NEWS and VIEWS

OPTICAL SOCIETY

NEW YORK MEETING REPORTED

The winter meeting of the Optical Society of America, held at the Statler Hotel in New York City on March 10–12, opened with a symposium on luminescence.

In a survey on present methods for determining the optical properties of phosphors, Wayne B. Nottingham pointed out that useful results are frequently obtained with measurements of fairly low accuracy. He described the control of color of product for fluorescent tubes and television screens and several recent instruments for recording emission spectra.

Ferd Williams spoke on the interpretation of luminescent phenomena and discussed the role of impurity levels and movement of electrons and positive holes for decay, thermoluminescence, interaction between impurity atoms, and competitive radiative and nonradiative processes. He was optimistic about going beyond present semi-empirical models and of calculating, at least for the simplest cases, the details of the luminescence mechanism from first principles. He voiced the hope that the theory would soon make it possible to produce, arbitrarily, phosphors of prescribed properties.

The application to temperature measurement of certain nonlinear phosphors was treated in several contributed papers by F. Urbach and his co-workers. Connected with this nonlinearity is a strong temperature dependence which may be controlled over a wide range of temperatures by suitable poisoning and adjustment of exciting intensity. When such phosphors are coated on surfaces, temperature changes and temperature distributions become visible as brightness variations. These may be measured by visual or photoelectric photometry but the results are more striking if photographs are taken. Pictures of thermal radiators obtained by imaging them with a high aperture concave mirror were shown. One such "thermoradiograph" was that of a human hand taken by its own radiation against a background of normal room temperature.

On Friday, the second day of the meeting, an outstanding paper "Ruling of Large Diffraction Gratings" was presented by G. R. Harrison of the Massachusetts Institute of Technology. His paper covered the historical development of grating ruling engines and pertinent data on the gratings produced by them, with especial reference to the more famous ruling engines developed by Rowland, Michelson, Gale, Anderson, Babcock, and Siegbahn. Dr. Harrison outlined present day needs for large gratings of higher resolving power and described the active program now under way at the Bausch and Lomb Optical Company and at the Massachusetts Institute of Technology toward this end. For this work, two large ruling engines of the University of Chicago have been brought into service. One of these, originally designed by Michelson to rule 14-inch gratings, has been moved to the Massachusetts Institute of Technology where it is being rebuilt for the purpose of ruling large gratings. The other, also started by Michelson but subsequently completed by Gale, has been transferred to the Bausch and Lomb Optical Company in Rochester.

Under the supervision of David Richardson at Bausch and Lomb, and in close collaboration with Dr. Harrison, a program is under way to rule large gratings with a large total number of lines. Of great interest is the novel method now under consideration by Harrison for ruling high resolving power gratings on the engine at MIT. As is well known, the resolving power of a grating depends upon the product of the total number of lines in the grating and the order of the spectra used. The conventional method of obtaining high resolving power with ruled gratings has been to use many lines and photograph spectra of low order. The ruling of large gratings with many lines entails serious difficulties because up to the present time no method has been found for advancing the grating blank by equal increments over a wide grating surface. Dr. Harrison's new attack is to make gratings with a much smaller number of rulings and work in the higher order spectra. A perfect ruling on such a grating should be possible with an engine in which the motion is controlled by interference fringes. The type of grating that Harrison proposes to rule in this way will possess a number of elements per unit width intermediate between that of the echelette and echelon gratings and he suggests it be called an "echelle." To prevent overlapping spectra, a prism will be used in conjunction with the grating to separate the different orders vertically. This combination has the added advantage of reducing enormously the number of photographic plates required in photographing the spectra.

On Friday afternoon, P. Debye presented a paper, "Measurement of Size and Shape of Large Molecules by Light Scattering." Dr. Debye gave a clear exposition of his theoretical work on this problem along with a description of the simple and straightforward optical experiments for determining the physical properties, weight, size, and shape of the molecules. It was pointed out that non-absorbing gases and liquids are not perfectly transparent but scatter light. The scattering is due to the non-homogeneous molecular structure and this inhomogeneity will be increased by addition of solute molecules to a clear solvent. In the simplest case of small particles at high dilution, the theory is based on derived expressions for the change of dielectric constant and turbidity with addition of solute molecules. Both expressions depend upon the dipole moment of the molecule per unit field and thus it is possible to eliminate the factor and obtain a working expression involving refractive index, turbidity, and number of solute molecules per cubic centimeter. By simple measurements of turbidity of the solution and difference of index between solvent and solution, it is possible to calculate the number of molecules per cubic centimeter and thus the molecular weight of the solute.

For the problem of small particles and high concentration, use is made of Einstein's theory of spontaneous fluctuation of molecular concentration. This theory shows that the magnitude of the fluctuations is connected with

the osmotic pressure of the solution, and that the light scattering power depends upon the changes of refractive index resulting from the local changes of concentration. Using these relations and Van't Hoff's law connecting osmotic pressure and molecular weight an expression is obtained connecting change of index of refraction, turbidity, and molecular weight. By a somewhat more elaborate theory it was shown that the distribution of scattered light intensity about the direction of the primary beam of light can be interpreted to give information on the size and shape of molecules even though they may have chain-like structures. Results were presented to show that the theory, when supplemented by very simple optical measurement, is capable of giving remarkably accurate values of physical attributes of the solute molecules.

An interesting event of the meeting was a talk by E. H. Land on a new color-translating ultraviolet microscope recently developed at Polaroid Corporation. Dr. Land described and demonstrated a reflecting ultraviolet microscope with its attached apparatus for developing and projecting the transparencies, which permits one to obtain microscopic images in three ultraviolet wavelengths and almost immediately project them as a composite color picture by means of filters in three visible wavelengths. The reason for using ultraviolet microscopy is that biological tissue often contains absorption bands in the ultraviolet, making it possible to obtain contrast on a specimen without resorting to the technique of staining, which will kill living cells. Methods of rapid processing developed at the Eastman Kodak Company are incorporated in the apparatus so that only a few seconds elapse between exposure and projection of a picture. The three pictures are first exposed and processed in order and then projected as a composite color picture, the three visible color filters being placed in a prearranged definite order of wavelengths, which may be changed at will.

Dr. Land's associates rounded out the program with several contributed papers relating to the same subject. D. S. Grey gave a survey paper on the development of the ultraviolet microscope; C. Matz discussed the qualities of available ultraviolet light sources; R. Clark Jones discussed the colorimetric problem involved in the color translation process; and finally, E. R. Blount and M. S. Flower discussed application to biology, pharmaceutical chemistry, and ultraviolet absorption spectroscopy and spectrophotometry.

—J. H. Webb

ALBERT EINSTEIN SEVENTY

SYMPOSIUM ON HIS SEVENTIETH BIRTHDAY

About three hundred physicists from the Eastern region assembled on March 19 in Frick Chemical Laboratory on the Princeton Campus to listen to six addresses, and even more, to express, by their presence, their good wishes and their appreciation for what Albert Einstein has done for physics. The occasion was Dr. Einstein's seventieth birthday, which he quietly celebrated a few days before at his home.

R. Ladenburg, who organized the symposium "The Theory of Relativity in Contemporary Science" in collaboration with members of the Institute for Advanced Study and of Princeton University, introduced the occasion with a few personal recollections dated back forty years and called on J. R. Oppenheimer as the first speaker. In his address on "Relativity in the Atomic Domain," Dr. Oppenheimer pointed, with the pride common to all physicists, to the accomplishment of the past forty years, much of which was based upon and almost all of which was permeated by the principles of relativity. As against these successes, he emphasized that our understanding of the elementary particles has remained almost where it was, that we have only vague and somewhat uncorrelated ideas for the reasons of their stability and their identity. He expressed the hope for future progress in this field.

I. I. Rabi's very warm and personal appreciation of Dr. Einstein's work followed. The theme of his address was the constant preoccupation of the experimenter in the laboratory with the principles which we owe to Dr. Einstein, the guidance which these principles provide even in research on simple and humble problems.

The last speaker in the morning session was E. P. Wigner who spoke on "Invariance in Physical Theory." He reviewed the history of the principles of invariance and the role which the theories of relativity played in it; the special one as the epitome of the classical principles of invariance and the general theory as the first step of a new development which he expected to come to full flourishment only in the future.

While the special theory of relativity was the morning session's principal theme, the general theory came to its rights in the afternoon meeting. H. P. Robertson's address "On the Present State of Relativistic Cosmology" summarized our present knowledge of the structure of the universe and the role which Einstein's theory of gravitation played in it both as a scientific theory and also as a stimulus for astronomical research in the cosmological field. Much emphasis was placed on the observational aspects and the promise which the bigger telescopes hold in store.

A masterful summary of the confirmation of the general theory in the solar system was given by S. M. Clemence. Many of those assembled realized for the first time the scope of this confirmation: that even though the perihelial motion postulated by the theory is only a very small fraction of the whole effect, the astronomer's accuracy permits one to narrow down possible deviations from the theory to less than a few percents.

H. Weyl's address on "The Theory of Relativity as Stimulus to Mathematical Research" concluded the symposium. He traced the influence of relativistic physics through the modern development of mathematics and found it in such widely different fields as differential geometry, analysis at large, and theory of groups and transformations.

There was a discussion period after each address and Dr. Einstein participated in much of the discussion, particularly when the general theory was the subject. A very notable contribution to the discussion was made by Dr. Godel who told about a solution of the equations of the