fact that these gases are composed of heavier atoms.

AN ELECTRON MICROSCOPE

A MICROSCOPE which uses electrons instead of light rays to "see" tiny objects has been developed by Dr. E. Ruska and reported in the *Zeitschrift für Physik*. By magnification in two stages a device has been developed capable of enlarging the apparent size of things some 10,000 times. The maximum magnification usually possible with ordinary optical instruments is 3,500 times.

Whether electrons or light rays are used in a microscope they must be brought to a focus. For electrons a magnetic field is used for this purpose since the electron's charge makes it react in a magnetic field.

The electron microscope has theoretically a resolving power a thousand times greater than that of a microscope using light, because the wave-length corresponding to the electron is a thousand times shorter than that of ordinary light. But to realize this power, strongly converging or short-focus objectives are required. Glass lenses can not be used. Electric or magnetic fields take their place and bend or converge the electron streams just as lenses bend or focus light rays.

One could use a series of low power objectives one after the other in a series of stages. But this would make the microscope unduly long and cumbersome. The development of a high power magnetic objective that will give a magnification of 10,000 diameters in two stages is therefore a considerable step in advance.

STANDARDS FOR X- AND GAMMA-RAY INTENSITIES

SUGGESTIONS for standardizing measurements of x-ray and gamma-ray intensities which should aid medical science in the treatment of cancer by radiation were advanced by Dr. Gioacchino Failla at the fourth International Congress on Radiology meeting in Zurich. Dr. Failla is chief physicist at Memorial Hospital in New York City and one of five American delegates to the congress.

At present the proper doses of x-rays can be determined with considerable accuracy, but deciding on the right dose of gamma-rays from radium is less certain. In practise, rule-of-thumb tests known from experience often serve as a gauge by which the conflicting and scattered observations of many investigators are judged.

The present unit for measuring x-ray and gamma-ray intensities, according to Dr. Failla, is the roentgen or R unit. Two ray beams are now compared by the amount of ionization, or atmospheric electricity, which they will produce in a small air chamber at fixed distances from the source.

For x-rays, where the length of the waves is not so short, the method works with some success. For gamma-rays, having much shorter wave-length, the ionization method of determining intensity does not work so well. This is due in part, Dr. Failla said, to the fact that what really needs to be known about a gamma-ray beam is its effect on body tissues.

What science now tries to do is to take ionization produced in air and apply the results to tissue which is 800 times more dense. For x-rays this discrepancy seems to make little difference but it does matter for the more penetrating gamma-rays.

Dr. Failla suggests that the intensity of gamma-rays be determined by the ionization they produce in liquid air rather than in gaseous air. Liquid air and human tissue

do not differ greatly in density. It is to be hoped that conditions could thus be achieved approximating more closely those found in actual treatment.

WATER LEVELS OF RIVERS AFTER THE DROUGHT

THE unparalleled drought in the midwest, soon to enter its fifth month, is showing up in the water-levels of the great rivers—the Mississippi, the Missouri, the Arkansas and the Red—which are approaching new low marks at many stations.

At the Little Rock river gauge, on the Arkansas, readings are the lowest in the history of the station. The readings, prosaically entered on Weather Bureau tables as minus 3.2 feet, reflect what is happening in the 158,000 square miles of land drained by the river above this point.

At St. Louis, where river height records go back seventy-four years to 1860, the gauge reading is the lowest for the month of July in the history of the station. And the same statement holds for the past four months of March, April, May and June.

The Mississippi and its tributaries (principally the Missouri) above St. Louis drains 691,000 square miles of land now drought-stricken.

At Shreveport, Louisiana, on the Red River, levels are low for July but a bit above the all-time low recorded in November, 1932. 60,000 square miles of land are drained by the Red River at this point.

M. W. Hayes, of the River and Flood Division of the Weather Bureau, pointed out that low levels taken indiscriminately throughout the year do not necessarily mean drought, for at many stations low marks come in the winter months when the particular stream under consideration may be frozen as well as its tributaries. Low marks for summer months do have great significance, however.

"Gauge readings of very low stages," Mr. Hayes said, "are a guide to the volume of water passing down a river, but they are not an infallible guide simply because the cross-section area of a river often changes either because of silting or erosion." Frequent discharge observations, or measurements of the amount of water carried by a river, are a better guide.

The Great Lakes reflect the dry spell in lower levels. Only Lake Superior is higher than the 10-year June average.

The U. S. Lake Survey Notice to Mariners of the War Department for June lists Lakes Michigan and Huron as 1.59 feet lower for that month than the average level for June during the last 10 years. Lake Erie is 1.89 feet lower by the same standard. Lake Ontario is 1.96 feet lower.

Low lake-levels bring trouble for certain harbors whose normal depth of water is only slightly greater than the deepest draught lake steamers. A drop of one foot sometimes means that a large boat may be unable to maneuver properly in the harbor.

AMEBIC DYSENTERY GERMS

THE cysts which transmit amebic dysentery can be filtered out of water by the usual filtration methods used to purify water supplies, according to tests conducted at the Chicago Experimental Filtration Plant.

That chlorination is not a practical method of freeing the water from these organisms has been found by Dr. Bertha Kaplan Spector, of the U. S. Public Health Service, and John R. Baylis and Oscar Gullins, chemists of the Chicago Department of Public Works. Chlorine and chloramine kill the cysts, but the amount necessary is more than could be used in a public water supply. Chlorine is more effective than chloramine.

The outbreak of amebic dysentery in a hotel in Chicago last fall and the possibility that it was caused by contamination of the hotel water from an unknown source emphasized the importance of knowing more about *Endamoeba histolytica*, the organism that causes the disease. It is particularly important to know more about this germ's life outside the human body, how it is transmitted and means of safeguarding the public from infection.

Cysts were used for the tests of water purification methods because they are generally considered the transmittable stage of the organism. Waste material containing these cysts was added to samples of water which were then treated with aluminum sulphate to coagulate the solid matter and filtered through rapid sand filters of a size and type found in many filtration plants throughout the country. All cysts were removed from the water by the treatment.

ITEMS

CHICKEN feathers may come into the market disguised as fountain pens, buttons, and various novelties now made from other plastic materials if the research carried on at Iowa State College becomes commercialized. Immense quantities of chicken feathers are produced every year. Many of these are utilized in such well-known articles as pillows and feather beds, but large quantities go to waste. Research work in the Chemical Engineering Department of Iowa State College has shown that these feathers may dissolve in caustic soda and then be thrown out of solution in a new form by acids. This new material may be molded to any shape and hardened by formaldehyde. The finished material is said to be fairly hard, very elastic, an excellent electrical insulator; resistant to water, heat, dilute acids and alkalies. Somewhat similar plastics are being made commercially from milk casein.

AQUATIC flowers on a strictly land plant is the botanical paradox described by Dr. Alexander F. Skutch, who is now working in Guatemala. The flowers of one species of the plant known as *Heliconia* develop totally submerged in a pool of water held within the tight-fitting fleshy leaves just below the flower cluster. In this pool of water, Dr. Skutch states, the buds develop, protected from the surrounding fluid by equally tight-fitting petals. When the time for pollination comes, the tips of the flowers are above the surface of the water. Hummingbirds serve instead of bees or other insects as the agency of pollen dissemination. Following their visit, the fruit starts to develop, also submerged. When the fruit is ripe, it is carried above the water by the elongation of its stalk.