of irksome Civil Service Commission restrictions. He also indicated the practical advantages to universities in having such contracts.

Kenneth S. Pitzer, director of the division of research of the AEC, emphasized the virtues of having government-supported laboratories with facilities (such as nuclear reactors or high energy accelerators) which would be impossible under private auspices. While much classified work is done in such laboratories, many of these rare facilities are available to the general scientific public for research and training. He indicated the belief that the establishment of these large government-supported installations under the sponsorship of groups of educational institutions is a tendency likely to increase and become a permanent policy.

John T. Connor, of Merck and Company, described the work of the committee appointed by Vannevar Bush, then chairman of the Research and Development Board, in considering plans for the effective mobilization of science in times of emergency. This committee, headed by Irvin Stewart, has completed its report which is currently being studied by the Research and Development Board. Dr. Connor reviewed the history of the committee's work and outlined the alternative policies which might be utilized for directing civilian research and development in the event of another national emergency.

—Marsh W. White

GASEOUS ELECTRONICS

SECOND ANNUAL CONFERENCE REPORTED

Important progress has been reported toward identification and quantitative understanding of the many individual processes that make analysis of gaseous conduction so complicated. This was reported at the second of what promises to be an annual conference on gaseous electronics, held at the Mellon Institute, Pittsburgh, Pennsylvania November 3–5, 1949; approximately two hundred scientists attended representing 21 educational institutions, 27 industrial laboratories, and 15 other organizations. The forty-four papers presented demonstrated the same breadth of interest that was evident in the first conference, held at Brookhaven in October, 1948.

Excellent agreement between theory and experiment was reported by a number of researchers. Papers by A. D. MacDonald and B. Lax emphasized that consistent results are now being generally obtained in breakdown measurements on microwave discharges. Yet to be explained in this field is the orders-of-magnitude difference between theoretical and observed electron-ion recombination coefficients. Further progress was reported by J. P. Molnar in determining quantitatively the relative importance of ions, resonance photons, and metastable atoms as sources of secondary electron emission at the cathode in the Townsend discharge. These experiments also are in quantitative agreement with the theory of the Townsend discharge. A. O. McCoubrey, D. Alpert, and T. Holstein reported interesting results (and their interpretation) on the persistence of band fluorescence in mercury vapor. This molecular effect was observed during the course of experiments which confirmed Holstein's theory of the imprisonment of atomic resonance radiation in the same gas.

Such a satisfactory state of affairs was not reported universally. Isolation of and qualitative measurements on individual processes remain as yet unattained objectives in the attempt to understand many gas discharges. Illustrative of this were papers and discussion on two problems of major importance in gaseous electronics: the propagation mechanism of fast sparks near atmospheric pressure, and the mechanism of electron emission in the low-boiling-point metal vapor arc. G. L. Weissler discussed a vacuum ultraviolet absorption experiment that is a promising beginning towards evaluating the contribution of high energy photons to spark propagation by photo-ionization, the process postulated in the streamer breakdown mechanism but so far unsubstantiated by experiment. Measurements of formative time lags of sparks in air by L. H. Fisher and B. Bederson more sharply defined the spark breakdown problem and the observations to be explained by an adequate theory. The processes of electron emission from the cathode in the metal vapor arc have not been identified and therefore were, quite understandably, the subject of spirited discussion and speculation.

The "electronic torch," described by J. D. Cobine, was probably the most spectacular discharge reported on at the conference. This 1000 megacycle per second discharge gives a very intense flame capable of melting tungsten if the gas involved is a polyatomic gas such as N_2. In pure noble gases, however, one's hand can be placed momentarily in the "flame" without being burnt.

Several papers were devoted to a discussion of various aspects of the plasma. These included an interesting investigation of plasma electron oscillations by K. G. Emeleus, Queens University, Belfast (paper read by W. P. Allis), a clarifying discussion of double probe measurements by E. O. Johnson and L. Malter, and theoretical solutions of plasma-sheath potential distributions by L. P. Smith and by O. G. Harrold, Jr. and R. Murray.

Two evening lectures added variety to the program. At a joint session with the Pittsburgh Physical Society D. Alpert demonstrated the imprisonment of resonance radiation in gases. As main speaker at the social evening and dinner, held at the Pittsburgh Athletic Association, H. E. Edgerton of MIT gave an illustrated talk on his experiences with stroboscopes.

The conference committee of W. P. Allis, D. Alpert, T. Holstein, C. Kenty, and J. P. Molnar did an excellent job of arranging the conference program. The smooth functioning of the entire affair may be credited mostly to D. Alpert and the Westinghouse Research Laboratories, which acted as the genial though unofficial host. The committee selected to carry on in 1950 consists of W. P. Allis, D. Alpert, J. D. Cobine, and J. A. Hornbeck.

A few bound copies of abstracts of the papers presented are available for distribution through D. Alpert, Westinghouse Research Laboratories, East Pittsburgh, Pennsylvania.

—John A. Hornbeck

LAST DAYS OF ASXRED AND CSA

AMERICAN CRYSTALLOGRAPHIC ASSOCIATION FORMED

After more than a year's study and discussion the

members of the American Society for X-Ray and Electron Diffraction and the Crystallographic Society of America have voted to form a single new society, the American Crystallographic Association. This new organization will eliminate the problems caused by the overlapping interests and memberships of the two previous societies but it is planned to continue similar types of meetings and publications. It now has about 500 members including physicists, chemists, physical chemists, mineralogists, metallurgists, mathematicians, and biologists from universities, government, and private research foundations and industrial research laboratories.

The ACA will cover the fields of crystallography and x-ray, electron, and neutron diffraction. Its object is to promote the study of the arrangement of the atoms in matter, its causes, its nature and its consequences, and of the tools and methods used in such studies. The first meeting will be held in early April at the Pennsylvania State College where R. Pepinsky will demonstrate his x-ray analogue computer.

Since the ACA has been planned as an extension of the two previous societies, a brief review of the history and last meetings of the ASXRED and of the CSA may give the reader a picture of the scope of the new society.

An affiliate society of the American Institute of Physics, the ASXRED was founded about ten years ago, being organized to meet the needs of those making use of x-ray or electron diffraction in various well defined and borderline sciences. It had more than 500 members, and local groups in Pittsburgh and Detroit were affiliated with the society. It published a semiannual bibliography of papers in the fields in mimeograph form, which has been an invaluable addition to the literature. The ACA plans to continue this publication and to extend the subject matter to include crystallography.

Early meetings held at Gibson Island, Maryland were characterized by a small number of invited papers, which constituted most of the program, followed by detailed, informal, and vigorous discussions which were usually longer than the papers. Since 1945 the summer meetings have been held at universities or at resort hotels and there have been shorter meetings in late fall. Recently the papers were mainly contributed and shorter, and the increase in membership necessarily limited the discussions.

The CSA, which was organized on a local basis in 1938 and on a national basis in 1945, had a total of 250 members. A three-day meeting was held every spring at a college campus.

In 1949 the ASXRED met at Cornell University, June 23–25, and at Franklin Institute, Philadelphia, December 1–3. The CSA met at the University of Michigan, April 7–9. A brief review of a few of the more important topics discussed at these meetings is given below.

At the Michigan meeting, thirty-two papers were given on crystal structure, crystal growth, crystal optics, miscellaneous topics, and twinning. The feature of the program was a symposium on twinning in which a number of invited papers were presented on many phases of the subject including theory, determination of twin laws in crystal projections, and the genesis, structure, and growth of twins. These were followed by papers on twinning in metals and minerals. About a month prior to the meeting a list of suggested reading on the subject was prepared by the speakers and distributed to the members to enable those who attended to have a better background in the field.

The largest number of papers given at the Cornell meeting dealt with the crystal structure of organic substances. Outstanding among these was the comprehensive investigation of napthalene by S. C. Abrahams, J. M. Robertson, and J. G. White. A triple Fourier series analysis summed over 54,000 points in half the chemical molecule led to an accurate determination of the bond lengths.

Perhaps the greatest remaining difficulty in x-ray analysis is the finding of the phases of the Fourier coefficients (scattering amplitudes) of the electron density. In x-ray diagrams only the reflected intensity, which is proportional to the square of the amplitude, can be measured, but the phases are unknown. If there was a way of measuring both the amplitude and phase of the reflected beam, the determination of the arrangement of the atoms which produced the reflection would be quite straight-forward.

R. Pepinsky described a new approach to this problem which has become possible by the use of the x-ray analogue computer. This large electronic computer for synthesizing Fourier series is also ideally suited for rapidly trying a large number of phase combinations because it is easy to vary the values and signs of the terms and to see immediately the effect of these variables on the electron density map on the cathode ray screen.

R. L. Collins and W. N. Lipscomb took x-ray pictures of hydrazine at low temperatures and determined its structure. This technique not only promises good results for low melting substances but also better detail in electron density determination of higher melting point organic substances because of the diminished temperature movement of the electrons.

A useful application of x-ray crystallography has been in the study of the deformation of metals. The primary effect of cold work in a metal is to broaden the powder pattern lines, but the interpretations led to several theories, none of which explained all the facts. B. E. Warren has made an important contribution by developing a new generalized theory based entirely on experimental data. Together with B. L. Averbach, Warren improved the instrumentation by using a focussed monochromator and Geiger counter spectrometer arrangement to measure line profiles accurately. The shape of the line is described in terms of Fourier coefficients which are related to root mean square atomic displacements. The coefficients give directly the average strain, averaged over different distances for different directions in the crystal. Strains in alpha brass were found to be highly localized and are not uniform over any appreciable distance.

P. P. North and L. K. Frevel have developed an apparatus and technique for x-ray spectrochemical analysis. The instrument consists of a point source of polychromatic x-rays, an absorption cell, and a "lens" consisting

of four sodium chloride crystals on a cylinder which is placed midway between the source and the receiver slit of a Geiger tube. The "lens" focusses a monochromatic beam on the slit and the wavelength is varied by moving the receiver slit and Geiger tube along the optical axis of the instrument at exactly twice the speed of the "lens." There are many types of analyses that can be made with the instrument, including the accurate quantitative analysis of the chlorine content in hydrocarbon mixtures. Elements with atomic number greater than 22 can be determined by their characteristic absorption edges.

At the Franklin Institute meeting, twenty-four papers were presented on the structures of metals, inorganic and organic compounds, theory of electron diffraction and structure analysis, and miscellaneous topics. One evening was spent at a cocktail party and banquet, after which W. G. Burgers of Technische Hoogeschool, Delft, Netherlands gave a fascinating lecture in which he demonstrated many geometrical features of x-ray and electron diffraction photographs by optical means.

W. H. Zachariasen, who has spent the past several years studying the structure and crystal chemistry of the 5-f elements, reported that in many compounds of these elements the observed interatomic distances correspond to a higher valence state of the 5-f element than is indicated by the usual chemical valence rules. Some examples of these subnormal valence compounds are ThS with Th valence 4.3 while in Th_2S_3 and ThP the valence is 3.8; in US the valence is 4.7 but in UP it is 4.3, etc.

The atomic energy program has made available strong sources of neutrons so that it is now possible to study the diffraction of neutrons from crystalline materials. C. G. Shull of Oak Ridge has been able to determine the relative orientation of the magnetic ions in the crystal lattice by neutron diffraction. Since there is larger interaction between the neutron magnetic moment and atomic magnetic moments, pronounced intensity effects are obtained in the diffraction patterns of ferromagnetic, antiferromagnetic, and paramagnetic substances. He found that the magnetic unit cell was larger than the chemical or structural unit cell in some substances.

—William Parrish

SPECTROSCOPY

JUNE SYMPOSIUM AT OHIO STATE

A symposium on molecular structure and spectroscopy will be held at the Mendenhall Laboratory of Physics at Ohio State University from June 12 to June 17, 1950. There will be discussions of the interpretation of molecular spectroscopic data as well as methods for obtaining such data. In addition, there will be sessions devoted to those phases of spectroscopy of current interest. A dormitory will be available for those who wish to reside on the campus during the meeting. For further information, or for a copy of the program when it becomes available, write to Professor Harald H. Nielsen, Mendenhall Laboratory of Physics, Ohio State University, Columbus 10, Ohio.

PROJECTS INVITED

FOR ARCTIC RESEARCH

The Arctic Research Laboratory, originated by the Office of Naval Research in August, 1947 as a frontier Arctic field station for basic scientific research of physical and biological phenomena associated with the region, will henceforth be operated by the Johns Hopkins University under contract with the ONR. The Laboratory, located at Point Barrow, Alaska, will be available to scientists from American institutions originating research of a type which can be carried out only in the arctic region; this, of course, excludes projects which can be studied in the academic laboratory under simulated conditions.

Detlev Bronk, president of the University, explained in making the announcement that the new arrangement is "designed to make the facilities of the Laboratory more available to the scientists of this country and to relate the activities of the Arctic Laboratory to research and teaching in American universities." George E. MacGinitie, who is on leave from the California Institute of Technology where he has been director of the Kerckhoff Marine Laboratory, has been appointed resident director of the Point Barrow Laboratory.

Scientists interested in special fields of arctic research are free to outline their projects and submit them to the ONR or to the Hopkins Institute for Cooperative Research for consideration.

AT INSTITUTE FOR NUMERICAL ANALYSIS

Appointments of summer studentships and of thesis fellowships are being offered to properly qualified graduate students in pure and applied mathematics at the Institute for Numerical Analysis of the National Bureau of Standards at the University of California, Los Angeles. In making the announcement, the Bureau points out that the central function of the Institute is to perform mathematical research and exposition pertinent to the use of automatic digital computing machinery, while it is a supplementary function to support certain projects which, while they do not bear directly upon the development of numerical analysis, nevertheless require extensive computations of a type for which automatic machinery is suitable.

The summer studentships involve stipends ranging from $500 to $700 and a program lasting for some ten weeks during the summer, from the middle of June to the end of August. The thesis fellowships are intended only for doctoral candidates whose research program seems relevant to the work of the Institute and who have completed all residence and language requirements for the PhD degree at an accredited university. The stipend is at present fixed at approximately $2,000 for an eleven-month period.

Applications for these appointments should be made in writing to the Director of Research of the Institute for Numerical Analysis before March 1. A transcript of the applicant's academic record should be included, as should two supporting letters addressed to the Director of Research from established scientists familiar with the work of the applicant.