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Trends of Research in Physics

By W. V. HOUSTON

PHYSICS is a very broad subject. It includes the basic knowledge and techniques of practically all branches of engineering and technology, and, in the minds of many people, includes the whole of these subjects. Nevertheless, the *actively* pursued lines of research in physics cover only a small part of this field and change from time to time. In a sense, this is because physicists share with other people the desire to be in style, the desire to be doing something that other people think is of importance and about which they can talk. In another sense, however, this change of emphasis in research stems directly from the fact that progress is being made, that some subjects are becoming well understood, and that it is necessary to look in other directions for new worlds to conquer.

HISTORICAL CHANGES

It is interesting to note some of the historical changes during the past 100 years. At about the middle of the 19th century a great deal of attention was directed to thermodynamics. The law of the conservation of energy and the laws concerning entropy were formulated and checked experimentally by various outstanding physicists as well as by many others whose names are less well known to us. After this first rapid development in the field, there remained a great deal of detailed work, but most of the underlying developments came during a rather short time.

At a slightly later period in the 19th century, possibly from about 1865 to the end of the century, a good deal of attention was directed to electromagnetic phenomena. It was during this period that Maxwell formulated his electromagnetic equations and that Hertz established experimentally the existence of electromagnetic radiation. Out of this has grown all of the tremendous electrical and communications industry, but it is not now a major field of research in physics. Activity along these lines at the present time is usually called engineering, and consists in the applications of Maxwell's equations to various specific situations.

With the beginning of the 20th century, physicists began to turn their attention towards the atomic and electronic constitution of matter. There grew out of this the establishment of the existence of electrons and the measurement of their properties. During the first

15 years of the 20th century this was regarded as an important field for research in physics, but as it became applied to more and more practical uses it became a branch of engineering almost of its own, and during the last few years the term "electronics" has become familiar to almost every person.

The discovery of X-rays and the discovery of radioactivity stimulated research in these directions at about the same time. X-rays have now become a tool in many branches of engineering and of medicine, but the X-rays themselves are rarely a direct object of research in physics.

Starting about 1910, however, attention became directed to the properties of the atoms, and using X-rays spectroscopic and electronic techniques, and every other available tool, scientists fell avidly on the problem of analyzing and understanding the properties of the atoms. In this connection, there developed the quantum mechanics, but since about 1930 it has been felt that problems associated with the external structure of atoms are essentially solved. Out of this has grown again a great many engineering and industrial applications. In particular, the study of spectroscopy, which was originally one of the more esoteric branches of physics, has become a standard means of quality control in many factories.

PRESENT FIELD

At the present time, there are roughly two kinds of things that physicists attempt to do.

On the one hand, there still remains a great deal to be done in understanding the way in which the atoms build up solid pieces of matter. The difficulty seems to be largely a matter of complication. It is believed that if one had the proper mathematical techniques, the properties of solid matter could be described accurately and quantitatively in terms of the properties of the individual atoms. Nevertheless, this has not been conclusively demonstrated, and even if it were true, there still remains the problem of finding the proper techniques.

In one sense, this study of the properties of matter is regarded by many physicists as uninteresting; it is a kind of mopping-up process after the major advances

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C. I. T. NEWS

December Meeting

THE December 13 Alumni Dinner Meeting, held at the University Club, was a great success. There were 70 members and guests present: the class of '33 being represented by six members—not bad! After a session of elbow bending and the partaking of a most delicious dinner, the meeting was formally opened by President Charles Varney. Vice-President and Program Chairman Al Laws introduced the speaker of the evening, R. G. Kenyon, vice-president of the Southern California Edison Company.

Mr. Kenyon gave a very interesting talk on Labor-Management Relations. He differentiated between labor as a commodity, and the laborer as an individual. Labor as a commodity is priced in accordance with standard economic laws of supply and demand and not according to the buyer's ability to pay. This classification fits very accurately into the picture when used with reference to the depression of 14 years ago and the huge demand for labor during the war years. Labor problems date back as far as 1350 A. D. At that time the great plague took place in England and people died in such large numbers that there was a serious labor shortage for food production.

Mr. Kenyon then went on to give a history of the organization of labor into unions. The earliest known labor union was organized in 1790, but not until 1886, when the Knights of Labor was formed with 700,000 members, did labor unionize into a large organization. However, the Knights of Labor lasted only six years, and not until the American Federation of Labor was started in 1900 were there any strong unions. With the A. F. of L. came the institution of collective bargaining. Mr. Kenyon then described the labor-management relations during the war and at the present time. He ended his talk with the statement that management is not hostile to labor unions as such, but to some of the corollary philosophies which have developed in the movement.

President Varney then asked for further business, and Al Laws gave a short resume of the coming meetings next year.

The meeting was then adjourned.

Affiliates With National Organization

AN organization known as the Association of Pasadena Scientists was formed at the California Institute of Technology in November 1945. Purposes of the Association will be to study the problems associated with the relationship between society and scientific developments, with special emphasis on problems of atomic power; to promote freedom of research, particularly nuclear research; to cooperate with other groups which are working to prevent the destructive use of atomic energy, and to convince the public at large of the necessity for taking action designed to achieve this goal.

At a special meeting of the new organization held December 19, addressed by Dr. J. R. Oppenheimer, former head of the Los Alamos bomb project and by Dr. Linus Pauling, the membership voted to affiliate with the American Federation of Scientists, the national group formed to gather and disseminate information concerning

developments in science insofar as they affect world peace and the general welfare.

Membership in the American Federation of Scientists is open to local associations with at least 25 "qualified" members. Qualified individuals (for voting purposes in the Federation) shall be natural scientists, mathematicians, or engineers active in scientific works with a minimum of a bachelor's degree or its equivalent, in science or engineering.

Physics Research

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have been made. To others, however, who see the value of such things to all engineering applications, as well as to those whose minds are only satisfied when everything is finally in order, this presents a challenging problem. At the present time, work is under way in a great many academic and industrial laboratories on what is roughly designated as the "theory of solids".

On the other hand, the field of research that is now so much in the public eye as to be a possible source of embarrassment to physicists, is that of nuclear physics. In a sense, nuclear physics began with the discovery of radio-activity. Its progress was slow until the early 1920's, when patient and persistent efforts of the physicists in the Cavendish Laboratory at Cambridge began to show results, and the first atomic nucleus was broken down. After that time interest grew at an increasing rate, until the tremendous expenditure of funds during the recent war produced results in the application of nuclear physics to the destruction of people and cities that has brought it to the attention of every thinking person. Most physicists are very unhappy because of the emphasis that has been put upon the destructive possibilities of the results, but many of them believe that by continued research and investigation this new source of energy can be made adaptable to extensive peacetime uses, and to uses that may tend to alleviate some of the causes of war.

NUCLEAR RESEARCH

Most active physics laboratories, both academic and industrial, are now making extensive preparations for nuclear research. It can be done in a variety of ways, but characteristic of most of these methods is the necessity for relatively large installations and equipment. There are those who think that such research should be operated and sponsored by the Government. But the Government has not yet decided to what extent and in what way it may contribute to research of this kind. There are others who think research would be much more fruitful if sponsored entirely by individual groups. In the meantime, active preparations are being made in the Kellogg Radiation Laboratory and the Norman Bridge Laboratory at California Institute of Technology for a resumption of nuclear research at something like the point where it was dropped in 1941. Some of the advances during the war can be turned to advantage, but, in general, it is a laborious process of attempting to recover the ground lost while developing lethal weapons of one kind or another.

Herbert Ingersoll '26

Herbert Ingersoll was killed December 15, 1944, in Subic Bay, when he was a prisoner of the Japs aboard a prison ship which was sunk. Herb was in action on Bataan. His wife has received the Silver Star Citation.